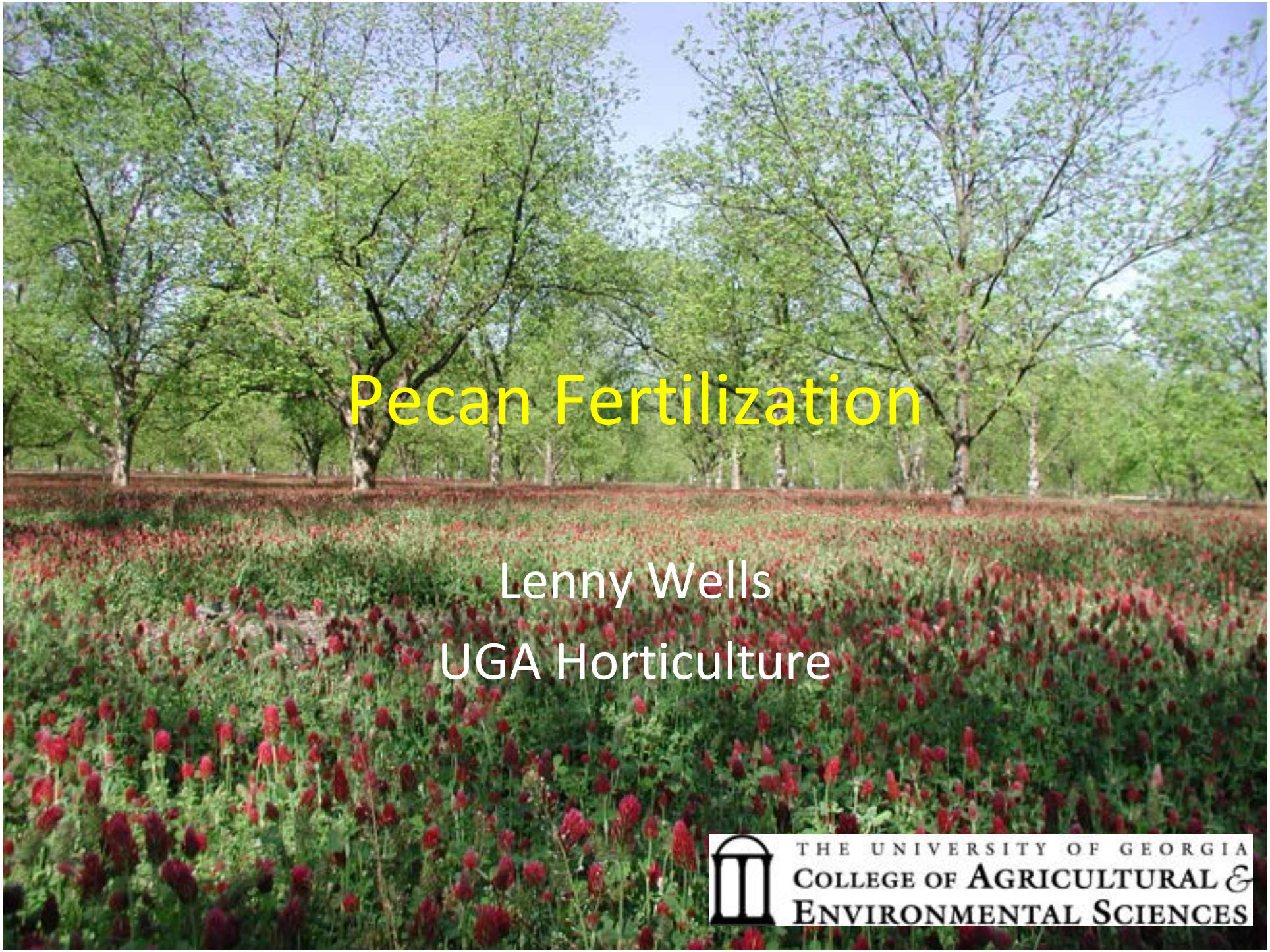
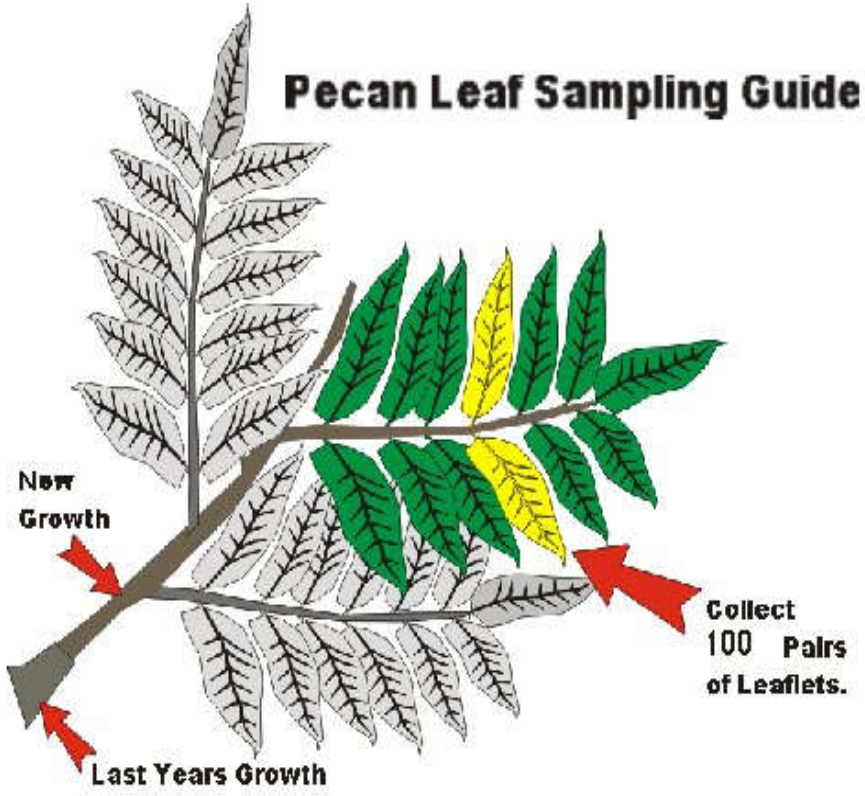

