SOIL FERTILITY WORKSHOP:

Soil Fertility for Louisiana Row Crops

Louisiana Agricultural Technology & Management Conference
Paragon Casino Resort, Marksville, LA
February 13, 2013

Brenda Tubana
Assistant Professor of Soil Fertility
School of Plant, Environmental, & Soil Sci.
LSU AgCenter

LSU AgCenter Research & Extension

- Sweeten 400 cans of pop
- 3 gal. ethanol

1 bushel = 56 lbs

- 1.5 gal. biodiesel and 48 lb protein-rich meal
- 11 lbs oil and 48 lb soybean meal

1 bushel = 60 lbs

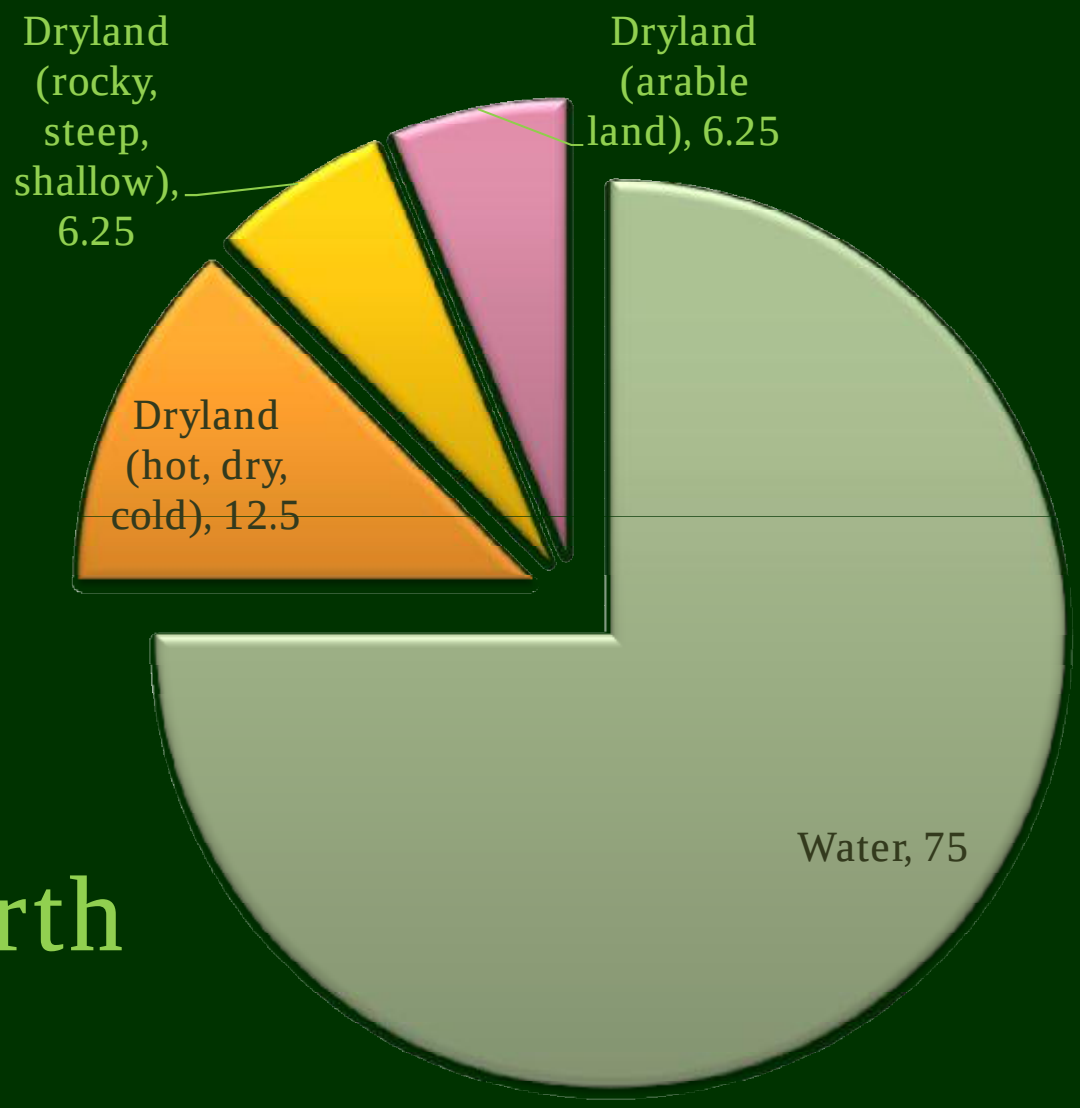
- 215 pairs of jean
- 3,085 diapers
- 313,600 $100 bills

1 bale = 500 lbs

	Grain, lb/bu	Soybean, lb/bu	Cotton, lb/bale
N	0.75	4.0*	32
P_2O_5	0.44	0.8	14
K_2O	0.29	1.4	19

Ability of the Soil to Supply

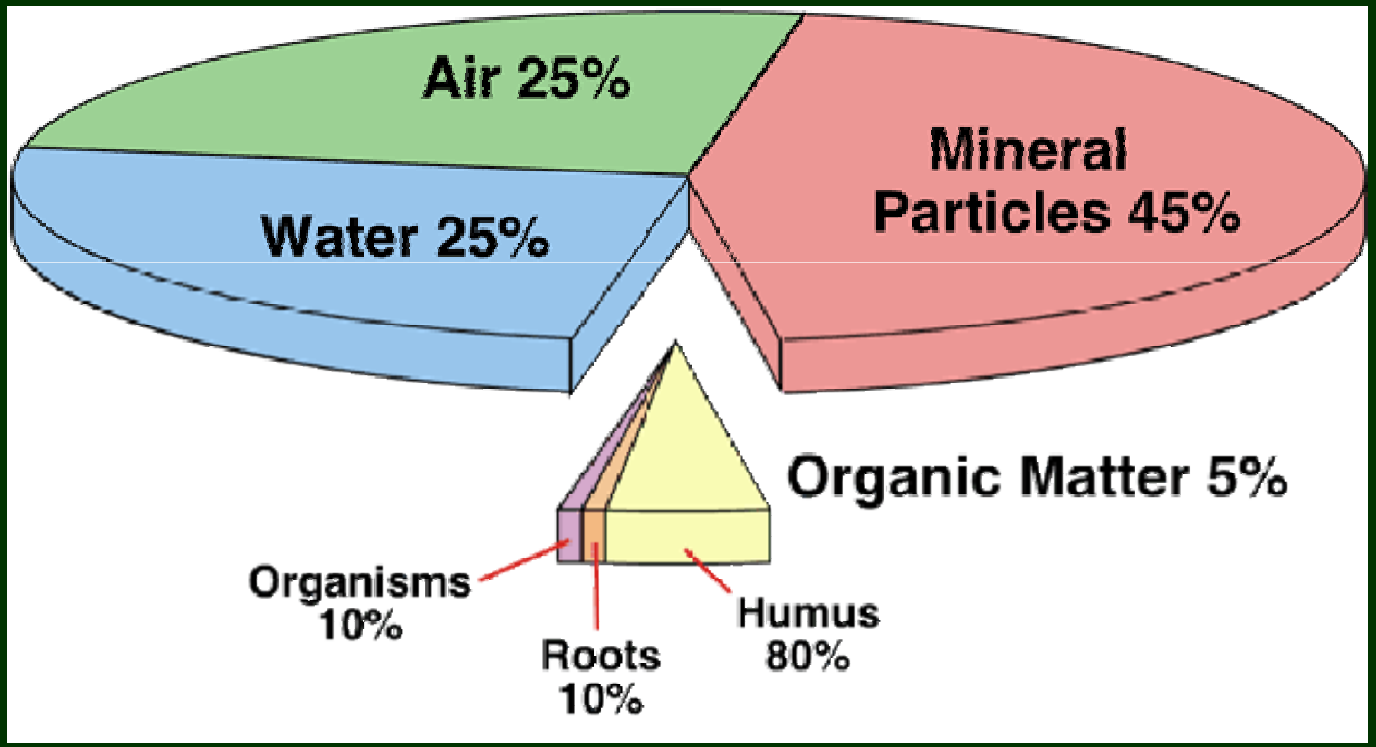
- One important fact remains--soils have <u>finite reserves</u> of the nutrient elements essential for plant growth.
- How much soil we have?

