What's an acceptable level of yield loss?

Proactive vs. Reactive Tissue Sampling

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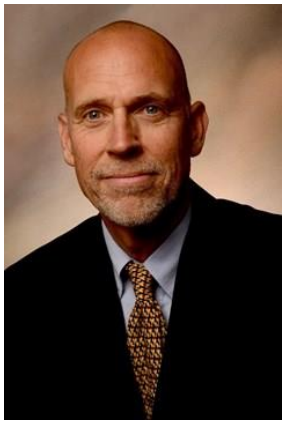
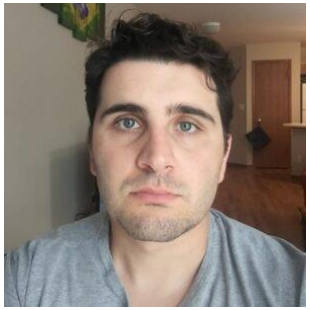




Soybean Field Data

Year	Field	Growth Stage	Critical K Concentration	Field Mean	Field Median	Deficient	CV
			%				
2020	Faulkner	R2	1.92	1.77	1.76	86	9.8
		R4	-	-	-	-	-
2021	Lonoke	R2	1.93	1.99	1.98	38	7.2
		R4	1.41	1.29	1.28	89	9.1
2021	Arkansas S	R2	1.89	1.96	1.96	18	6.1
		R4	1.61	1.66	1.65	35	7.4
2021	Arkansas E	R2	1.80	1.68	1.62	77	7.5
		R4	1.47	1.89	1.87	0	5.7
2021	Arkansas W	R2	1.89	1.99	1.98	20	5.7
		R4	1.63	1.56	1.57	92	3.3

2023 K and Cl Monitoring Program

- County Agents sampled ~23 soybean production fields at R2 and R4

- At R2 12/23 locations were deficient in K
  - Anticipated yield loss of 8-25%

- At R4 16/23 locations were deficient in K
  - Anticipated yield loss of 10-25%

Hidden Hunger is Real

Applications of Tissue Analysis

Determine nutrient uptake (research)

Determine fertilizer use efficiency (research)

