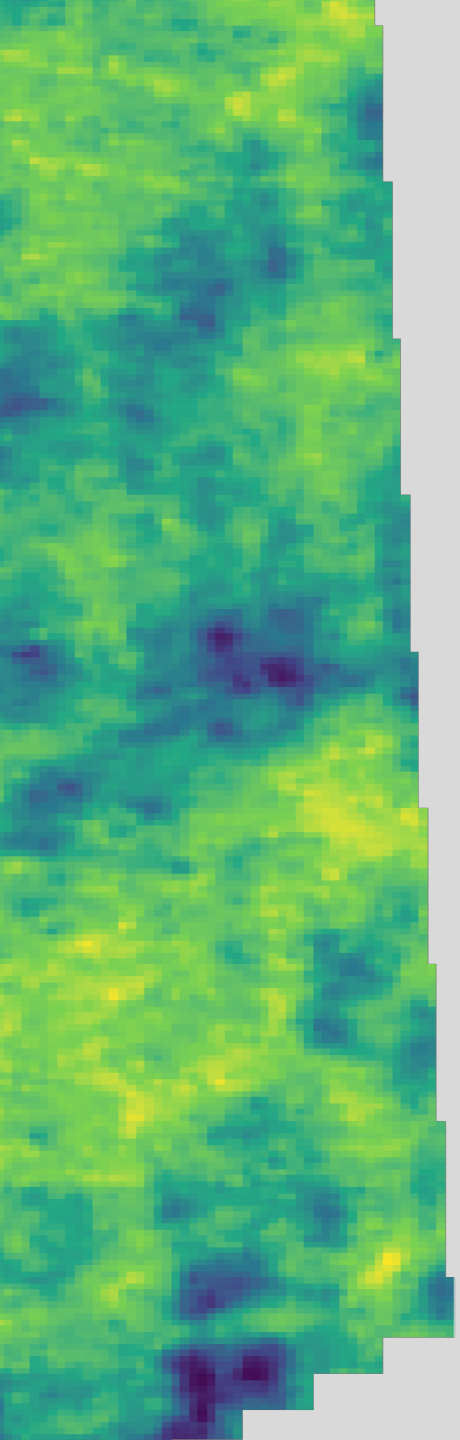

Applications of In-season Imagery for Crop Management

SE Regional Fruit and Vegetable Conference

Leo Bastos
Assist. Prof. Integrative Precision Ag

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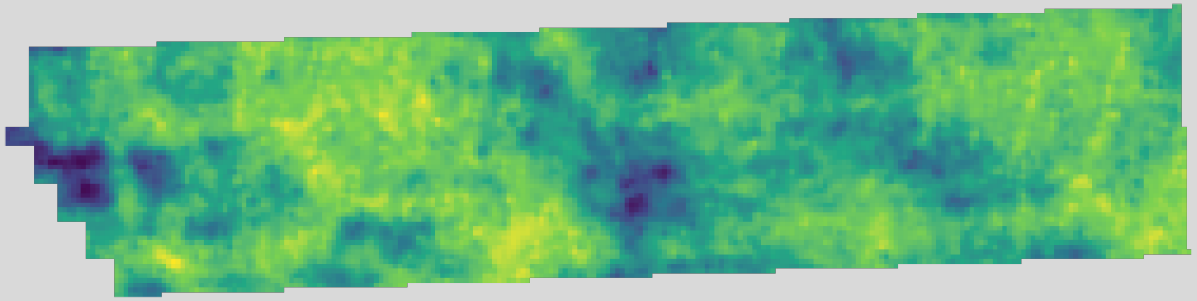
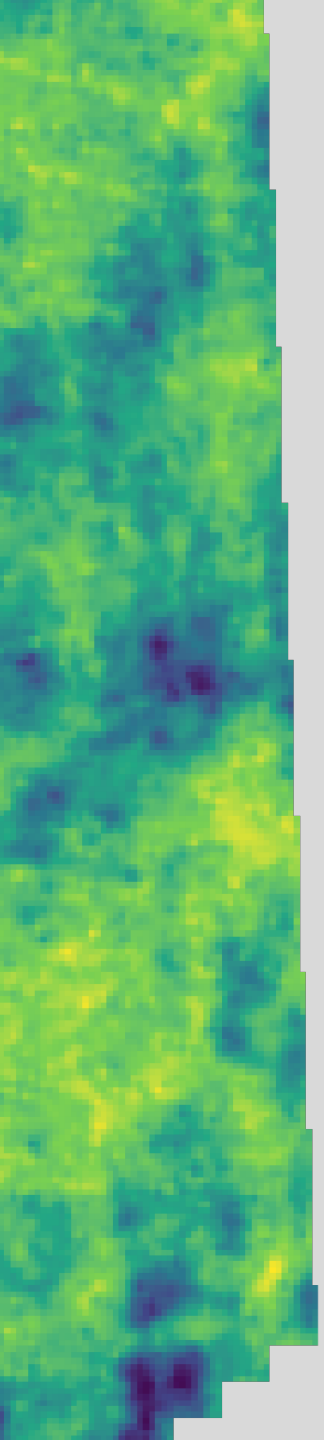
College of Agricultural & Environmental Sciences
UNIVERSITY OF GEORGIA

