
Sensor-Based Fertigation for More Efficient N Management
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Motivation

- Efficient N use is important for achieving acceptable water quality
- Optimal N use results in higher profits
- Potential for regulation = need for methods and technology to mitigate impact on productivity
- Fertigation inherently offers many N use efficiency benefits
- Prior research has demonstrated that using sensors to guide fertigation decisions may maximize N use efficiency benefits

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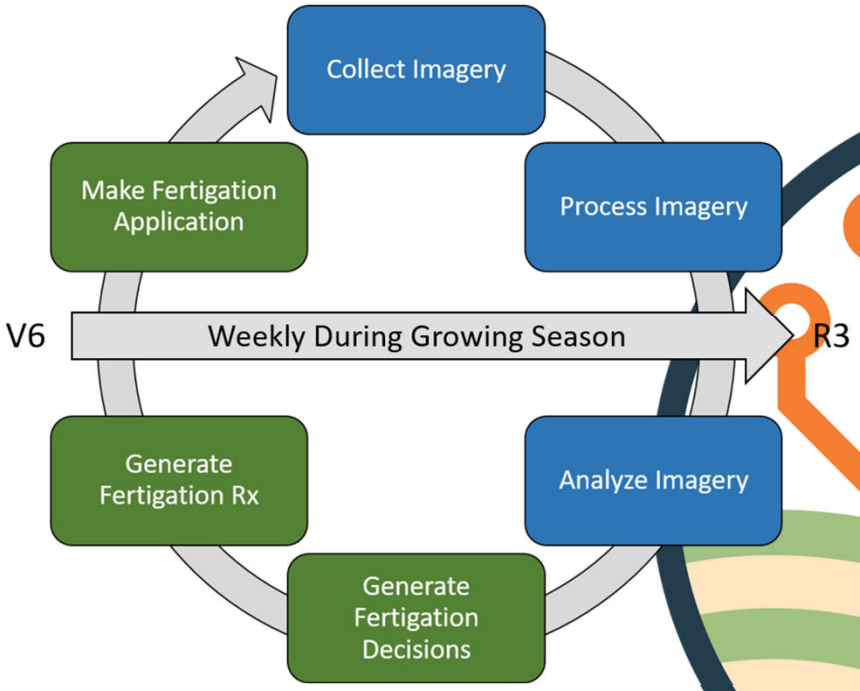
Method

Preseason Data Collection and Site Setup

Indicator-block Establishing Application by V6



R3 at Time of Flight

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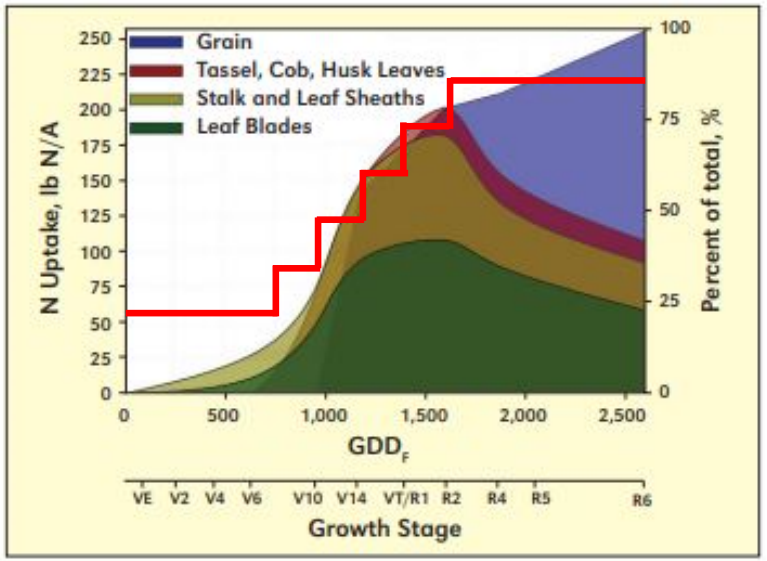
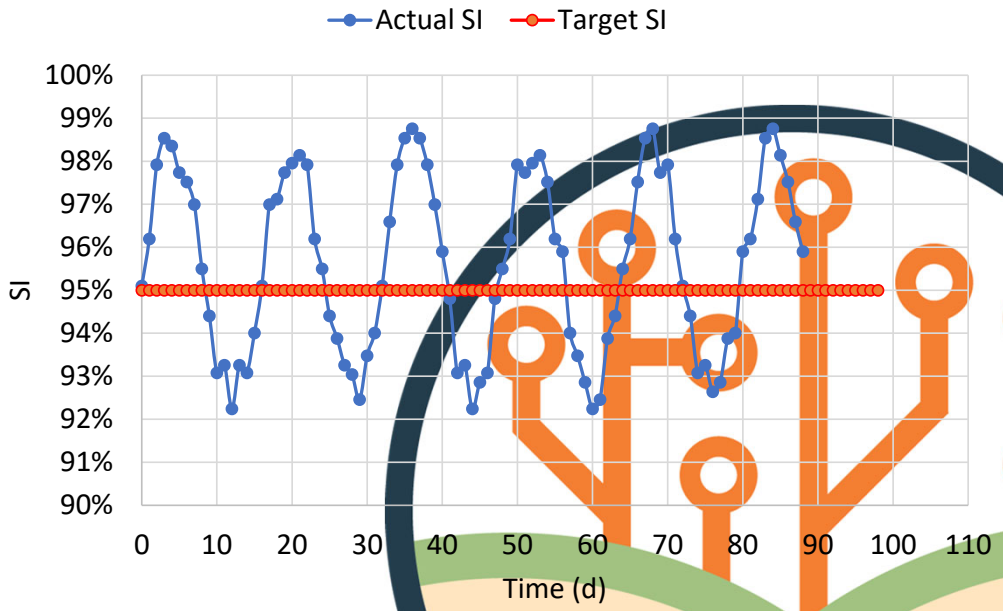
Method Objective





