Texas A&M AgriLife Extension

NITROGEN RECOMMENDATIONS FOR PECAN TREES

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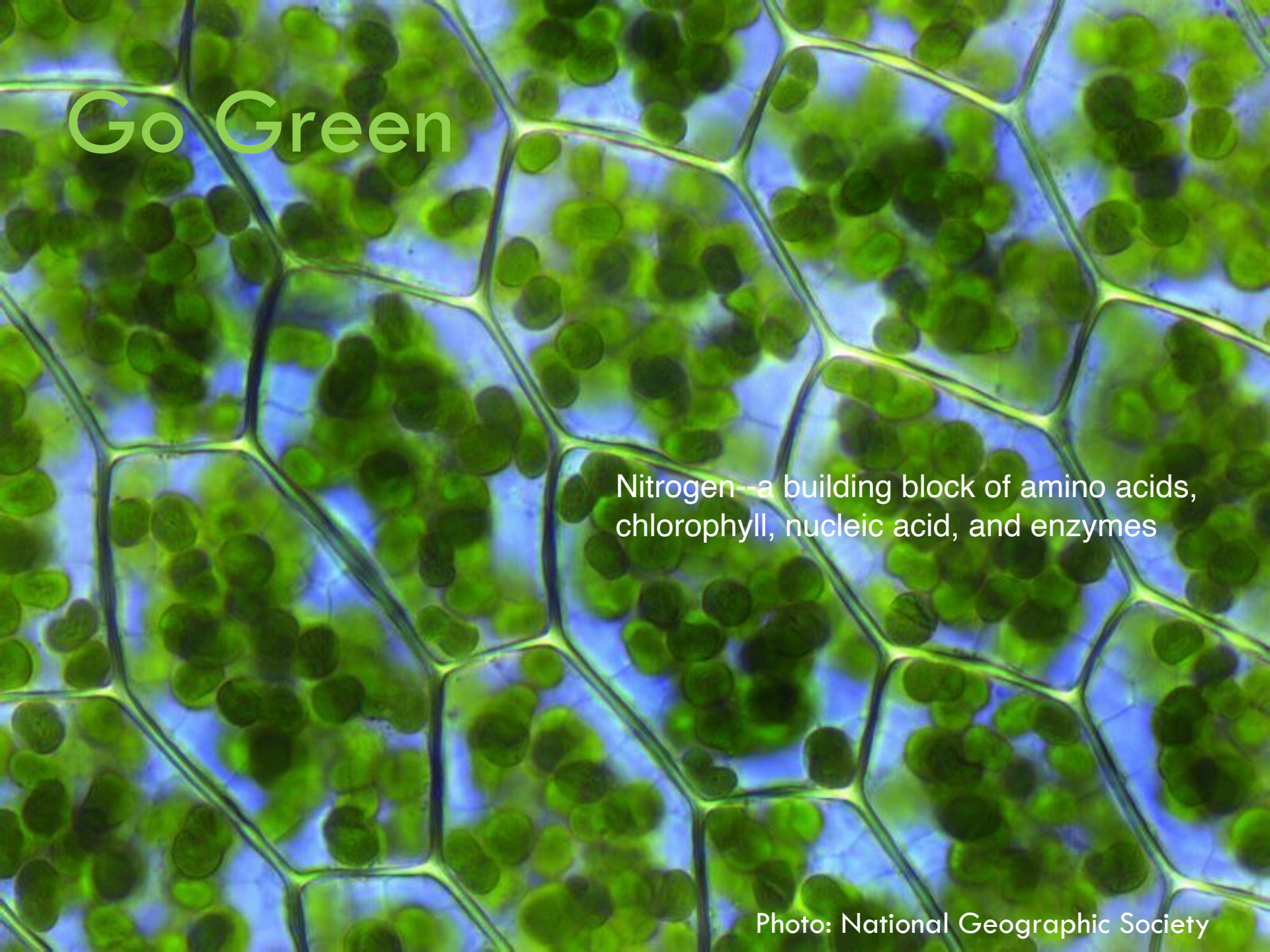
Go Green



Nitrogen--a building block of amino acids, chlorophyll, nucleic acid, and enzymes