Pecan Fertilization
Lenny Wells
UGA Horticulture
THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

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

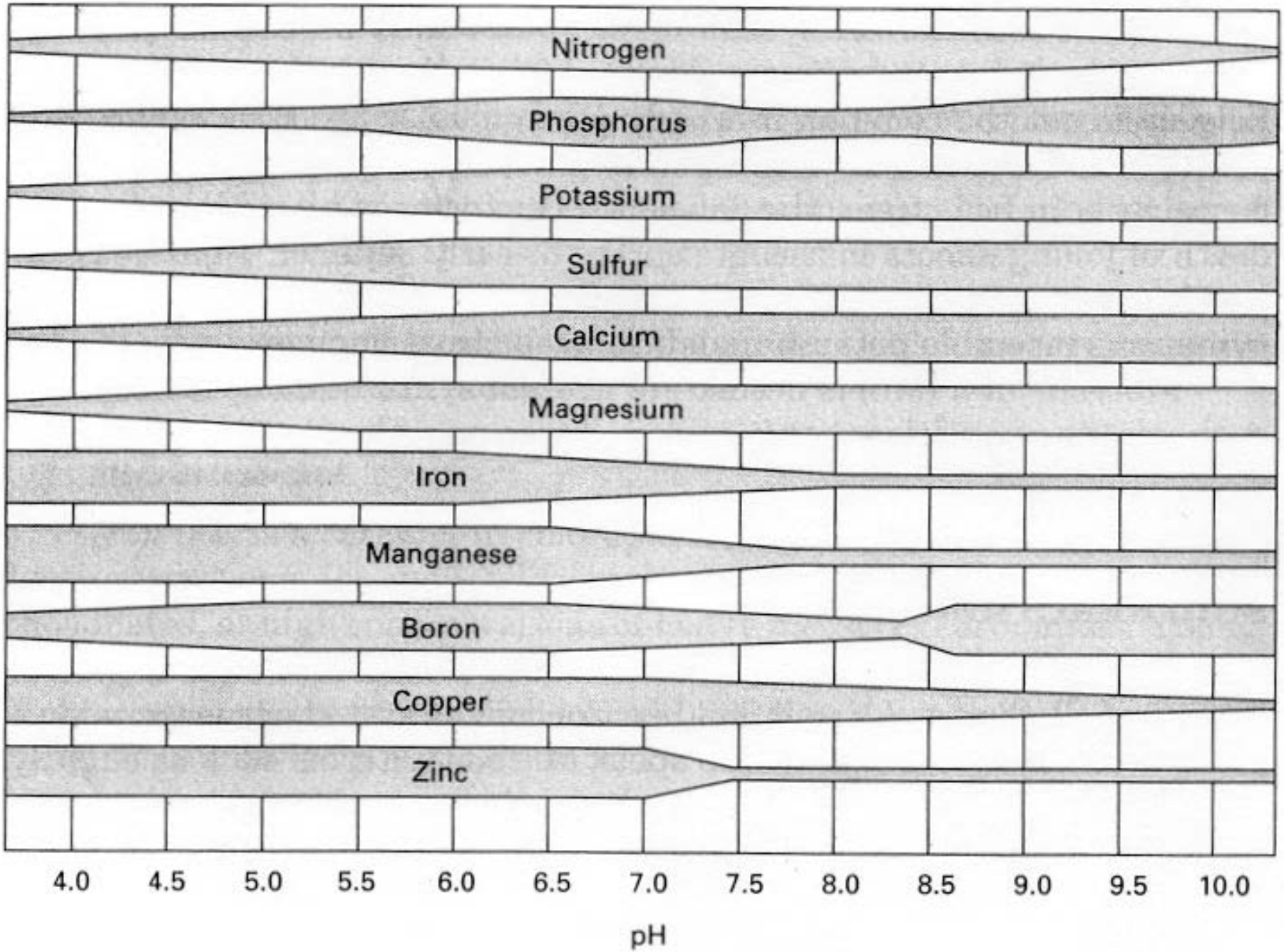
Leaf Sampling

- 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.