Why use imagery during the season?

- Bird-eye view of a field



- Identify stresses early on and
    1. Provide **location** for directed scouting
    2. Provide **information** for variable rate in-season management



Case Study #1

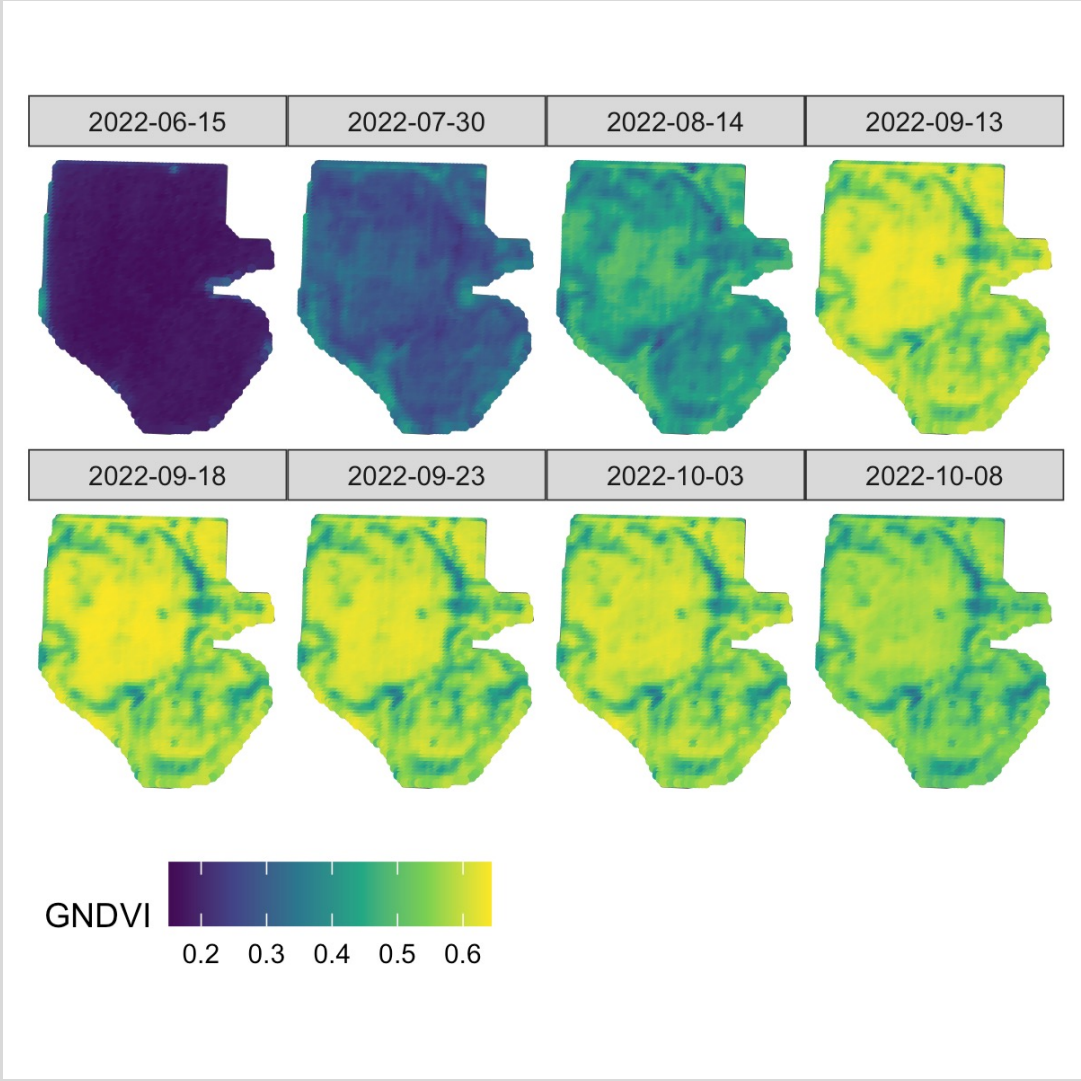
Early stress detection and directed scouting with satellite imagery