Photo: National Geographic Society

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

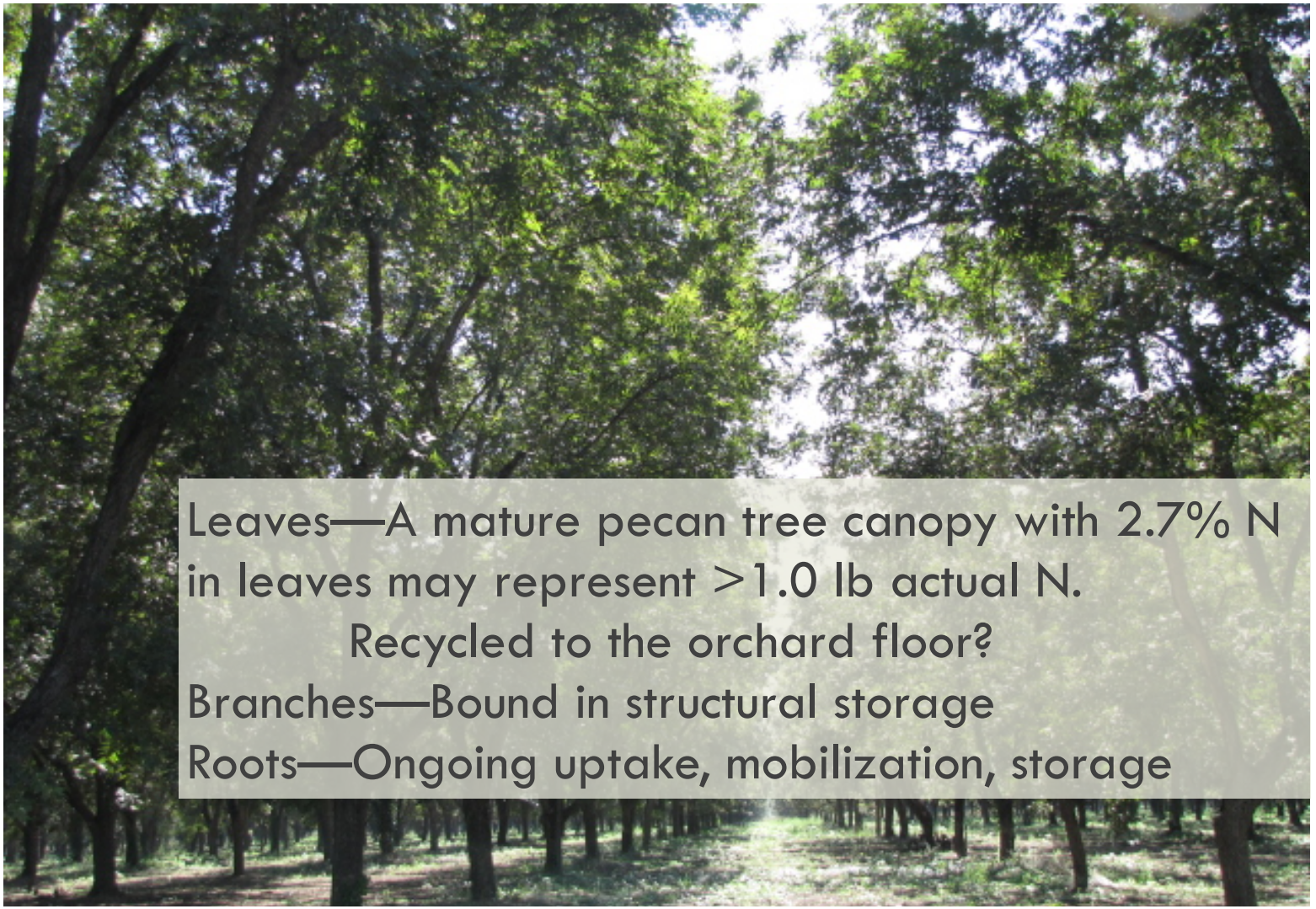
Pecan leaves contain more N than any other element

Element	Dry Wt. Concentration Texas
N-Nitrogen	2.4 to 3.0%
P-Phosphorus	0.14 to 0.30
K-Potassium	1.0 to 2.5
Sulfur	0.20 to 0.35
Calcium	0.70 to 1.75
Mg-Magnesium	0.30 to 0.60
Fe-Iron	50 to 300 ppm
Mn-Manganese	100 to 2000
Zn-Zinc	60 to 150
B-Boron	15 to 50
Cu-Copper	6 to 30
Ni-Nickel	>2.5

Smith, Rohla & Goff, 2012

Collect 50 central leaflet pairs

All pecan tree organs use N



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.

