Development of a New Procedure to Design In-season Variable Rate Nitrogen (N) Fertilizer Prescription Maps for Michigan Wheat Farmers

Year 1 Summary

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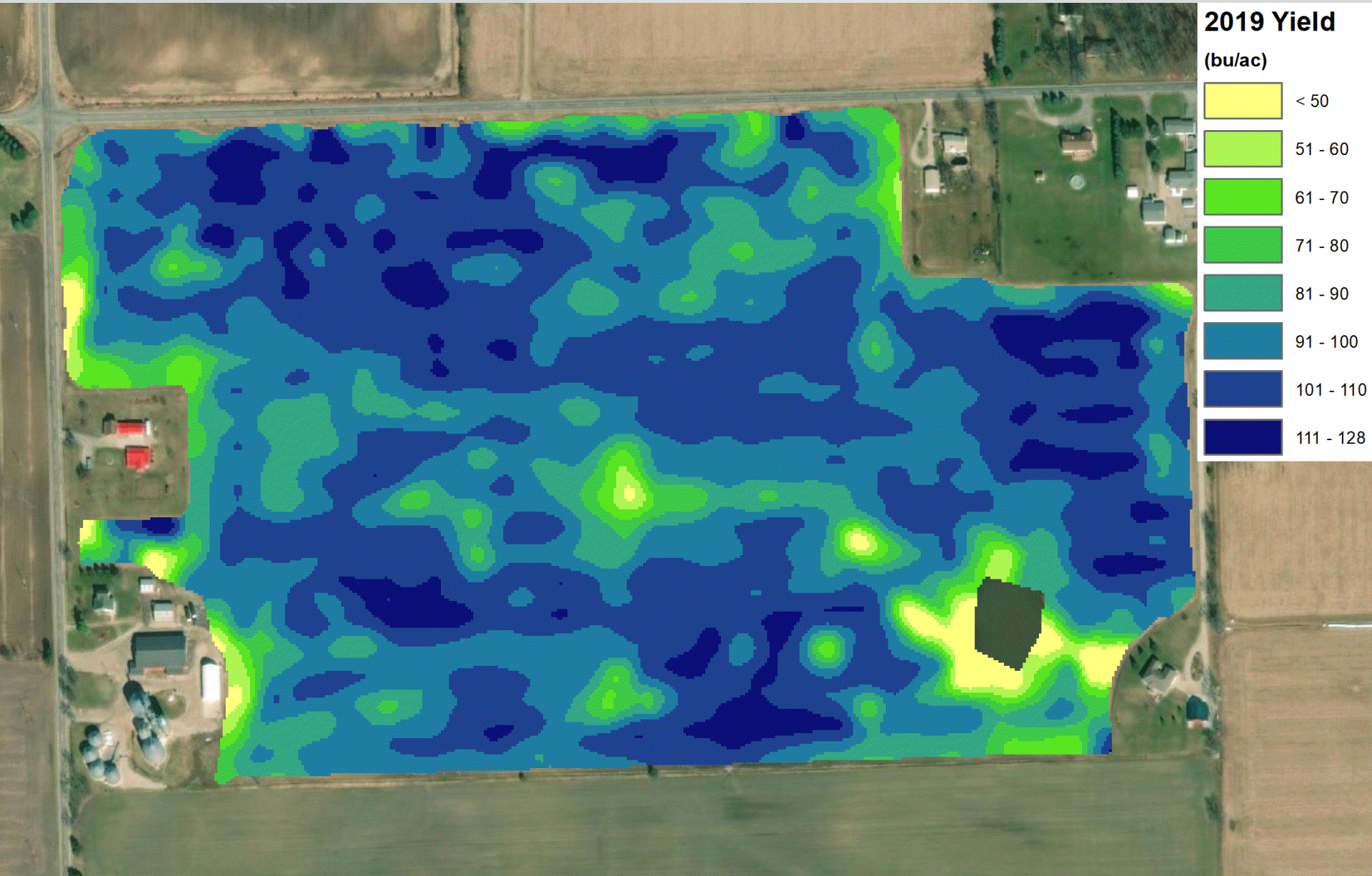
Rationale

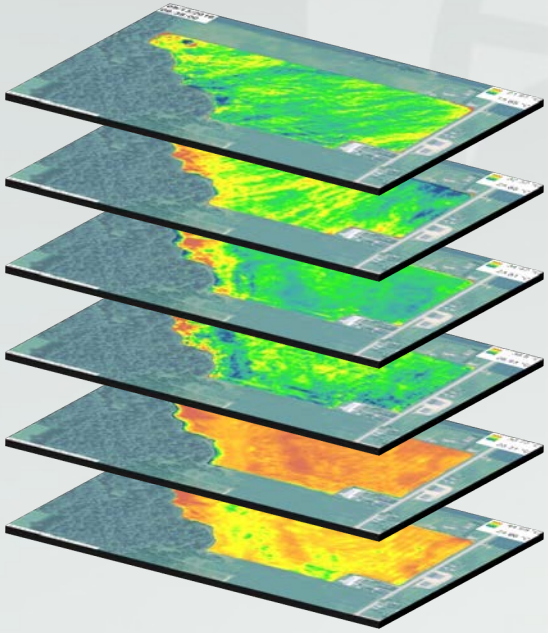
- Precision agricultural technologies are useful tools to apply fertilizer more efficiently for Michigan wheat
- Current N prescription services are costly, complicated, and sometimes incorrect
- Increasing N use efficiency in wheat will make farmers more productive and profitable

2019 Yield Map



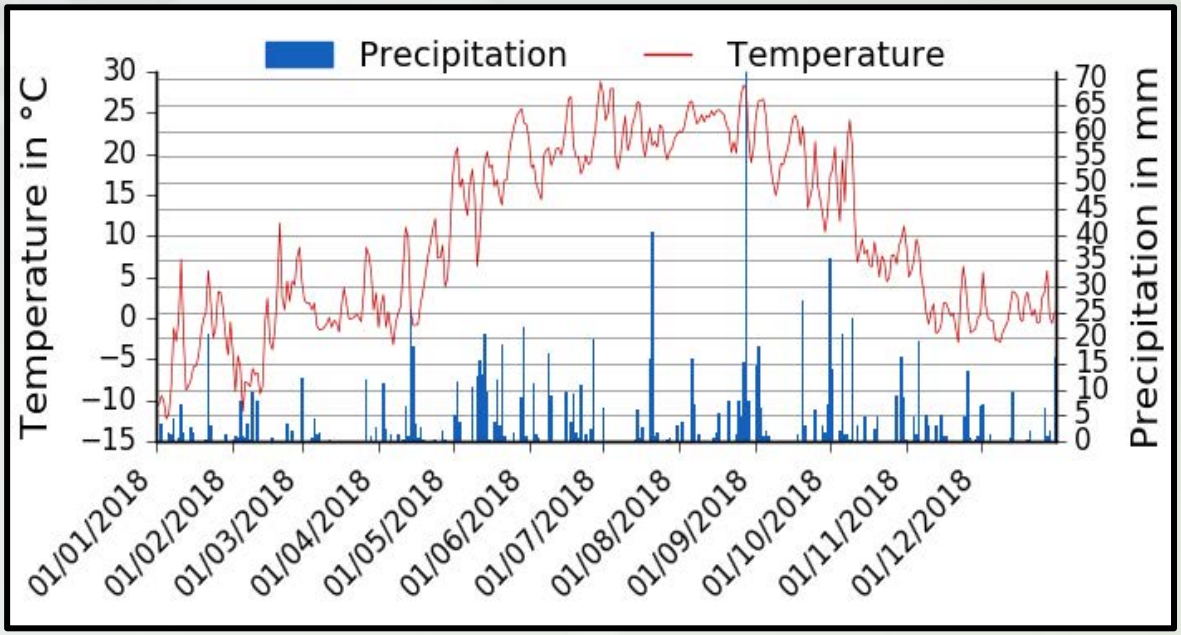
Objectives

1. Synthesis of historical field observations and image analysis



Objectives

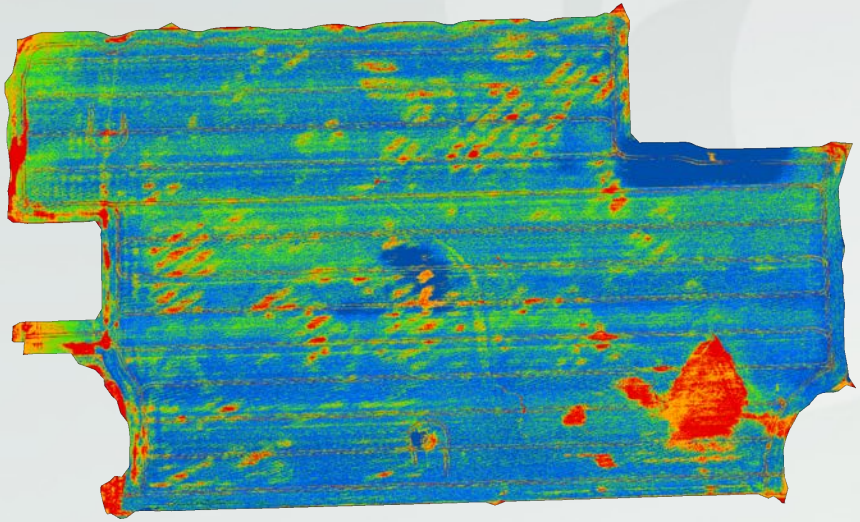
2. Crop simulation modeling using up-to-date weather forecasts



