Fertilizing Pecan and Fruit Trees

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Plants require nutrients for growth and fruit production. Fertilizers furnish nutrients and may be applied to infertile soils to correct nutrient deficiencies. Deficient fertility can cause poor shoot growth and reduced fruit set. The trees also become susceptible to damage by insects, such as borers.

The vigor of pecan and fruit trees can be stimulated by cultivation, heavy pruning, irrigation, and application of fertilizer. The best combination of these practices should be employed to provide the vigor necessary for optimum fruit and nut production.

Orchard Fertility Program

Time Period	*Step*	*Fertility Practice*
Pre-plant	1	Soil test (routine plus micro-nutrients) and adjust pH and all nutrient elements except nitrogen.
	2	Plant trees - fall or spring.
First year		The following rates per tree are suggested for a 10-10-10 fertilizer. If another grade of fertilizer is used, adjust amount used according to amount of nitrogen contained, i.e., approximately half the amount listed below would be needed if a 19-19-19 fertilizer were used.
	3[a]	Wait until trees begin to grow before applying any fertilizer (April). Apply the fertilizer in 3 equal amounts about 2 weeks apart. If trees are not actively growing omit later fertilizer applications. Adequate water and weed control is more important than fertilization during the first year. APPLE: 1 lb. PEACH: 1 lb. PECAN: none to 2 lbs. 3-6 foliar sprays of zinc[b], 10-20 days apart during first half of growing season may be required.
Second year	4[a]	Fertilizer should be divided into 3 equal parts and applied during March, 2 weeks after budbreak and 2 weeks later. APPLE: 2 lbs. PEACH: 2 lbs. PECAN: 1 to 3 lbs. 3-6 foliar sprays of zinc[b], 10 to 20 days apart during first half of growing season may be required.
Third year	5[a]	Fertilizer should be divided into 3 equal parts and applied during March, 2 weeks after budbreak and 2 weeks later. APPLE: 3 lbs. PEACH: 3 lbs. PECAN: 2 to 4 lbs. 3-6 foliar sprays of zinc[b], 10-20 days apart during first half of growing season may be required.
Subsequent years	6	Collect leaf samples during July.
	7	During March, make fertility adjustments to pecan and fruit trees according to analyses of leaf samples collected (Step 6).
	8	During July, collect leaf samples from pecan and fruit trees.
	9	Soil test (routine) every 5 years or when requested by leaf analysis recommendations.

[a] Spread fertilizer in a band about 24 to 36 inches long, 18 to 24 inches from the trunk..
[b] Zinc sulfate (2 lbs of 36% zinc sulfate per 100 gallons water) or commercially prepared zinc materials may be used according to the manufacturer's recommendations.

Excessive fertility can cause limb breakage, poorly colored and soft fruits, and delayed ripening and bearing. More than the required amount of each nutrient may harm the plant. Fertile soils will supply adequate levels of the essential nutrients to plants throughout the growing season. Fruit and nut production cannot be improved by fertilizing these soils. March is the preferred time to fertilize pecan and fruit trees in Oklahoma. In the case of peaches, which are especially vulnerable to spring frosts, and pecans, where spring flooding may be an issue, a split application of fertilizer may be advisable. The last application on peach can be made following fruit set when the danger of frost is past. The second application on pecan should be during early to mid-May to ensure rapid nutrient uptake.

When trees lose their flowers or fruit due to spring frost, they usually require less fertilizer for that year. Reduce recommended nitrogen rates by ½ to ¾, but maintain the recommended phosphorus and potassium rates. On pecan, continue your normal zinc program.

Nitrogen should be spread evenly from the trunk to the canopy drip line, or if applied with a spreader directed to a similar area the length of the row. Avoiding spreading nitrogen in the row middles will reduce the amount of nitrogen required and the frequency of mowing required. For pecans, phosphorus and potassium should be applied in a band 6 to 24 inches wide about mid-way between the trunk and drip line.

Heavy pruning of fruit trees during the dormant season produces an effect similar to applying nitrogen. When a tree is pruned heavily, fertilization may be reduced or omitted that year.

The visual appearance of individual trees is often a useful guide to the trees. This requires regular "walkin' and talkin'" with the trees. Leaf color, quantity and retention, and shoot length and diameter are significant measurements of growth. They usually offer a clear picture of the tree's nutritional condition. Look at your trees!

