Pecan Orchard Fertilization

Guide H-602

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The size and quality of pecans are influenced by the leaf-nut ratio (the number of leaves per nut). Roughly 10 compound leaves, each consisting of 9 to 13 leaflets, are required to produce and support a medium-size pecan. More are needed for large nuts. Pecan clusters are borne terminally on new shoots, and most of the leaves have already formed on a tree when the cluster develops. The soil needs to be fertile to stimulate this strong, vigorous growth and provide a generous number of leaves to support the tree and enable it to mature a good crop of pecans.

Sixteen essential elements are known to be needed for plant growth. However, most pecan research has shown increases in yield and nut quality only when a few of these elements are supplied to orchard trees. The greatest response reported has been from using nitrogen (N) on soils deficient in this element. Pecan trees are usually slow to respond to nitrogen fertilizer applications and response may not be apparent for several years, especially on fertile soils. Zinc (Zn) deficiency in pecans is well-known and occurs frequently in most pecan growing areas. Pecan trees with sufficient zinc tend to have bigger leaves than zinc-deficient trees. Foliar zinc sprays have become standard practice by most growers.

Response of pecans to phosphorus (P) and potassium (K) are reported infrequently, although these elements are used by plants in relatively large amounts. Because the pecan tree's root system invades a large volume of soil, it has been assumed that pecan trees need not receive some nutrients in large amounts, i.e., potassium, phosphorus, calcium (Ca) and magnesium (Mg).

This statement is true, in general, but soils vary in chemical composition, and a nutrient believed to be at adequate levels may be lacking in some soils. Soil and leaf analyses are helpful in determining causes of a problem or potential problems. It is highly desirable to have the right nutrient levels in the tree to prevent negative effects on tree growth and yield. Soil and leaf analyses help a grower learn about the fertilizer needs of pecan trees. Important factors to consider are:

Soil Analysis

- pH above 7 is found in most New Mexico soils and zinc and iron are not readily available at pH greater than 7.
- Salt accumulation (conductivity above 4 E.C. x 10^3 will impair water infiltration and will cause some stress on the trees.
- High sodium content (greater than 20 percent exchangeable sodium) will flocculate clay particles in soil, increase soil compaction and decrease soil permeability.

Leaf Analysis

- Mainly status of N,P, K, Zn, iron (Fe), and manganese (Mn)
- Indicates nutrients taken up by root systems rather than existing soil nutrients as indicated by soil analysis.
- In general, there are four basic factors to consider when developing a fertilizer program for a pecan orchard—the right kind, the right time, the right place and the right amount.

THE RIGHT KIND

Nitrogen

One source of nitrogen is not better than another. However, ammonium nitrate is believed to increase pH temporarily. Ammonium sulfate is suggested over other types of nitrogen because it acidifies (decreases the pH) in the soil. This results in Zn, Fe and Mg being more available to pecan trees, however temporarily.

Zinc

Zinc chelates are recommended over zinc sulfate when applied to the soil. Chelates release zinc slowly, making

it available to the root system before it is tied up by soil particles. Most zinc in zinc sulfate is tied up in the soil rapidly and is not available for pecan trees. Zinc sulfate is better absorbed when applied as foliar spray, especially when a foliarly formulated urea solution is used as carrying agent to improve leaf absorption. Zinc chelates also seem to be easily absorbed. A formulation combining nitrogen and zinc has also been successfully used to furnish zinc foliarly to pecan trees.

THE RIGHT TIME

Nitrogen

Recommended rates are usually applied in two parts, half in March and the other half in mid-June. Recent studies conducted at New Mexico State University confirm the high nitrogen losses through lixiviation (washed out of the root system). It is clear that all nitrogen fertilizers are converted to nitrates, and it is a fact that nitrates are water-soluble, therefore easily leachable.

Growers could have better use of the nitrogen fertilizer by distributing the recommended rate in several applications, especially in light (sandy) soils where the water-(and nutrient) holding capacity is very low.

Urea should not be incorporated in moist soil. If urea is applied on a moist soil and not incorporated, nitrogen will be lost through volatilization when converted to gaseous ammonia. Do not apply urea in sandy soils before irrigation, because irrigation water will leach urea out of the root zone.

