

## INTRODUCTION

Extraordinary advances have been made in the field of chemistry in the past century, and the high yields and high quality produced by modern farms can be attributed in large part to the use of synthetic pesticides and fertilizers. However, borne out of concern that these synthetic chemicals might cause human disease and environmental damage, the organic movement has developed in support of agriculture that uses safe, environmentally friendly and natural (i.e., non-synthetic) means of enriching soils and controlling pests.

It took several decades for organic agriculture to gain popular acceptance, but by the 1990s organic agriculture had clearly entered mainstream America. According to the Food Marketing Institute, about half of U.S. shoppers now buy organic foods and almost 3/4 of retail food stores in the U.S., including some of the largest national grocery store chains, carry organic foods. Furthermore, there are 2.2 million acres of organic cropland and pasture in the U.S. today. The organic tree nut industry makes up a tiny but very rapidly growing sector of U.S. organic agriculture. In 1997 there were 4,908 acres of organic tree nut acres nationwide; by 2005 the U.S. organic tree nut industry had more than tripled in size, reaching 15,986 acres. Most of this growth was in California, but in 2005 there were 111 acres of certified organic pecan orchards in New Mexico.

Until recently, there were no nationally agreed upon standards as to which methods or chemicals were permissible within organic agriculture and, as a result, it was often difficult for consumers of “organic” products

### What does “organic” mean?

“Organic food is produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality for future generations. Organic food is produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; or ionizing radiation.”

—National Organic Program, “Organic Food Standards and Labels: The Facts”

to know exactly how the products they were buying differed from “conventional” products. But with an ever-increasing presence of organic agriculture nationwide, the U.S. Department of Agriculture (USDA) put into action in 2002 the National Organic Program (NOP), a formalized organic certification program. Today, all agricultural products bearing the “organic” label must have been produced and handled in accordance with the National Organic Standards.

### Mineral Nutrition in Organic New Mexico Pecan Orchards

To grow and set fruit normally, pecan trees require adequate levels of 14 mineral nutrients: nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, zinc, iron, boron, manganese, molybdenum, copper, chlorine and nickel. Deficiency in any one of these nutrients can potentially limit pecan yield—but only a few of these minerals are commonly deficient in New Mexico pecan trees. As the basis of your orchard min-

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## Can a legume cover crop meet the nitrogen needs of my pecan orchard?

Legumes inoculated with the appropriate strain of bacteria can capture (“fix”) atmospheric nitrogen. Some legume species, including clovers, vetches and alfalfa, can fix enough nitrogen to meet much of your pecan orchard’s nitrogen needs when planted between the tree rows. In addition to nitrogen fixation, planting a legume cover crop in your orchard also carries with it other benefits:

- Cover crops provide beneficial insect habitat.
- Keeping the area between tree rows vegetated can reduce soil erosion.
- A cover crop can increase soil organic matter in your orchard.

But this option for nitrogen fertilization also presents some limitations in orchards:

- Cover crops can compete with your trees for nutrients and water, reducing orchard growth or yield.
- Legumes only fix enough nitrogen to meet their own needs, and none of it is immediately available to the trees. The fixed nitrogen only becomes available once the legume plants have died (or been mown) and decomposed into the soil.
- A legume cover crop may not fix enough nitrogen to meet the entire demand of a high-yielding pecan orchard, yet application of supplementary nitrogen fertilizers can further reduce nitrogen fixation rates.
- Shading can make it difficult to establish a cover crop under mature pecan canopies during the growing season.
- Some legume ground covers harbor pest insects such as stink bugs.

eral nutrition program, the nutritional status of your trees should be assessed annually, using tissue analysis of July-sampled leaves.<sup>2</sup>

Nitrogen (N) deficiency often limits pecan yields in New Mexico; this is particularly true in organic orchards. Conventional pecan growers in New Mexico typically apply 150–300 lbs of actual N per acre annually. Synthetic fertilizers allow conventional growers to precisely control the rate and timing of N application in

their orchards, because these fertilizers have a consistent known content of N and the N in these fertilizers is immediately available to the tree for uptake. Without all the advantages of synthetic N fertilizers, it is *critical* for organic pecan growers to monitor the N status of their trees much more closely than conventional growers do, in order to avoid deficiencies and maintain productivity.