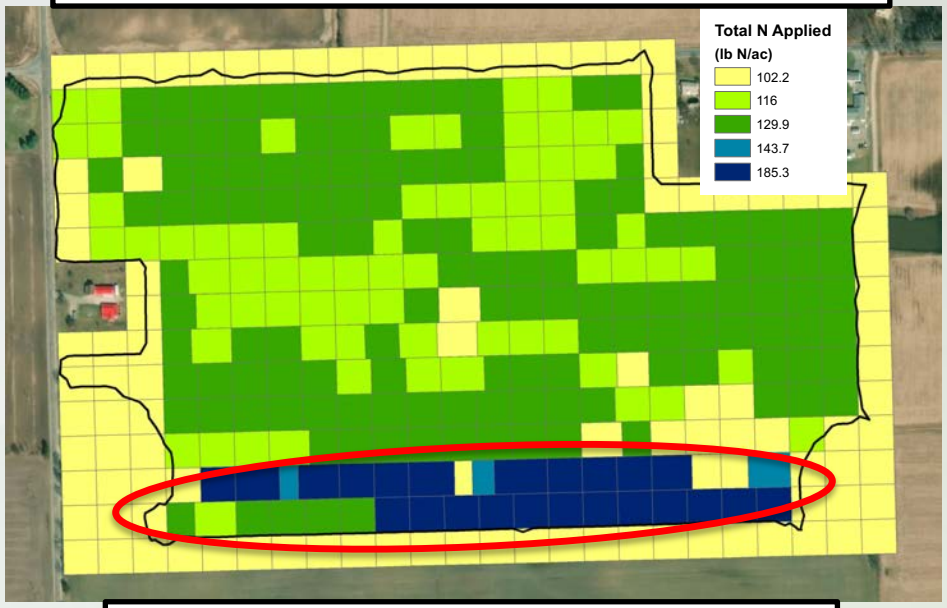
Objectives

3. In-season variable rate N application

Remotely Sensed Imagery

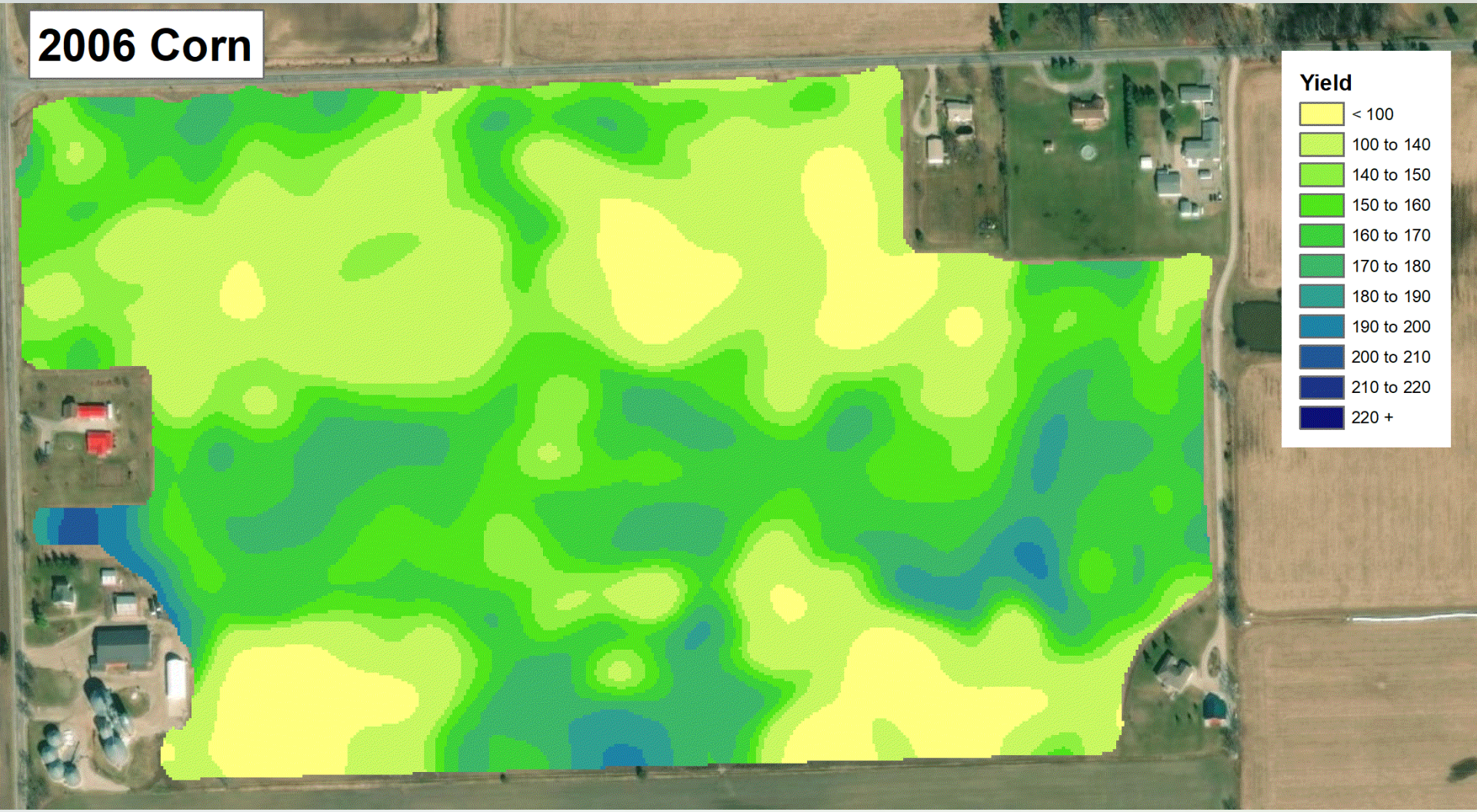


Total N As Applied



Wrong tips & rate caused additional 55 lb N/ac applied