Nitrogen applications late in the season have not negatively affected established pecan trees. Mature trees can be fertilized in late July or early August. However, do not apply nitrogen fertilizers to young trees after June, because it will delay leaf fall and result in winter injury. Young trees require more frequent nitrogen applications than bearing trees. Beginning with the second season, small nitrogen applications (1/4 to 1/2 pound of ammonium sulfate) can be applied every six weeks until June.

Time and nitrogen fertilizer rate are affected by crop load. More nitrogen is incorporated in the second application (if the rate is split in two) to give the tree a needed boost during nut filling. Also, during a season when trees have a heavy crop load, the nutrient reserves are depleted. During the following year, the nitrogen needs to be applied early in the season (early March) to be sure it will be available for early foliage growth. In those years when trees are in the "on" season (and the previous year was an "off" season), the trees have high nutrient reserves to start the season. The nitrogen fertilizer would be needed later than in the low-yield season.

Zinc

Because young leaves on the ends of shoots favor zinc absorption, the treatments should be applied in the early part of the season.

In **mature trees**, about four sprays are needed with the first spray at leaf burst (when leaves are unfolding), second spray 7 days after first spray, third spray 14 days after second spray, and fourth spray, 14-21 days after third spray. New flushes of growth should receive a zinc spray.

In young **trees**, follow the same schedule as recommended for mature trees but continue to spray every two weeks until the end of July (young trees continue to grow and new foliage needs zinc).

Potassium

Potash deficiency is not common. Both phosphorus and potash should be applied according to soil tests. With the exception of sandy soils annual applications usually are not necessary or recommended. Immediate response to potassium seldom occurs, even in soils shown to be deficient by analysis.

Phosphorus

Light-textured soils are likely to be deficient in phosphorus. Phosphorus becomes insoluble when reacting with soil and soil components (i.e. $CaCO_3$) in high pH soils. When superphosphate or 18-46-0 are applied annually over the soil surface or shallowly incorporated, it won't be carried down by the irrigation water; therefore it should be incorporated in the soil before planting. Annual applications of monoammonium phosphate (MAP) had been successful in other fruit trees, mainly because it is soluble and it travels down the soil profile. Foliage applications of soluble phosphorus specially formulated for foliar sprays are also recommended, if deficiencies are determined through leaf analysis.

THE RIGHT PLACE

Nitrogen

Be sure fertilizer is placed correctly to ensure all parts of the tree are well-nourished.

Place in feeder root zone 1 to 3 feet laterally from drip line in each direction. As the tree grows, the fertilizer application zone should be enlarged. Roots of pecan trees normally grow to about twice the spread of the branches and feeder root depth is approximately 6 feet, 18 inches deep. Nitrogen fertilizers are usually incorporated into the top 4-6 inches of soil, and irrigation water carries the fertilizer down to the root zone.

Do not apply urea on the soil surface because it will lose nitrogen by conversion of nitrogen to gaseous am-

monia. Urea should be incorporated into the soil. Place fertilizer in root zone around trees up to 7 years of age. Fertilizer can be spread over entire orchard floor from the seventh year on.

Zinc

Because lower leaf surfaces absorb more zinc, the sprays should be directed to the tree from the ground. Zinc will be absorbed and used by young, expanding leaves.

THE RIGHT AMOUNT

Nitrogen

The amount of fertilizer needed by a pecan tree depends on its size, age (young and smaller trees respond more to nitrogen fertilizer), production (the heavier the crop, the greater the response to fertilizer application), and soil type (pecan trees in sandy soils respond faster to nitrogen fertilizer). Cultural practices also influence the amount of fertilizer needed by the trees and will not offset the effects of shallow soil, inadequate irrigation or varietal adaptability.

Young trees. Rapidly growing trees require about 1 pound of ammonium sulfate per tree during June. Do not supply any nitrogen if trees are not growing fast. One pound to 11/2 pounds ammonium sulfate in early March and late June is recommended during the second year if trees are growing rapidly. Decrease the recommended rate to 1/3 if trees are growing slowly. From the third year until bearing, rate can be increased to 2 pounds per application for a total of 4 pounds per year for a tree. In sandy soils, the recommended rate can be split in thirds and applied in March, April and June.