Grower-reported issue

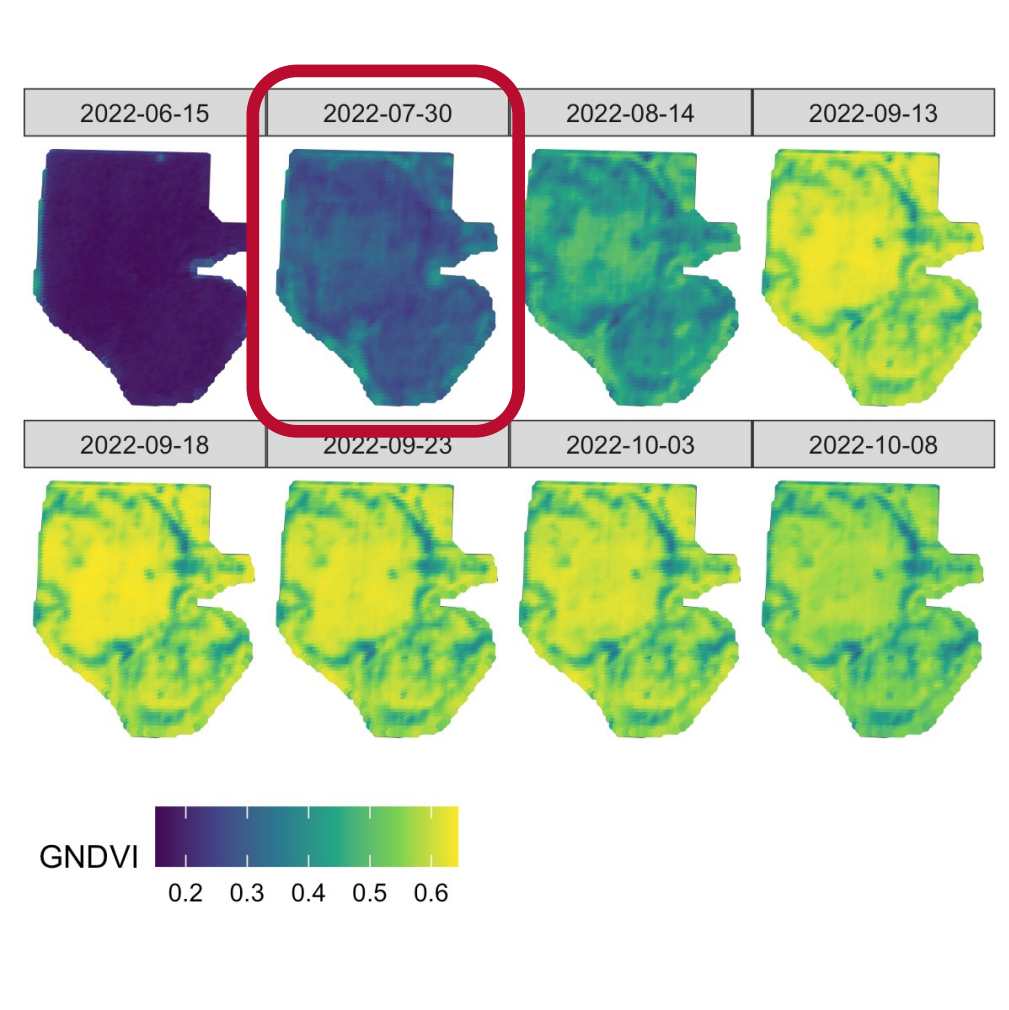
- Cotton grower in SE Georgia

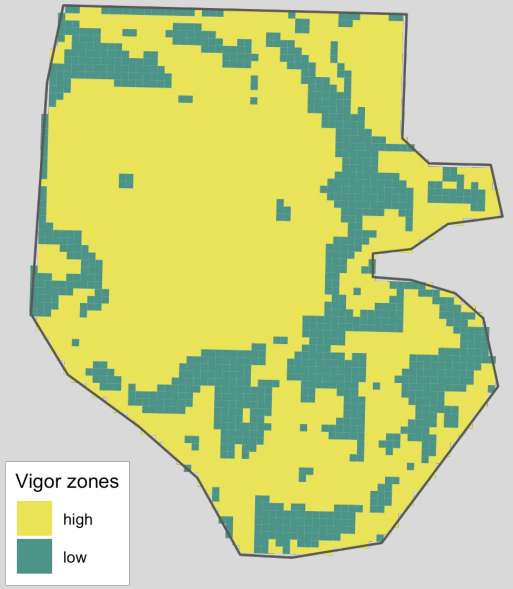
