

Pecan Fertilization

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Pecans are a Perennial Crop

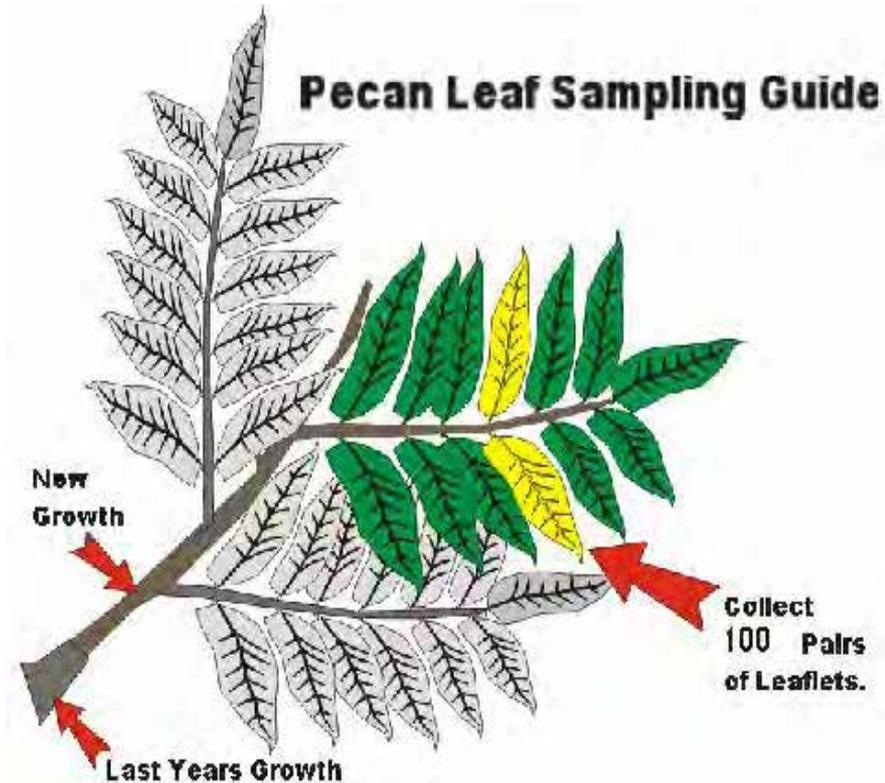
Not an Annual Crop

- Respond differently to inputs
- Orchard soils are not tilled
- Row Crops grow from seed or young plants
 - Birth, Growth, Death in 6-8 months
 - Everything you do to annual crops affects it that year
 - Effects on perennial crops are often delayed and long term