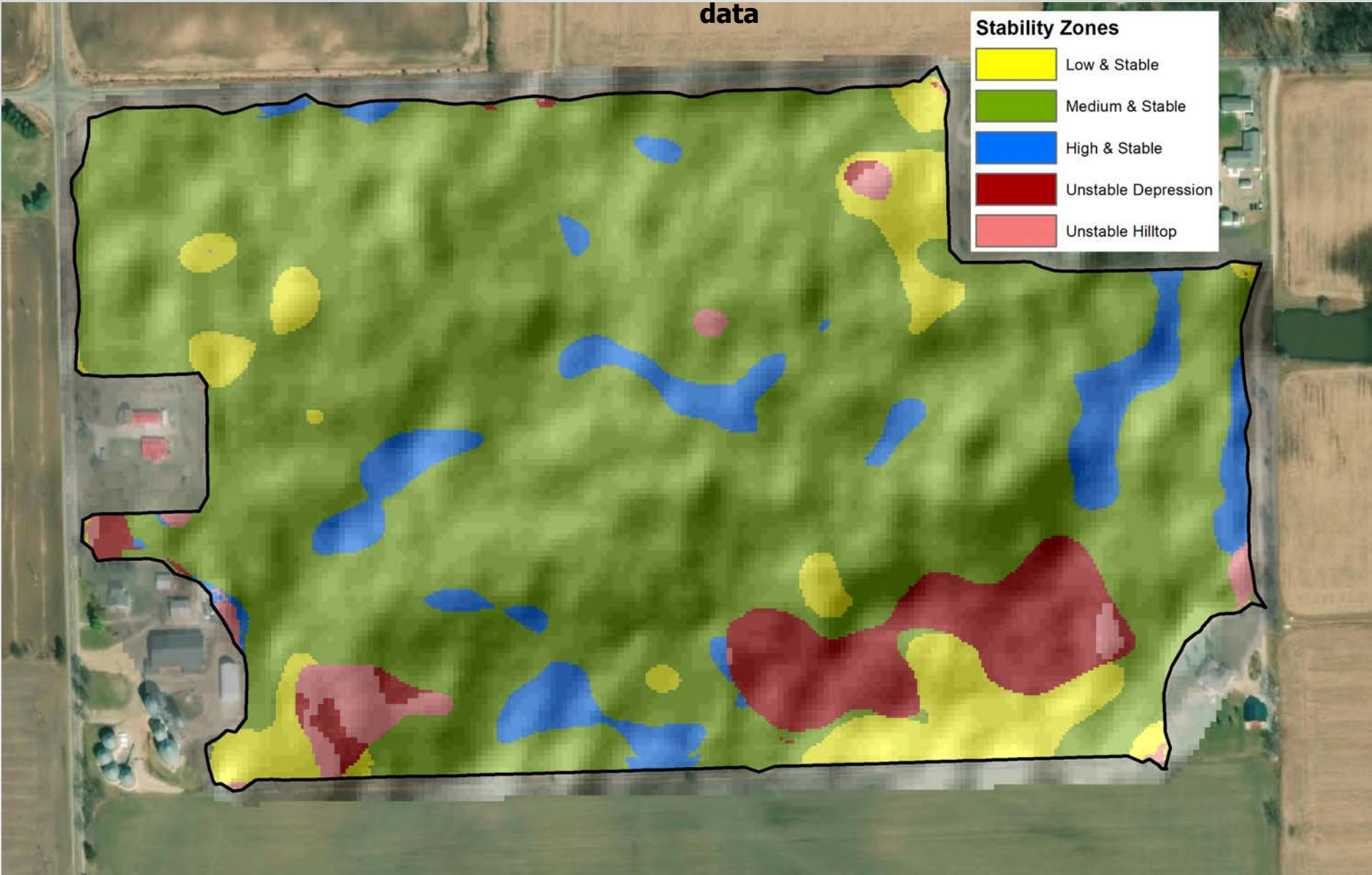
Historical Yield Monitor Data



Yield Stability Map

Total area: 85 acres

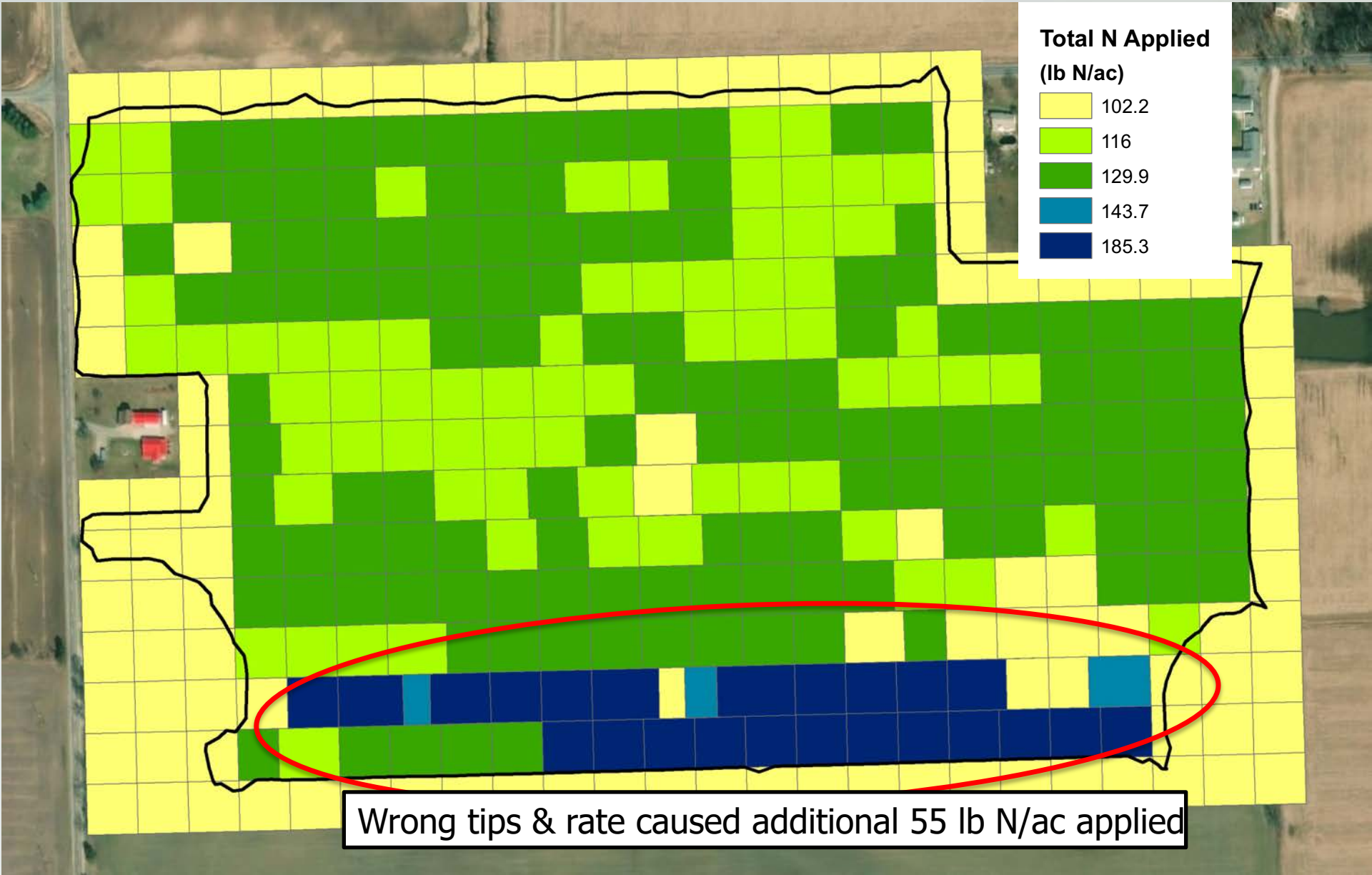
13 years of yield data



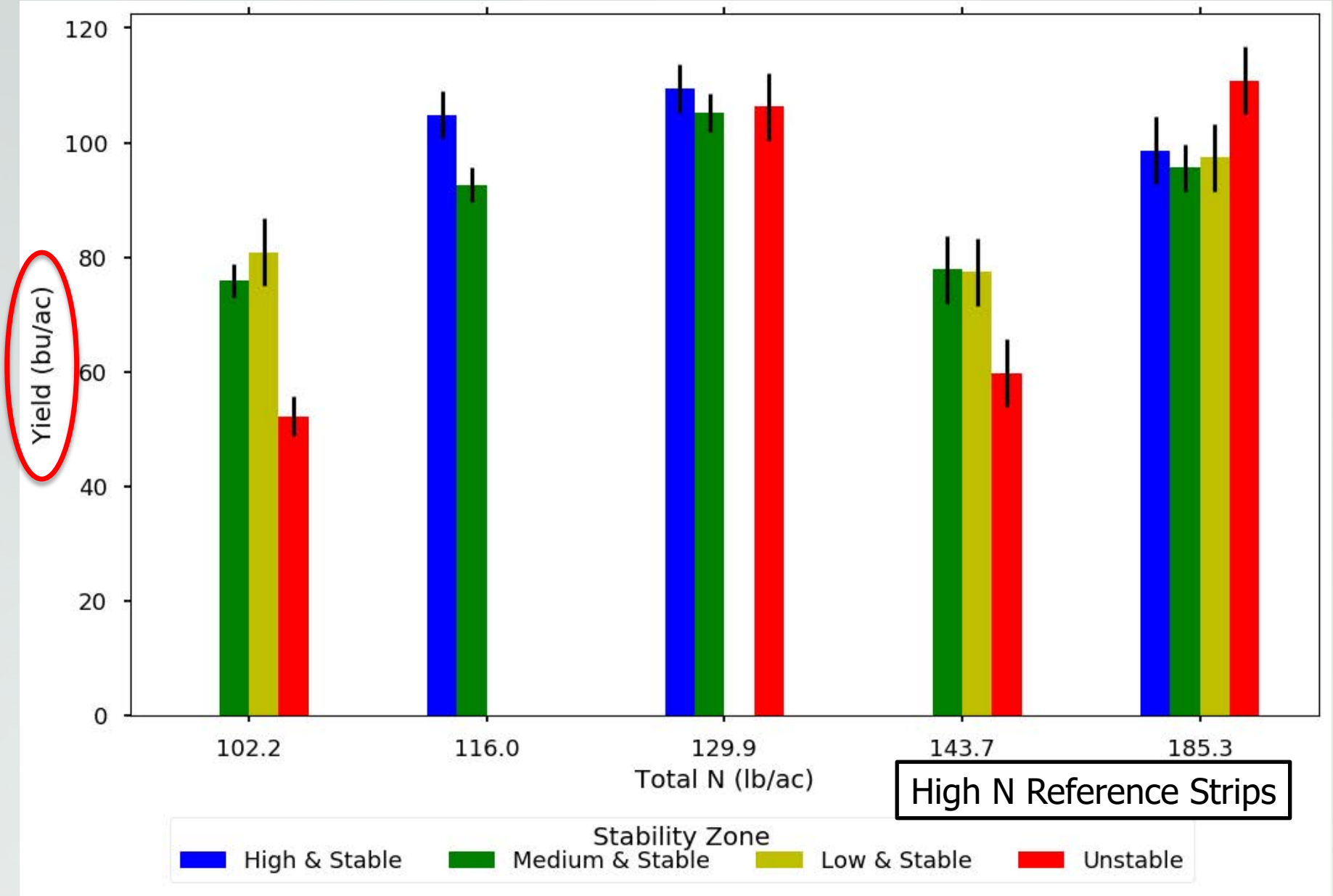
Applied From Rx