- Crop was looking stressed in some parts of the field

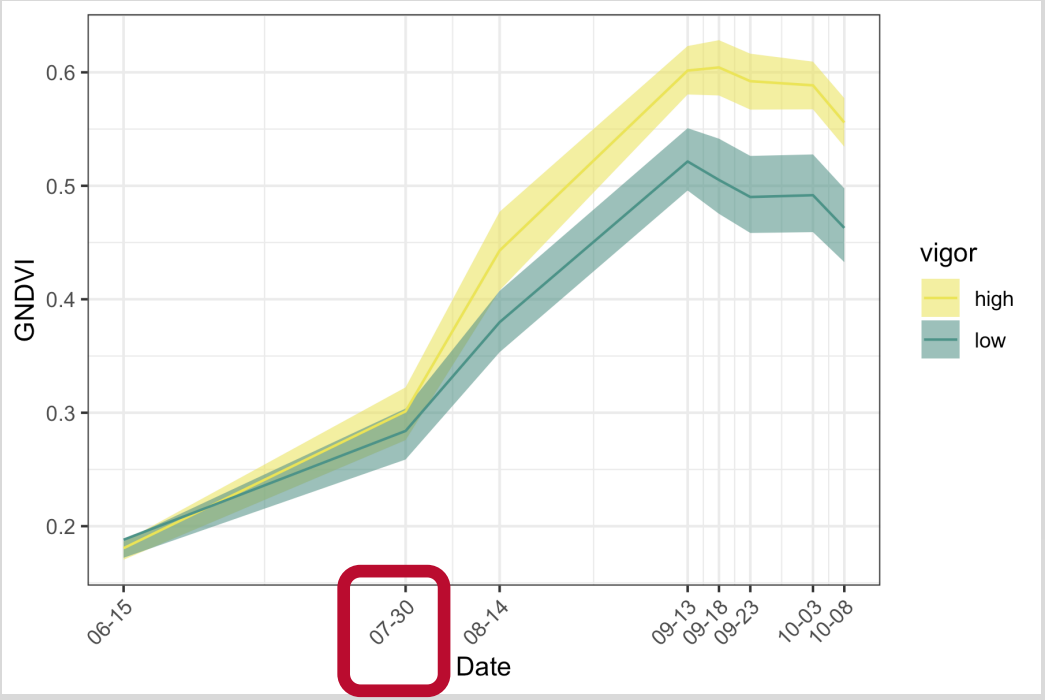
- Pulled satellite imagery to inspect problematic areas