Leaf Sampling

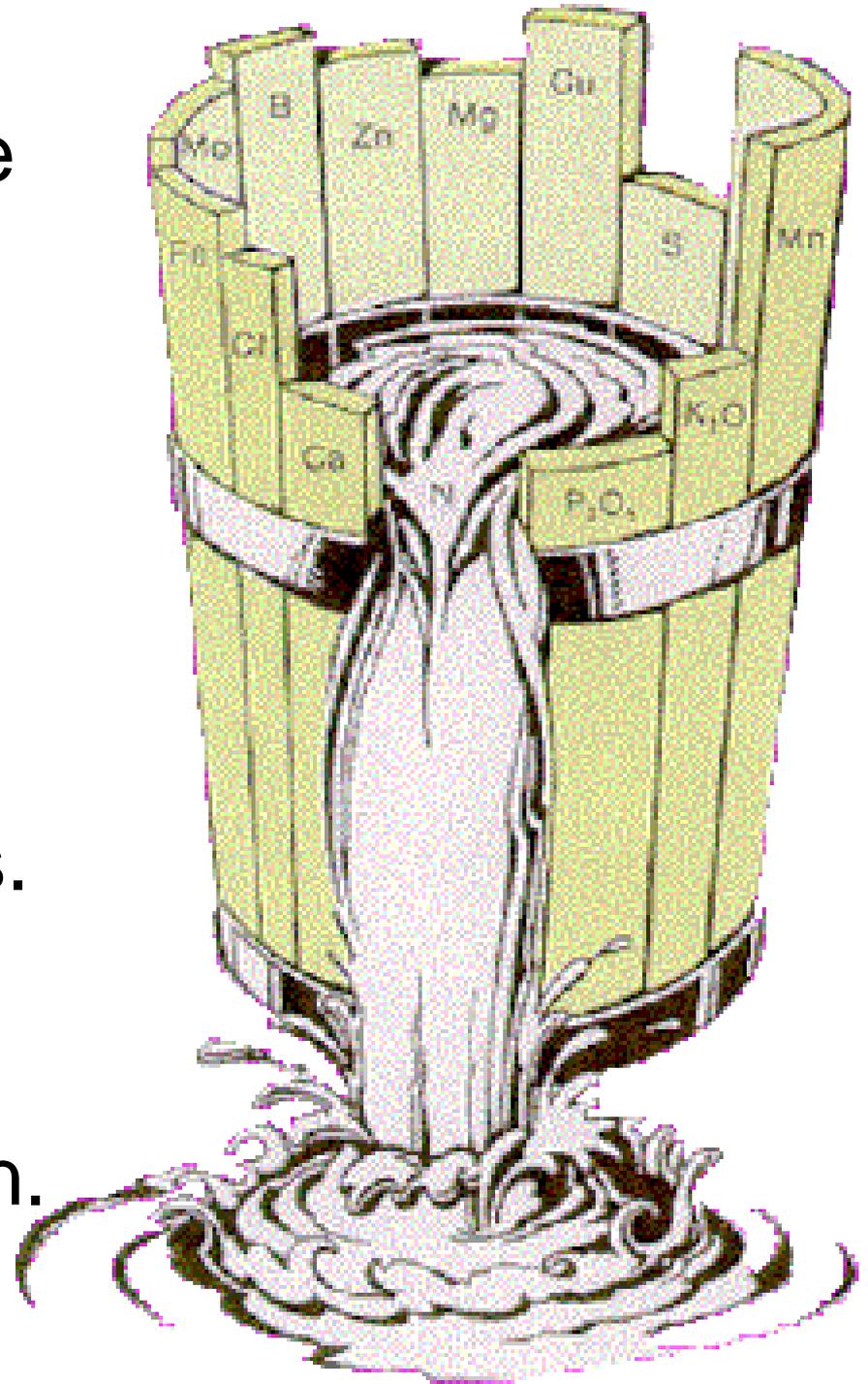
- Sample trees between July 7th and August 7th.
- Use terminal shoots exposed to the sun.
- Collect leaflets from all sides of the tree.
- Avoid leaflets damaged by insects and diseases.



Soil Sampling

- Useful for pH and toxicities
- Late Fall/Winter
- Sample uniform area
- 1 pint/sample (15-20 cores) over large area
- Sample to 8" depth

- Maintaining a balance among nutrients is essential.
- Excessive application of a nutrient will not increase growth or production and may cause other problems.
- Typically, the only nutrients needed annually are N and Zn.



Leaf Tissue Results

	Desired Range	Mean	% Low	% High	Sample Range
Leaf N	2.5-3.3%	2.77%	3	0	2.58-3.09
Leaf P	0.12-0.3%	0.14%	0	0	0.13-0.18
Leaf K ¹	1.25-2.5%	1.26%	45	0	1.04-1.50
Leaf Ca	1.0-1.5%	1.84%	0	48	1.37-2.36
Leaf Mg ²	0.35-0.6%	0.53%	7	0	0.32-0.66
Leaf S	0.25-0.5%	0.24%	3	0	0.22-0.28
Leaf Fe	50-300ppm	71.7ppm	0	0	50-142
Leaf Zn	50-100ppm	125ppm	7	34	41-292
Leaf B	50-100ppm	84ppm	0	20	50-146
Leaf Cu	6-30ppm	9.8ppm	0	0	6-14
Leaf Mn	100-800ppm	562ppm	0	21	190-1251
Leaf Ni	?	2.5ppm	?	?	1-11

Soil Sample Results

	Desired Range (lbs/A)	Mean (lbs/A)	% Low	% High	Sample Range (lbs/A)
Soil P	30-60	98.3	0	90	48-183
Soil K	100-150	153	0	34	94-361
Soil Ca	400-900	988	3	48	192-2241
Soil Mg	90-100	184	7	90	35-436
Soil S	10-50	26.6	3	0	4-41
Soil Fe	12-25	22.6	3	24	8-76
Soil Zn	15-20	25	28	55	3.9-55.3
Soil B	0.5-1.0	0.99	41	14	0.22-6.0
Soil Cu	0.5-1.5	1.1	14	10	0.2-7.2
Soil Mn	15-40	31.9	28	7	13-45
Soil Ni ¹	?	1.26	N/A	N/A	1-7
pH	6.0-6.5	5.96	41	12	5.3-7.0

