Soybean Phosphorus and Potassium

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Presentation Outline

- General soil fertility and crop nutrition in soybean production
- LSU AgCenter research in P and K management in soybeans
- Take home points

Soybean production

- Important crop to Louisiana
- Around 1 to 1.2 million acres in 2012*
  - Nearly $700 million gross farm income

*Louisiana Agricultural Summary

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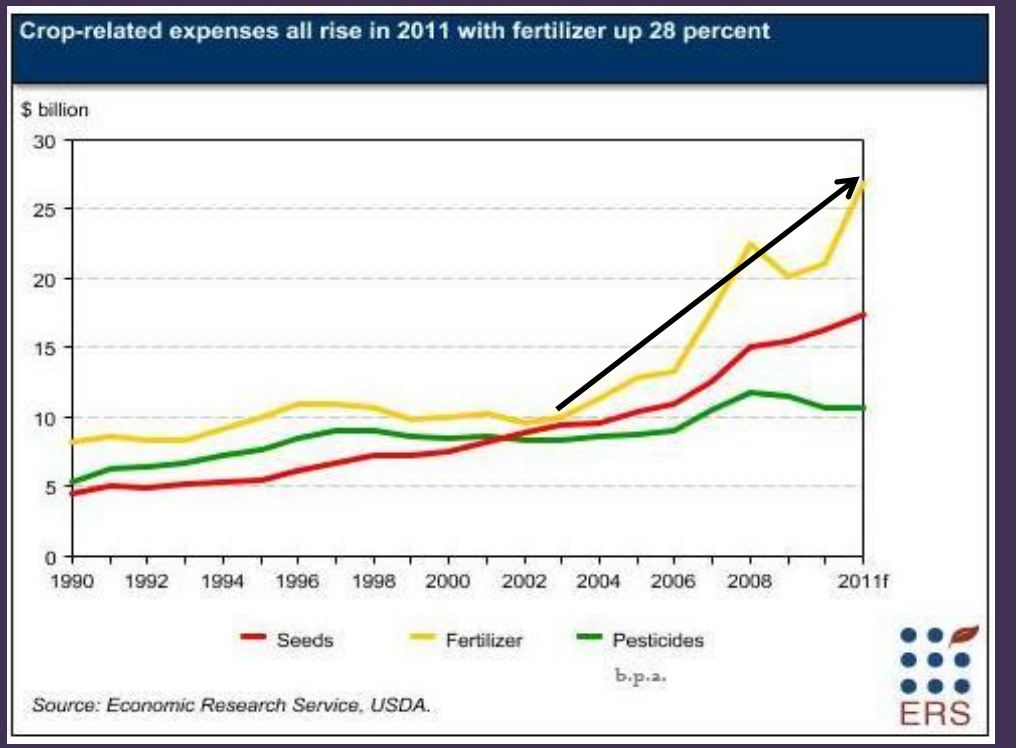
Why should we be interested in fertilizers?

- One of this highest cost production inputs
- Recent years
  - Continual increase in price
  - Some signs of slowing
  - No signs of decrease



14 Essential elements

- Needed by all crops
  - Complete its life cycle
    - Yield
- Divided based on crop uptake

Soil obtained nutrients		
Primary Macro	Secondary Macro	Micro
N	Ca	Fe
P	Mg	B
K	S	Cu
		Cl
		Mn
		Mo
		Zn
		Ni

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14 Essential elements

- Needed by all crops
  - Complete its life cycle
    - Yield
- Divided based on crop uptake
- Soybeans are legumes
  - N not typically managed

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Primary Macro	Secondary Macro	Micro
~~N~~	Ca	Fe
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Soybean P and K uptake*

	Uptake lbs/bu	Uptake (60 bushel soybeans) lbs/ac
Phosphorus	0.96	58
Potassium	3.42	205

- Phosphorus
  - Lower uptake compared to K (as well as N demand)
- Potassium
  - Over triple the uptake of P
  - Very high uptake compared to application rate

*specific rates of uptake are know to vary slightly

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Soybean P and K removal

	Removal lbs/bu	Removal (60 bushel soybeans) lbs/ac
Phosphorus	0.9	54
Potassium	1.5	90

- Actually what is taken off the field at harvest
  - Remainder is re-deposited on soil surface and can potential become available to future crops
- Phosphorus
  - Nearly all uptake is removed at harvest
- Potassium
  - Less than half (44%) is removed at harvest

Nutrient uptake in soybeans

- Phosphorus accumulates in seeds are pods
  - Still needed throughout the growing season
- Potassium accumulates in stems and leaves

Stage	N	P_2O_5	K_20
	lbs/ac		
Three tri-folates	30	6	27
Six tri-folates	46	12	57
Full bloom	171	40	149
Pod Development	308	74	293
Soft Green	548	132	433
Mature	494	112	397

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Questions?