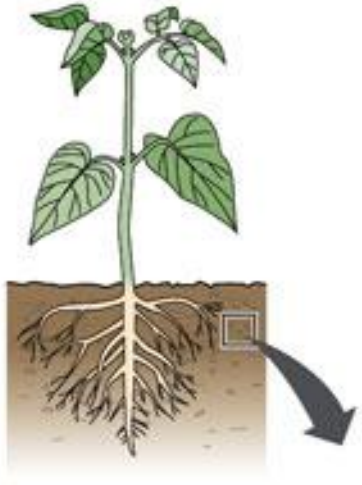


Earth

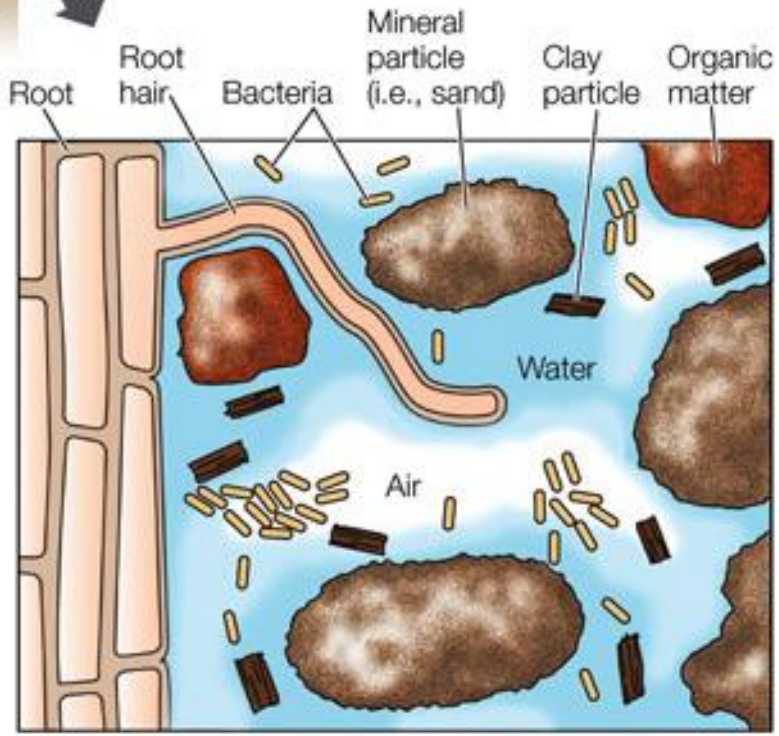
Courtesy of: *The Natural Resources Conservation Service*,Syracuse, NY, U.S. Department of Agriculture