How Often Should You Lime the Orchard?

pH	6.0-6.5	5.96	41	12	5.3-7.0
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- High N rates can lower pH in upper soil layers (2-3") in the short term
- Lime applied to surface raises soil pH in upper 2-3" only
- Once soil pH reaches 6-6.5 below surface layer, it tends to remain there for a long time
- There is **NO** research-based evidence for increased yield and growth of mature pecan trees with lime application (Hunter and Hammar, 1947; Johnson and Hagler, 1955; Hagler et al. 1957; Brooks, 1964; Hunter, 1965; Worley et al. 1972)
- Excessive liming can lead to Zn deficiency, mouse ear, and problems with K uptake
- Lime when pH is <6.0 or every 3rd year at most on SE Coastal Plain soils (6.0-6.5); Keep N rates between 75-125 lbs/acre
- Savings: \$20/acre

Nitrogen



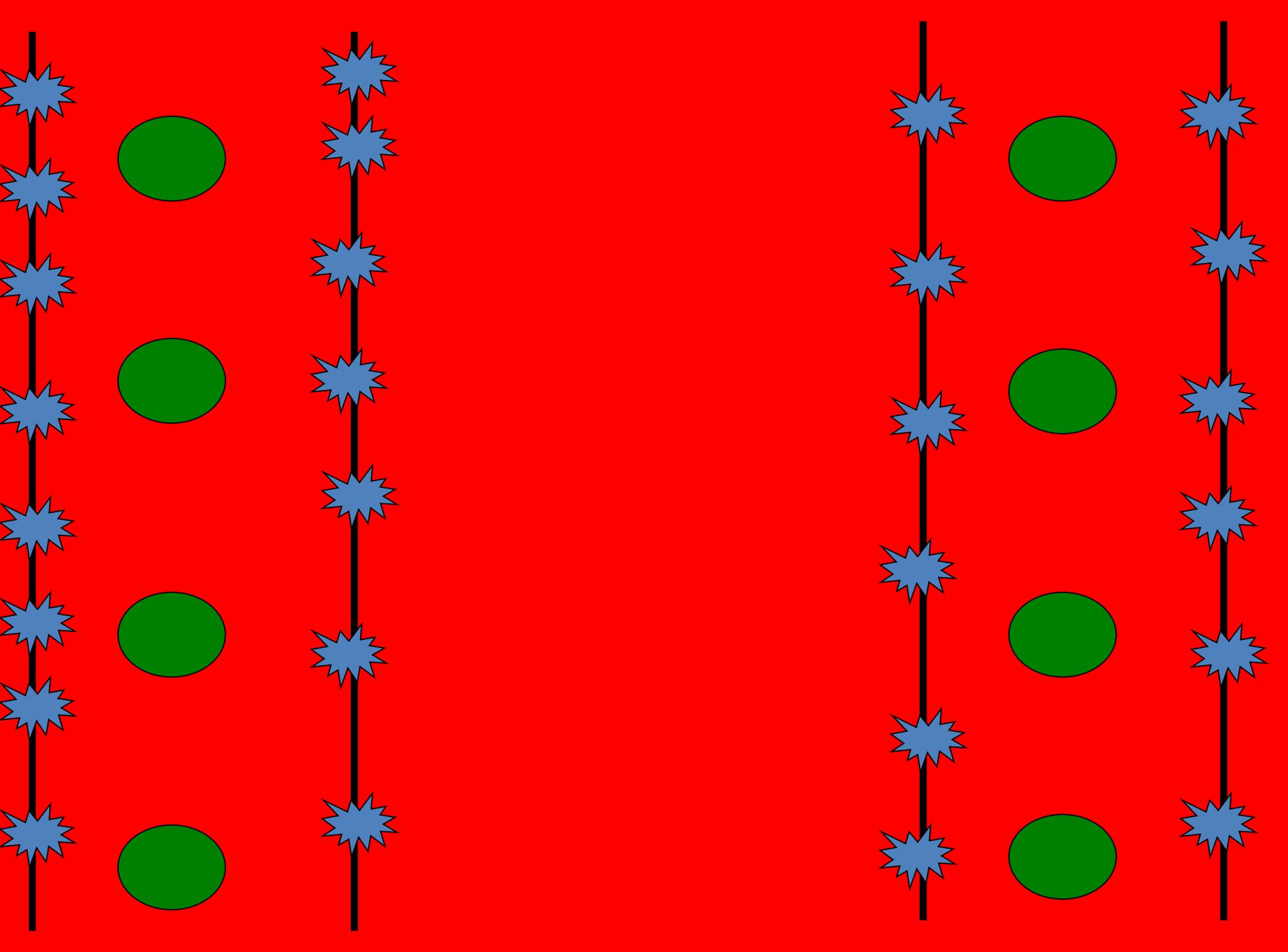
- Initial spring N used by developing foliage comes from storage pools within the tree.
- N demand will be greatest for “on” trees bearing a heavy crop load, since expanding leaves, shoots, and fruit create the greatest demand.