Total area: 85 acres

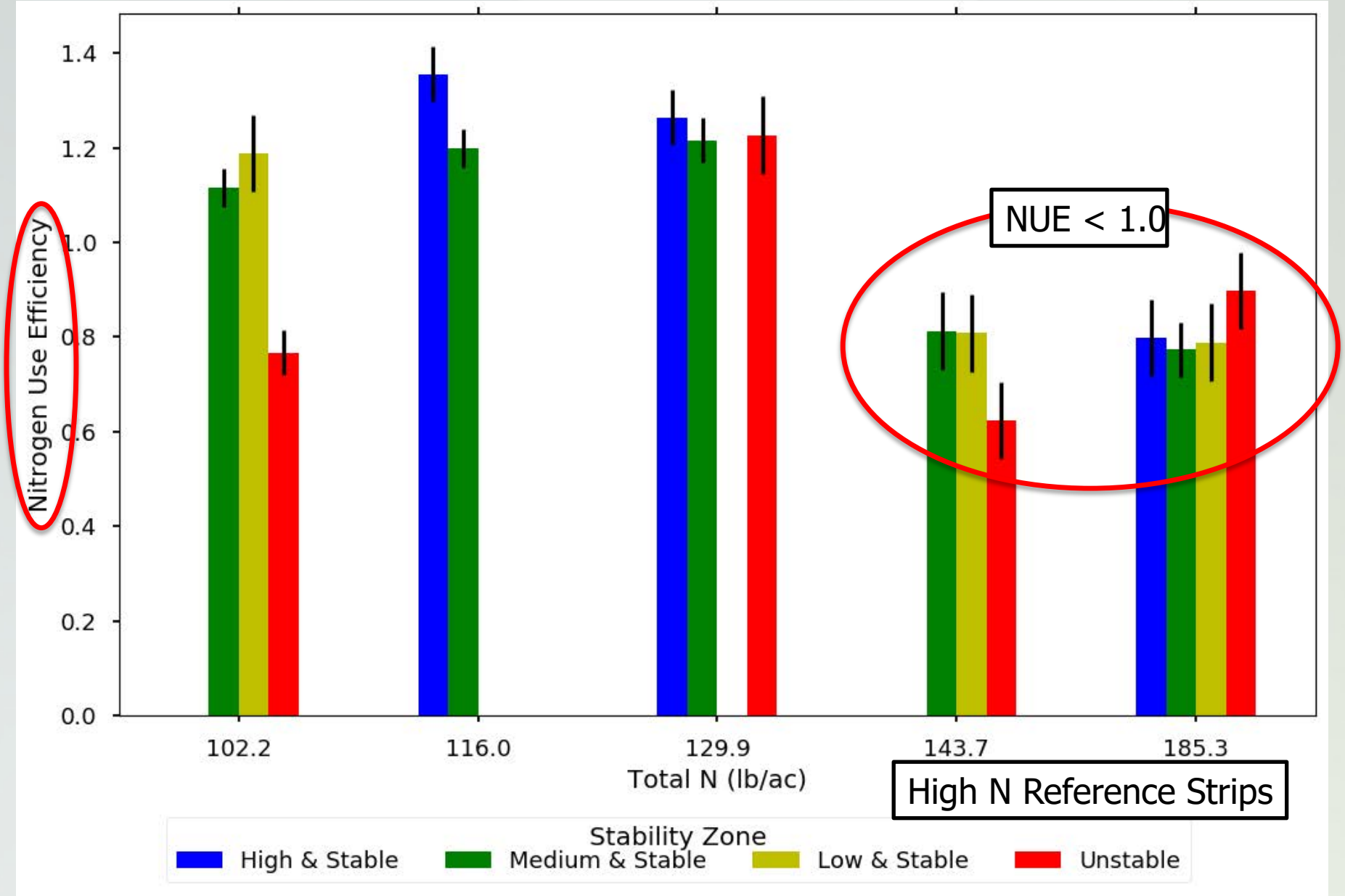
13 years of yield



2019 Yields by Yield Stability Zone

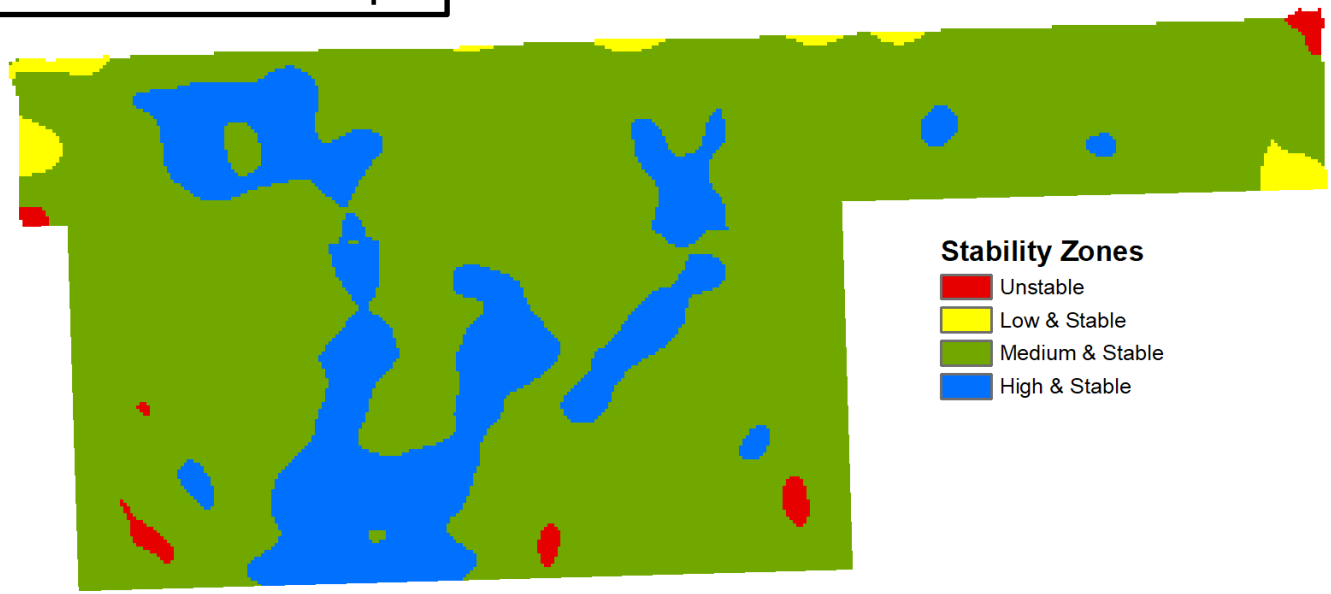


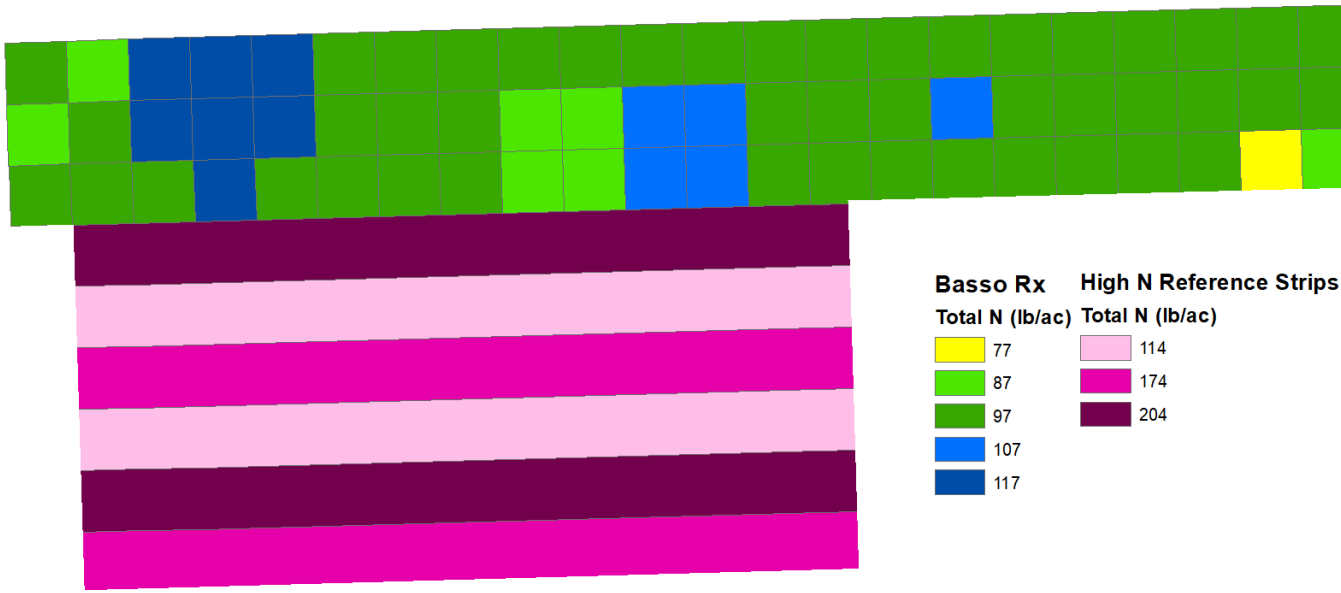
2019 NUE by Yield Stability Zone