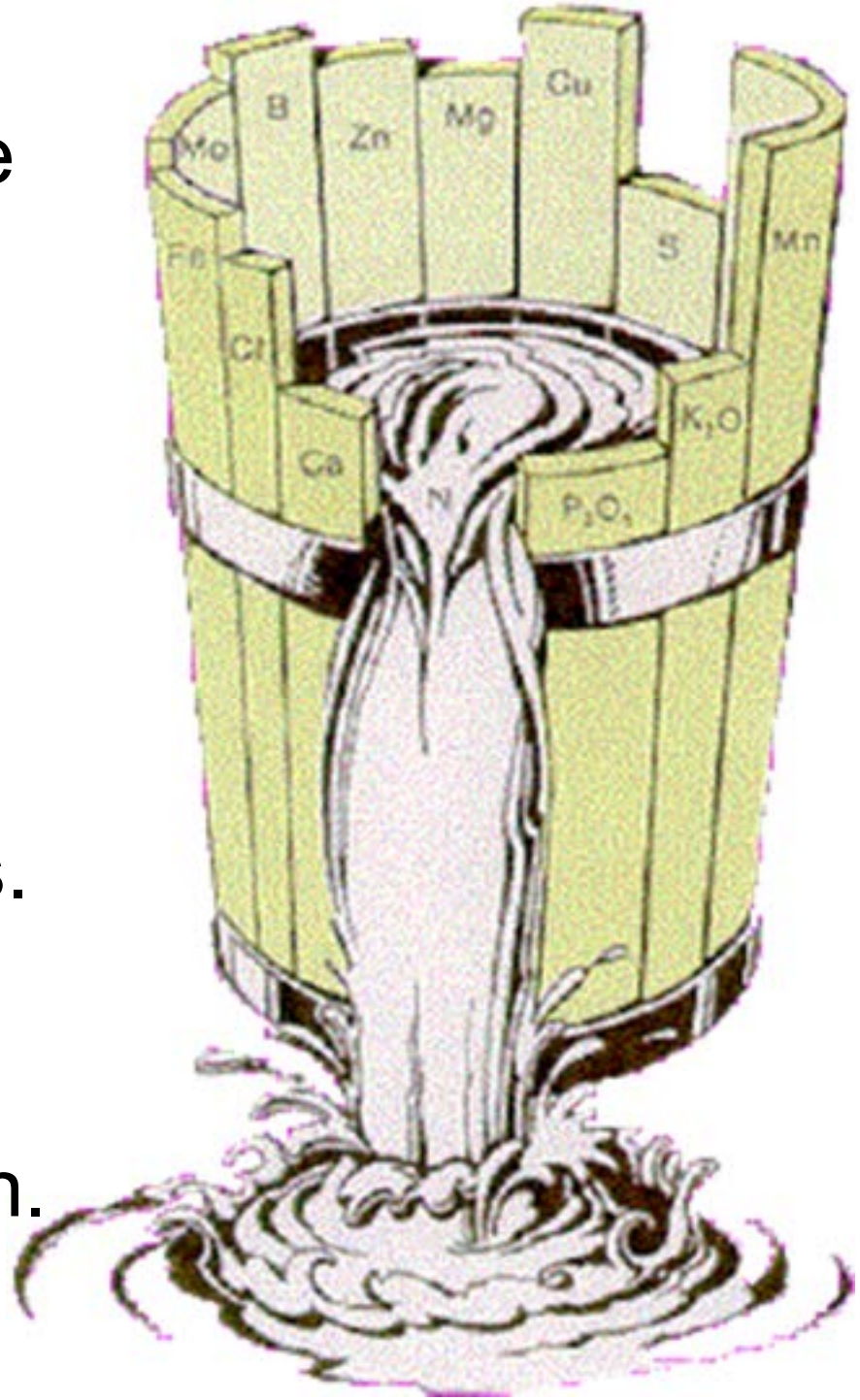


Soil Sampling

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


Nitrogen
Phosphorus
Potassium
Sulfur
Calcium
Magnesium
Iron
Manganese
Boron
Copper
Zinc
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
pH

- 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

- 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?