Match corn N uptake using on/off N application control.

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Important Definitions

- Indicator Plot – small area receiving less N used to indicate N stress
- Reference Plot – small area receiving sufficient N used to determine crop performance potential
- Indicator Block – area with an adjacently paired indicator and reference plot
- NDRE – reflectance-based vegetation index
- Sufficiency Index (SI) – calibrated N sufficiency measurement

$$SI = \frac{NDRE_{indicator}}{NDRE_{reference}}$$

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Treatments Investigated

- Risk-Averse Approach: designed to prioritize protecting yield potential while still reducing total N applied
- Risk-Tolerant Approach: designed to prioritize saving N while retaining most yield potential

2019 Treatments	2020 Treatments
• Grower Management • Risk-Averse Sensor-Based Management* • Risk-Tolerant Sensor-Based Management* * - both treatments only implemented for last 60 lb N applied.	• Grower Management • Risk-Averse Sensor-Based Management (Full Season) • Risk-Tolerant Sensor-Based Management (Last 60 lb N)

The objective of the on-farm research trials was to optimize the method for commercial scale implementation.

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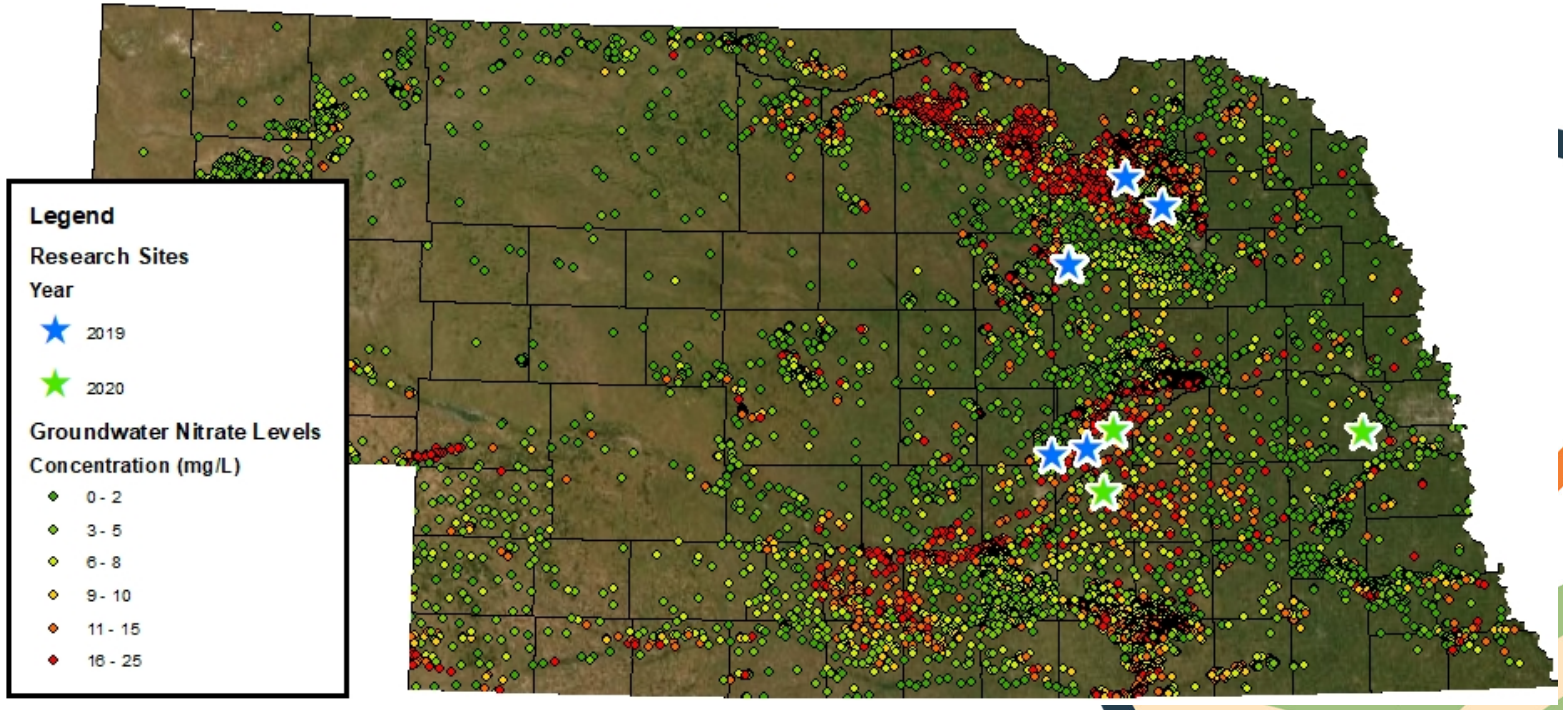
Research Trial Locations



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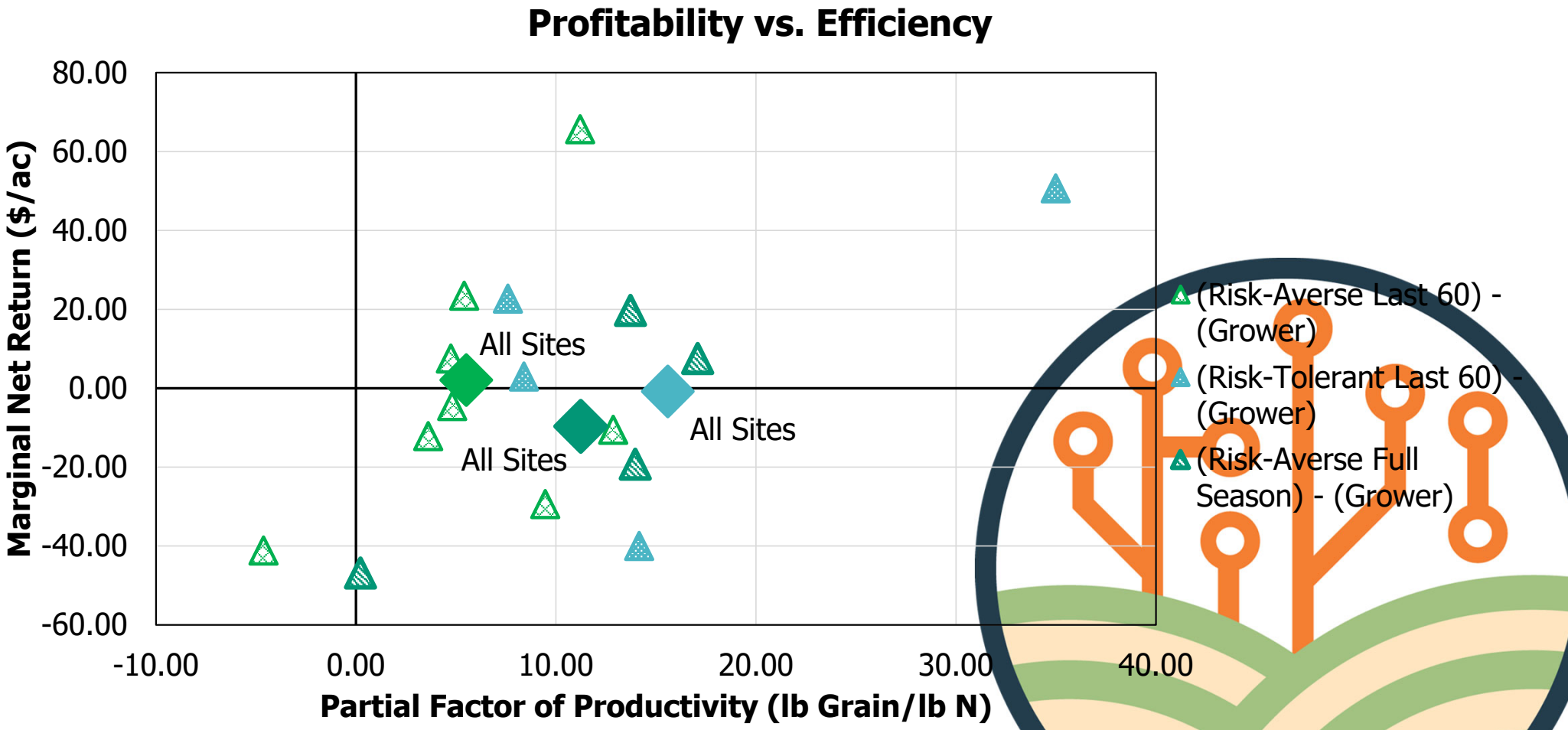

