NITROGEN RECOMMENDATIONS FOR PECAN TREES
Nitrogen--a building block of amino acids, chlorophyll, nucleic acid, and enzymes.
Nitrogen-Essential for growth & tree development

- Mobile in plants, old leaves will be robbed to supply new leaves, resulting in overall pale green or yellow color.
- High levels in atmosphere. Small amounts of N2 gas infiltrate upper soil profile.
- Plants use NO3 and NH4 forms made available from soil mineralization and nitrification.
- NH4 is being continually created and converted to NO3 by certain biochemical processes mediated by biological components in soil (mineralization).
- NO3 is not stable in soil
  - Leached by irrigation & rainfall.
N contributes to tree vigor when other cultural conditions are met.

First year tree--struggling

Second year tree--thriving
Pecan leaves contain more N than any other element

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Smith, Rohla & Goff, 2012

Collect 50 central leaflet pairs.
All pecan tree organs use N

Leaves—A mature pecan tree canopy with 2.7% N in leaves may represent >1.0 lb actual N. Recycled to the orchard floor?

Branches—Bound in structural storage

Roots—Ongoing uptake, mobilization, storage
Pecan crop removal of N

- 5.5% of kernel-shell-shuck weight (Kraimer et al, 2001). 1% in shucks
- 55 lbs N/Acre needed for 1,000 pound crop
- 10 lbs N per 1000 lbs shucks could be recycled to the orchard
Net Positive Nitrogen

- To be perennially productive, the depletion of N by woody tissue growth, leaf, and fruit production must be offset by recapture, natural cycling, or intentional fertilization.
Sources of nitrogen for small orchards

- Grass clippings from mowing
- Unused fruit
- Mulch decomposition
- Soil-fixed nitrogen from clovers and other legumes
- Manure from grazing animals
  - Potential Salt Damage; Excessive Phosphorous
  - Food Safety concerns
- Composted manure and other organic materials
  - Food Safety concerns
- Natural materials
  - Blood meal (13%), Bone meal (4%)
- Inorganic fertilizers
  - Ammonium sulfate, 13-13-13, etc.

Unquantified and tested sources of organic fertilizers deliver N slowly and with great variation.
Anhydrous Ammonia
- Most cost efficient
- Gaseous form must be injected into the soil

Urea (46%)
- Dry form converts to volatile ammonia
- Must water-in timely manner (very water soluble)
- Incorporate by knifing or dribbling to stabilize
- Sulfur and other polymer coatings extend delivery

UAN (28-32%)
- Urea ammonium nitrate—liquid
- Drench into soil or inject through drip system

Ammonium Sulfate (21%)
- Delivers sulfur and acidifies soil
- Volatility when applied to wet soils

Ammonium Nitrate (33%)
- Low volatility risk
- Delivers nitrate form—quick availability, leachable
- Can still be purchased in some areas.
In the first five years of development, annual N fertilization should be 1/10 to 7/10 pounds actual nitrogen per tree per year.

- 17 to 117 lbs Ammonium Sulfate per acre or equivalent
- Applied by fertigation
- Broadcast granules in expanding area: 5 x 5, 10 x 10 ft.

Split into multiple, small applications, ending by or before August 15th.
Rates for bearing orchards?

- Texas Pecan Handbook: 80-200 lbs/Acre/year
- NMSU Guide H-642: 150-200 lbs/Acre/year
- OK State (2017): 150-200 lbs urea/Acre/year (46% N)
- Univ. Georgia: 10 lbs/100 lbs expected nut yield (100-150 lbs/Acre/year)

Why Not Push It Higher? What happens at 400 lbs N/Acre?
Too much of a good thing

- N study in Texas with 400 lbs N/Acre reduced yield by 80%, doubled sticktight, and reduced nut size compared to 100 and 200 lbs N/Acre (Storey, McEachern, Stein, 1986).
- Excess N can create imbalance with potassium resulting in scorch symptoms.