- How does P and K application affect soybean production systems?
- How are these applications influenced by soil pH?

P, K, Lime study in Soybeans (Upland Loess Soils)

- Location
  - Macon Ridge Research Station
- Investigated
  - P and K application rates
  - Both with and without lime applications
  - Stale-seedbed
  - Irrigated (center pivot)
  - Following all LSU AgCenter recommendations for cultural management

P, K, Lime study in soybeans

- Pre-plant soil samples taken yearly
  - Lime applied to half the plots when recommended
- P application
  - 0, 30, 60, 90, 120 lbs/ac
- K application
  - 0, 30, 60, 90, 120 lbs/ac
- At harvest
  - Grain harvested
  - Soil samples
    - 0-6
    - 6-12

Trt No.	P_2O_5–K_2O lbs/ac^{-1}	Trt No.	P_2O_5–K_2O lbs./ac^{-1}	Trt No.	P_2O_5–K_2O lb/ac^{-1}
1	0 – 0				
2	30 – 0	6	0 – 30	10	30– 30
3	60 – 0	7	0 – 60	11	60 – 60
4	90– 0	8	0–90	12	90–90
5	120– 0	9	0–120	13	120–120

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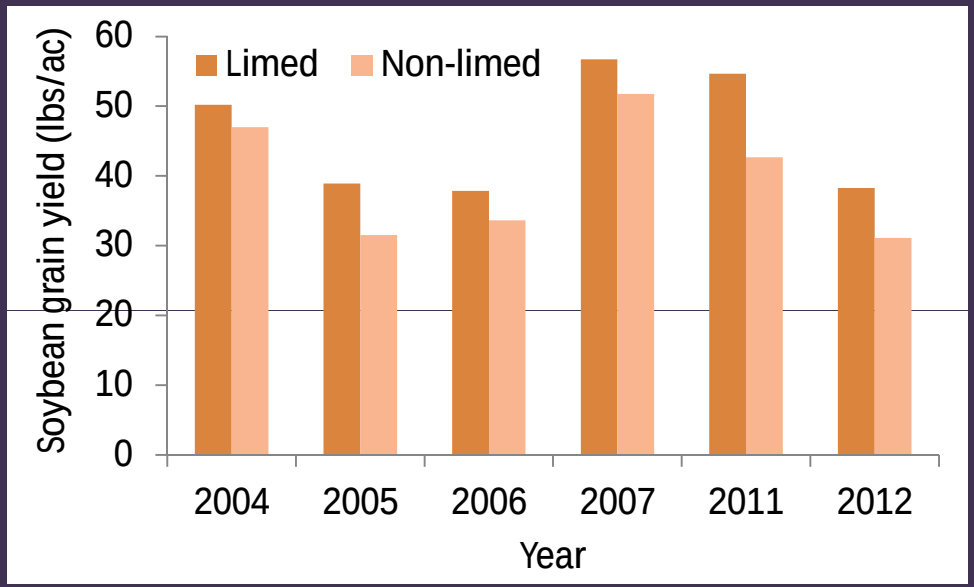
Effect of P, K, and Liming on yield

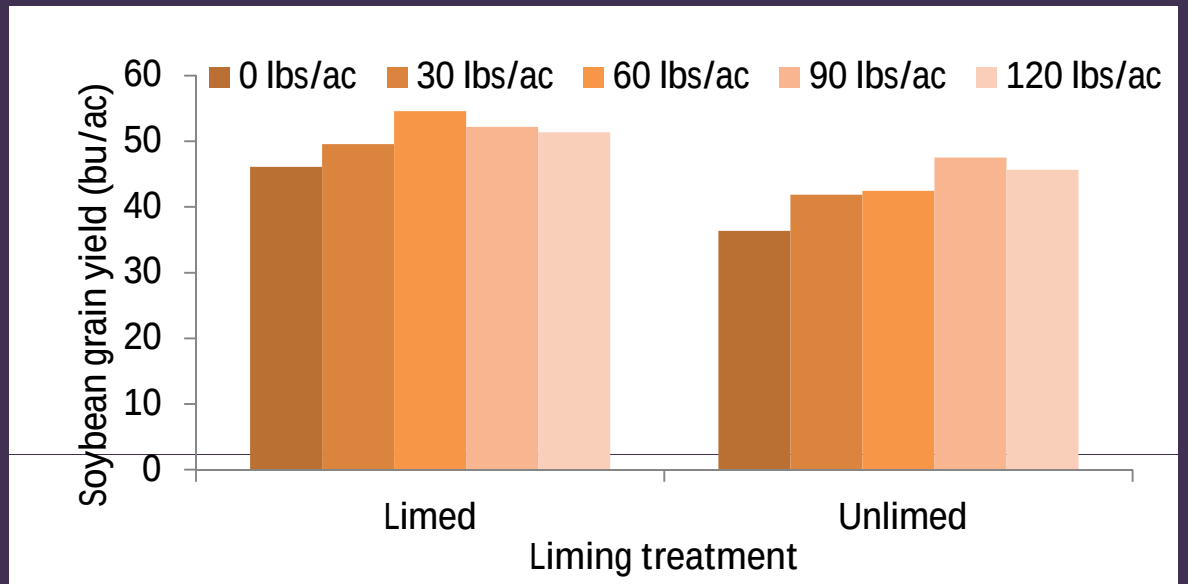
- P or K did not have a consistent significant effect on yields
  - Depended on soil test levels
- Ensuring optimum pH
  - Increase yield
  - Although may not be significant every year