Components of the soil

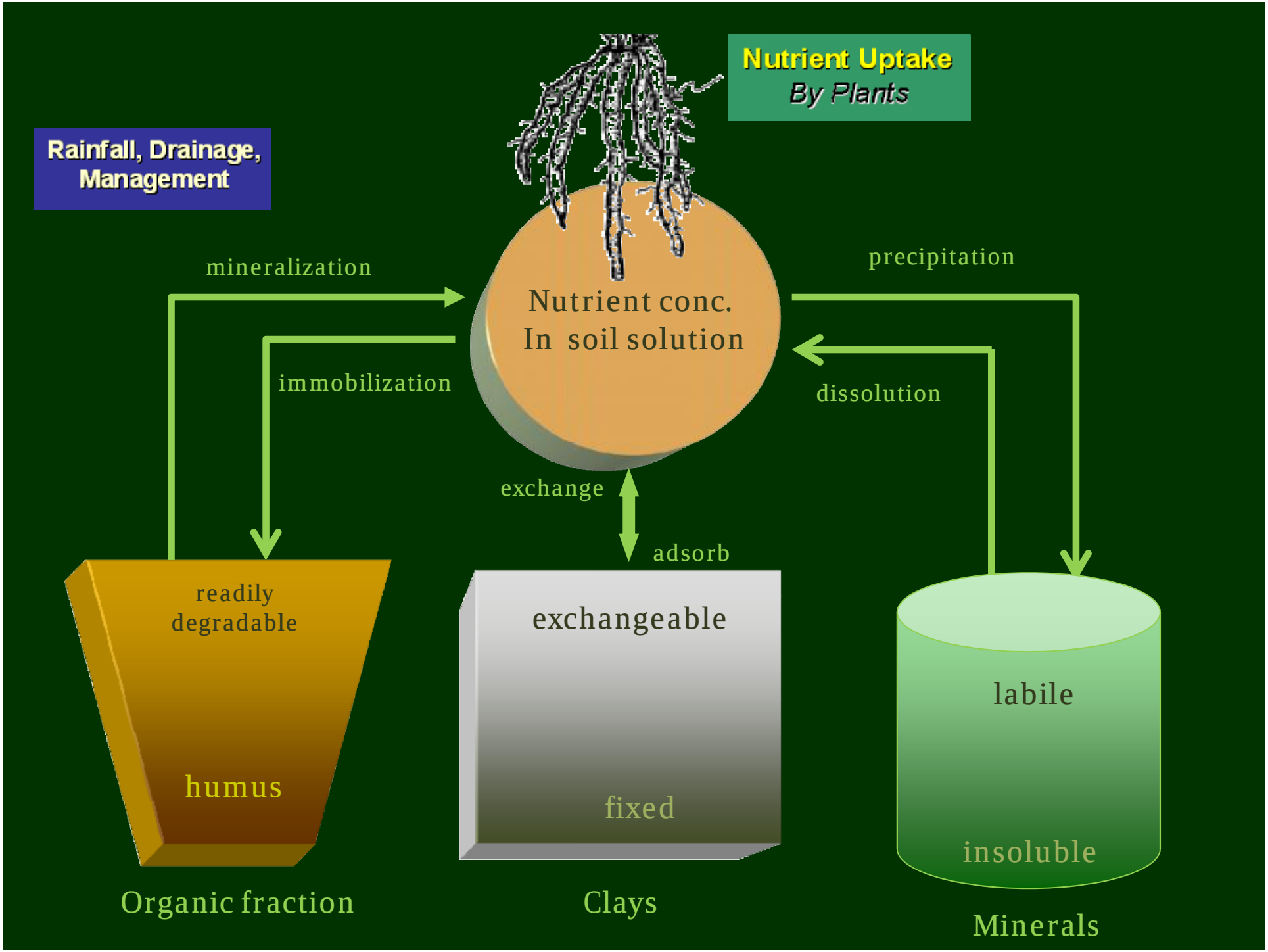




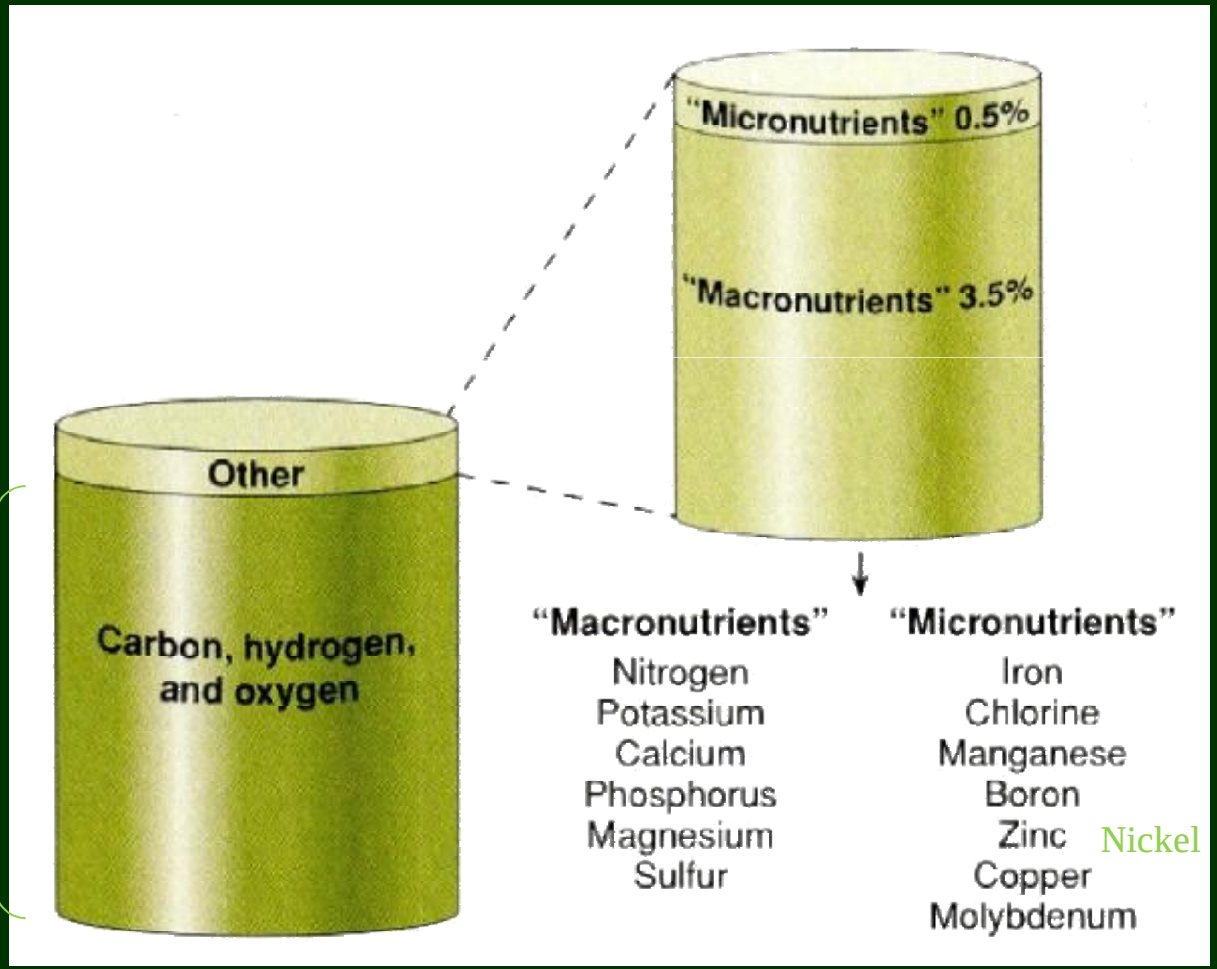
Soil fertility is the result of a number of different soil factors and processes working together. These relates to soil physical, chemical, and biological components that make up the soil.



LIFE 8e, Figure 36.4


Nutrient Uptake
By Plants
Rainfall, Drainage, Management
mineralization
immobilization
Nutrient conc.
In soil solution
precipitation
dissolution
exchange
adsorb
readily
degradable
humus
exchangeable
fixed
labile
insoluble
Organic fraction
Clays
Minerals