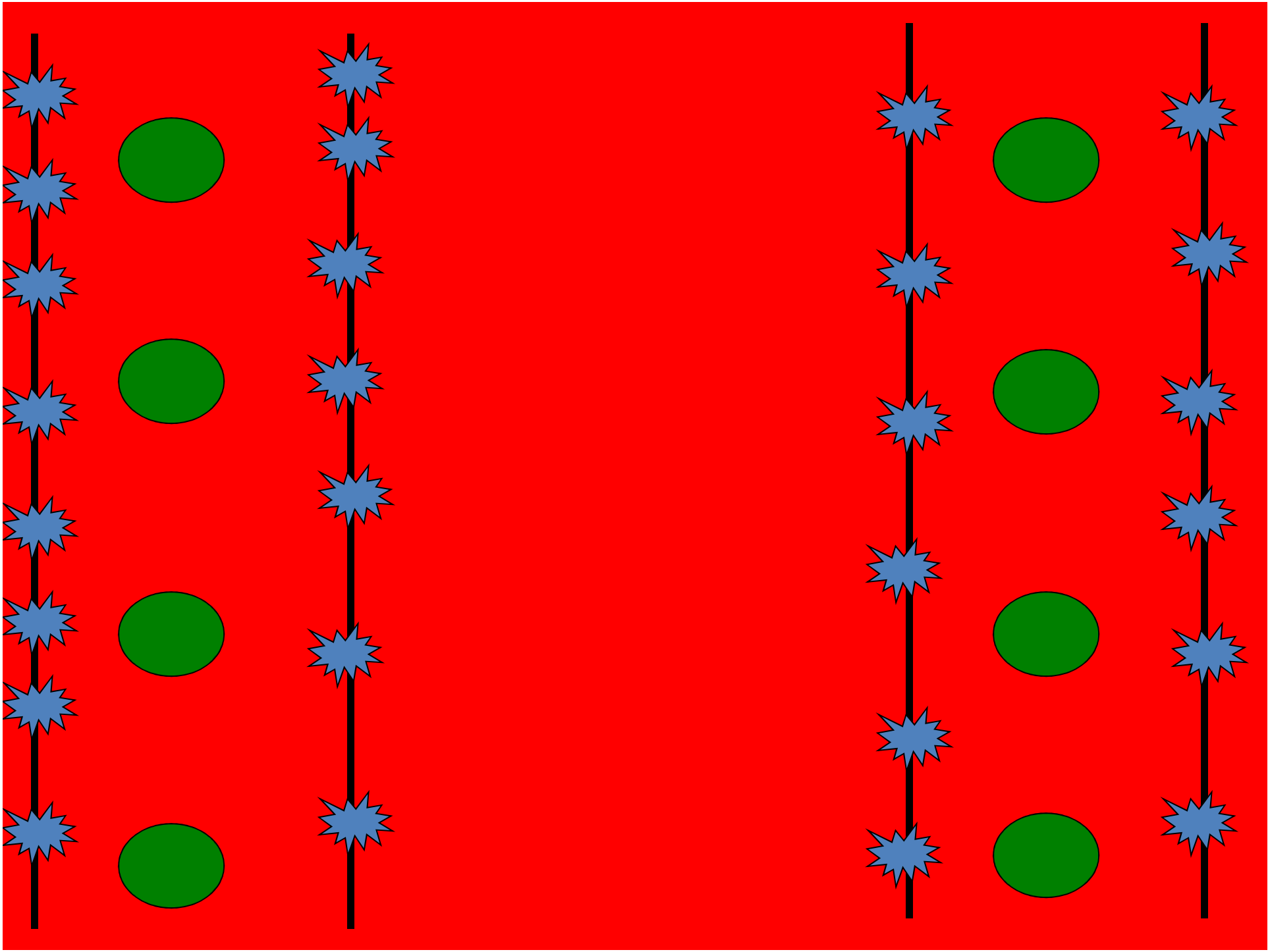
- Apply 75-125 lbs N
- Inject liquid N
  - 3 applications beginning in April (10 day intervals)
  - 1 application in June
    - 1 application in late August/early September if heavy crop
  - No more than 25 lbs N/acre/injection