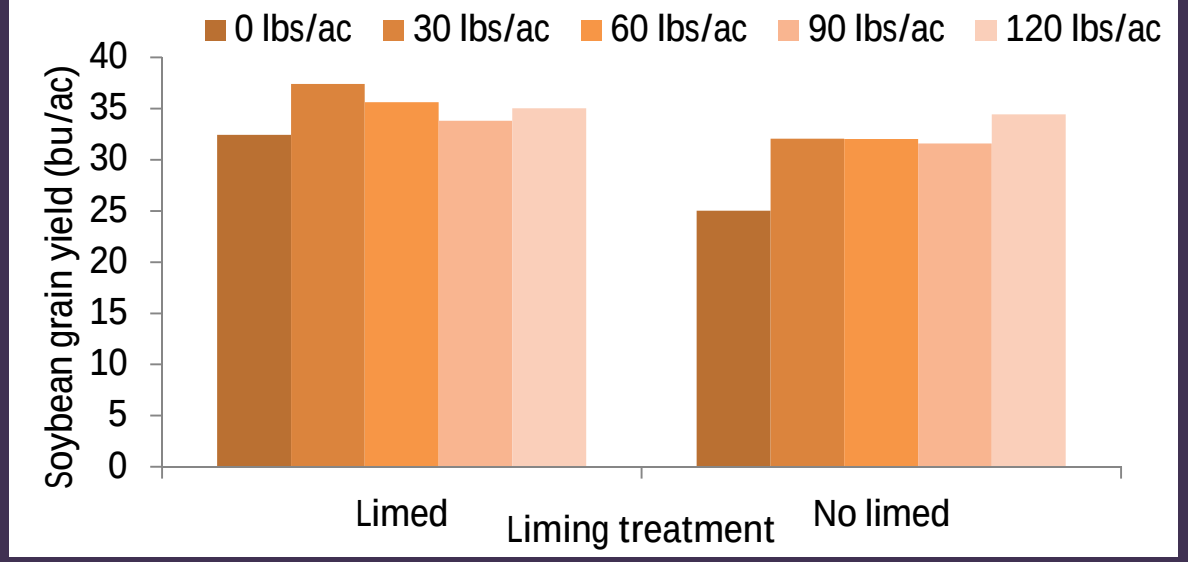
Visualization of liming effect

How does liming effect P availability?

2011- Responsive year



2012- Non responsive year



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How does liming effect nutrient availability?