Tissue levels of essential nutrients

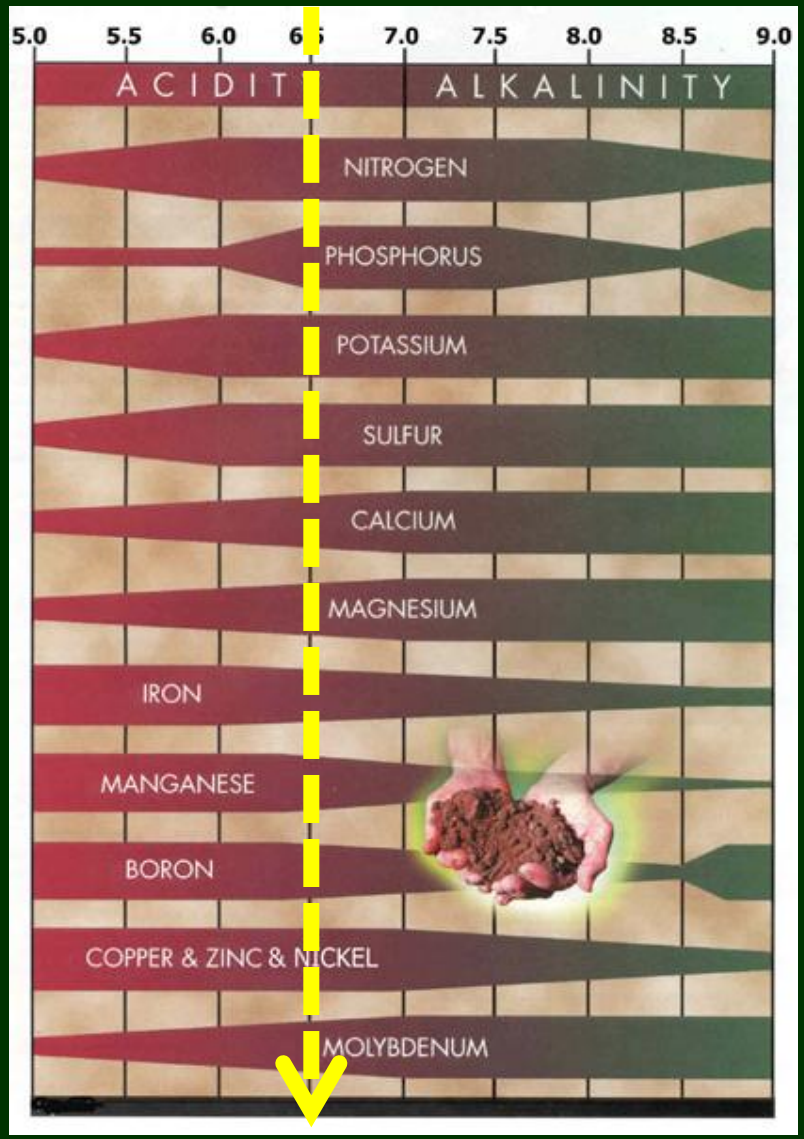


Factors Affecting Plant Availability of Various Soil Nutrients

Factor	N	P	K	S	Ca & Mg	Micros
Soil pH	X	X	X	X	X	X
Moisture	X	X	X	X	X	X
Temperature	X	X	X	X	X	X
Aeration	X	X	X	X	X	X
Soil Organic Matter	X	X		X	X	X
Amount of Clay	X	X	X	X	X	X
Type of Clay		X	X		X	X
Crop Residues	X	X	X	X	X	X
Soil Compaction		X	X			
Nutrient Status of Soil		X	X		X	
Other Nutrients		X	X		X	
Crop Type	X	X		X		X
Cation Exchange Capacity			X		X	X
% CEC Saturation					X	

Source: IPNI

Optimum soil pH



LSU AgCenter Research & Extension

Incorrect soil pH resulted in P deficiency

Loess soil (Winnsboro)

Zinc deficiency in high pH Red River alluvial soil

Cornerstone of Fertilizer Best Management Practices

Right Rate

Match amount of fertilizer to crop needs

- Soil testing
- *Yield goal analysis*
- *Crop removal balance*
- *Nutrient management planning*
- *Plant tissue analysis*
- *Record keeping*
- *Variable rate technology*
- *Site-specific management*

Right Place

Keep nutrients where crops can use them

- Application method
- *Incorporation of fertilizer*
- *Buffer strips*
- *Conservation tillage*
- *Cover Cropping*

Right Time

Match nutrients available when crops need them

- Application timing
- *Controlled release technologies*
- *Inhibitors*
- *Fertilizer product choice*

Right Source

Match fertilizer type to crop needs

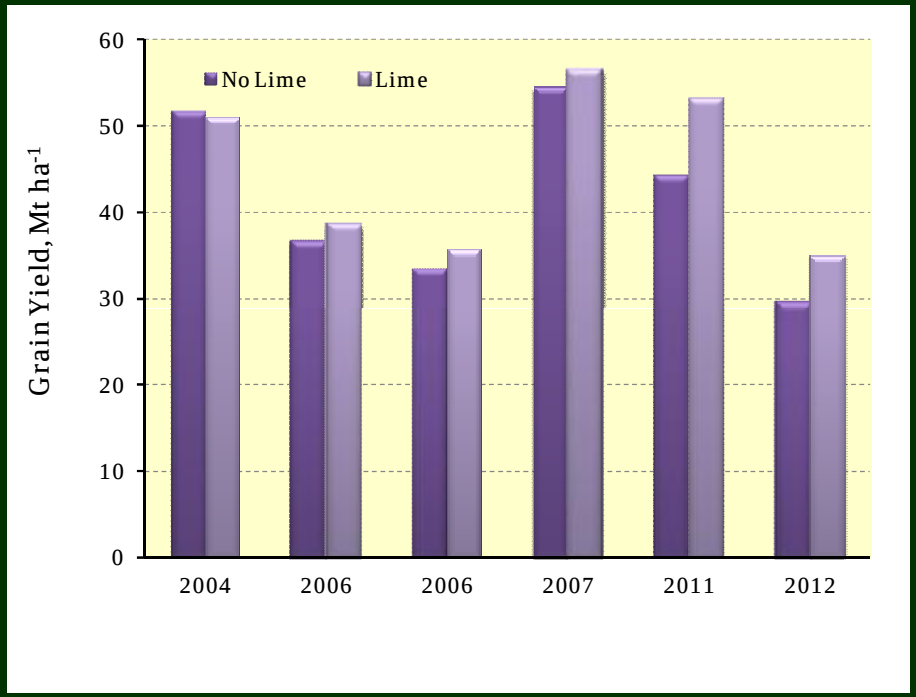
- Select appropriate fertilizer and on-farm nutrient sources for the cropping system
- *Soil testing*
- *N, P, K secondary and micronutrient*
- *Enhanced efficiency fertilizers*
- *Nutrient management planning*