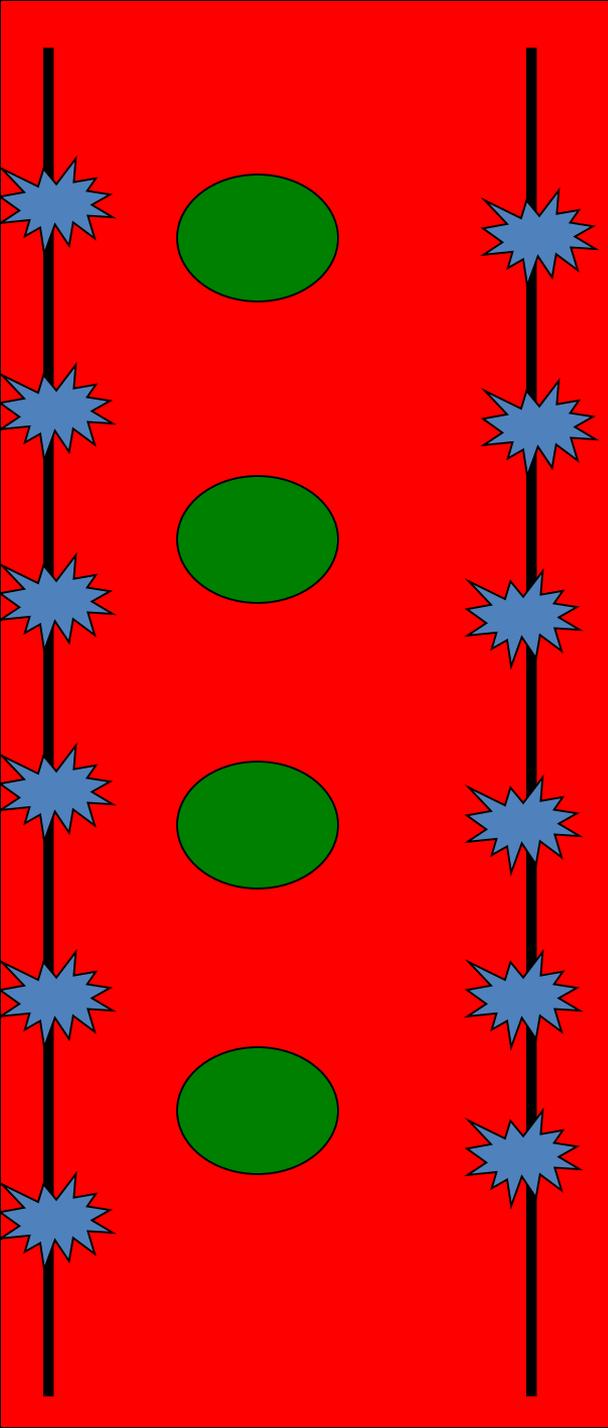
What's the Best Way to Fertilize Pecans with Nitrogen?

- Apply 75-125 lbs N
- Inject liquid N
 - 3 applications beginning in April (10 day intervals)
 - 1 application in June
 - 1 application in late August/early September if heavy crop
 - No more than 25 lbs N/acre/injection
- **Direct broadcast applications toward herbicide strip**
 - Base total acreage applied on width of spread, not on total size of orchard
 - Use rate of 75-125 lbs/acre on treated area only
- Eliminate late season applications of N with:
 - Poultry Litter Application in Feb/March or
 - Establishment of good clover stand for 3 yrs