- Soil pH effects availability of all plant nutrients

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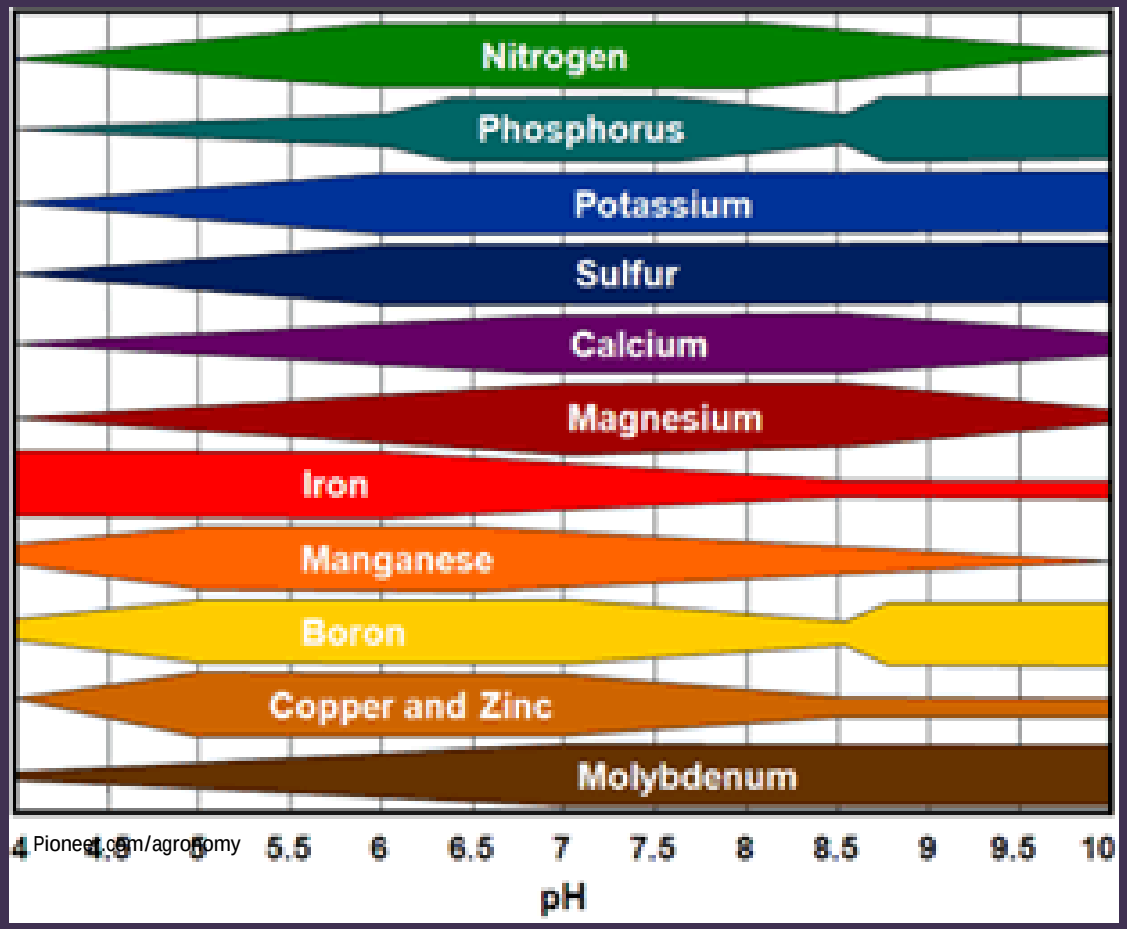
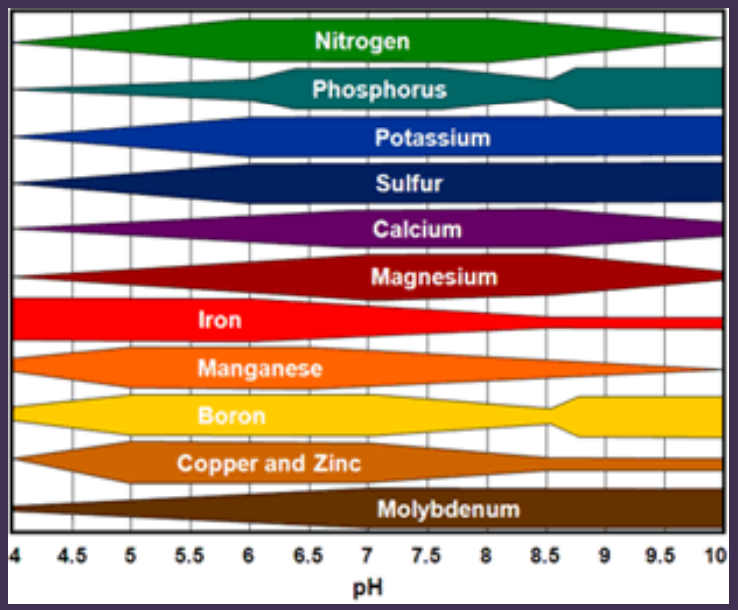


How does liming effect nutrient availability?

- Soil pH effects availability of all plant nutrients
- Soil P
  - Lower pH increase Iron and Aluminum binding
  - Higher pH increase Calcium and Magnesium binding

Take homes

- Balanced nutrition is critical
  - Cannot overcompensate for one deficiency with another nutrient
  - Ensure pH is optimum
    - Crop grown
    - Nutrient availability



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Take homes

- Decline in natural P and K fertility in many soils across the state
  - Due to increased
    - Production
    - Yields
  - Make P and K management increasing critical
    - Soil sampling is key

Thank you and questions?

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