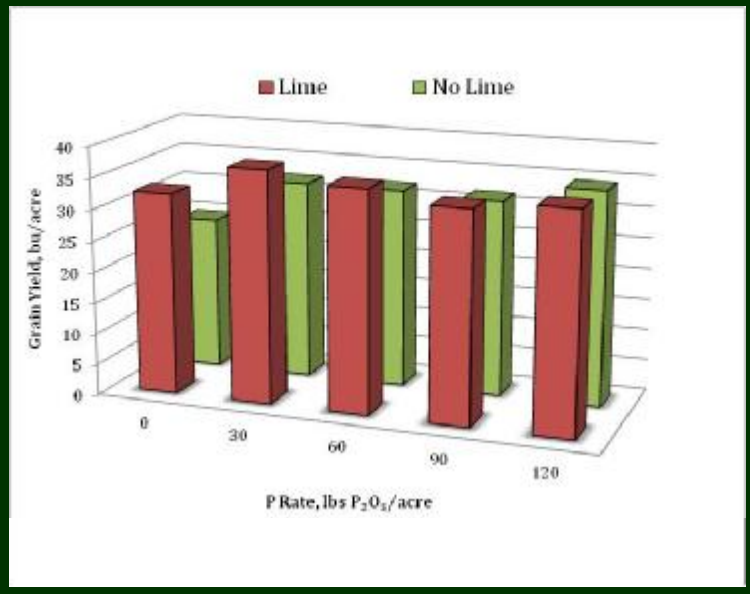
Source: IPNI

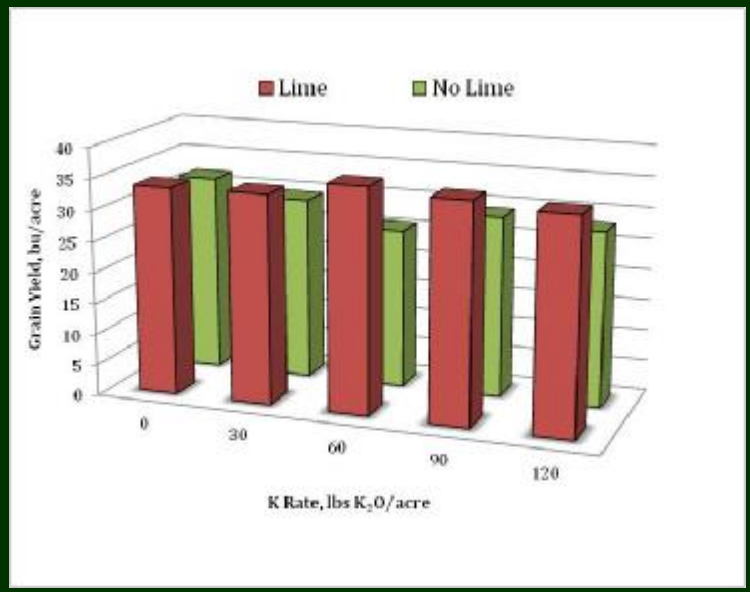
Factors Affecting Nutrient Requirements

- Crop species (and cultivar)
- Yield level
- Soil type
- Climatic conditions
- Cultural management practices
  - Tillage system (conventional tillage, strip tillage, no-till)
  - Residue management
  - Others: cover crops, crop rotations, row configurations

Correcting soil acidity in soybean







Presidedress soil nitrate level

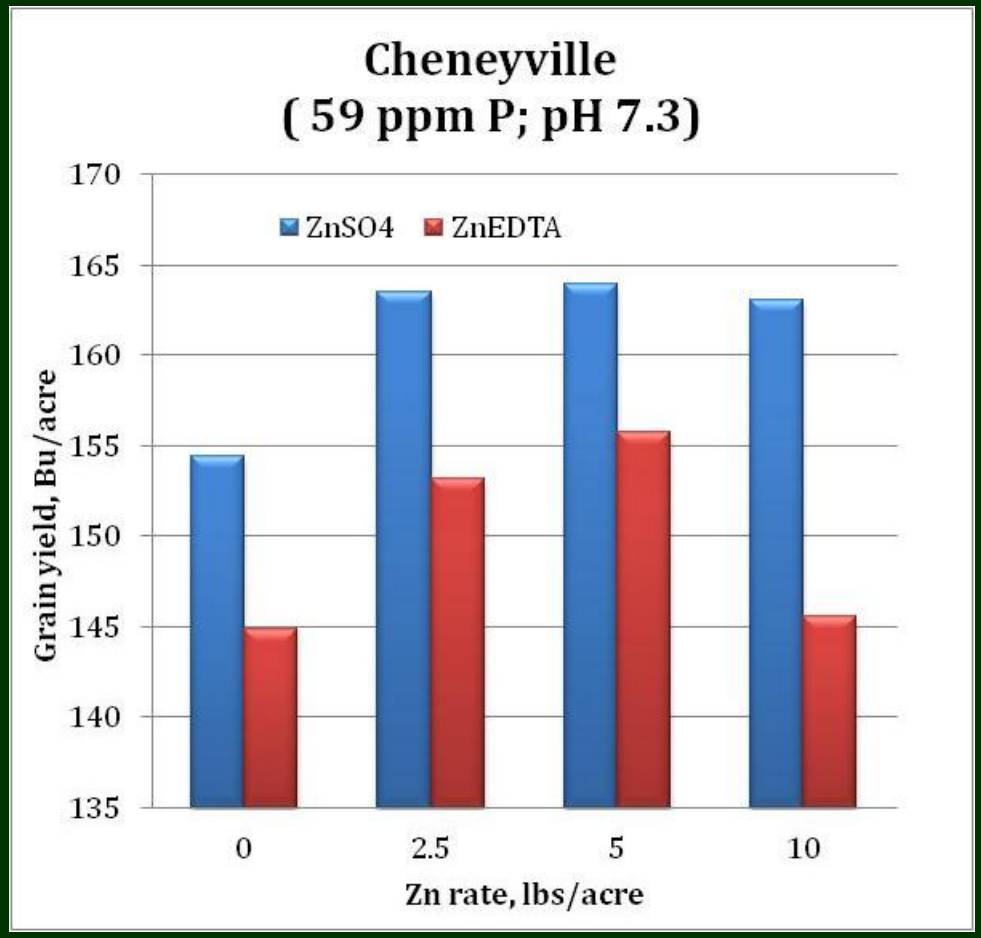
- Check Plot – 30 bu/ac
- 240 lb N – 210 bu/ac

- St. Joseph, clay, <12 lbs NO_3-N/A

- Check Plot – 70 bu/ac
- 120 lb N – 140 bu/ac

- Winnsboro, silt loam, 33 lbs NO_3-N/A

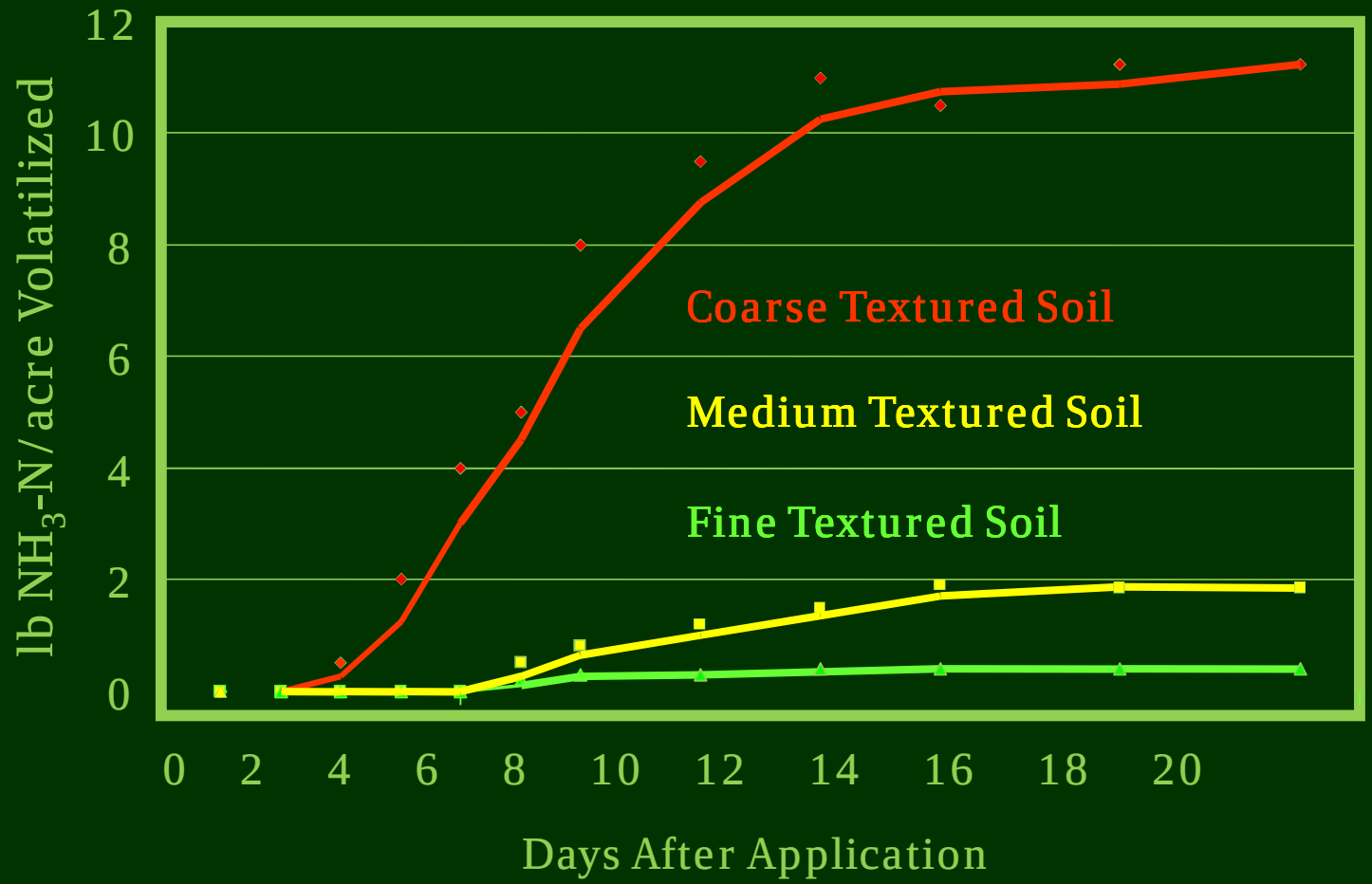
Zinc Source Effect on Corn Yield and Application Rate (Red River alluvial soils)