Fertility programs for proposed orchards can easily be developed in sequence by the chart shown on the previous page. For established orchards, begin the fertility program by obtaining a soil test, performing step 6 and continuing with steps 7 and 8.

Orchard Pre-Plant Recommendations Based on Soil Test Results:

Phosphorus and Potassium. Pre-plant correction of phosphorus and potassium levels in the soil can be made according to Table 1. These rates are corrective and should be applied only once. Subsequent applications should be based on analysis of leaves.

Magnesium. Table 2 provides magnesium soil correction recommendations for new orchards. If lime is required and magnesium soil levels are low, dolomite is a logical lime to use. This magnesium-containing material can supply much of the magnesium needs.

Zinc. Zinc may be unavailable to fruit and pecan trees in high pH soils (7.0 and above), even though soil tests indicate adequate levels. In this case, zinc should be supplied directly to the trees via foliar application.

Soil application recommendations of zinc are given in Table 3.

Calcium. Generally, calcium will never be deficient unless soil pH is extremely acidic, in which case lime should be applied according to the soil test's buffer index. The applied lime will bring the available calcium up to an adequate level.

Table 1. Pre-plant recommendations of phosphorus and potassium based on soil test.

Phosphorus Soil Test lbs./Acre	*P_2O_5 lbs./Acre*	*Potassium Soil Test lbs./Acre*	*K_2O lbs./Acre*
0	80	0	150
10	60	75	100
20	40	125	75
40	30	200	50
65	none	250	none

Table 2. Pre-plant recommendations of magnesium based on soil test.

Magnesium Soil Test lbs./Acre	*Magnesium lbs./Acre*
0	100
100	50
150	0

Table 3. Pre-plant zinc fertilizer requirements based on soil test.

Soil Test Value (ppm)	*Level*	*36% zinc sulphate lbs./Acre*
0	low	10
.5	medium	8
1.0	marginal	6
2.0	adequate	none

Iron. Iron levels less than 4.5 indicate a possible deficiency. Correction of a deficiency is dependent upon the type of tree and soil involved and should be handled on an individual basis.

Manganese. Manganese levels less than 1 ppm indicate a deficiency. Deficiencies on pecan have been identified on sites near the Red River. These have been effectively corrected using foliar application of 6 lbs/acre of $MnSO_4$ applied as the leaves unfurl in the spring and then 2 to 3 weeks later.

Lime. Soil acidity for both pre-plant and established orchards can be corrected by applying the recommended amount of lime given in Table 4.

Soils with pH readings less than 5.8 should be corrected to more neutral conditions by applying lime. This can be done by referring to Table 4 and locating the appropriate soil buffer index reading. The recommended amount, given in tons per acre, of dolomite, agricultural lime, or hydrated lime will correct the soil pH to 6.8.

Liming of orchard soils is most effective when lime is mixed into the soil. A lime application is usually effective over several years.

Do not over-lime because higher pH conditions frequently result in zinc and iron deficiencies.

Table 4. Rates of lime to apply to correct soil acidity.*

Soil Buffer Index	*Dolomite Tons/Acre*	*Agricultural lime** Tons/Acre*	*Hydrated lime Tons/Acre*
7.1	0.4	0.8	0.4
7.0	0.6	1.2	0.6
6.9	0.9	1.7	0.8
6.8	1.1	2.0	1.0
6.7	1.2	2.3	1.1
6.6	1.7	3.2	1.6
6.5	2.3	4.2	2.0
6.4	2.8	5.2	2.5
6.3	3.3	6.2	3.0
6.2	3.8	7.0	3.4

* If more than 2 tons per acre are needed, the amount should be divided and applied over two or three years.

* Rate is based on an effective calcium carbonate equivalent (ECCE) of 60%.

Leaf Analysis

The most reliable indicator of fruit and pecan tree fertility needs is chemical analysis of the foliage, commonly called leaf analysis. This service is available through the county Extension centers throughout Oklahoma. For a list of the county Extension offices - http://countyext2.okstate.edu.

Leaf analysis may be used to diagnose or confirm a particular nutrient problem in an orchard after symptoms are present. More importantly, leaf analysis can determine nutrient shortages or excesses before symptoms develop and yield is reduced. Frequently, it reveals that certain fertilizers being used are not needed, resulting in a more economical fertilizer program.