Additional Field with High Reference N Strips

- Variable rate applied in 3 different applications
- High total N in Reference Strips was 204 lb N/ac
- High total N in Rx was 117 lb N/ac
- **How can we maximize yield with intensive management?**





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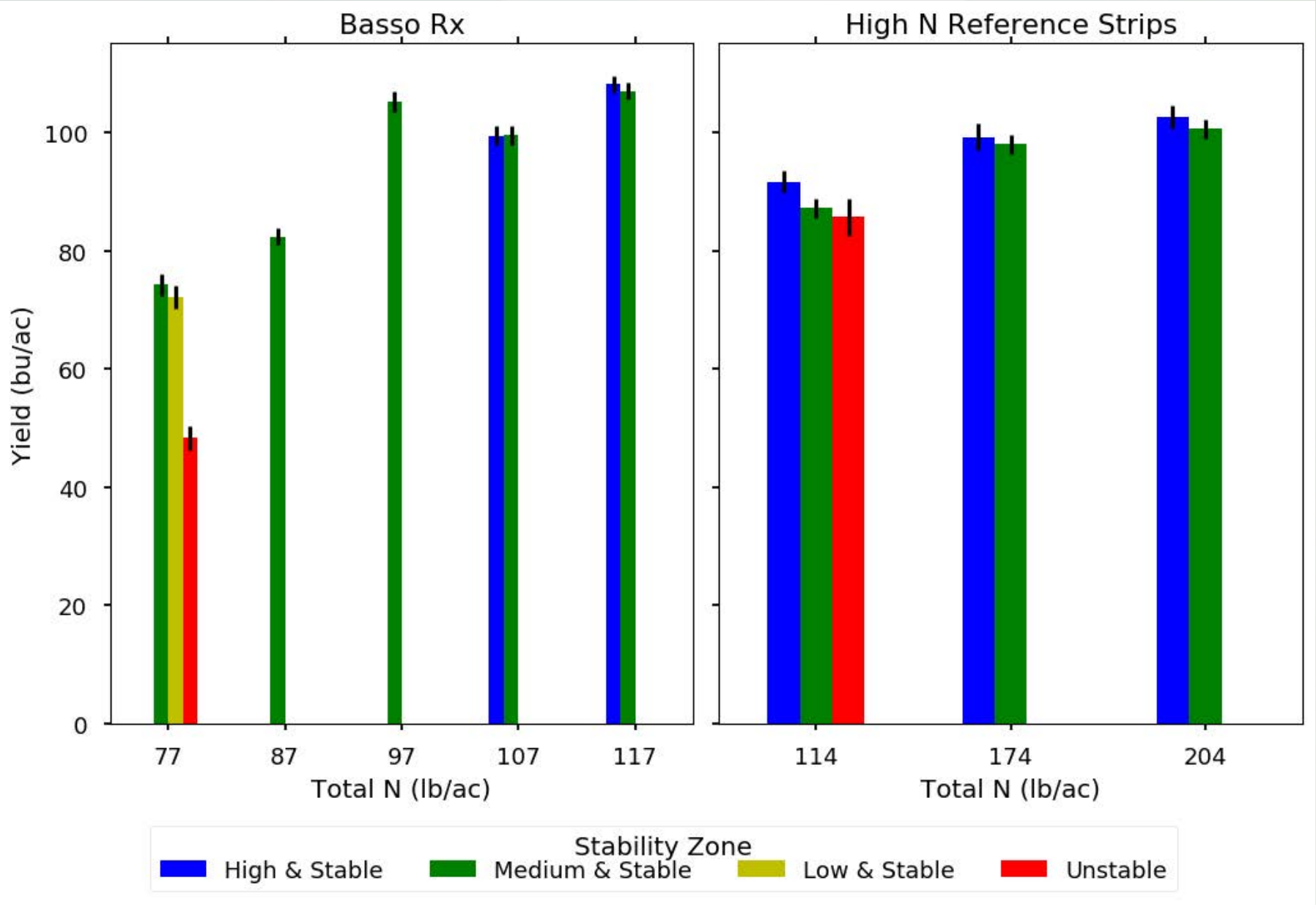
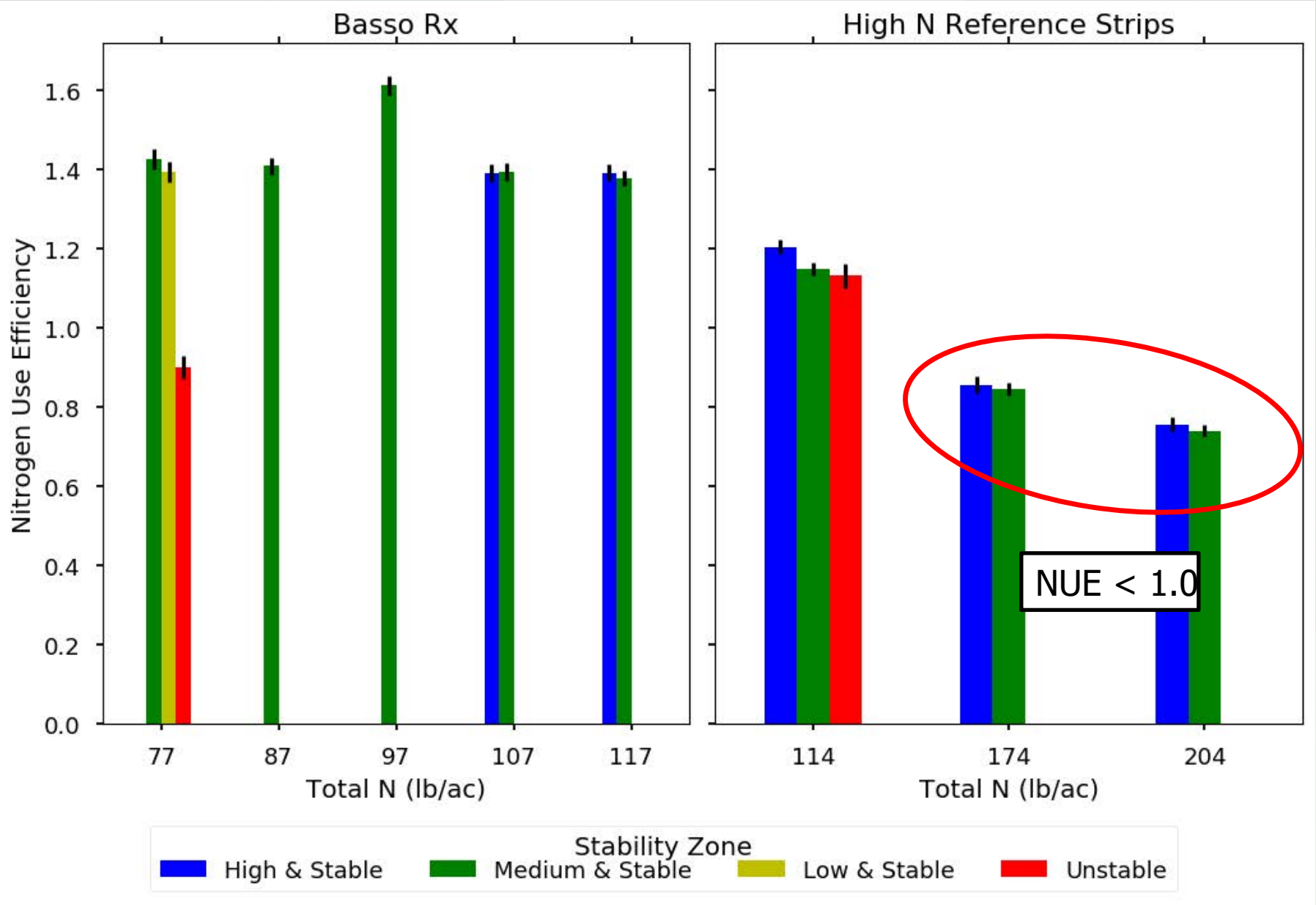
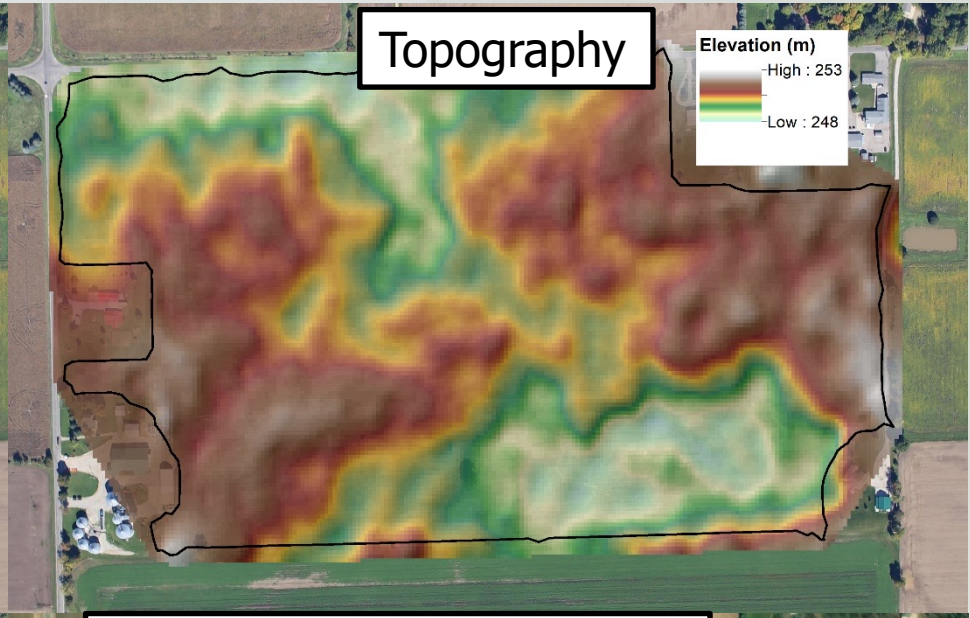
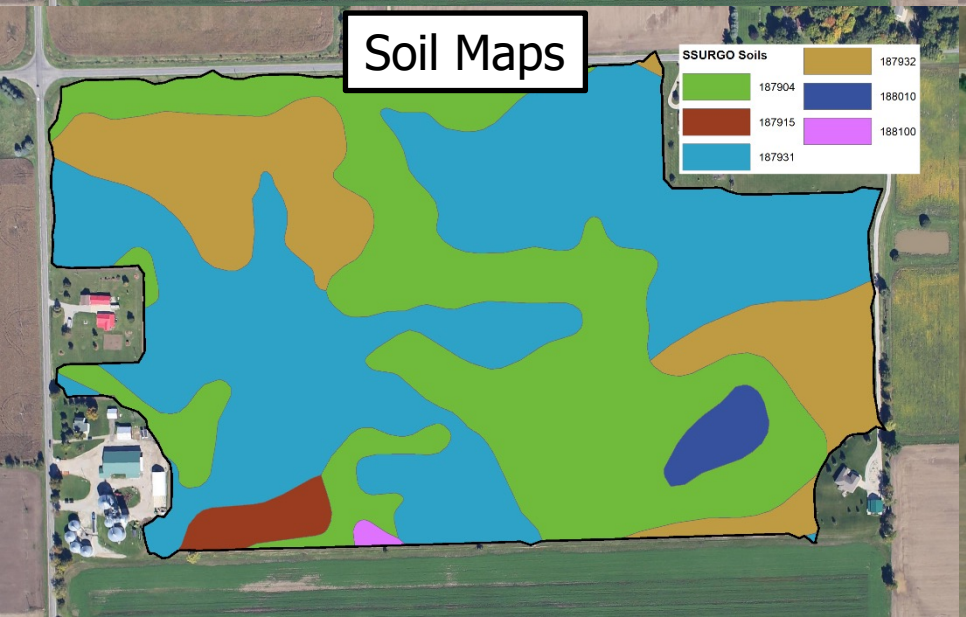