A general rule of thumb for young fruit and nut trees, pecans included, is to apply about 1/4 pound of actual nitrogen per inch of trunk diameter measured 3 feet above soil line. Never place fertilizer on trunk or close to trunk. Keep fertilizer at least 12 inches away from the tree trunk.

Terminal growth should be 2-3 feet, reduce or increase nitrogen rates accordingly.

Mature trees. Apply 150-200 pounds of actual nitrogen per acre annually. Terminals on bearing portion of trees should be growing 6 to 12 inches per year. If growth is more than 12 inches, reduce nitrogen fertilizer. If growth is less than 6 inches, nitrogen is probably needed. If the trees have been hedge pruned or if several branches have been eliminated, lower the nitrogen application rate.

A general recommendation for nitrogen fertilizer applications during the "on" year is to apply half the recommended rate in April (100 lbs of actual nitrogen) and for the second application incorporate 5 lbs per every 100 lbs of nuts expected (100 lbs of nitrogen for 2,000 lbs of potential crop).

Zinc

Mix 2-3 pounds of zinc sulfate (36 percent) per 100 gallons of water for the spray mixture (should be mixed as a slurry in a 5-gallon can before dumping it into a sprayer). Add 1 1/2 quarts of urea formulation (32 percent liquid nitrogen). It aids in zinc absorption by leaf tissue. For the common liquid formulation of zinc and nitrogen, mix 11/2 quarts/100 gallons of water.

Iron

Iron chelates should be used whenever leaf yellowing (iron chlorosis) appears.

Iron sulfates can be sprayed if zinc sulfate is being applied. Both can be mixed using a comparable rate as desired above.

Sometimes a combination of minor elements (iron, manganese, magnesium and sulfur) is sold under different names. Apply 1 to 2 applications per year of this mix, along with the last two zinc sprays.

Phosphorus

Soil incorporation of 100 to 150 pounds of actual phosphorus before planting the orchard is usually recommended. Soil tests may indicate the specific amount needed. Applications of 100 lbs of MAP per acre in alternate years can also be helpful.

SOIL–BUILDING PRACTICES

In some instances, soil-building practices may be needed to improve soil texture in the orchard. This is one way to get better use of applied fertilizers and better water-holding capacity as well. Sowing cover crops is one of the practices more commonly used.

Pecan trees respond favorably to soil-building practices. One way to build soil organic matter and fertility is to grow a winter cover crop that will be plowed under in the spring. Barley is an excellent green manure crop when accompanied by applications of high-nitrogen commercial fertilizers. Legumes such as Hubam clover and sour clover also are suitablewinter and spring cover crops. Alfalfa, although a good soil-building crop, is not recommended in a pecan orchard because it competes with the trees for moisture and nutrients. Do not deep plow an orchard because that destroys the tree's small feeder roots. Land may be fallowed with shallow disking to control weeds during the summer. Manure tends to cause deficiencies in some minor elements. However, sometimes manure is recommended to improve soil texture —the

use of compost may be a better option. Minor elements, especially zinc and manganese, should be incorporated into the soil in chelated form. When manure is applied, foliar sprays must be increased..

Sodding is not a common practice in commercial orchards like it is in homegrown trees. Young pecan trees growing in backyards and surrounded by lawn areas usually show symptoms of nitrogen deficiency and grow slowly unless nitrogen fertilizers are applied regularly and grass growth is controlled by regular mowing. Water must be applied infrequently, but deeply, to the young trees to avoid moisture stress.

Young orchards should not be sodded. After the trees have developed to full production, sodding has some advantages. Permanent sod in the orchard will build up the organic matter of the soil. A moderate sod probably competes less with the trees than a heavy growth of annual weeds. Sod cover reduces surface evaporation so soil moisture can be maintained at more constant levels. During the first two or three seasons of sod management, extra nitrogen fertilizer is needed to maintain tree growth. Occasional mowing to control weeds during the first two or three seasons may be needed. Sodded orchards need more nitrogen fertilizer than those under clean cultivation. If water penetration is a problem, shallow cultivation with a chisel every two or three years may be necessary.

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