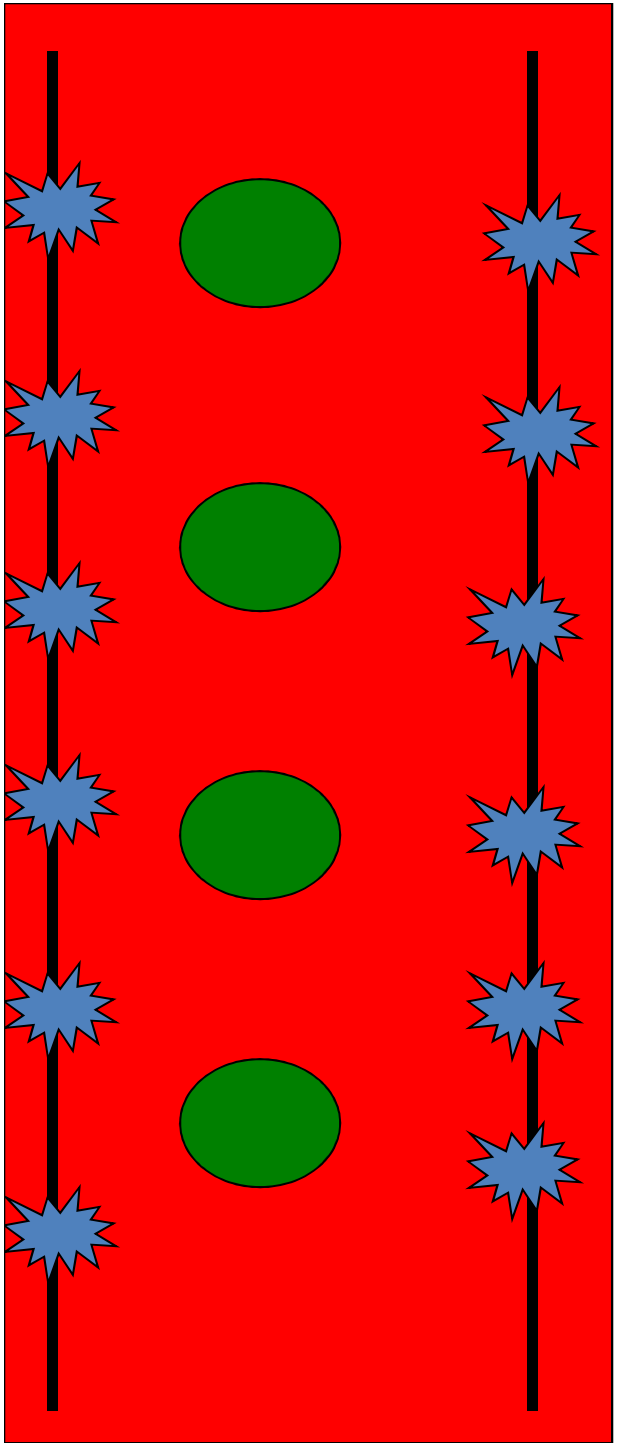
- Direct broadcast applications toward herbicide strip
  - Base total acreage applied on width of spread, *not on total size of orchard*
  - Use rate of 75-125 lbs/acre *on treated area only*

- Eliminate late season applications of N with:
  - Poultry Litter Application in Feb/March or
  - Establishment of good clover stand for 3 yrs

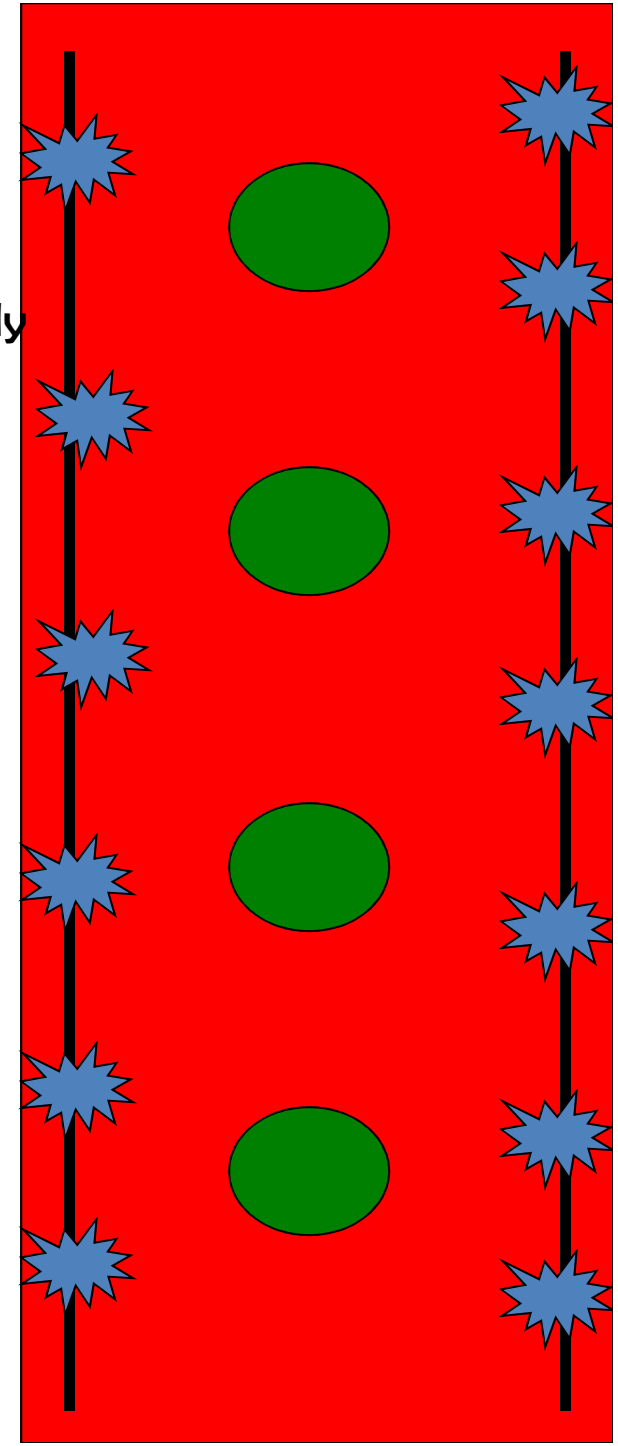
Sandy Soils: Increase rates by 25% and use multiple applications

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

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.