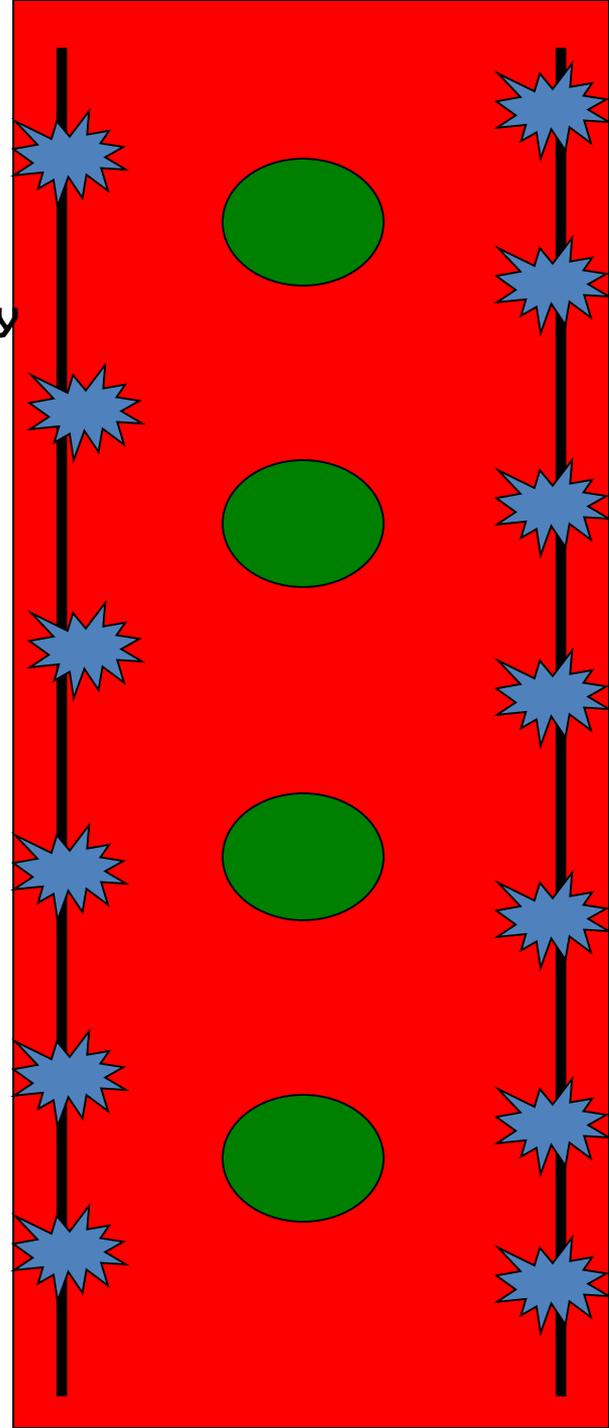
Sandy Soils: Increase rates by 25% and use multiple applications

**Dry-Land /Neglected Orchards:
Split March/June**





- 40 X 40
- 12 foot wide herbicide strip:
- $12/40 = 30\%$
- Can reduce area that you apply fertilizer to by 70% with band application



Phosphorus (P)

- **Phosphorus is rarely deficient**
 - **P movement in the soil is extremely slow**
 - **Young trees with small root system frequently respond to P**
 - **Drought stress can induce P deficiency on mature trees**
 - **Excess P can reduce Zn availability and some other minor elements.**



Leaf symptoms



Rating
1



Rating
3



Rating
5

Element applied	Trees with any necrotic leaf symptoms	
	29 Aug. 2009 (%)	Tree necrosis rating 4 Oct. 2010
None	66	3.7a
P	33	1.5b
K	100	3.3a
P + K	17	1.3b

Symptoms appear closely linked to P shortage, even in July.

Phosphorus removal during harvest

- **1000 LBS/ACRE YIELD**
 - 540 lb kernels – 1.5 lb P
 - 460 lb shell – 0.1 lb P
- **Total P removed = 1.6 lb/acre**

How Often Should You Soil Apply Phosphorous

	Desired Range (lbs/A)	Mean (lbs/A)	% Low	% High	Sample Range (lbs/A)
Soil P	30-60	98.3	0	90	48-183

- P relatively immobile and accumulates on soil surface in non-tilled soils
- 1000 lb/acre pecan crop removes 1.6 lbs P per acre
- Annual turnover
- **Yield response to broadcast application of P on mature pecan is extremely rare** (Alben and Hammar, 1939; Worley and Harmon, 1964; Sullivan, 1974; Worley, 1974; **Sparks 1988**; Smith 1991;)
- Rates of >13,000 lbs P/acre only slightly increased nut size
- No benefit to annual maintenance broadcast application of P to pecans in most managed orchards
- Savings: \$20.40/acre
- If soil P<30 lbs per acre, broadcast P
- If soil P>30 lbs/acre and leaf P<0.12, band P

