

Soil fertility questions from growers for the 2021 season

Dorivar Ruiz Diaz
Professor and Soil Fertility Specialist

K-State Crop Talk Series
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Questions/topics for today

- Best time to collect soil samples
- Sorghum fertility for top yields
- Lime and pH in long term no-till
- Target pH and other soil benefits
- Sulfur management
- Potassium and high testing soils

What is the best time to collect soil samples?

- | | |
|-----------------------------------|--|
| Immobile nutrients (P, K, Zn, pH) | Mobile nutrients (NO ₃ , S, Cl) |
|-----------------------------------|--|
- More flexibility (but be consistent)
 - Some tests with small effects of sampling time (K, pH)
 - N and S in particular are affected by mineralization
 - Measuring “residual” profile from previous crops
 - Before spring warm-up is ideal

Always avoid collecting samples after fertilizer application!

Sorghum fertility for top yields

- Most common limiting nutrients for sorghum
 - Nitrogen
 - Phosphorus
 - Soil pH
 - Sulfur
 - Micros: Zn and Cl

Kansas sorghum yields in 2020

- Yield contest: Kansas dryland top yields: 170-190 bu/a
- Nitrogen and P demands vs corn at comparable yield levels?
 - Nutrient uptake by sorghum for N, P and K

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Sorghum grain yield with chloride

Cl rate (lbs/acre)	Grain sorghum yield (bu/acre)
0	92
10	94
20	96
30	95

15 locations 2013-2017

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Sorghum nitrogen uptake vs yield

- 230 lbs of N total uptake
- N from organic matter (2%) = 40 lbs
- Previous crop (soybean) = 40 lbs
- Some profile N? = 30 lbs
- $40 + 40 + 30 = 110$
- $230 - 110 =$
- ~ 120 lbs of N from fertilizer

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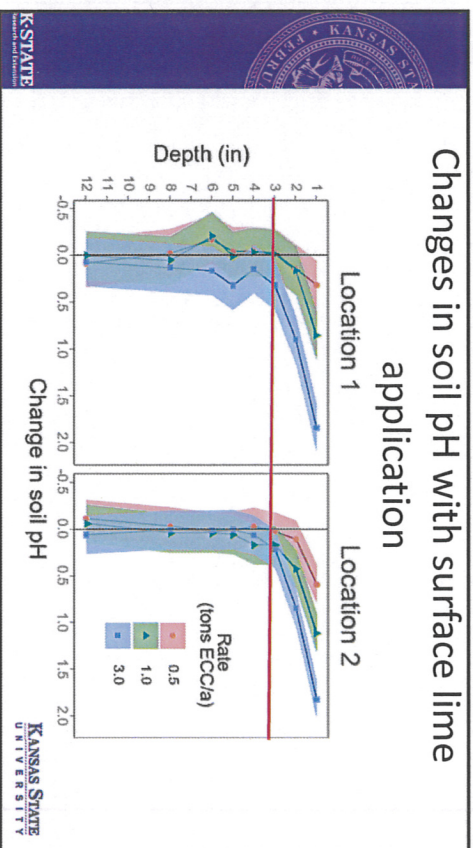
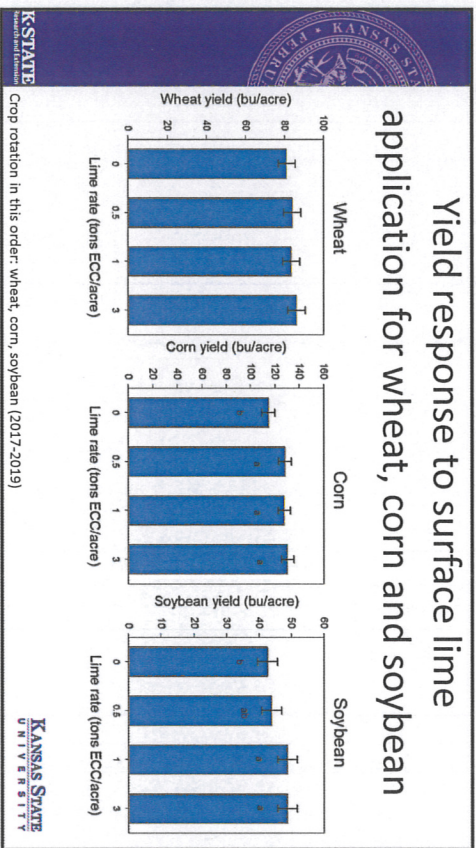
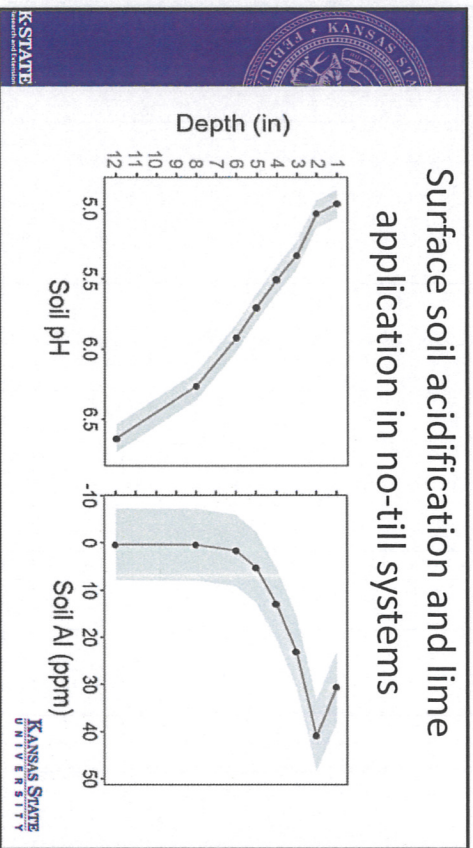
Band-applied Zn and sorghum grain yield