Many organic producers use manure or compost as the primary sources of N in their operations. Since nuts are harvested onto the ground, the use of raw (non-composted) animal manures in pecan orchards carries with it the risk that nuts will be contaminated with bacteria that cause food-borne illnesses in humans. To minimize this risk as much as possible, and to preserve consumer confidence in the safety of organic products, the NOP rules require that non-composted animal manures be incorporated at least 120 days before harvest (NOP § 205.203). Composted manures do not pose the same threat and may be applied at any time, but must be composted following the rules set

out in the Organic Standards 205.203.

Manure and compost should always be tested by a qualified analytical laboratory before they are applied in an orchard, because of variability in quality. First, the laboratory analyses should tell you the N concentration of the manure (it can vary from 1–3%) so that you can calculate how much N you are actually applying in your orchard. Second, the analyses should tell you how much inorganic N (immediately available N) vs.

<sup>2</sup>For more information about leaf sampling and leaf analysis read NMSU Extension publications Guide H-619, *Sampling Pecan Leaves for Analysis*, at [www.cahe.nmsu.edu/pubs/\\_h/h-619.pdf](http://www.cahe.nmsu.edu/pubs/_h/h-619.pdf), and Guide H-617, *Interpreting Leaf Analysis and Deficiency Symptoms of Pecans*, at [www.cahe.nmsu.edu/pubs/\\_h/h-617.pdf](http://www.cahe.nmsu.edu/pubs/_h/h-617.pdf)

organic N (slowly available N) is present in the manure or compost.<sup>3</sup> Third, the analyses should tell you the Carbon:Nitrogen (C:N) ratio of the manure or compost. As its C:N ratio increases, manure or compost increasingly ties up soil N and may actually induce temporary N deficiencies in pecan orchards. NOP guidelines specify that compost must have an initial C:N ratio between 25:1 and 40:1 (NOP § 205.203). Finally, the analyses should tell you the salt concentration of the manure or compost, so that damaging salts (e.g., sodium and chloride) do not build up in your soils. Avoid manures with high salt content, particularly if your orchard has a heavier-textured soil.<sup>4</sup>

Additional non-synthetic fertilizer sources of N commercially available for organic growers are available, but note that if you plan to use a compounded nitrogen fertilizer product you must determine its suitability for use in organic production. The word “organic” on a fertilizer label does not necessarily mean that this fertilizer is allowed for use in organic production. If you are unsure, check with your organic certifier. Allowable nitrogen sources include blood meal, feather meal, fish meal, cottonseed meal and soybean meal. Cottonseed or soybean meal must not be derived from genetically modified plants.

Chilean nitrate (sodium nitrate) is a mined source of highly soluble nitrogen which provides many of the benefits of conventional fertilizers but is allowable in organic agriculture, with certain restrictions. Chilean nitrate is allowable only if it accounts for no more than 20% of your orchard’s total annual nitrogen requirement (NOP § 205.602); the reasons for its use must be addressed in the organic system plan. Also, be aware that use of Chilean nitrate may significantly contribute to salinity and sodicity problems in heavier and poorly drained soils and, since its use is prohibited in the organic standards of some other countries, it may not be appropriate for organic pecans intended for export.

New Mexico’s soils are generally calcareous type soils, having an alkaline pH (>7). Some micronutrients, such as zinc, might be present in such soils in adequate quantities, but are largely unavailable for uptake by pecan trees because of the alkaline pH. Generally, micronutrient deficiencies are only effectively prevented or reversed through foliar fertilizer applications. Although sulfates and oxides of zinc and other micronutrients are considered “synthetic,” these

chemicals are permitted by the NOP for use in organic pecan orchards if a deficiency can be demonstrated (NOP § 205.601).

## **Pest Management in Organic New Mexico Pecan Orchards**

One of the goals in an organic pecan orchard operation is to rely first and foremost on *non-chemical management practices* for maintaining insects, diseases and weeds at acceptable levels. Organic growers should use chemical controls (i.e., nonsynthetic chemicals or synthetic chemicals from the NOP-approved list) only if management practices alone do not provide adequate control and if proper documentation has been provided (NOP § 205.206). Due to its arid climate and geographical isolation from other pecan growing areas, New Mexico has few arthropod pests or diseases that affect pecans, which greatly simplifies pest control for organic orchardists.