Diagnosis/confirmation of plant nutrient deficiencies — **Reactive**

Monitoring crop nutrition — **Proactive**

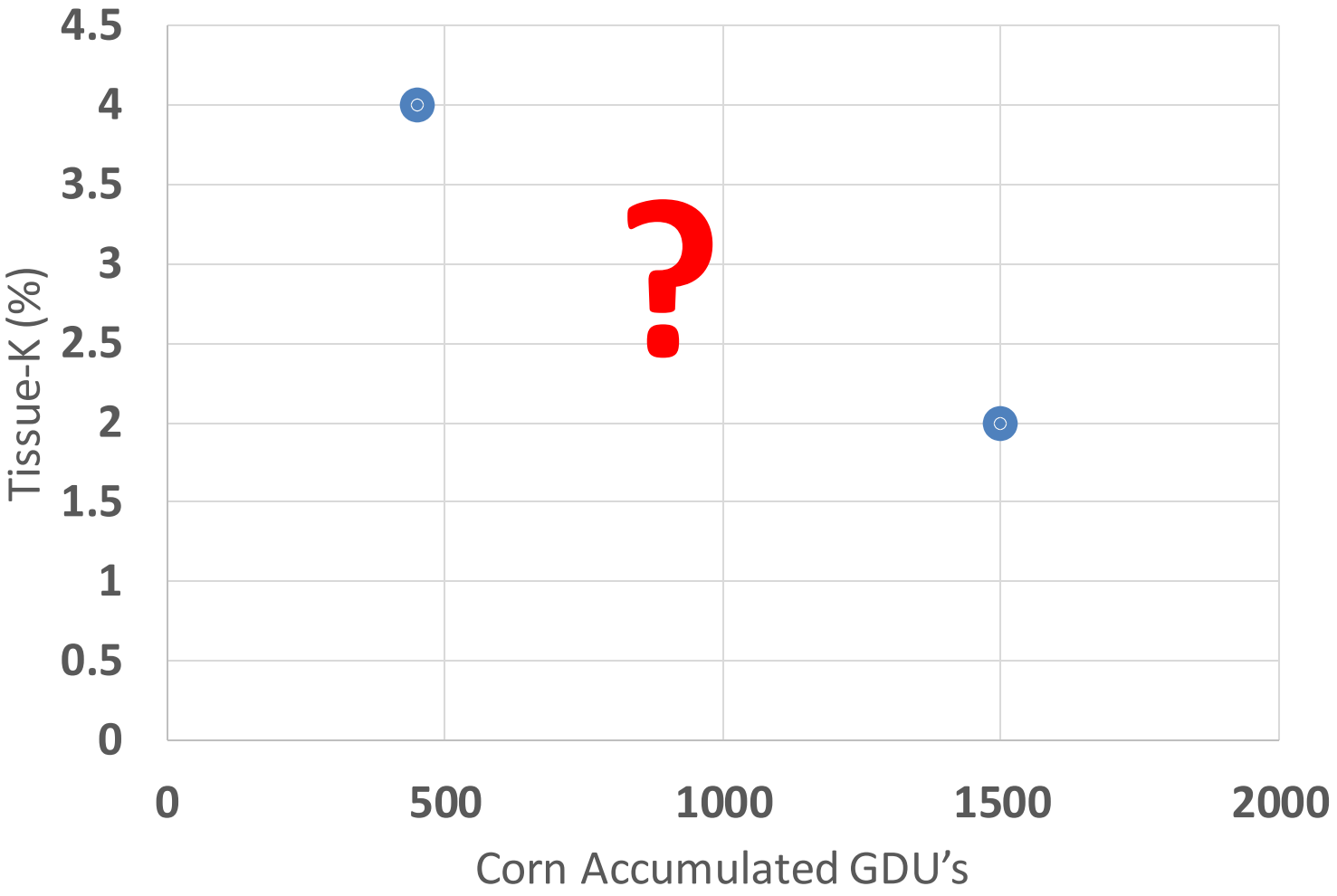
Limitations of Proactive Sampling

- Interpretation
- Correction
- Economics

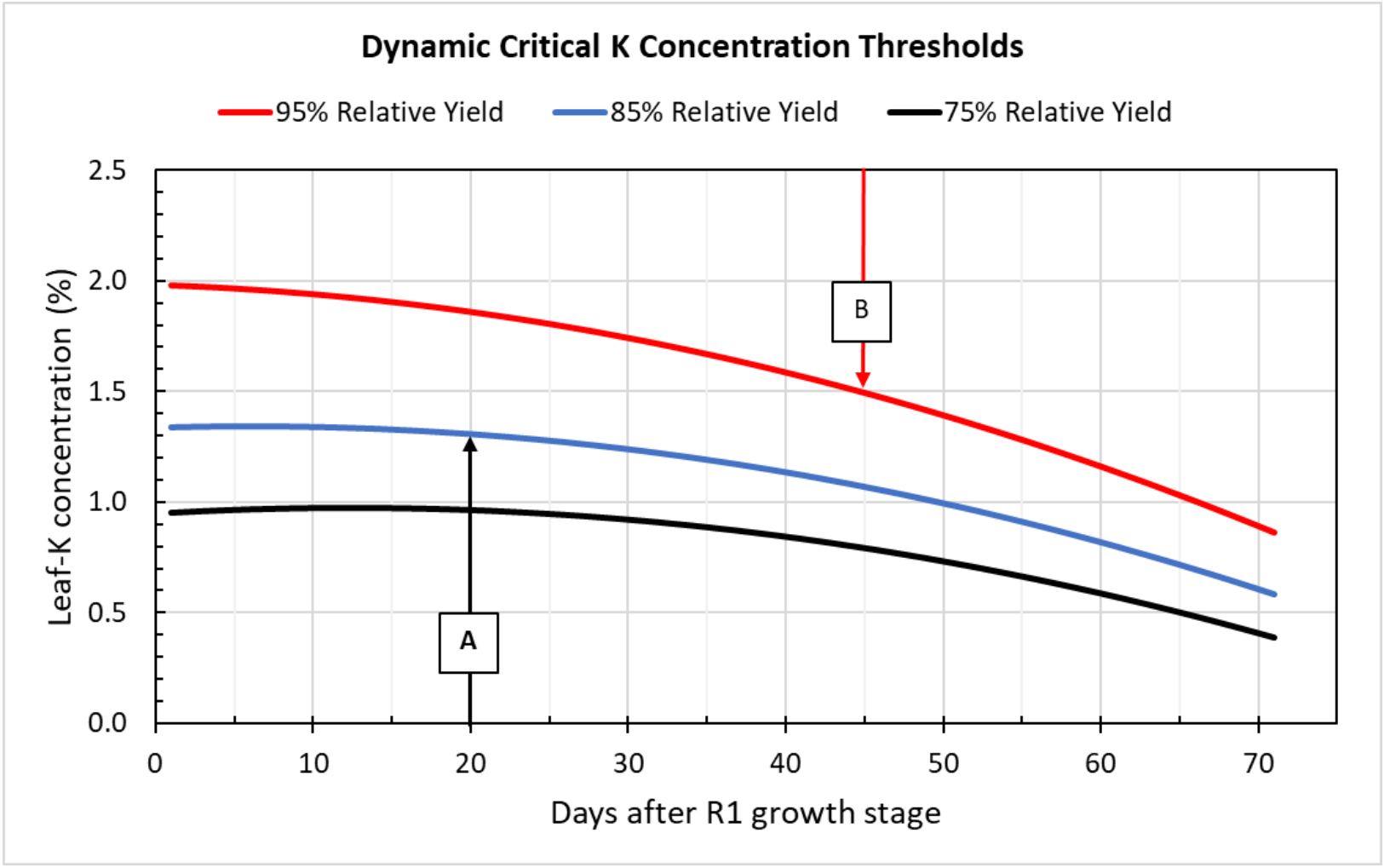
Limitations of Proactive Sampling: Interpretation

- **Most row crops only have limited interpretative value**
- Corn
  - Seedling/Early growth, VT/R1, Maturity
- Cotton
  - Early bloom, Maturity
- Rice
  - Mid-tillering, Panicle Initiation
- Soybean
  - Early growth/R2

Corn Example



Soybean Dynamic Critical K



Limitations of Proactive Sampling: Correction

- **Most row crops recommend blanket rates across varying levels of deficiency**
- Corn
  - 45 lb N/acre
- Cotton
  - ??
- Rice
  - 100 lb AMS, 100 lb urea, 100 lb potash…
- Soybean
  - 60 lb K_2O/acre

Do We Treat All These the Same?

- Mild deficiency (hidden hunger)
  - 0-15% yield loss
- Moderate deficiency (hidden hunger/some visual symptoms)
  - 10-20% yield loss
- Severe deficiency (drastic visual symptoms)
  - >15% yield loss