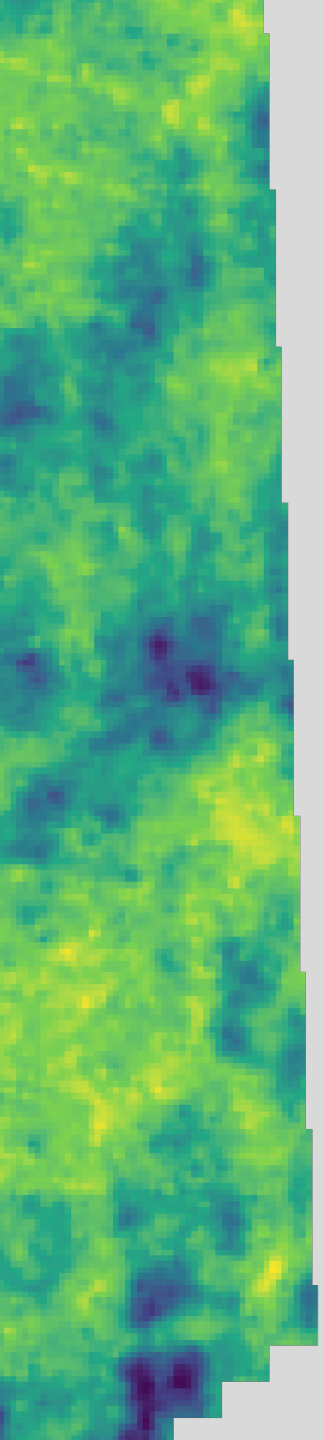


Grower-reported issue







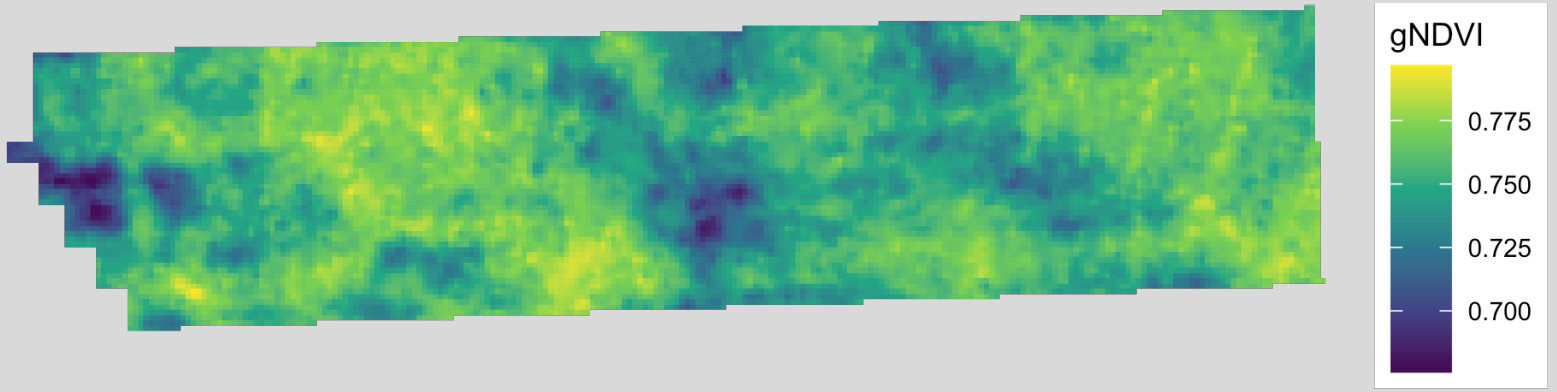


Case Study #2

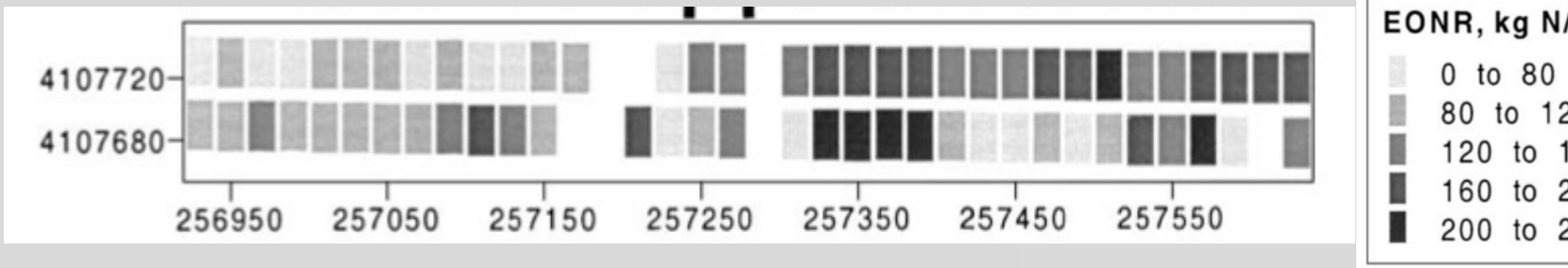