Crop Age Effect on N Requirement

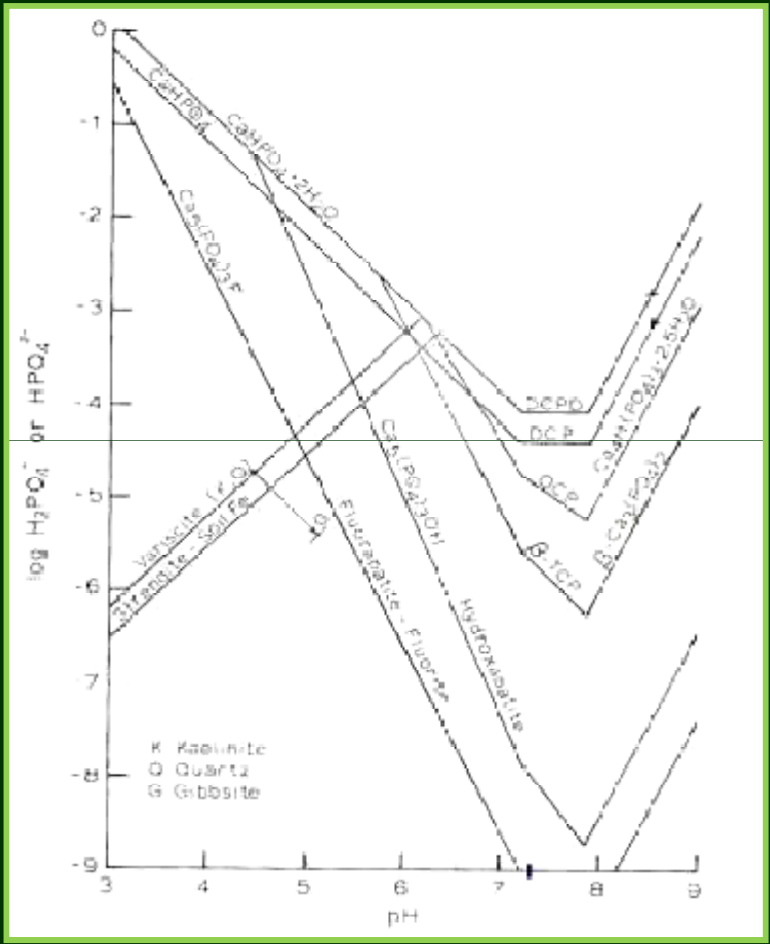
SUGAR YIELD	2007	2008	2009	2010
	Plant Cane	1st Ratoon	2nd Ratoon	3rd Ratoon
Variety Effect	*<0.0001*	*<0.0001*	*<0.0001*	*NS*
HoCP 96-540	9835	7888	7196	7844
L99-226	9426	7232	5865	7556
LCP85-384	7542	5425	5562	6985
Nitrogen Effect	*<0.05*	*<0.0001*	*<0.0001*	*<0.01*
check	8982	6110	4722	6298
40 lbs N/ac	9050	6922	6454	7795
80 lbs N/ac	9173	7150	6809	7684
120 lbs N/ac	8529	7212	6837	8068

Nitrogen: Surface Volatilization



Source: IPNI

Phosphorus Solubility



SOIL

INORGANIC P

Non-Labile

- Specific adsorption to Fe, Al,+ Mn oxides and broken clay edges
- Precipitation of Ca or Mg-P at pH>7
- Precipitation of Fe, Al, or Mn-P at pH<5

Labile

- Weakly sorbed phosphates
- Newly-precipitated Fe, Al, or Mn-P in acid soils
- Newly precipitated Ca or Mg-P in alkaline soils