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			%				
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		R4	-	-	-	-	-
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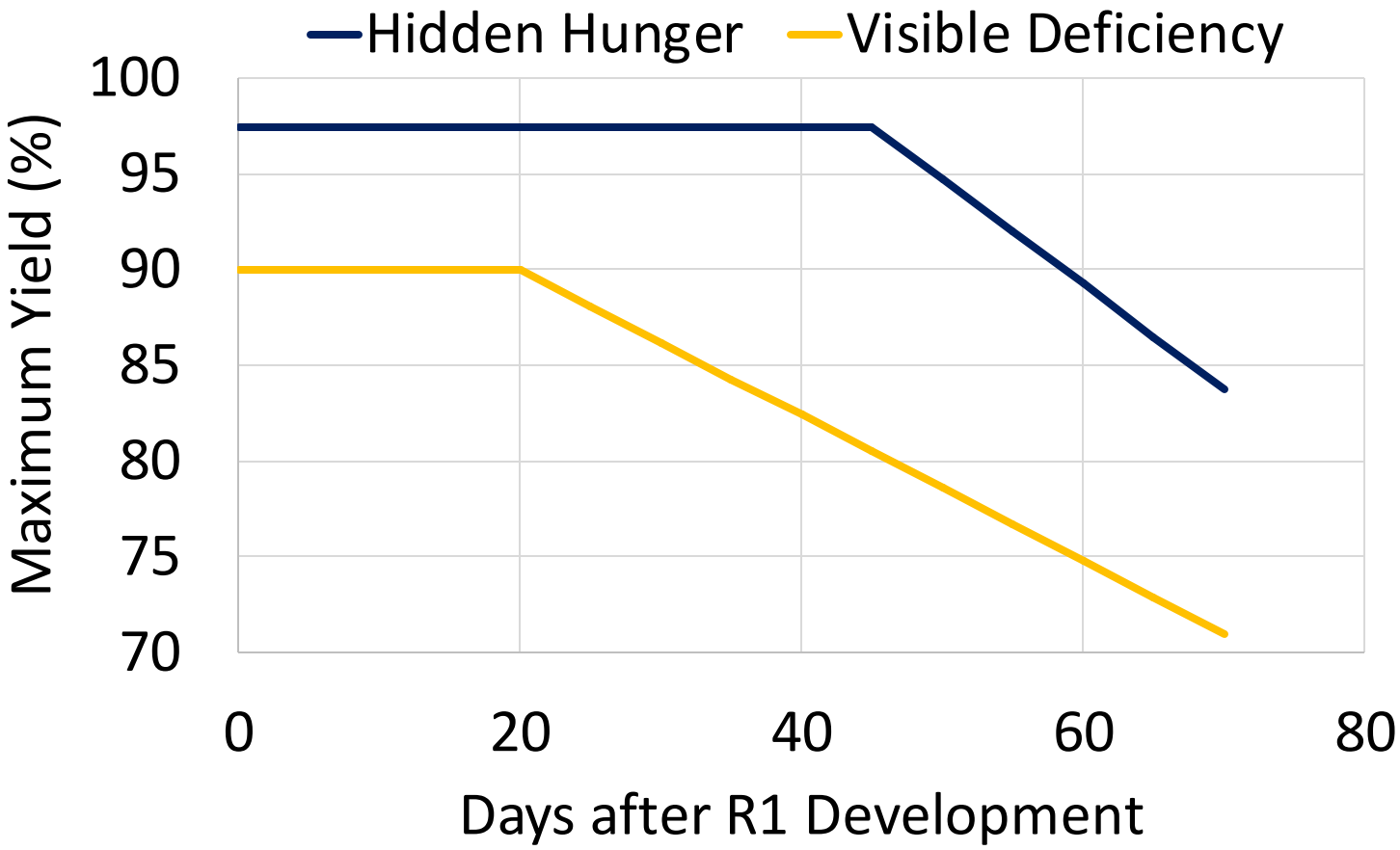
Correcting In-season Nutrient Deficiencies