Commercial Orchard Sources

- **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.**

Young Pecan Tree Fertilization

- 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 sticktights, 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.

N Fertigation in Pecans-Successful since 1990's

102 vs 204 lbs N/Acre

EFFECT OF APPLYING N THROUGH THE DRIP IRRIGATION SYSTEM ON PECAN TREE YIELD

Ray E. Worley*, J.W. Daniel, J.D. 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.

FURTHER RESEARCH ON NITROGEN FERTIGATION OF PECANS

Ray E. Worley* and Ben G. Mullinix, Department of Horticulture, and Department of Statistical and Computer Services, University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31793-0748

After 10 years, application of 112 kg N/ha, divided into four annual applications and applied through the drip irrigation system (fertigated), provided nut yield and quality as good as 224 kg·ha^{-1} all broadcast or 1/2 fertigated and 1/2 broadcast. Leaf N was well above the 2.50% deficiency threshold. Treatment rates were halved for six additional years with no detrimental effects on yield and quality from fertigation. All treatments still provided leaf N well above the deficiency threshold. After 16 years of N fertigation there appears to be no serious reduction of pH or flushing of other nutrients [illegible] the emitter. Leaf and soil analysis indicate a l[illegible] area away from the emitter when N was b[illegible] nutrients were lower in the wetted zone of the emitter than in the area not wet by the emitter, and soil pH, K, and Mg were reduced in the 15- to 30-cm layer with fertigation. Leaf nutrient concentrations reflected the cation concentrations in the nonwetted area. Broadcast N was from NH_4NO_3 and fertigated N was from URAN (16% N from NH_4NO_3 and 16% N from urea).

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**

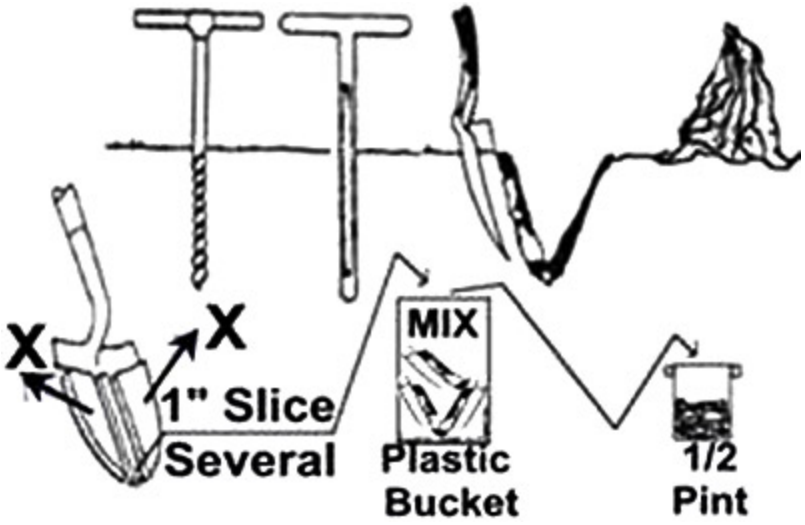
Timing of Nitrogen Fertilization: General Principles

- 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)