Potassium (K)

- **Potassium is a common deficiency**
 - Pecans inefficiently absorb K
- **Deficiencies**
 - More common in sandy soils
 - Faster correction in sandy soils
 - Clays bind K so that K is very slowly available
- **Low potassium causes**
 - Symptoms more pronounced with large crops
 - Poor shoot growth
 - Irregular shuck opening
 - Poor nut quality with a low kernel oil content.
- **K, Mg, Ca are competitively absorbed — an excess of one can induce a deficiency of another**



Potassium (K)

- K is transported to nuts at leaf's expense
- 50-100 lbs K applied in February/March
- 1.25-2.5 ppm in leaf analysis
- Manage N/K ratio to 2:1
- Manage Mg---(No Dolomitic lime above .45% Mg)
- Deficiency most common on Desirable and Schley

Potassium removal during harvest

- **1000 LBS/ACRE YIELD**
 - 540 lb kernels - 2 lb K
 - 460 lb shell – 0.3 lb K
- **Total K removed = 2.3 lb/acre**

How Often Should You Soil Apply Potassium?

Soil K	100-150	153	23	34	94-361
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- 1000 lb/acre pecan crop removes 2.3 lbs K per acre
- Annual turnover
 - 70% of total nutrient content of fruit returned to soil in shucks (Sparks, 1975)
- **Yield response to broadcast application of K on mature orchards is extremely rare** (Hunter and Hammar, 1947; Hunter and Hammar, 1948; Sharpe et al. 1950; Sharpe et al., 1952; Hunter, 1956; Gammon and Sharpe, 1959; Hunter and Hammar, 1961; Worley, 1974; Worley, 1994)
- No real benefit to maintenance broadcast application of K in most mature managed orchards
- Savings: \$23.40/acre
- If soil K drops below 100 lbs/acre: broadcast K
- If soil K is >100 lbs/acre and leaf K is less than 1.1: band K
 - Need to keep leaf K at 2:1-2.5 ratio with leaf N, but broadcast application will not increase leaf K to 1.25



Zinc



45. Interveinal chlorosis and undulating margins of pecan leaflets with mild zinc deficiency. (Courtesy R. D. O'Barr)

- Necessary for shoot elongation, leaf expansion, and yield
- Formulated Zinc Sprays or 2 lbs Zinc sulfate + 4 lbs Urea
- Begin 2 wks after budbreak until shoot elongation complete



How Often Should You SOIL-apply Zinc?

Soil Zn	15-20	25	28	55	3.9-55.3
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- Most Coastal Plain soils not planted to pecan are very low in Zn
- Most mature orchards have high soil Zn levels
- Zn is immobile in soil
- Broadcast Zinc Sulfate when soil Zn is <15 lbs/acre
- If soil Zn >15 lbs/acre and leaf Zn<50 ppm or visible rosette: band Zn
- Savings: \$25/acre
- Make annual foliar Zn applications



Mouse Ear

- Nickel Deficiency
 - Zinc Management
-
- **Apply 1 pt/A in spring (April) while canopy is developing (parachute stage);**
 - **2nd application: 1 pt/A 30-60 days after 1st appl.**
 - **Third application of 1.5-2 pts/A in late Sept.-early October before leaf fall to prevent mouse ear in the spring flush.**