Mike Smith, Oklahoma State University

Rating 1

Rating 3

Rating 5

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

- 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

- 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

Cutting Costs and Not Corners

Soil Zn	15-20	25	28	55	3.9-55.3

- Broadcast Zn to orchard soil at 5-10 lbs/acre during years 1-4
- IN MATURE ORCHARDS: Broadcast Zinc Sulfate ONLY when soil Zn is <15 lbs/acre in mature orchards.
- Can save $25/acre
- If your soil levels are 15 lbs per acre or more but you see visible symptoms of Zinc deficiency or leaf Zn concentrations are below 50 ppm, inject Zn EDTA through the irrigation system.

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

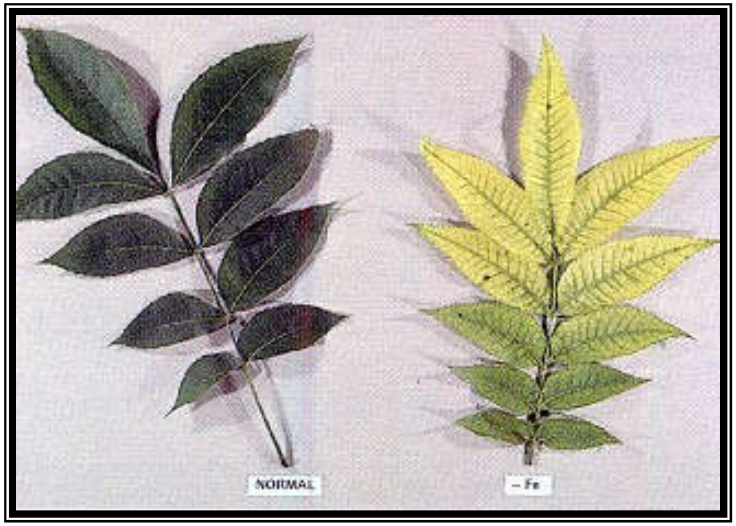
- Foliar B application improves fruit retention and percent kernel in the absence of noticeable B deficiency

- Poor mobility of B to flowers

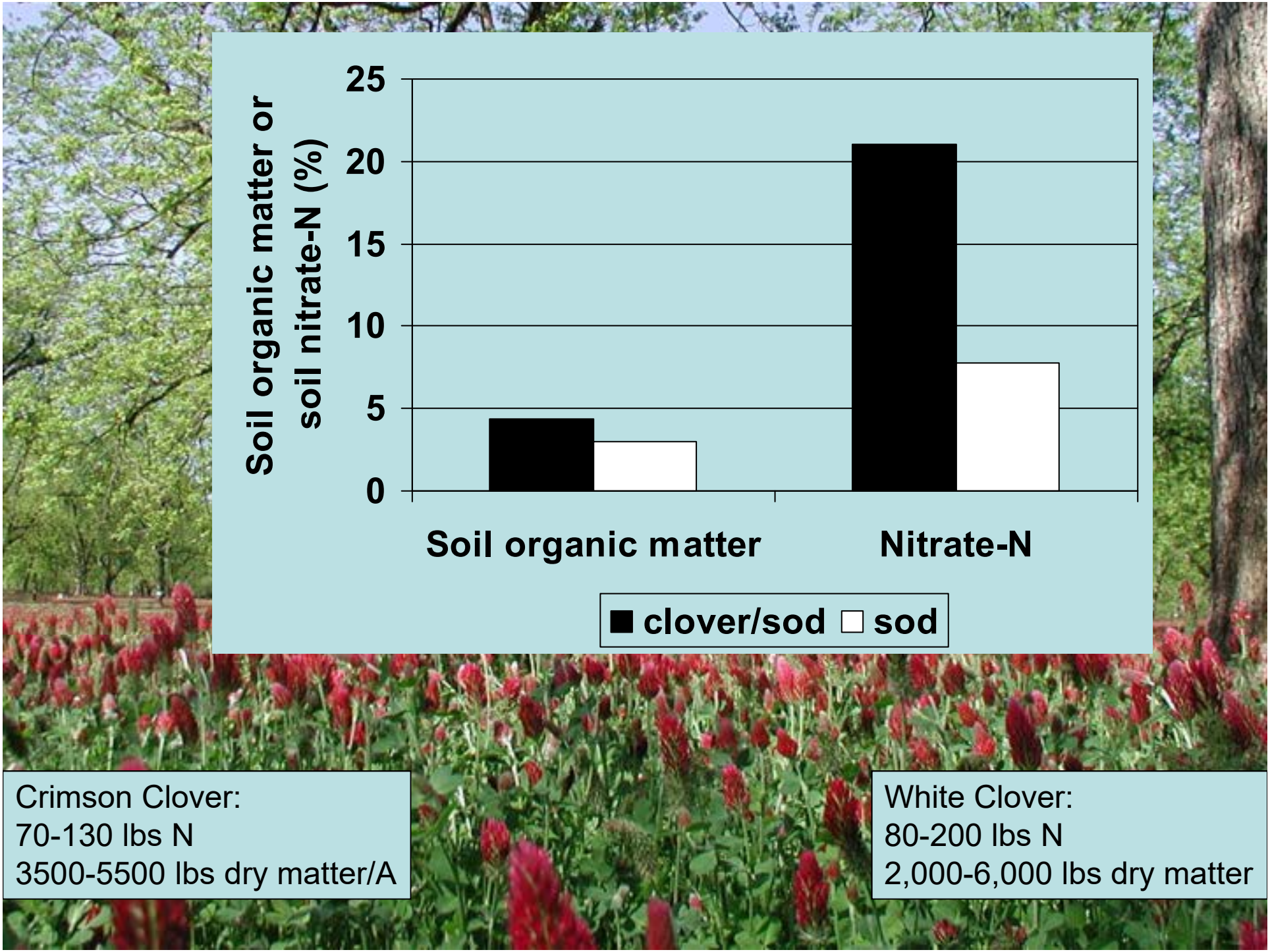
- 3 sprays beginning with 2nd spray
- Timing of applications should be during the pre-pollination stage