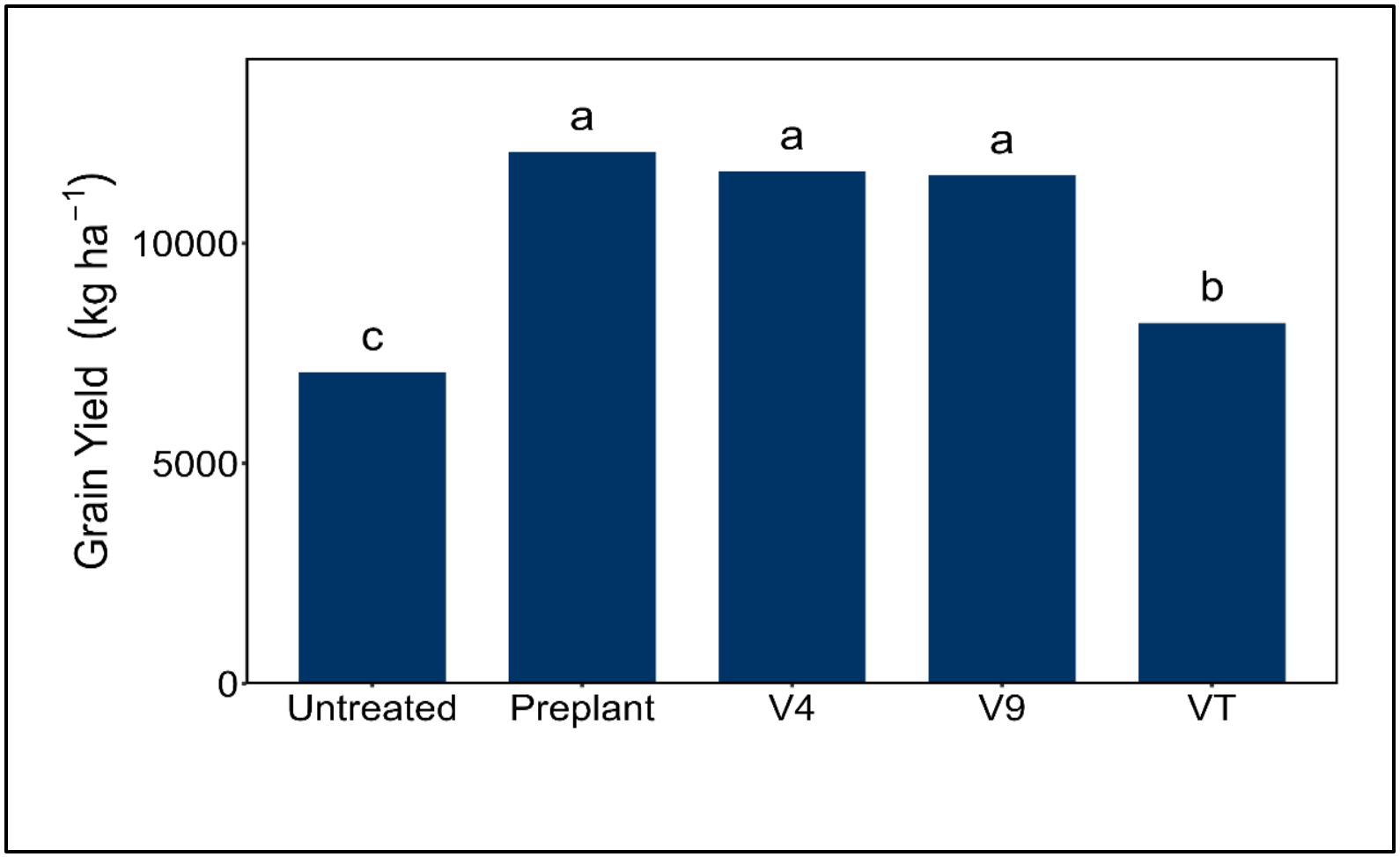
- Timing
  - What is the window of opportunity to positively influence yield?
  - What is the point (growth stage) of no return?