Treatment	Grain yield (bu/acre)
+ Zn	95
- Zn	91

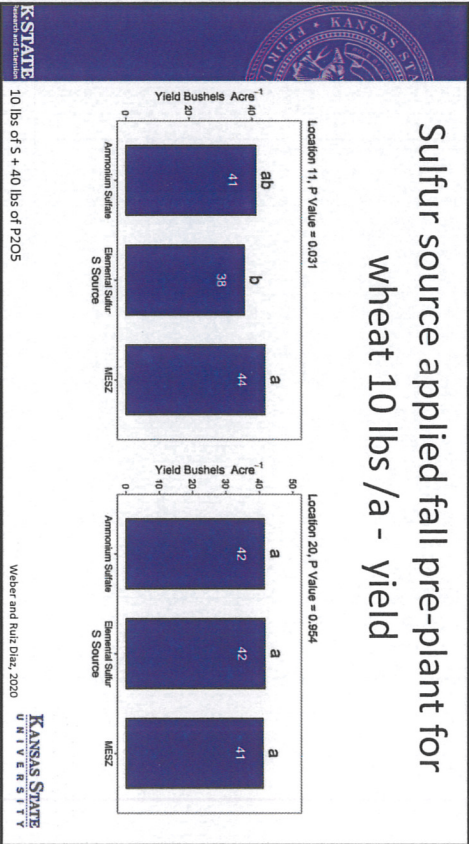
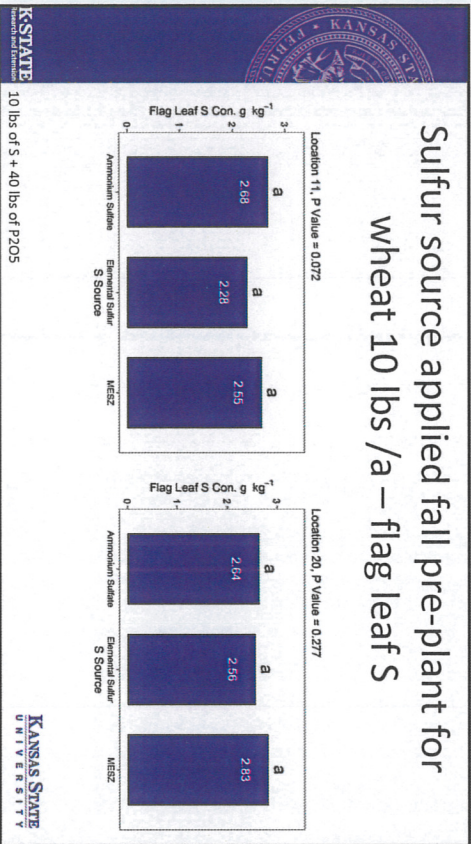
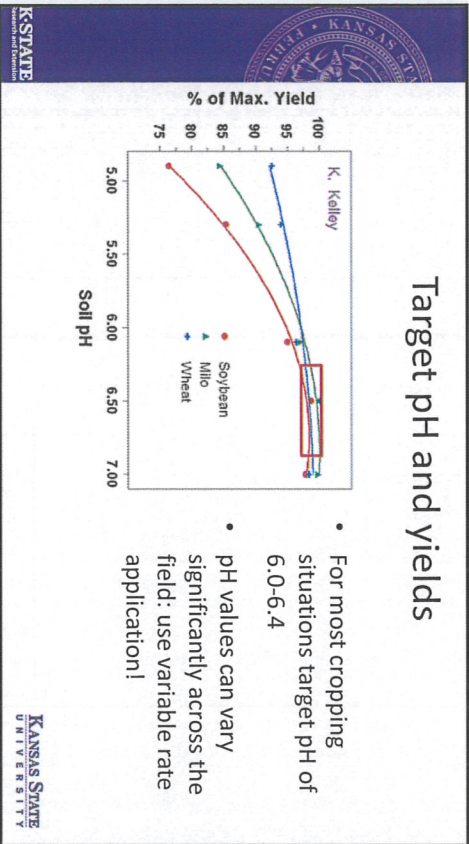
Zn fertilizer (0.5 lbs/acre 2x2)