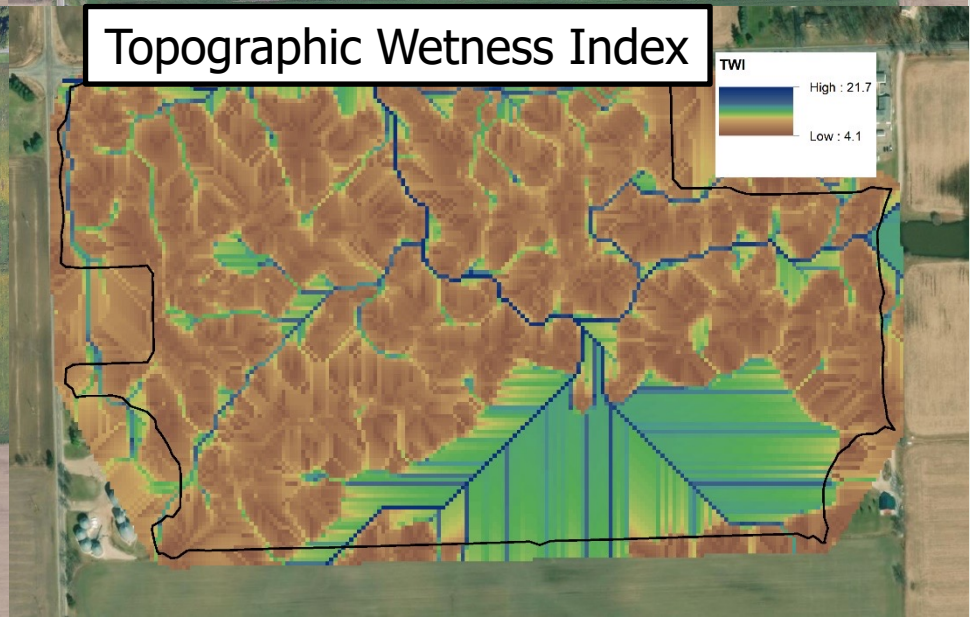
2019 NUE by Yield Stability Zone



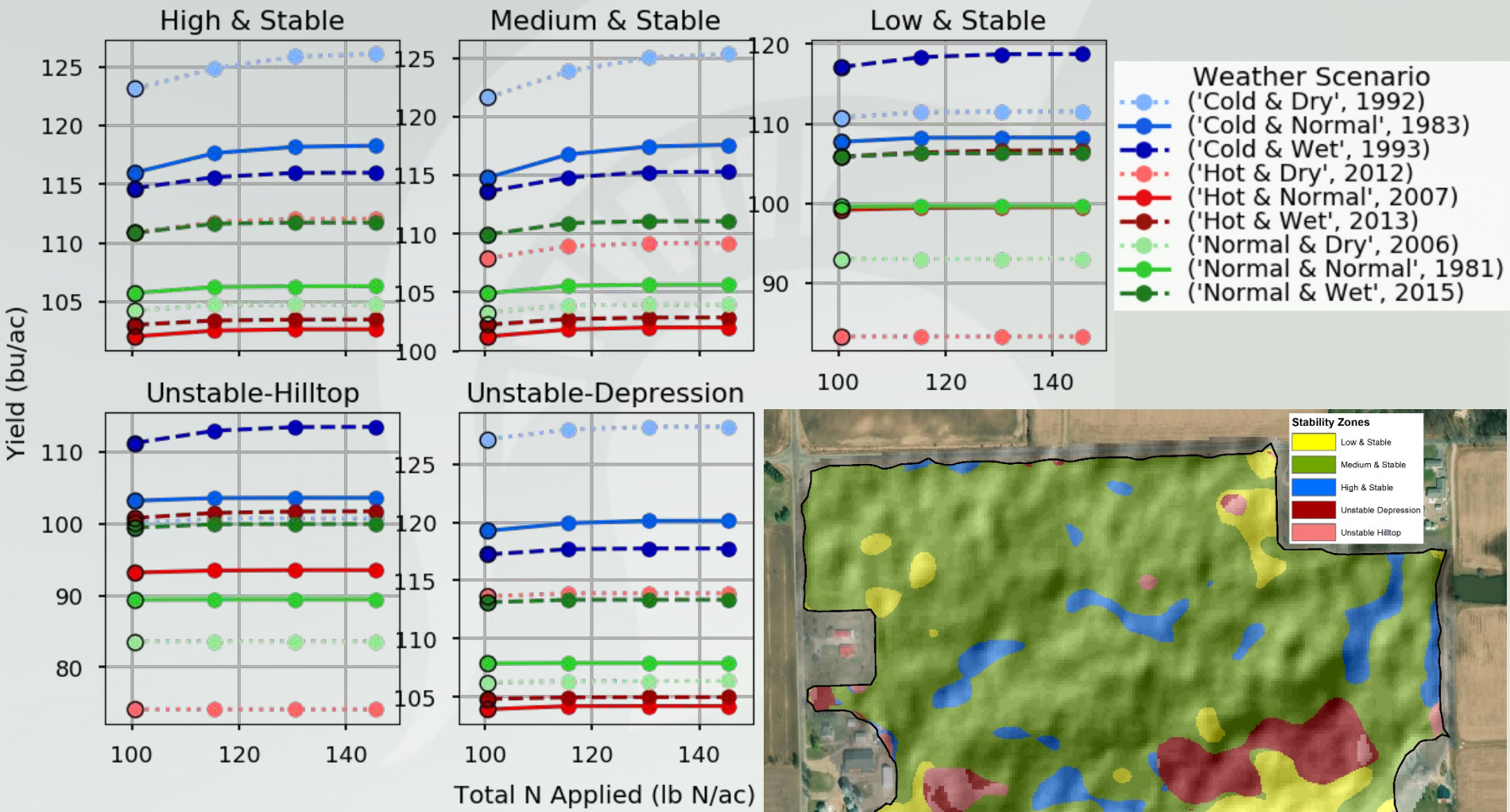
Data Layers Included







In-Season Crop Modeling



40 yrs Wx x 5 YSZs x 10 N scenarios x 10 soils = 20,000 outputs!

Management Information

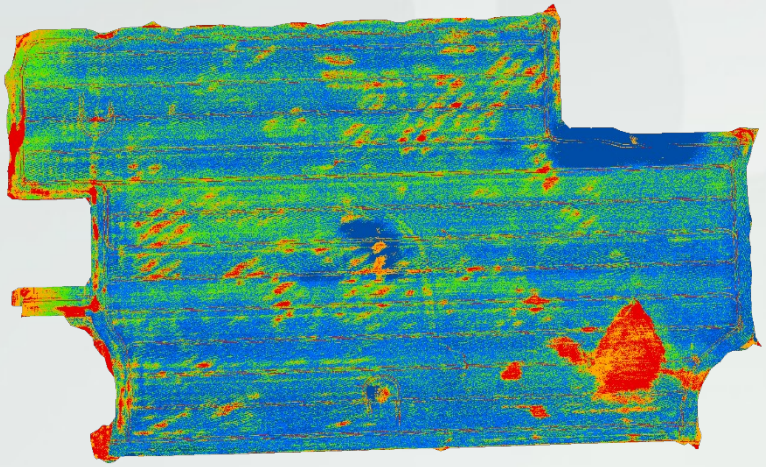
- Planted September 27th & 28th (Drilled)
- Granular 60 lb N/ac applied with clover on April 3rd
- Liquid 19.7 lb N/ac applied with a fungicide on May 14th
- Variable Rate applied on May 31st

Varied Rates	At planting (lb N/ac)	Top-dress 1 (lb N/ac)	Top-dress 2 (lb N/ac)	Top-dress 3 (lb N/ac)	Total N (lb N/ac)
Low	22.5	60.0	19.7	0.0	102.2
Medium	22.5	60.0	19.7	13.8	116.0
High	22.5	60.0	19.7	27.7	129.9

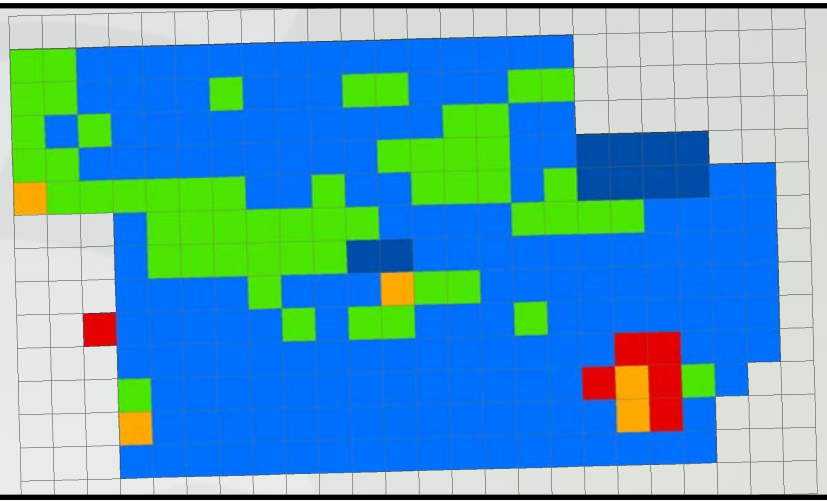
Rx Creation

1. RGB on May 23

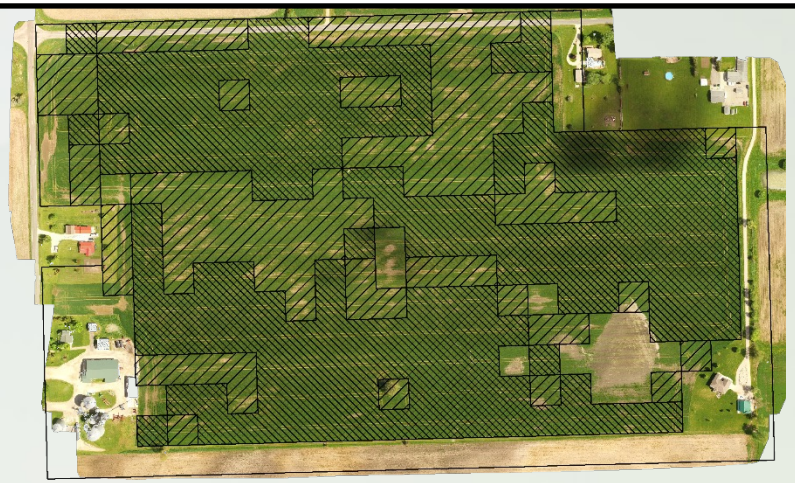
2. Classified RGB on May 23



3. Assigned classes to a grid using the majority class value



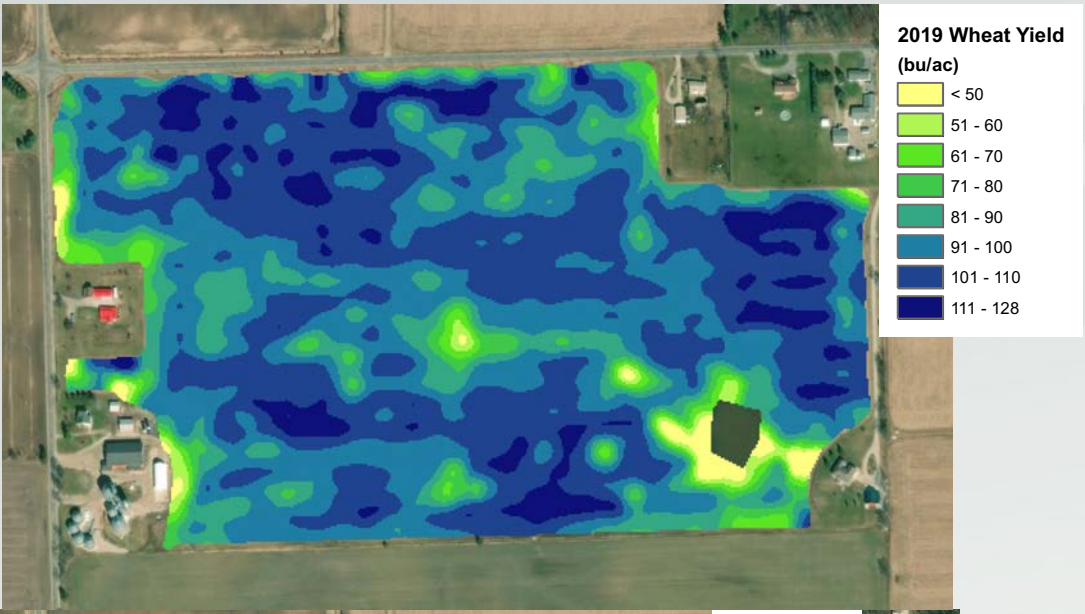
4. Assigned rates and adjusted areas without wheat