- Rate
  - One size (rate) approach doesn't make sense

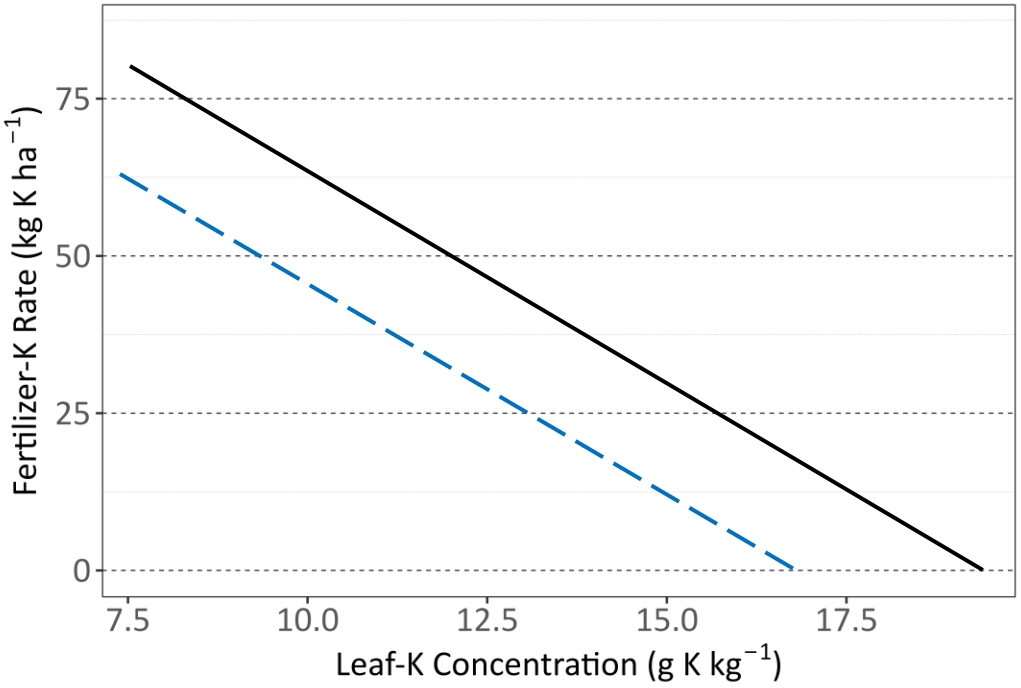
Soybean Timing



Corn Timing


Grain Yield (kg ha^{-1})
10000
5000
0
c
a
a
a
b
Untreated
Preplant
V4
V9
VT

Calibrated In-Season K Rates



15 DAR1

$$f(x) = \begin{cases} 130 - 6.9x & if\ x \leq 18.9^{a} \\ 0 & if\ x > 18.9^{a} \end{cases}$$

30 DAR1

$$f(x) = \begin{cases} 119 - 6.9x & if\ x \leq 17.3^{a} \\ 0 & if\ x > 17.3^{a} \end{cases}$$

[a] (Slaton et al., 2021)

Limitations of Proactive Sampling: Economics

- **Soybean Example**
  - **Yield recovery of 6 bu/acre= value of $90/acre**
  - **Corrective application = cost of $30/acre**
  - **Net ROI $60/acre**