Iron (Fe)

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

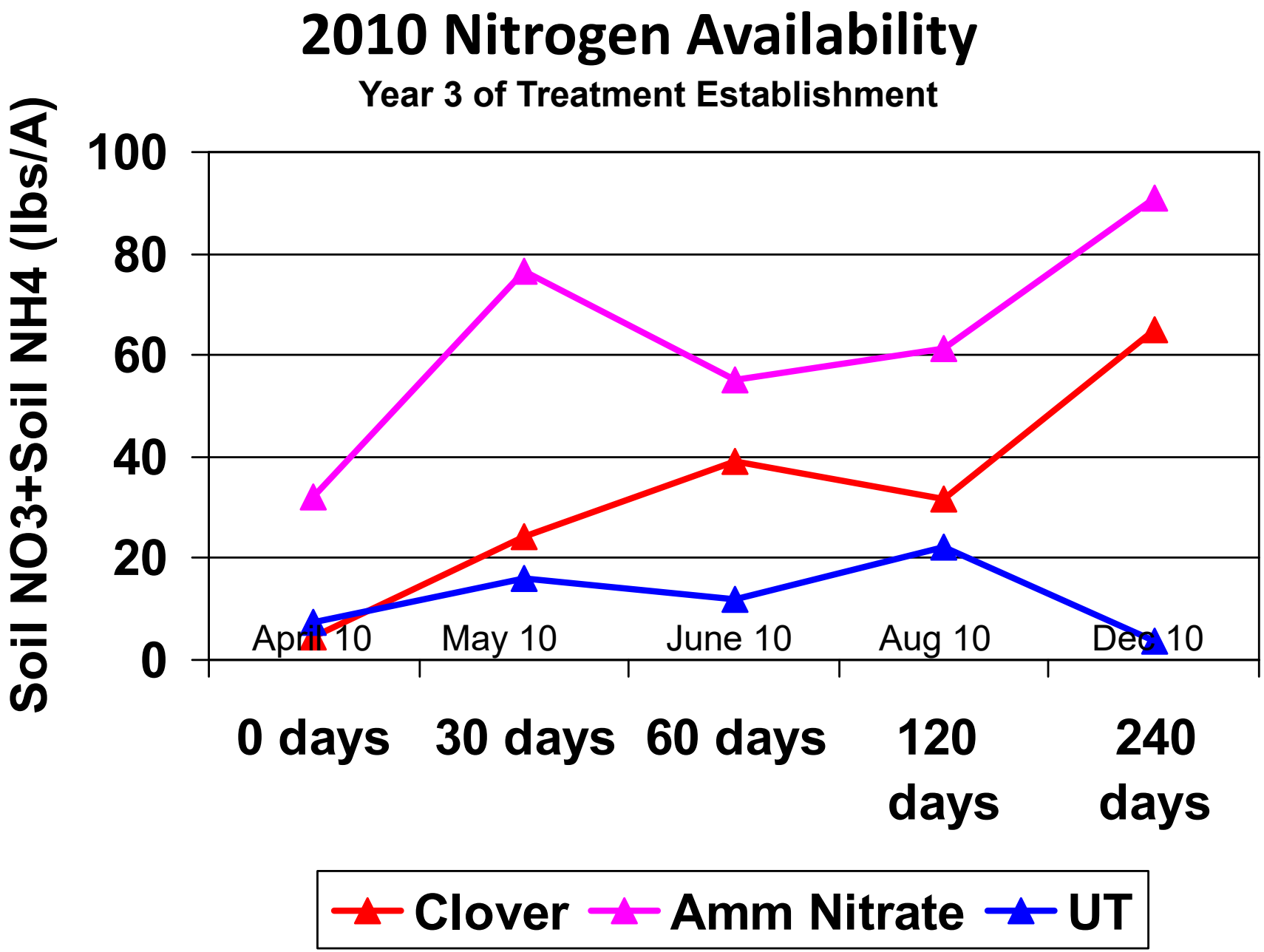


- High concentrations of P, Mn, Cu, Ni or Zn can induce an Fe shortage.
- Can be corrected with foliar applications of $FeSO_4$ or Fe chelates.