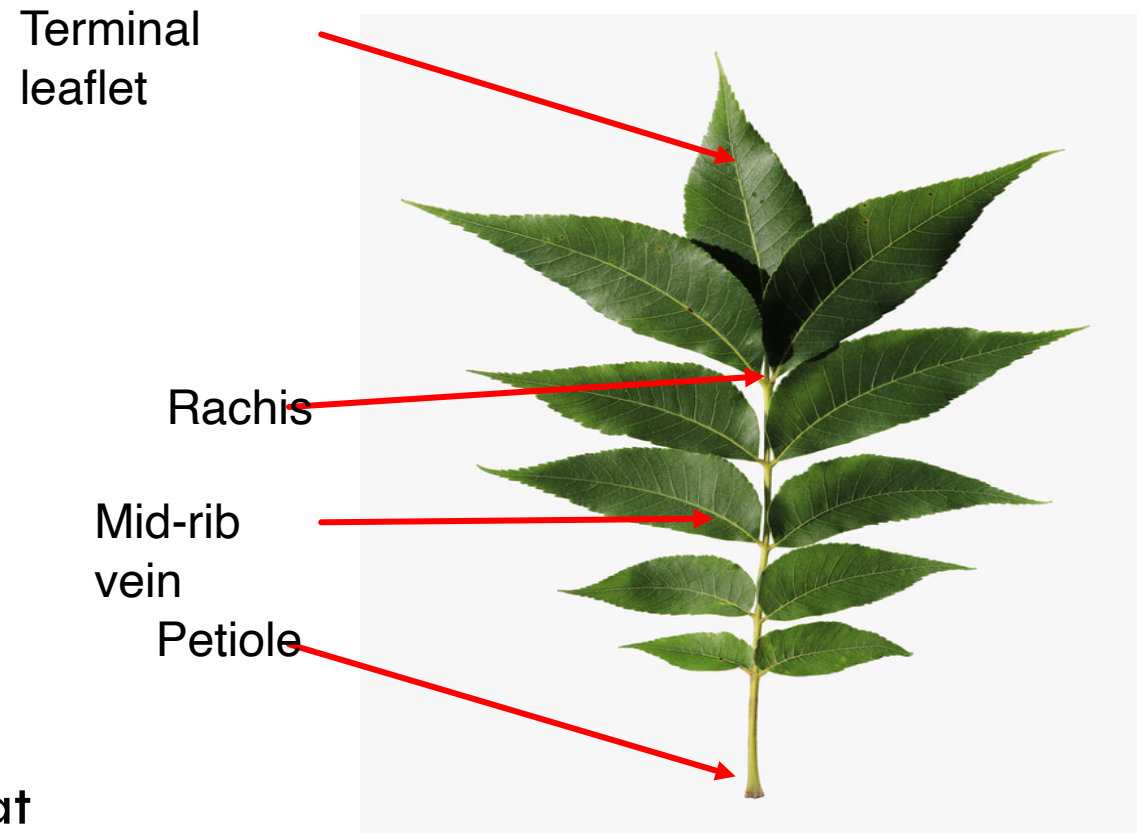
Tells how past and present farming practices impacted soil chemistry?