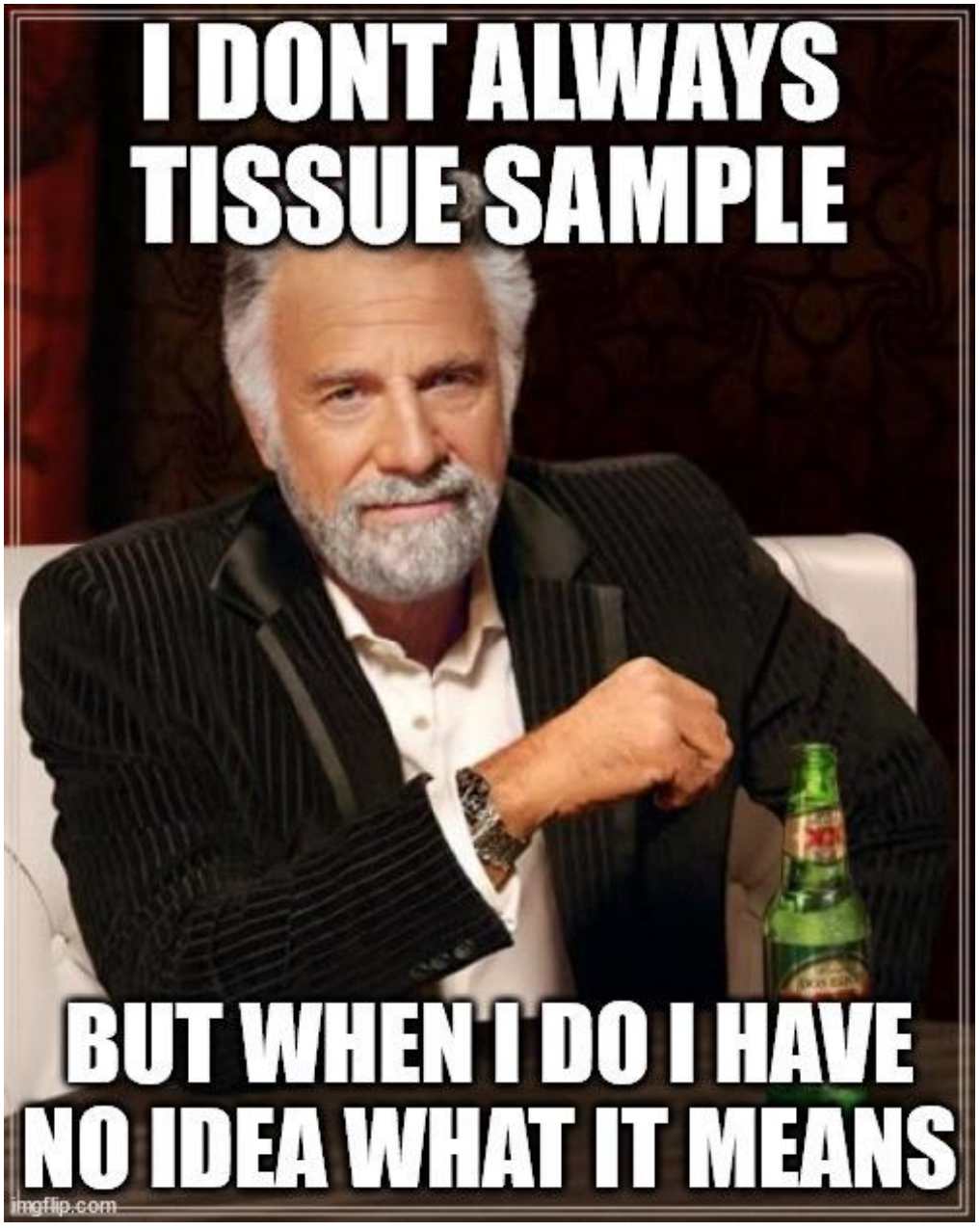
- **Some corrective in-season applications will not be economical!**

Key Takeaways

- Collect proper plant sample based on:
  - Purpose
    - Proactive vs. reactive
  - Growth Stage
  - Diagnostic/Method protocols
- In-season tissue testing can be useful to determine if additional fertilization will aid crop performance- but timely diagnosis is critical

Key Takeaways

- For Proactive Sampling to be useful we need:
- Dynamic Critical Concentrations
- Calibrated In-season Corrective Rates
- Economics


I DONT ALWAYS
TISSUE SAMPLE
BUT WHEN I DO I HAVE
NO IDEA WHAT IT MEANS
imgflip.com

Acknowledgements

- University of Arkansas System Division of Agriculture
- Soil Fertility Crew
- Arkansas Soybean Promotion Board
- Arkansas Corn and Grain Sorghum Promotion Board
- Fertilizer Tonnage Fees

Questions?

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