Pecans, peaches, and apples are included in the OSU leaf analysis program. Each sample will be analyzed for 1) nitrogen, 2) phosphorus, 3) potassium, 4) calcium, 5) magnesium, 6) manganese, 7) iron, and 8) zinc. Specific fertility recommendations based on results of the leaf analysis will be made available to the grower by OSU horticulturists. If the soil pH has not been determined within the past five years, a soil test may be useful. Otherwise, a soil sample will not be necessary unless indicated by the leaf analysis recommendation.

Procedure for Submitting Leaf Samples

Leaf sample bags may be obtained from OSU county Extension centers throughout Oklahoma. These offices are usually located in the county seat town. A charge per sample is made to cover costs of the analysis.

Taking Leaf Samples

Accuracy of diagnosis depends upon accuracy of sample collection. Each leaf sample should represent a condition rather than a certain acreage. It may represent one tree or several acres. The trees selected for each sample should be representative of the acreage or condition and the condition should be uniform as to soil and management practices.

You must judge the uniformity of your own trees to determine the number of samples necessary for accurate recommendations.

Sampling Guides for Apple, Peach, and Pecan*

1. Collect all leaf samples during **July**.
2. Do not mix varieties or kinds of fruits into one sample. Native pecan trees of a uniform area may be sampled as one variety.
3. Before sampling, inspect selected trees for mechanical injury, mouse or gopher damage, winter injury, or wet feet. These factors could influence nutrient levels without showing the true nutritional condition of the tree or trees.
4. Apple and Peach—Collect 100 leaves for each sample.
5. Pecan—Collect 100 leaflets for each sample.
6. Collect leaves from shoots that are convenient from the ground and located on different sides of the trees. Do not collect leaves from suckers or water sprouts.
7. Do not collect more than two leaves from one shoot.
8. Select apple and peach leaves from the middle of current season's terminal growth (Figure 1).
9. Select the middle pair of pecan leaflets located on a middle leaf of current season's terminal growth (Figure 2).
10. Remove leaves with a downward or backward pull so that the leaf stem (petiole) remains attached to the leaf.
11. Avoid leaves that have insect, disease, or mechanical damage or leaves not representative of the sample.

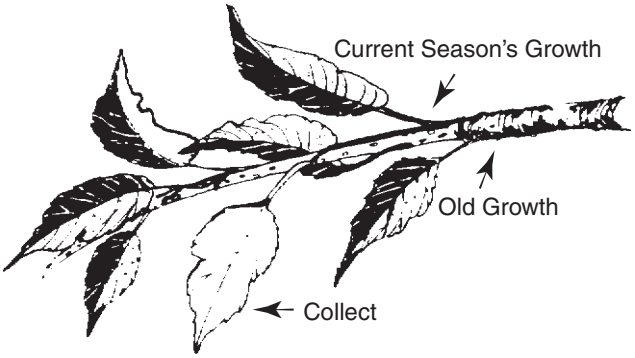

Figure 1. Apple and peach—Collect leaves from the middle of current season's growth.

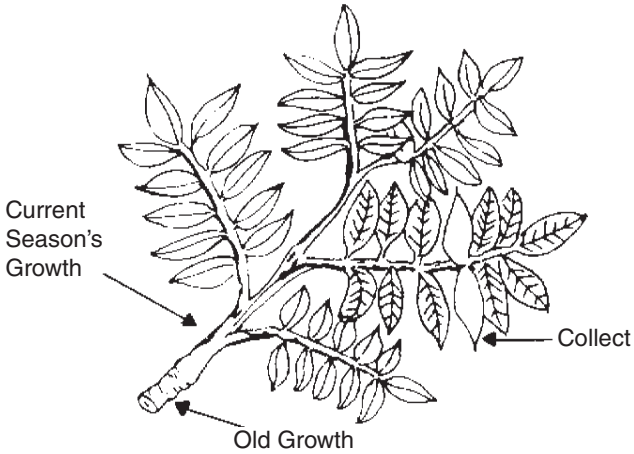

Figure 2. Pecan—Collect the middle pair of leaflets located on a middle leaf of current season's growth.

12. Do not use galvanized containers, rubber gloves, rubber sponges, or allow leaves to contact rubber material to prevent contamination of the sample with various elements.
13. Before the leaves wilt, wash them to remove spray residue and dirt. This may be done by dipping the sample in clear tap water, not exceeding one minute.
14. After washing, spread the leaves out to air dry until they will crumble. This will prevent molding. Do not expose the leaves to direct sun or allow them to heat in a bag while drying.
15. Place the dried leaves in sample bag and submit with sample identification to the county Extension office. Sample identification can be as simple as an identifying location or variety.