Boron

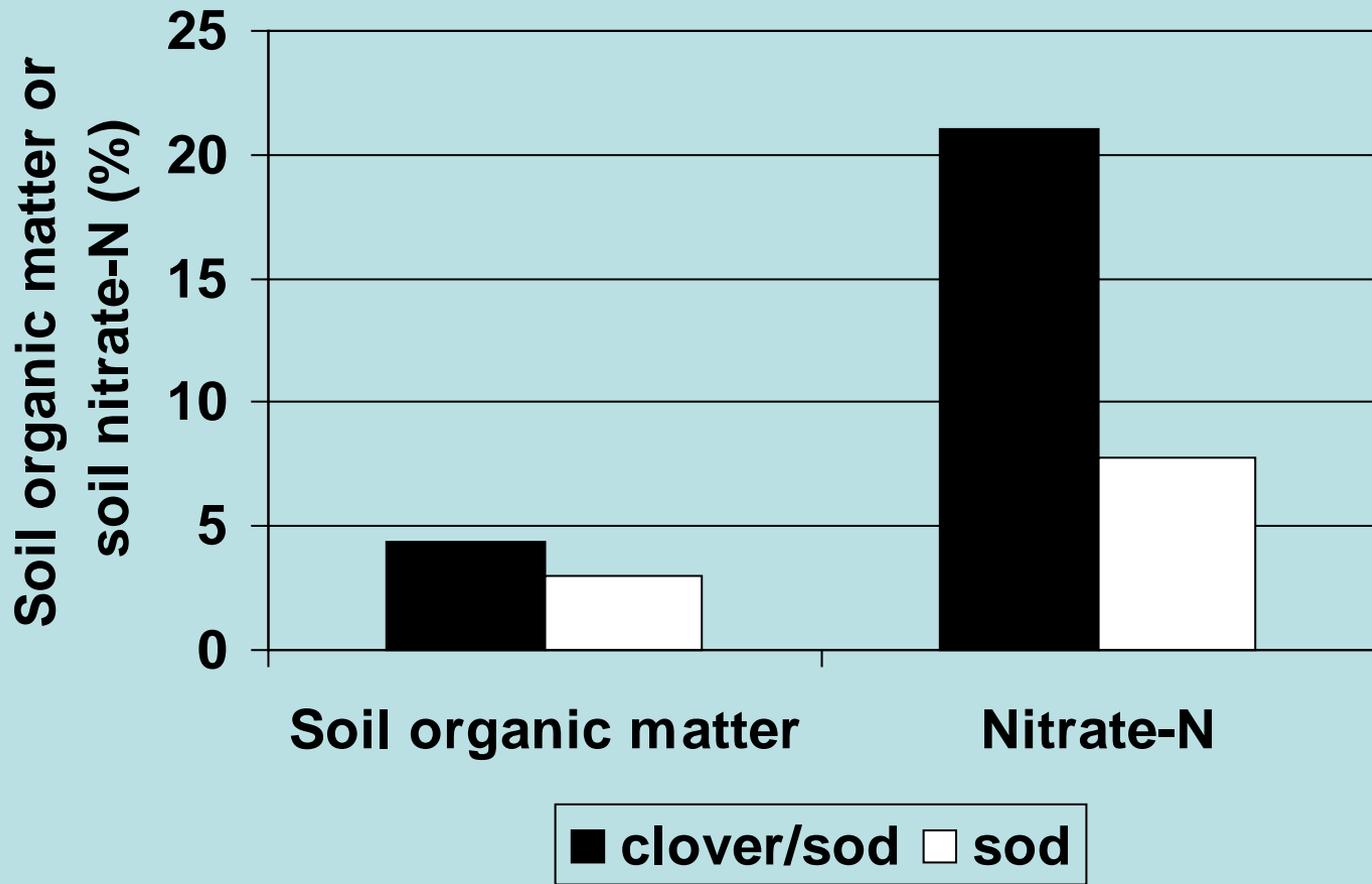
- Foliar B application improves fruit retention and percent kernel in the absence of noticeable B deficiency
- Poor mobility of B to flowers
- 3 sprays beginning with 2nd spray
- Timing of applications should be during the pre-pollination stage

Iron (Fe)

- Fe deficiencies are common in spring
- Cool, wet conditions increase Fe shortages – interferes with transport in the plant



- High concentrations of P, Mn, Cu, Ni or Zn can induce an Fe shortage.
- Can be corrected with foliar applications of FeSO_4 or Fe chelates.