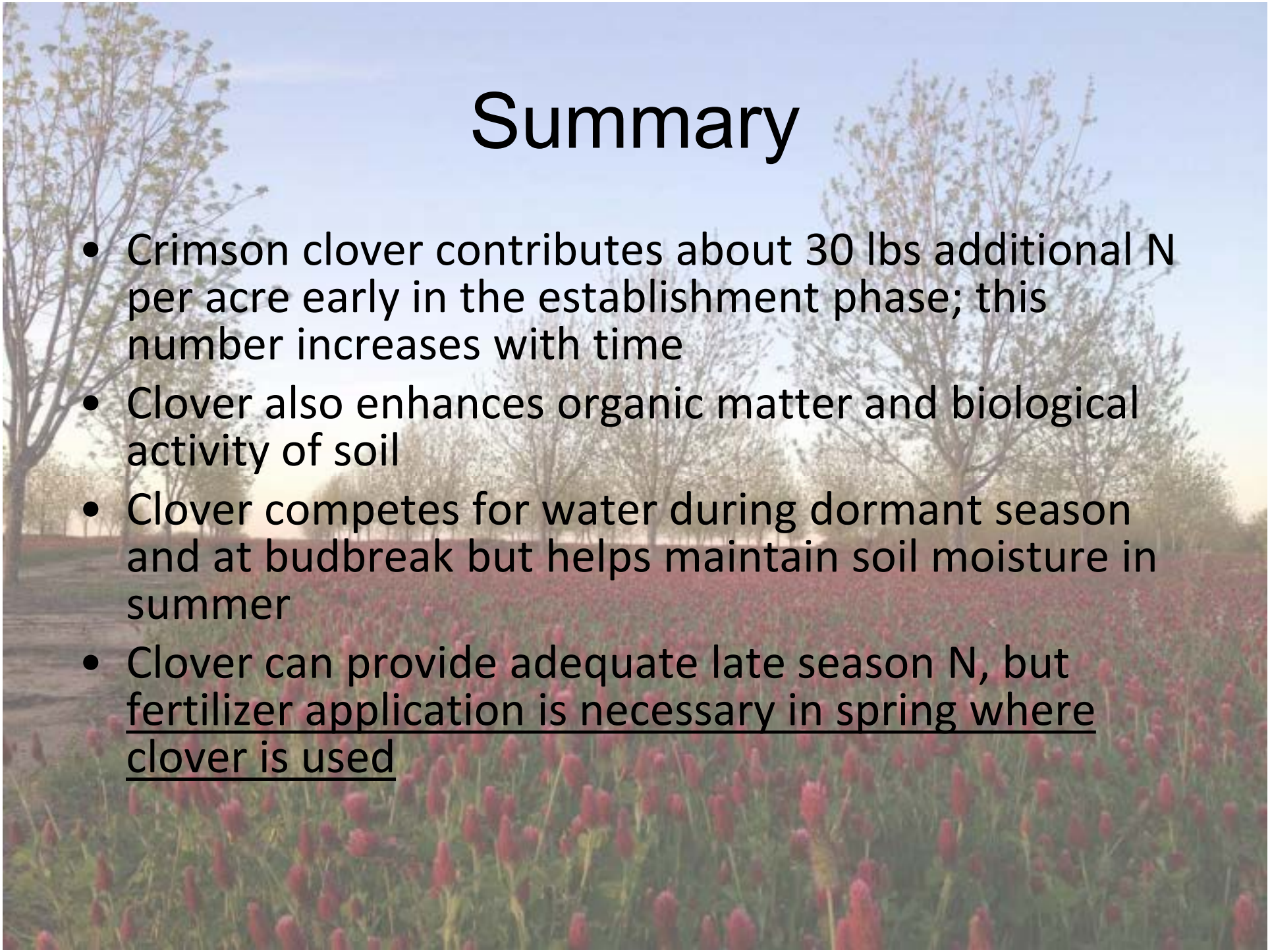


Crimson Clover:
70-130 lbs N
3500-5500 lbs dry matter/A

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


2010 Nitrogen Availability
Year 3 of Treatment Establishment
Soil NO3+Soil NH4 (lbs/A)
100
80
60
40
20
0
April 10
May 10
June 10
Aug 10
Dec 10
0 days
30 days
60 days
120 days
240 days
Clover
Amm Nitrate
UT

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?