pH--Nutrient availability--Salinity

http://soiltesting.tamu.edu

Leaf Sampling

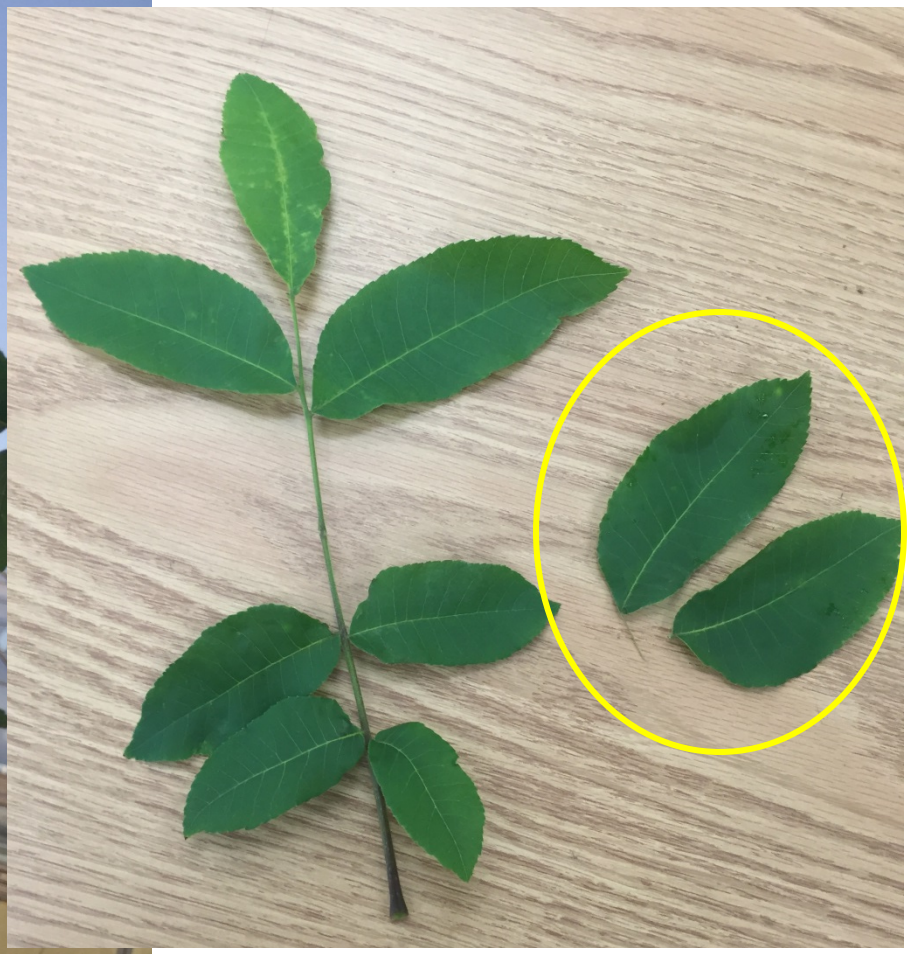
- Digest leaves into their basic elemental composition percentages
- Assess how current & previous year fertilizer (or lack thereof) ***directly*** influences trees in the orchard to either meet or exceed comparable benchmarks.
- Provides little help if not used as a comparison to known standards sampled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



One pinnately compound pecan leaf with
13 leaflets.

Find leaf at midpoint of branch in July

How to Sample



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."