Why Not Go Lower? What happens at low rates?
Past research studies have in some cases shown little difference between rates of 50 & 100 lbs/Acre and likewise between 100 and 200 lbs/Acre.
EFFECT OF APPLYING N THROUGH THE DRIP IRRIGATION SYSTEM ON PECAN TREE YIELD
Ray E. Worley*, J.W. Daniel, J.O. Dutcher, and K.A. Harrison, Department of Horticulture, University of Georgia Coastal Plain Experiment Station, Tifton, GA 31793

Nitrogen at rates of 112 or 224 kg·ha⁻¹ was applied to nonirrigated and drip irrigated mature pecan trees for 9 years. Some irrigated trees received 224 kg·ha⁻¹ N either all broadcast or ½ through the drip irrigation. Other drip irrigated trees received only 112 kg·ha⁻¹ all through the drip irrigation system. Fertigation was in 4 equal monthly doses beginning April 1. Irrigation increased yield for 2 years for Schley and 3 years for Stuart. Nut size was increased by irrigation in 6 years for Schley and 8 years for Stuart. Applying ½ N through the irrigation system caused no detrimental effect on yield or nut quality. The lower rate of N all applied through the drip irrigation system gave yield and nut quality as good as the higher rate either all broadcast or ½ broadcast and ½ fertigated.

Lower rate of N all applied through drip equaled higher broadcast rate.
After 16 Years……

Treatment rates cut in half for six years with no negative effect.

Soil pH and nutrients were lower in the wetted zone of the emitter than in the area not wet by the emitter. Soil pH, K and Mg were reduced in the 6-12” layer with irrigation.
N Fertigation----Why?

- It’s Texas
- Because Rainfall is Necessary for Incorporation of Ground Applications
- Because it is Highly Mobile in Soils and Subject to Leaching, In-Season Applications Can Be Made at the Time and Amount of Growers’ Choosing
What: UAN (Urea + Ammonium Nitrate)

- Comes as 28-32% N
- Safe, Easy to Handle
- Can Be Volatile if Left on Soil Surface
- 32% UAN Weighs 11.08 lbs/gallon
- One Gallon is Approximately 3.5 Units (Lbs Actual) Nitrogen
Timing of Nitrogen Fertilization: General Principles

- Should coincide with rain or irrigation to move into soil.
- Should be reapplied if heavy rainfall/flash floods occur after application (especially in sandy soils).
- Should coincide with plant need for N—(growth of some tissue).
  - Should be applied before biological event is visible, because of required soil conversion time.
  - Very few fast-acting nitrate forms available
- Should avoid making trees less freeze hardy by application in Fall of year.
Pecan Tree Fertilization Timing

- First application in March or around budbreak
  - Delay 3-4 weeks if anticipating On-Year.
- Second application in May/June as nut growth commences
- Third application in July as final dose for current year growth and nut production
- Fourth application mid August to mid September for next year return bloom if crop is heavy.
Quantitative Assessments: Soil Testing—(Every 1-3 years)

http://soiltesting.tamu.edu

Tells how past and present farming practices impacted soil chemistry?

pH--Nutrient availability--Salinity

http://soiltesting.tamu.edu
Leaf Sampling

- Digest leaves into their basic elemental composition percentages.
- Assess how current & previous year fertilizer (or lack thereof) directly influences trees in the orchard to either meet or exceed comparable benchmarks.
- Provides little help if not used as a comparison to known standards sampled at the same time (July).

One pinnately compound pecan leaf with 13 leaflets.
How to Sample

Find leaf at midpoint of branch in July

Collect 50 leaflet pairs
Leaf Washing Procedures

- 1. Send leaves directly to laboratory and request acid wash. OR
- 2. Wash leaflets in a 1% hydrochloric acid solution (Although it depends on the concentration of the muriatic acid, usually 2 TBSP /gallon of water will approximate a 1% hydrochloric acid solution.),
- Rinse in five separate distilled water baths and air dry before shipping.”

http://soiltesting.tamu.edu/
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Contact

- Monte.nesbitt@ag.tamu.edu
- (979-862-1218)
- Texas Pecan Short Course
  - January 22-25, 2024
  - AgriLife Register (tamu.edu)
If new trees are making new leaves and shoots, nitrogen only or complete fertilizers can be broadcast around trees to facilitate new vegetative growth.

Nitrogen delivery rates for first year trees are typically $\frac{1}{2}$ pound of ammonium sulfate (0.1 lb actual N) total. Or 1.0 pound 10-10-10 or 13-13-13. First application not before May of planting year and not later than August 15.

Second year trees can receive from 0.25 to 0.40 lbs actual N per tree if early spring growth is vigorous (species dependent—consult crop guides and fact sheets).