*Simple leaves are produced on apple and peach trees while the pecan leaves are compound. Each compound leaf actually consists of several leaflets. For simplification the term leaf is occasionally used to denote leaflet in the case of pecan.

General Recommendations

If leaf analysis results are not available, the following suggestions may be used as a guide for applying fertilizer. These fertility guides should be adjusted according to such variables as growth and fruiting characteristics, amount of pruning, and soil. Some common grades of complete fertilizers are 10-10-10, 10-20-10, and 12-24-12. In some situations an application of nitrogen alone may be adequate.

Apples. Apply about one pound of complete fertilizer per year of tree age (maximum of 10 pounds). When needed (according to fruit set), add three pounds of ammonium nitrate per tree in May. The annual terminal growth of bearing trees should be maintained at about eight inches in length, and fruit spurs should have about eight leaves.

Pears. Pears do best under medium or low fertility. High fertility increases succulent growth and susceptibility to fireblight disease. One-third to one-half pound of complete fertilizer per year of tree age, with a maximum of six or eight pounds per tree is sufficient under most conditions. Annual terminal growth of six to eight inches on mature trees is sufficient.

Peaches, Nectarines, and Apricots. Each tree may need one pound of complete fertilizer per year of age, depending on shoot growth, (maximum six pounds). After the danger of frost is past, it may be advisable to add two to four pounds of ammonium nitrate or its equivalent per tree if a good crop is set. The annual growth of mature peaches and nectarines should be maintained between 10 to 18 inches in length.

Plums. One pound of complete fertilizer per year of age (maximum eight pounds) for each tree may be used as a guide. No other fertilizers are normally needed.

Cherries. Fertilize with one-half to one pound of complete fertilizer per year of tree age, depending on tree vigor (maximum eight pounds per tree).

Pecans. Properly fertilized pecan trees will have an abundance of large, dark green, healthy leaves forming a full canopy. Most of the annual terminal growth on mature bearing pecan trees should be four to eight inches long. Young, nonbearing trees should make more growth.

The fertilizer needs of pecan trees can vary tremendously. For example, young pecan trees transplanted in deep, loamy, fertile soil may not need fertilizer addition the year of planting. In contrast, trees transplanted in non-fertile, shallow, upland, or very sandy soils may require annual fertilizer additions beginning the first year of transplanting.

The following are rule-of-thumb guidelines for fertilizing pecan trees in situations where leaf analysis results are not available:

- Individual trees may be fertilized at the rate of one pound of mixed fertilizer per year of age or inch of trunk diameter. Trees 15 to 25 inches in diameter may require two pounds of mixed fertilizer per inch diameter. The rate can be increased to three pounds per inch diameter on trees larger than 25 inches in diameter.
- Several pecan growers in Oklahoma apply 400 to 600 pounds of a mixed fertilizer per acre annually to mature native trees. If soil phosphorus and potassium levels are high, only nitrogen may be needed. In this case 100 to 250 pounds of urea per acre is commonly applied to satisfy nitrogen needs. Loss of nitrogen as a gas from urea is rapid if applied on wet soils at temperatures above 70 °F. Ideally, urea should be applied when rainfall is imminent. If other crops are grown under the trees, additional fertilizer should be applied to satisfy the specific crop needs.
- When zinc deficiency symptoms are critical, apply 36 percent zinc sulfate to the soil at the rate of one-half pound per inch of trunk diameter with a maximum of 10 pounds per tree per year. Effectiveness of soil applied zinc decreases as soil pH increases above 7.0.
- Zinc may be applied via foliar spray. This is especially expedient in soils of 7.0 pH and higher. Two pounds of 36 percent zinc sulfate can be added to 100 gallons of spray solution when spraying for insects and diseases. This rate assumes a dilute application rate of 300 gallons per acre. If less solution is applied per acre, adjust the rate of zinc sulfate accordingly. Two or four applications may be made during the first half of the growing season at 14- to 21-day intervals beginning at budbreak.
- Other sources of zinc such as chelate and oxide may be used. Commercial zinc materials can be applied as a foliar application to correct zinc deficiency. Use these zinc sources according to label directions.
- Fertilizers cannot compensate for poor growing conditions such as lack of moisture, inadequate disease or insect control, undesirable soil and sites, or poor varieties.

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