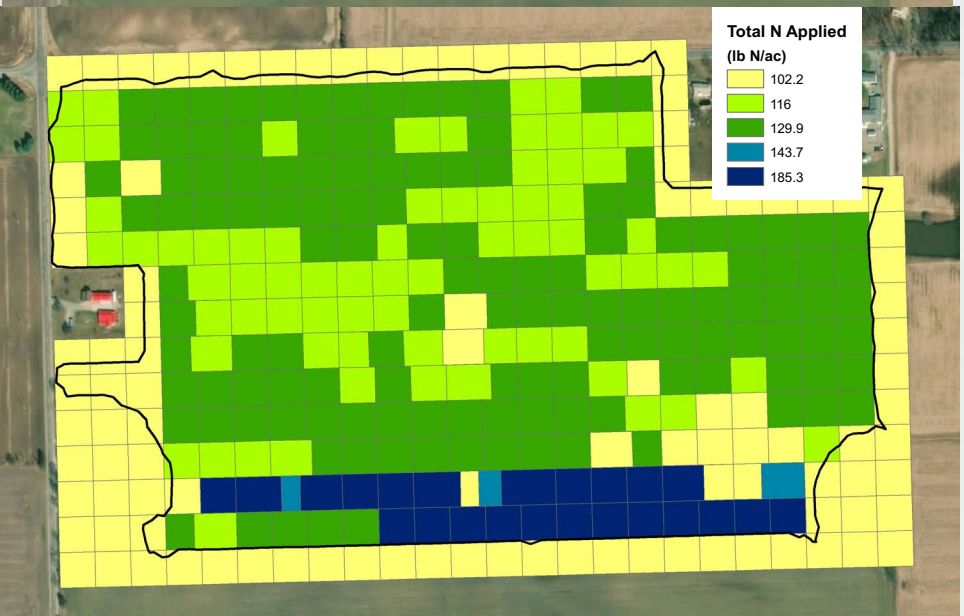


Rx Map

Rx Map (Applied May 31)

Total N Applied

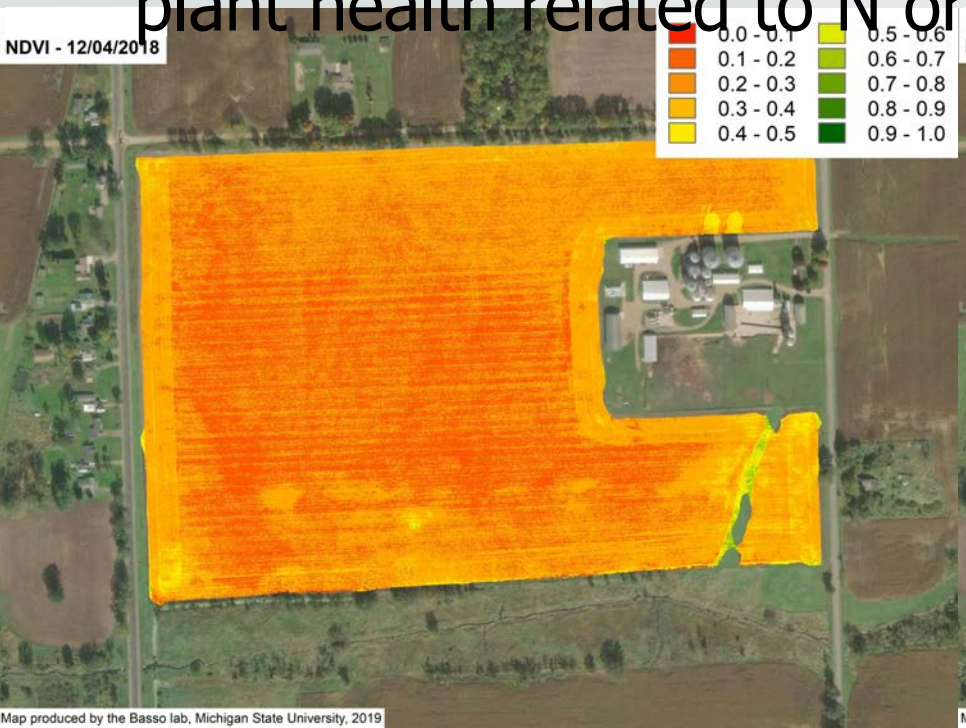


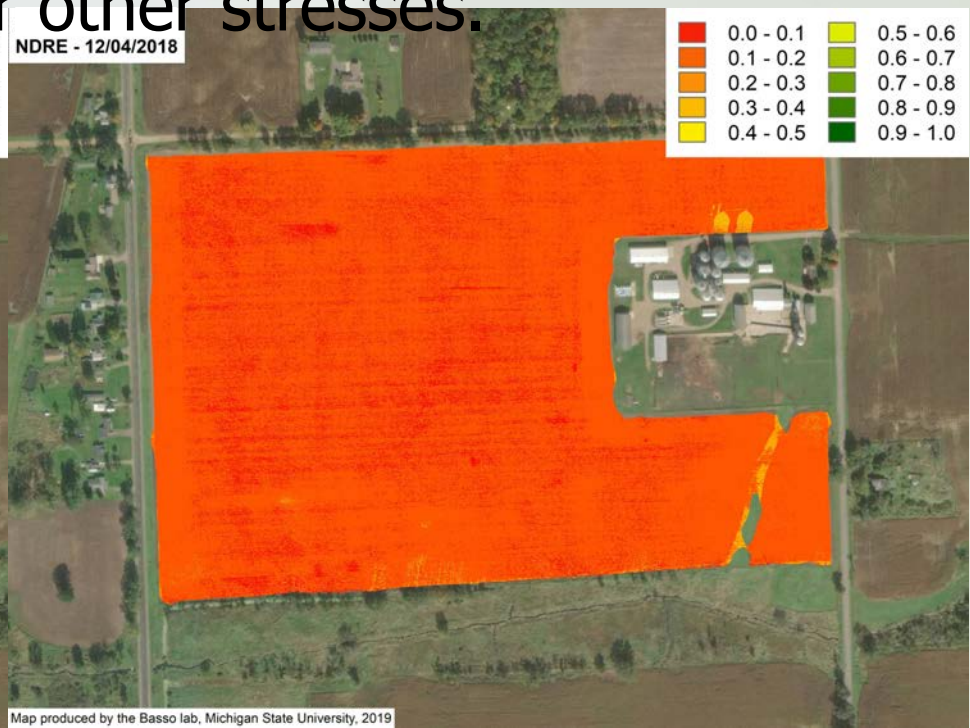


Inherent field scale variability with the interaction of weather, wheat variety, management, and soil are the causes of these yield differences year after year…

Take Home Messages

- **Technology** is not the **solution**, **technology** is only a **tool**.
- Using yield history, remotely sensed imagery, and crop simulation modeling offers a more complete picture of plant health related to N or other stresses.





Additional Considerations

- How do growth regulators assist in N uptake at different yield stability zones?

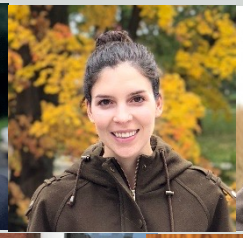
- How early can we vary N at the field-scale without losing potential yield in areas that might improve?

- How scalable is field-based research unless a system based approach is implemented?

Many thanks to Michigan Wheat for their support!

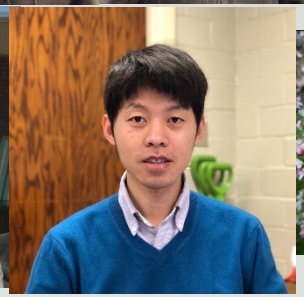
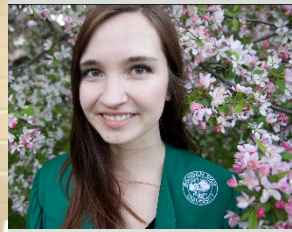










MICHIGAN WHEAT PROGRAM

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