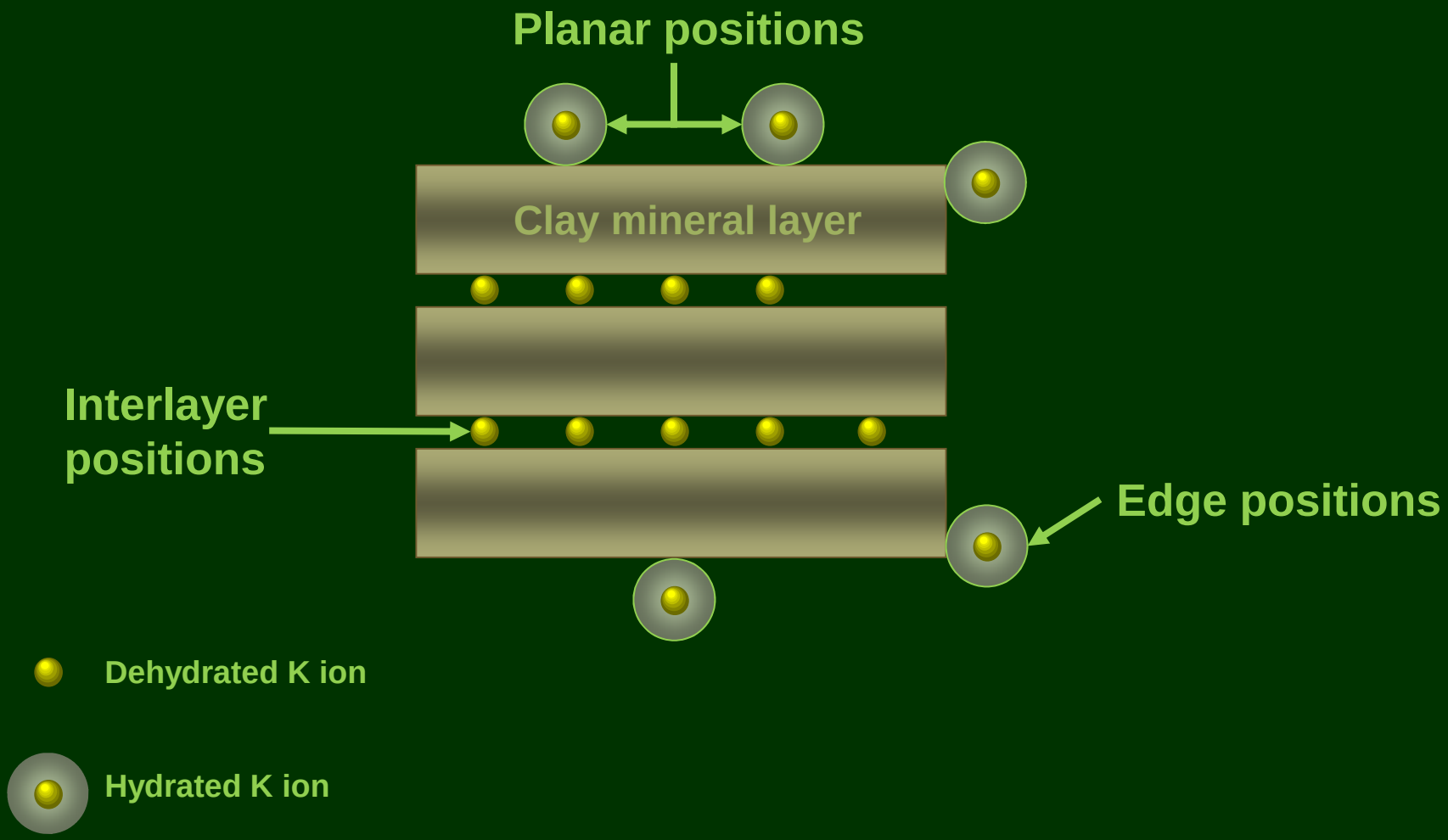
Soil Solution

- Phosphate released from labile pool or added via fertilizer

ORGANIC P

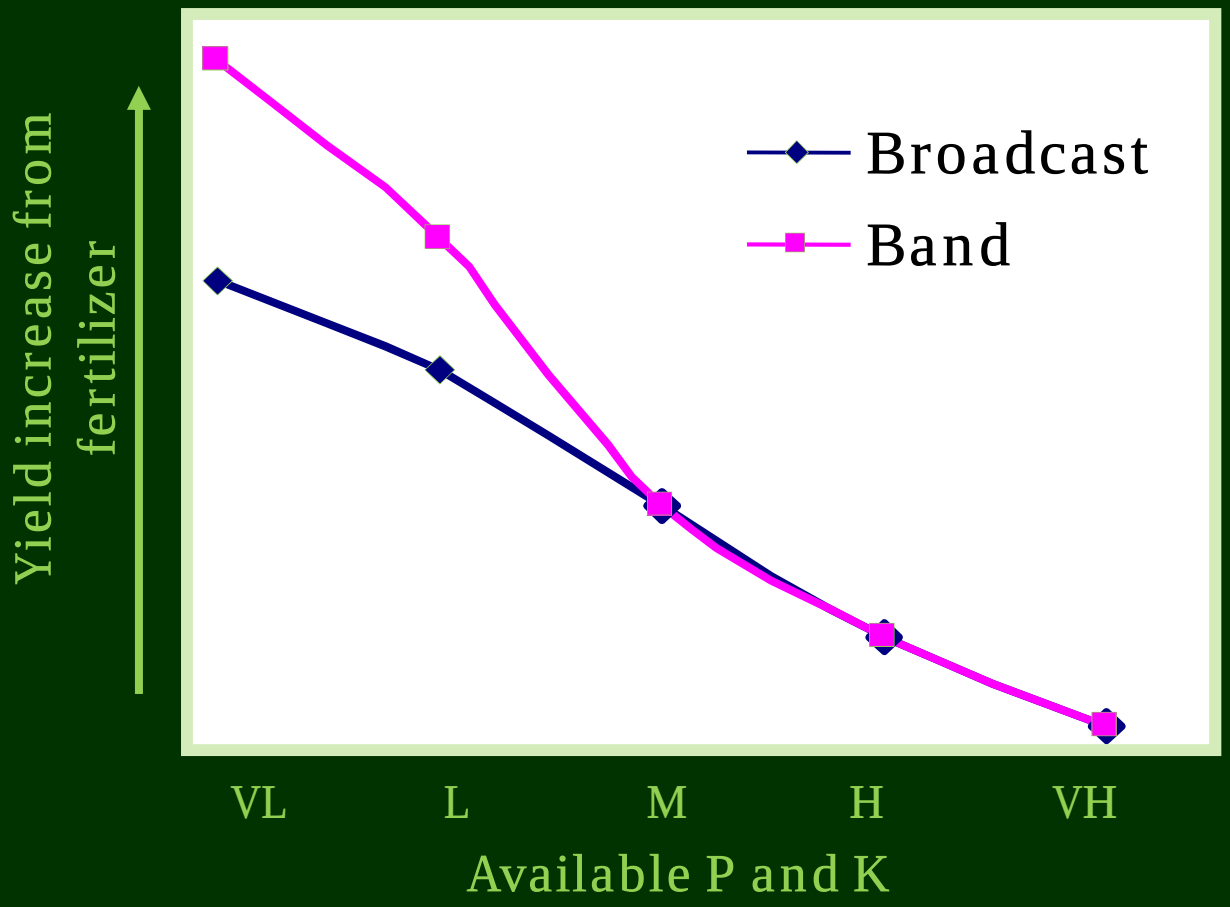
- Humic acid
- Inositol phosphates
- Phospholipids
- Phosphate sugars
- Nucleic acids

Potassium Fixation



T.S. Murrell, 2004

Fertilizer Placement



Cornerstone of Fertilizer Best Management Practices

Right Rate

Match amount of fertilizer to crop needs

- Soil testing
- *Yield goal analysis*
- *Crop removal balance*
- *Nutrient management planning*
- *Plant tissue analysis*
- *Record keeping*
- *Variable rate technology*
- *Site-specific management*

Right Place

Keep nutrients where crops can use them

- Application method
- *Incorporation of fertilizer*
- *Buffer strips*
- *Conservation tillage*
- *Cover Cropping*

Right Time

Match nutrients available when crops need them

- Application timing
- *Controlled release technologies*
- *Inhibitors*
- *Fertilizer product choice*