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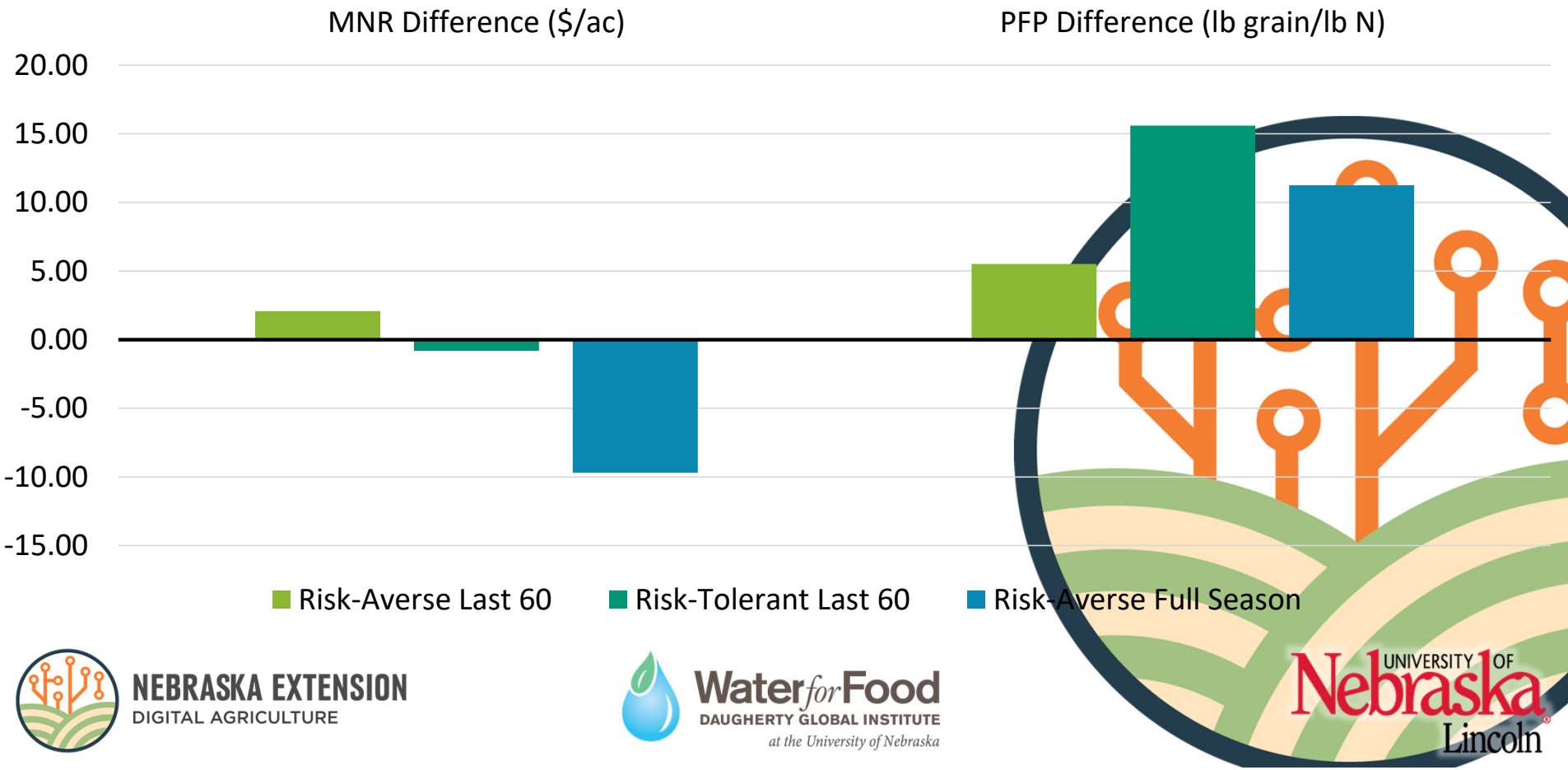
Aggregate Results