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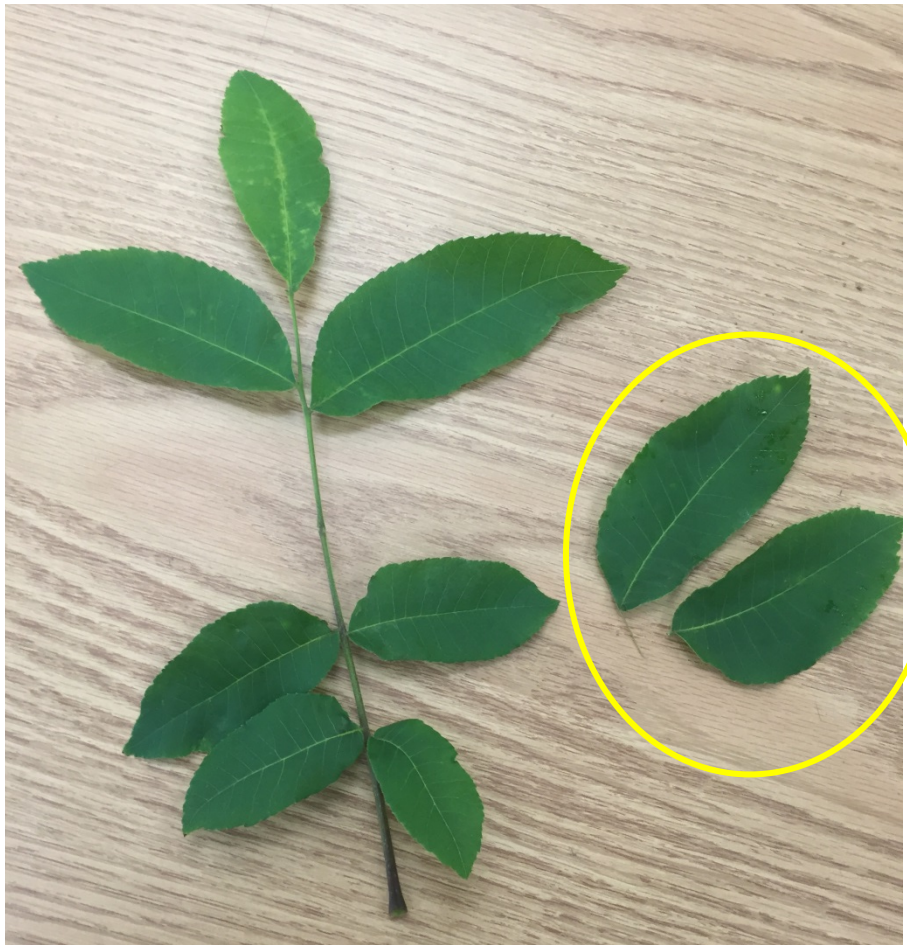
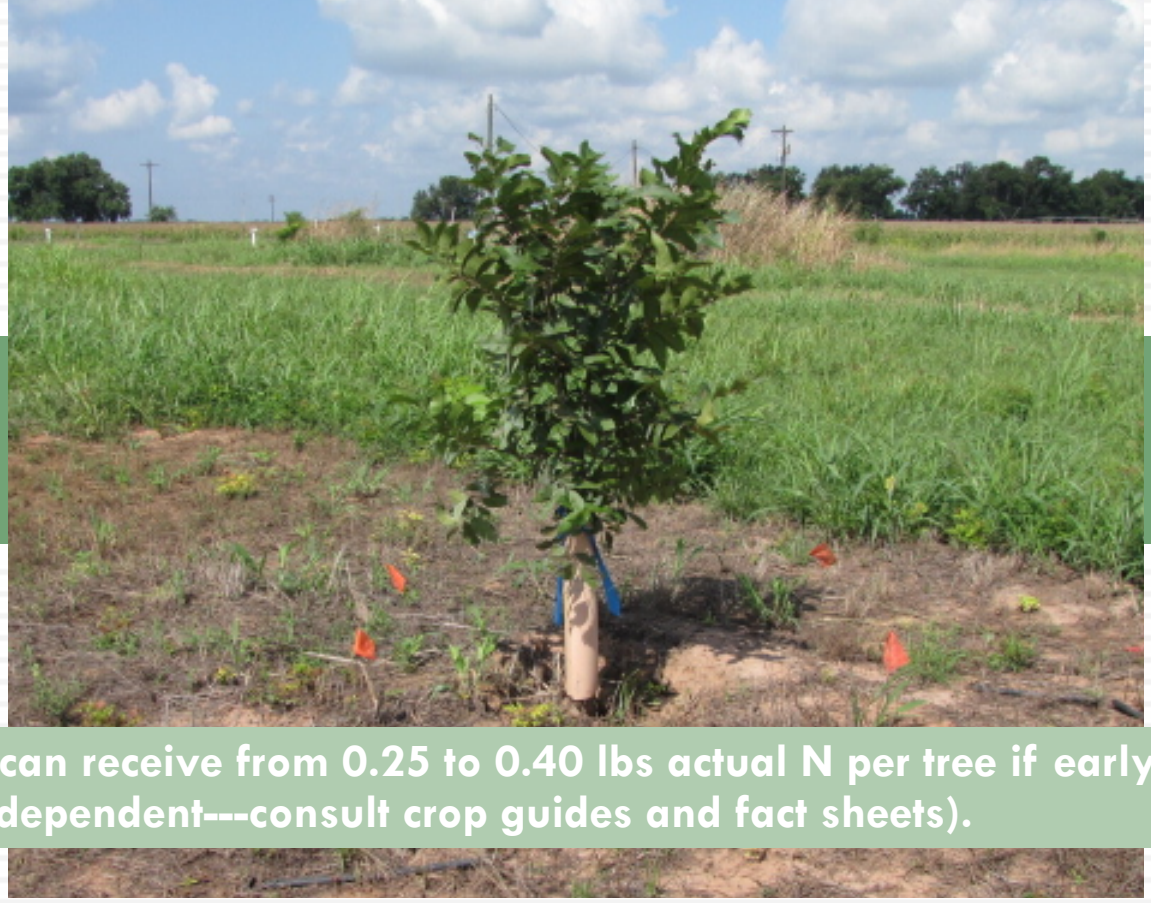


Collect 50 central leaflet pairs

Contact

- Monte.nesbitt@ag.tamu.edu
- (979-862-1218)
- Texas Pecan Short Course
  - January 22-25, 2024
  - AgriLife Register (tamu.edu)



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).

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 ½ 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.