In-season variable rate nitrogen management with satellite imagery

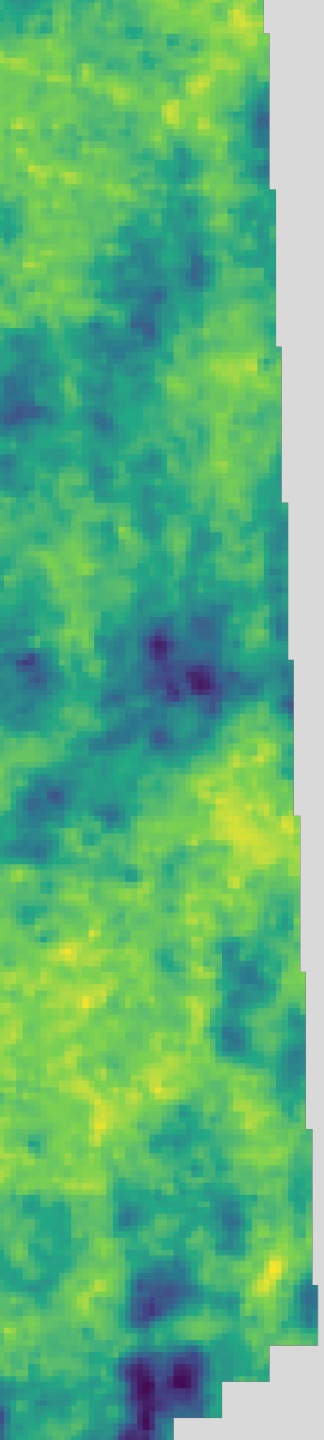
Why variable rate N?