Aphids are one of the most important insect pests affecting New Mexico pecans—and one of the most difficult to control in organic operations. The yellow pecan aphid species complex, which includes blackmargined aphids (*Monellia caryella*) and yellow pecan aphids (*Monelliopsis pecanis*), can be a problem throughout most of the growing season. Yellow pecan aphids exert their negative influence in two ways: 1) by “stealing” sugars and nutrients necessary for tree growth and fruiting, and 2) by blocking sunlight for photosynthesis when leaves become coated with sticky honeydew (aphid excrement), which promotes sooty mold growth. Black pecan aphids (*Melanocallis caryaefoliae*) are a threat mainly in the late summer and fall, especially in shady, crowded orchards. When black aphids feed, they inject a toxin, killing surrounding leaf tissues and sometimes entire leaves. Black aphid infestations reduce trees’ active photosynthetic leaf area at a critical time in the season—when the kernels are growing and winter carbohydrate storage reserves in the trunk and roots are being filled.

Some pecan cultivars are resistant to aphids, so the first line of defense against aphids in organic orchards can lie within the genetics of the trees themselves. For new organic plantings in New Mexico, ‘Pawnee’ is a good choice for a main cultivar because it is high yielding, well-adapted to New Mexico’s climate, and quite resistant to yellow pecan aphid infestation. On the oth-

<sup>3</sup>In this case, the term *organic* has nothing to do with NOP regulations per se, but refers to the presence of nitrogen in carbon-containing molecules.

<sup>4</sup>Read more about managing soil salinity in NMSU Extension publication Guide H-644, *Leaching Requirements of Pecan and Fruit Trees*, at [www.cahe.nmsu.edu/pubs/\\_h/h-644.pdf](http://www.cahe.nmsu.edu/pubs/_h/h-644.pdf)

er hand, 'Burkett' is reportedly much more susceptible to black pecan aphid infestations than other cultivars.

Ladybeetles, lacewings, mirids and a number of other predatory insects have a voracious appetite for aphids and can also play an important role in suppressing aphid populations. Predatory insects may be naturally abundant in your orchard. There are commercial suppliers of these predatory insects; if natural populations of these insects are low in your orchard, you can try to boost populations through periodic releases within your orchard. Vegetation on the orchard floor provides cover for predatory insects and may help to encourage these insects to actually take up permanent residence in your orchard. If you want to encourage orchard floor vegetation in mature orchards, maintaining good canopy sunlight penetration (less than 60% shade on orchard floor at noon) by means of tree thinning or pruning will help; this will also lessen your orchard's susceptibility to black aphid infestation.

The pecan nut casebearer (PNC) is a moth which, in its larval form, feeds on pecan nuts. In New Mexico there are three or four PNC generations per year; the first generation, appearing in mid to late May, is the most destructive to pecan yields and should be the main focus of PNC control programs. Parasitoid wasps found in New Mexico can help keep PNC populations in check.<sup>5</sup> But there are pesticides effective against PNC available labeled for organic pecan orchards (see text box) and, especially in low yield seasons, it will likely be necessary to sometimes apply one of these chemicals to keep PNC damage sufficiently low. To control PNC, it is critical that sprays targeted against the caterpillars be carefully timed to the 1- to 2-day period between egg hatch and larval entry into the developing nutlets. As the appearance of the first

### What insecticides may I use in my organic pecan orchard?

There are only a few insecticides available to organic pecan growers. Before applying a chemical, be sure to compare the pesticide *formulation* to an up-to-date list of approved pesticides, since approved active ingredients often appear in formulations not approved for organic use. The Organic Materials Review Institute (OMRI) maintains such a list, but the final decision about whether a pesticide is approved rests with your certifier. Check with your certifier before you spray, and list pesticides you may want to use in your annual certification application. The following is a list of some insecticides currently approved for use in organic pecan orchards:

- Oil extracted from neem tree (*Azadirachta indica*) seeds has both repellent and insecticidal properties against a number of insect species. One chemical component of neem seed extract, azadirachtin, is commercially available under the trade names Aza-Direct® and Neemix®. Neem oil and azadirachtin can assist in aphid population management in organic pecan orchards.
- Pyrethrum, an extract from plants of the genus *Chrysanthemum*, has long been used as an insecticide. It can be useful for aphid control in pecans, but its insecticidal activity decreases quickly after it has been sprayed in an orchard. An approved pyrethrum formulation is sold under the trade name Pyganic®.
- *Bacillus thuringiensis* (Bt) bacterial proteins are insecticidal against caterpillars and have been used with limited success for controlling PNC. Bt residual activity is short, making application timing especially critical with this insecticide. Organic Bt formulations are commercially available under such trade names as Javelin® and Dipel®. Other Bt products are available, but if you use them you may be asked by your certifier to provide verification that these were not derived from genetically engineered sources.
- Spinosad, a fermentation product of the bacteria *Saccharopolyspora spinosa*, effectively controls PNC. Currently the cost of spinosad, when used at label-prescribed rates, is significantly higher than that of Bt insecticides. An approved spinosad formulation is sold under the trade name Entrust®.

**Remember: even natural chemicals can be dangerous!** In order to effectively and safely use pesticides, it is always important to follow directions on the label.

<sup>5</sup>See Guide H-653, *Biological control of pecan nut casebearer and aphids in New Mexico pecans*, available online at [www.cahe.nmsu.edu/pubs/\\_h/H-653.pdf](http://www.cahe.nmsu.edu/pubs/_h/H-653.pdf)

PNC generation may vary between years by as much as two weeks, you should use pheromone traps and physical orchard scouting to determine when to spray. Temperature-based PNC emergence models are available for some parts of New Mexico and can also help to predict spray dates.

Weeds are both a blessing and a curse for New Mexico organic pecan orchards. Weed growth below the orchard canopy benefits the soils in various ways, and ground covers—including weeds—provide cover for beneficial insects in the orchard. However, weeds often interfere with normal orchard operations and compete with pecan trees for precious nutrients and water. Especially in young orchards, a weed-free area of at least a few feet should be maintained around the base of each tree.

Assuming care is taken not to damage tree trunks, methods such as cultivation (e.g., discing or hand hoeing) and flaming with a propane torch are simple and effective non-chemical management practices organic pecan growers can use to maintain weed-free areas around pecan trees, or even an entirely weed-free orchard floor. However, some of these non-chemical approaches to weed management are highly labor intensive and are practical only for very small orchard operations. There is one approved herbicide currently allowed for use in organic operations and registered for pecan orchards, a contact herbicide whose main active ingredient is clove leaf oil (trade name, Matran®).

If strips of weeds are permitted to grow between tree rows, those weeds should be mowed (or grazed) regularly so that they do not interfere with harvest and other orchard operations. The irrigation system you choose can also greatly affect your weed management program: compared with flood irrigation, micro-irrigation (e.g., drip or microsprinkler irrigation) that wets only part of the orchard floor significantly reduces orchard weed pressure.

### **Harvesting, Processing, and Storing Organic Pecans**

National organic program standards “address the methods, practices, and substances used in producing and handling crops, livestock, and processed agricultural products” (NOP Organic Production and Handling Fact Sheet), but give

little specific guidance to organic pecan producers regarding how harvesting and processing equipment is to be used. Cleaning harvesting equipment before use in an organically-certified orchard is necessary to prevent contamination of organic nuts with conventional nuts or prohibited substances. But harvesting equipment need not be exclusively dedicated to organic production.

As with harvesting equipment, an organic producer does not have to find a processor who handles organic products exclusively, but to maintain organic certification, a processor does need to ensure that equipment is clean and that organic and conventional products are neither mixed nor come into direct contact with each other. All handlers (first and subsequent processors) must implement measures necessary to clean processing equipment, prevent commingling of organic and conventional products, and protect organic products from contact with prohibited substances.

Most shellers segregate organic pecans into a separate area of the cold storage unit to avoid conflict, reduce record-keeping issues, and eliminate risk of accidental commingling. Check with your broker, sheller and subsequent processors to make sure that adequate precautions will be taken to segregate pecans in sepa-

#### **What organic labeling options exist?**

There are three primary options for organic labeling. Depending upon your choice of production, harvesting, and marketing opportunities, you must decide which one fits you best.

- **100% Organic** means that the product contains 100% organically produced ingredients.
- **Organic** means that the product contains at least 95% organically produced ingredients.
- **Made with Organic Ingredients** means that the produce contains at least 70% organically grown ingredients.

In the three-year period between commitment to organic certification and actual certification, pecans may be labeled *transitional*. In some markets growers may receive a price premium for transitional products relative to other conventional products.

rate areas of the storage facility and that adequate bulk labeling measures will be taken.