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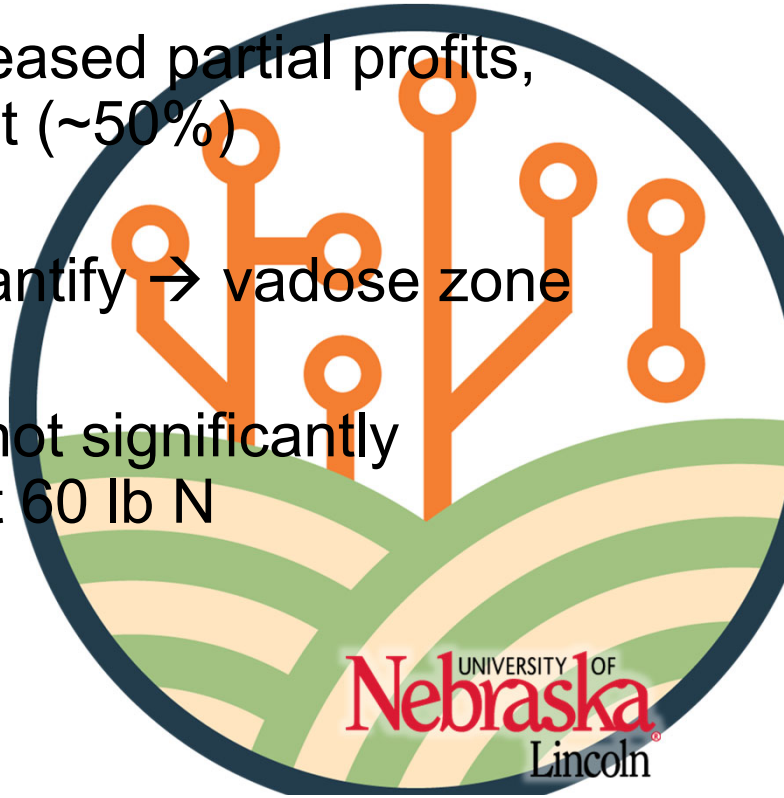
The Bottom Line

- Sensor-based fertigation leads to increased N use efficiency (~95% of the time)
- Sensor-based fertigation can lead to increased partial profits, but outcomes are much more inconsistent (~50%)
  - Yield potential and market dependent
- Exact N loss mitigation challenging to quantify → vadose zone sampling to help determine
- Full-season sensor-based management not significantly different from implementation for only last 60 lb N



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Ongoing Work

- Determining environmental and management contexts that most significantly influence method success
- Further method adaptations
  - Cutoff timing
  - Rate adjustments by growth stage
- Indicator block implementation alternatives
  - Only center pivot usage
  - Combined operations
- Automation through software

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