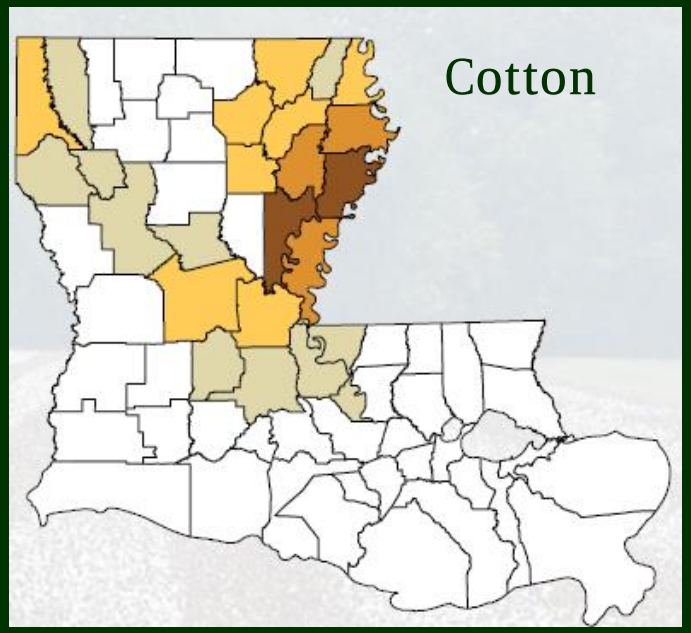
Right Source

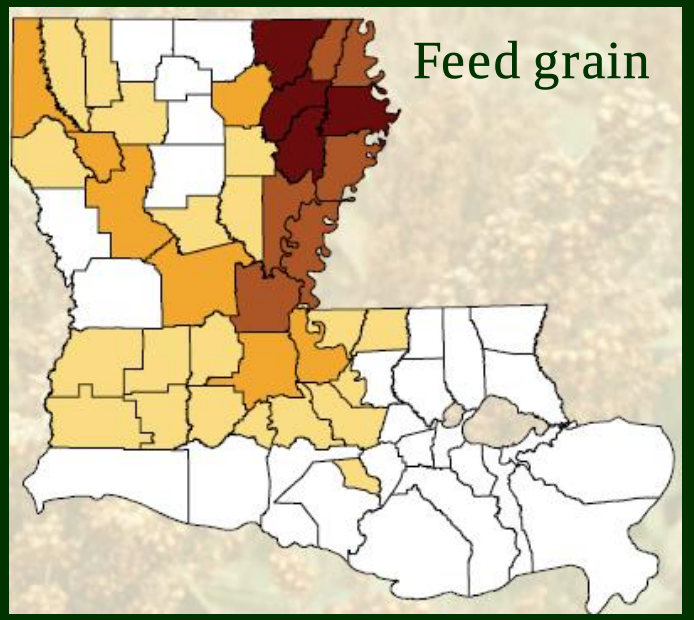
Match fertilizer type to crop needs

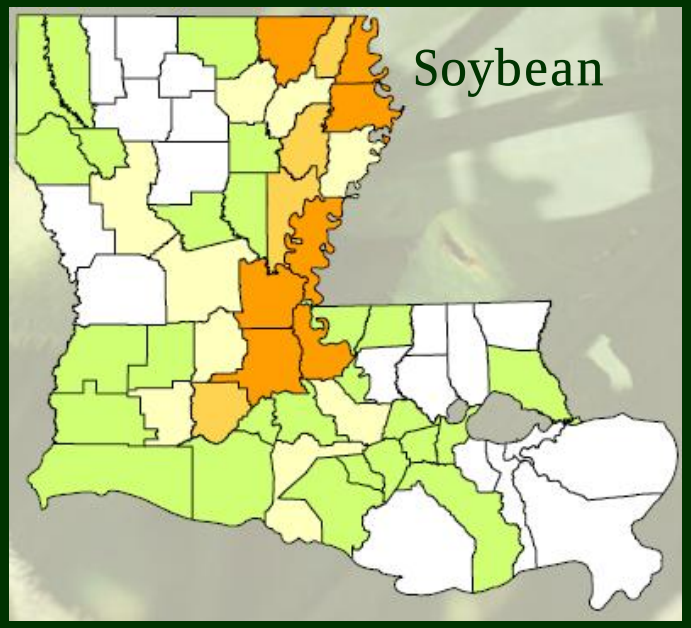
- Select appropriate fertilizer and on-farm nutrient sources for the cropping system
- *Soil testing*
- *N, P, K secondary and micronutrient*
- *Enhanced efficiency fertilizers*
- *Nutrient management planning*

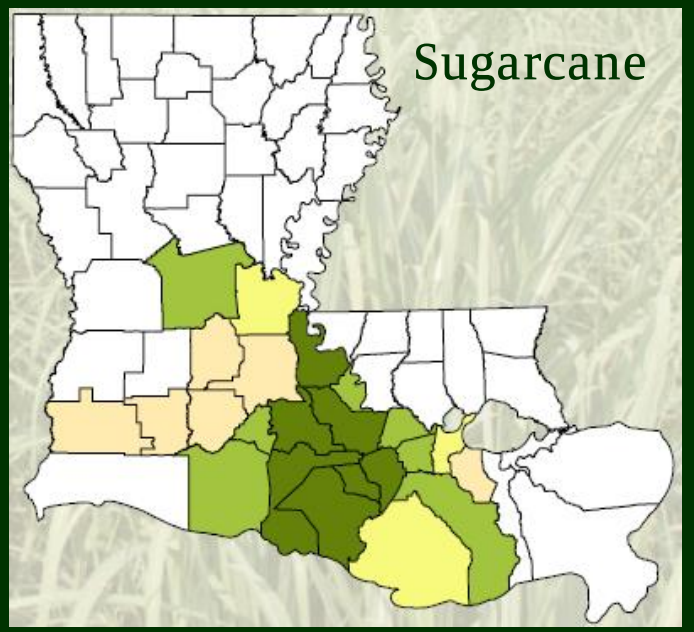
Source: IPNI

Major Row-Crops Grown in Louisiana









Nitrogen Fertilizer Management (Mobile Nutrient)

Crop	Rate	Placement	Time	Source
Sugarcane	Response Trial	Inject	Spring	UAN
Cotton	Response Trial	Dribble	Preplant Sidedress	UAN
Soybean	-	-	-	-
Corn	Response Trial	Dribble, Inject	Preplant Sidedress	UAN

Rate – refine based on soil type, irrigated vs. dryland, and crop age (cane)

P and K Fertilizer Management (Immobile Nutrients)

Crop	Rate	Placement	Time	Source
Sugarcane	Soil testing	In furrow	Early spring	TSP/MOP
Cotton		Broadcast, in furrow,	Preplant	TSP/MOP *
Soybean			-	TSP/MOP *
Corn			Preplant	TSP/MOP *

* Manure, compost and other organic sources

Thank You!