pH	OM	STP	Zn
5.5	%	ppm	ppm
	3.1	16	0.6

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- ### Surface lime for no-till
- Small crop yield increase with lime (assess economic return to lime in a multi-year context).
 - The increase in soil pH was only in the upper three inches of the soil profile.
 - pH effect on herbicide efficacy under no-till system?
 - Other factors:
 - Microbial population/activity
 - Physical properties from Ca application?
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Fertilizer sulfur sources and application time

- Dry environment and low temperature may slow the sulfur oxidation process with fall applications
- However, regular use of elemental S may provide residual S in the soil
- Ongoing improvements in S fertilizer sources (smaller particle size of elemental S)

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**“Rescue” application of S in wheat
(response 10 days after application)**

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Yield response with in-season sulfur application

Treatments	Yield (bu/acre)
Control	~55 (b)
Urea	~55 (b)
Urea+S	~55 (b)
AMS	~65 (a)
Gypsum	~65 (a)

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Soil test sulfur and accumulation in clay layers

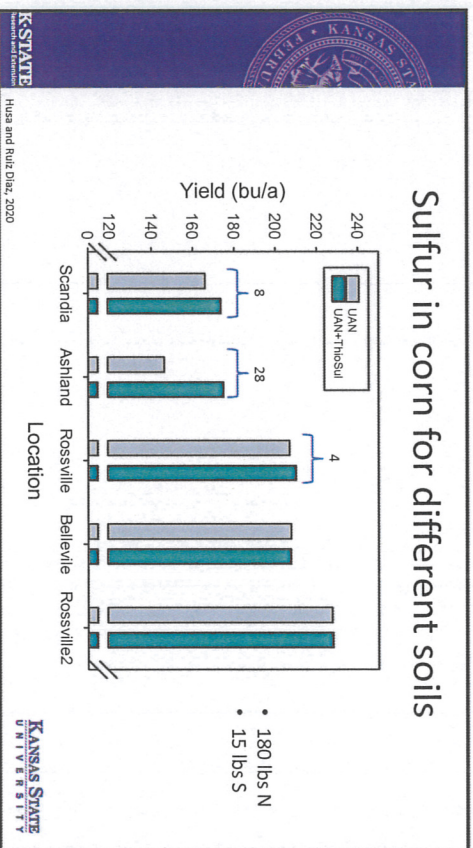
Soil sampling depth (in)	Soil test sulfur (ppm)
0-3"	~2
3-6"	~3
6-9"	~4
9-12"	~5
12-15"	~12
15-18"	~25

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Soil test sulfur

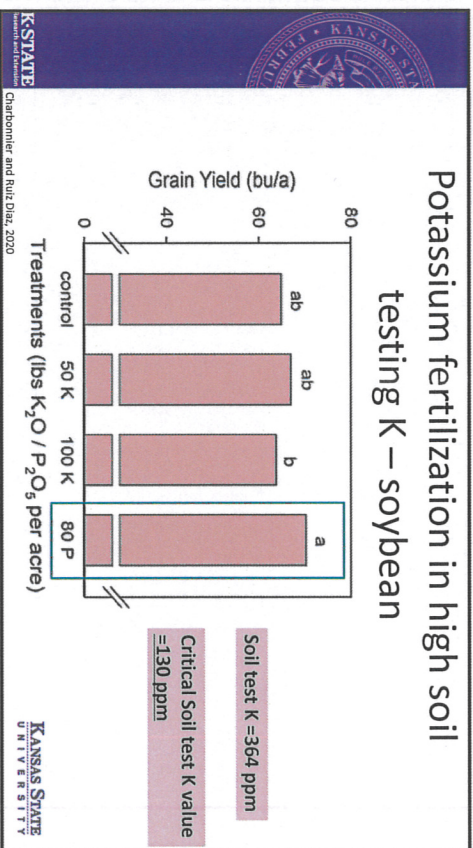
- Soil organic matter and soil texture can help with interpretation
- Need profile samples
- Rate of mineralization can be difficult to estimate
- High demand for S during the rapid growth of corn and wheat, and relatively shallow rooting can contribute to poor correlation

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Potassium fertilization in high soil testing K

- Soybean is the bigger user of K per bushel
- Potassium fertilizer (KCl) also provide chloride (can increase yields in corn, sorghum and wheat)
- Other factors affecting K uptake? (root growth, moisture, compaction etc.)



Questions?

@SoilFertilityKS
ruizdiaz@ksu.edu