## Marketing Organic Pecans<sup>6</sup>

Organic pecans, like virtually all organic commodities, generally have a per-pound cost of production disadvantage relative to their conventional counterparts. Yields are often lower as a result of higher losses due to nutrient deficiencies and pests. Although chemical costs may be lower as well, reduced costs may not offset reduced yields. To maintain or exceed conventional profitability, an organic producer should receive price premiums or make use of special marketing opportunities.

Organic certification certainly opens new avenues

for sales without closing any others. Market opportunities are worth a great deal, a factor that is not always measured in sales price. To continue competitively, however, price advantages are necessary. So far, organic buyers are showing willingness to pay a premium at retail (and consequently at wholesale) for organic produce.

Plan on either using an established organic pecan marketer or spending a great amount of time on the telephone developing personalized local (as well as regional and national) contacts. First-time organic pecan producers are almost always better off selling pecans at established farmers' markets or by contracting the services of an established organic pecan broker—there is a steep learning curve in getting direct retail or wholesale organic or conventional product sales going.

When working with local, individual organic food markets, expect most sales to be in case sizes, but just a few cases at a time. Sales to chains (such as Whole Foods, Wild Oats, or Wal-Mart) may involve greater volume, but are very difficult to arrange, since those chains usually already have contracted with a supplier.

Organic pecans represent a small but growing segment of the pecan market. This suggests that room remains for additional market expansion. However, expansion will not come without a significant amount of individual work and effort. Overall, the outlook for all organic foods in the United States, Canada, Western Europe, and Japan is positive, both for market penetration volumes and for prices. Markets for organic and for conventional foods are distinct but not separate. Organic premiums cannot greatly exceed conventional prices; some consumers may switch back to conventional products if prices in the two market segments diverge too much.

### What marketing outlets can I use for my organic pecans?

- Organic pecans can be sold at farmers' markets or roadside stands. This requires that someone be present who can speak to customers and complete sales.
- Another attractive option is direct sales to consumers—through Internet or mail-order sales, through direct sales to retail grocery outlets (whether they specialize in organic produce or carry a broader range of foods) or through direct sales to restaurants.
- Organic pecan brokers are likely to be the best option for most organic nut producers, at least until the marketing landscape becomes more familiar. Organic pecan brokers typically offer a sliding price premium schedule, providing a high percentage price premium relative to conventional prices when conventional prices are low, and a small percentage (but higher dollar value) when conventional prices are high.
- International sales are possible, but because of the extensive paperwork required to move agricultural products through international markets, use of an established international food brokerage will generally be preferred for new organic marketers.

<sup>6</sup>To read more about ways to market your organic pecans, see Guide Z-307, *Marketing Channels for Pecans*, available online at [http://cahe.nmsu.edu/pubs/\\_z/Z-307.pdf](http://cahe.nmsu.edu/pubs/_z/Z-307.pdf)

*The purpose of this publication was to answer your questions about organic pecan production and marketing in New Mexico. Perhaps it has stimulated your interest in learning more about organic pecans, specifically, or about pecan production in general. You can find out much more about the particular cultural requirements for pecan trees by consulting your county Extension office or the NMSU College of Agriculture and Home Economics website ([www.cahe.nmsu.edu](http://www.cahe.nmsu.edu); click on “publications and videos”) for viewable/printable pecan publications in addition to those cited here.*

## **SOURCES & FURTHER ONLINE READING**

Agricultural Marketing Service, USDA ([www.ams.usda.gov](http://www.ams.usda.gov)).

ATTRA—National Sustainable Agriculture Information Service ([www.attra.org](http://www.attra.org)).

Economic Research Service, USDA ([www.ers.usda.gov](http://www.ers.usda.gov)).

Food Marketing Institute ([www.fmi.org](http://www.fmi.org)).

New Mexico Organic Commodity Commission ([nmocc.state.nm.us](http://nmocc.state.nm.us)).

Organic Materials Review Institute ([www.omri.org](http://www.omri.org)).

Organic Trade Association ([www.ota.com](http://www.ota.com)).

Sustainable Agriculture Research and Education ([www.sare.org](http://www.sare.org)).

*References to chemical tradenames contained in this publication do not constitute endorsements of those products by the authors or by New Mexico State University.*

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## NOTES

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