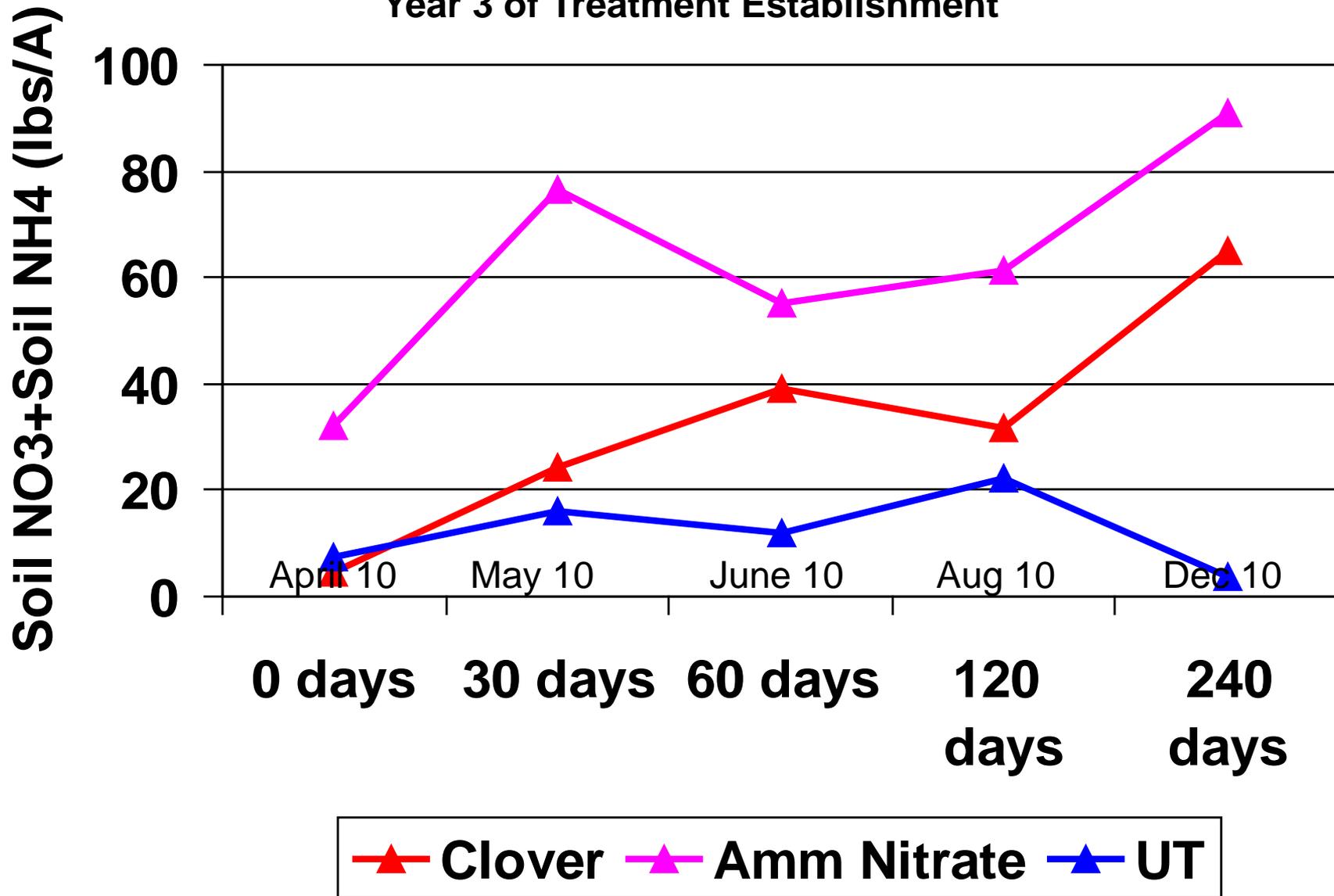


Crimson Clover:
 70-130 lbs N
 3500-5500 lbs dry matter/A

White Clover:
 80-200 lbs N
 2,000-6,000 lbs dry matter

2010 Nitrogen Availability

Year 3 of Treatment Establishment



If you maintain clover in row middles, apply N to herbicide strips



Summary

- Crimson clover contributes about 30 lbs additional N per acre early in the establishment phase; this number increases with time
- Clover also enhances organic matter and biological activity of soil
- Clover competes for water during dormant season and at budbreak but helps maintain soil moisture in summer
- Clover can provide adequate late season N, but fertilizer application is necessary in spring where clover is used



Chicken Litter

- Have sample analyzed
- Typically:

N	60 lbs/A
P	60 lbs/A
K	40 lbs/A
Ca	30 lbs/A
Zn	0.6 lbs/A
Cu	0.6 lbs/A



Nutrients are organically bound

- 60% (36 lbs N/ton) is available for crop uptake during the season.
- Excellent for building up weak land

Chicken Litter



- 1 ton/A of poultry litter -- February

DO NOT APPLY AFTER MAY!!!

Within the first 3 years of using poultry litter, apply additional N in spring (50-75 lbs/acre)

Questions?