Crop vigor



Economic return on N

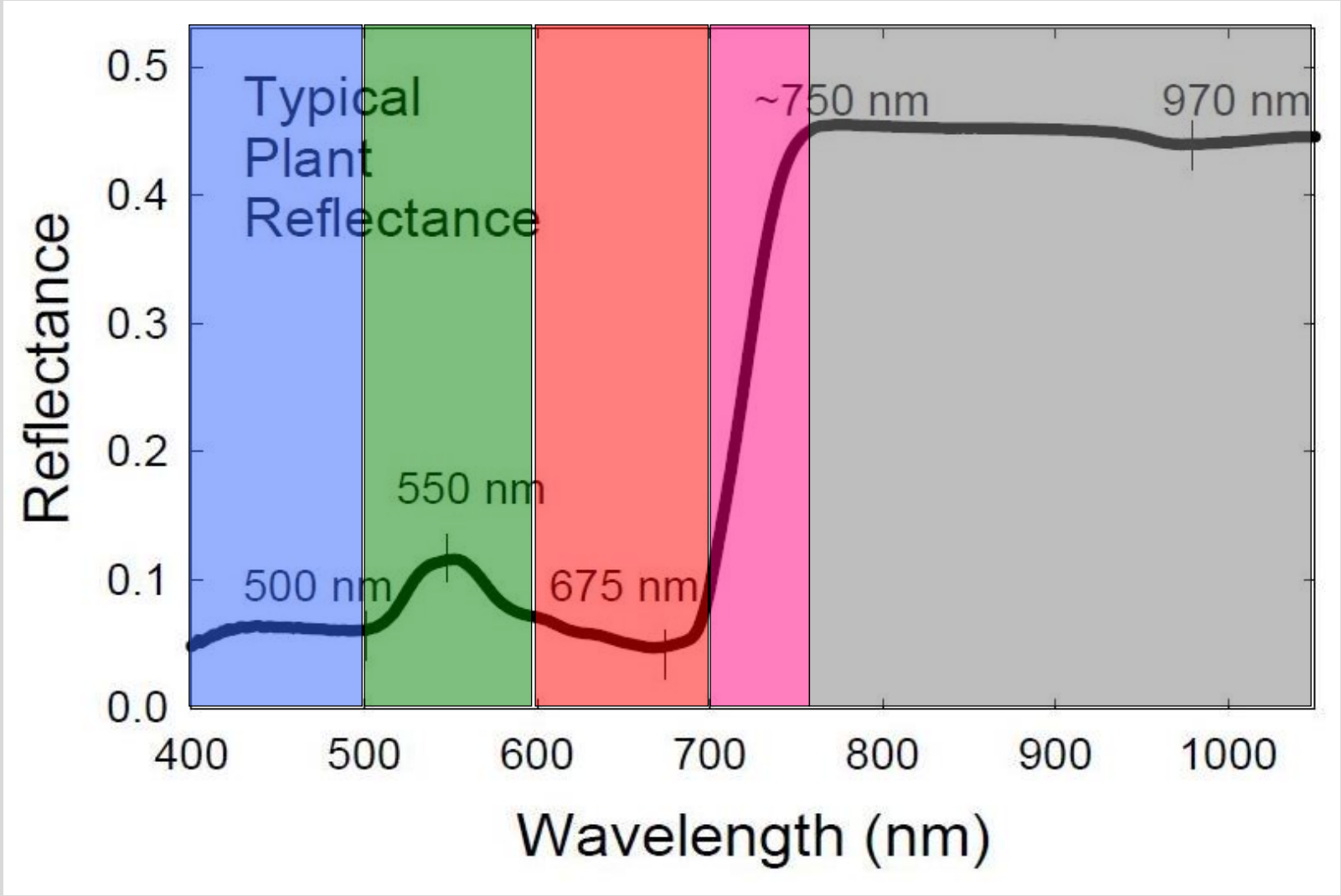




Sensor

Variable rate N components: **Sensor**

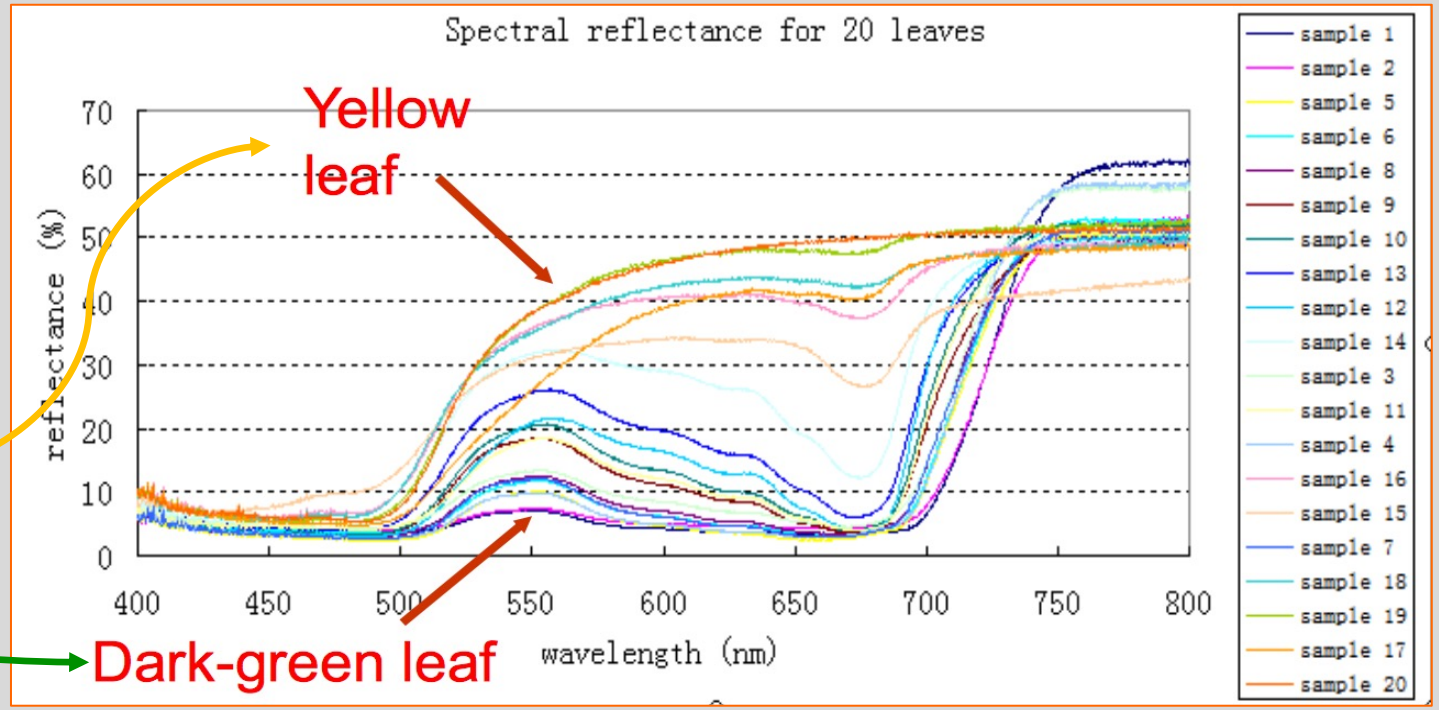
Sensor bands



Variable rate N components: **Sensor** Bands and plant characteristics

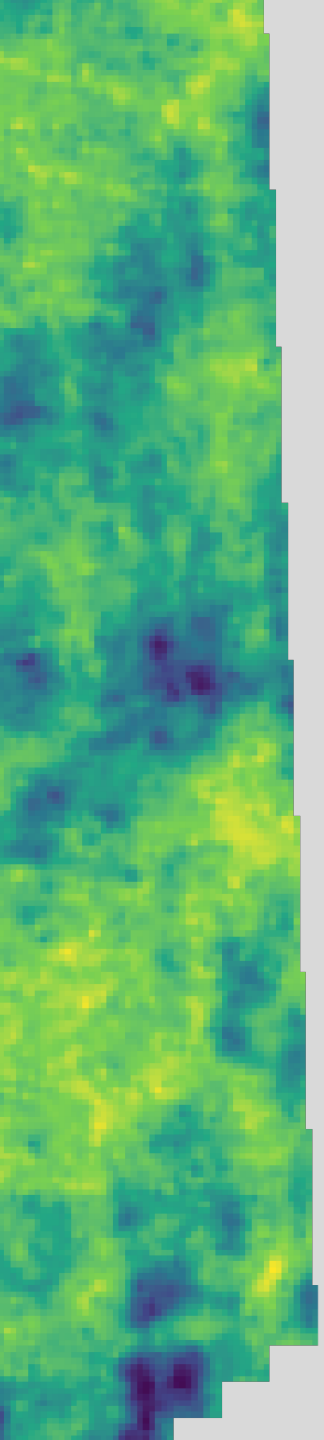
Sample #	Chl Content (mg/m2)
1	669
2	565
3	381
4	368
5	347
6	309
7	286
8	269
9	161
10	126
11	156
12	98
13	73
14	25
15	11
16	25
17	5
18	12
19	4
20	4

Variable rate N components: **Sensor** Bands and plant characteristics

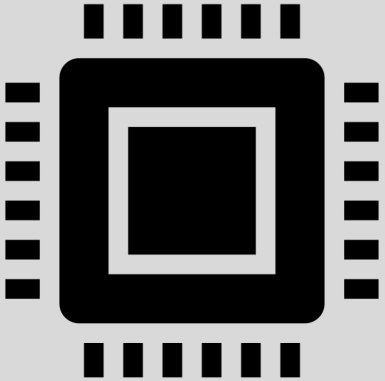


- **Visible** region (400-700 nm): related to leaf pigment
- **NIR** region (800-1200 nm): related to leaf structure/biomass

To assess if a crop is healthy, combine **both** in a vegetation index.



Algorithm



Variable rate nitrogen components: **Algorithm**

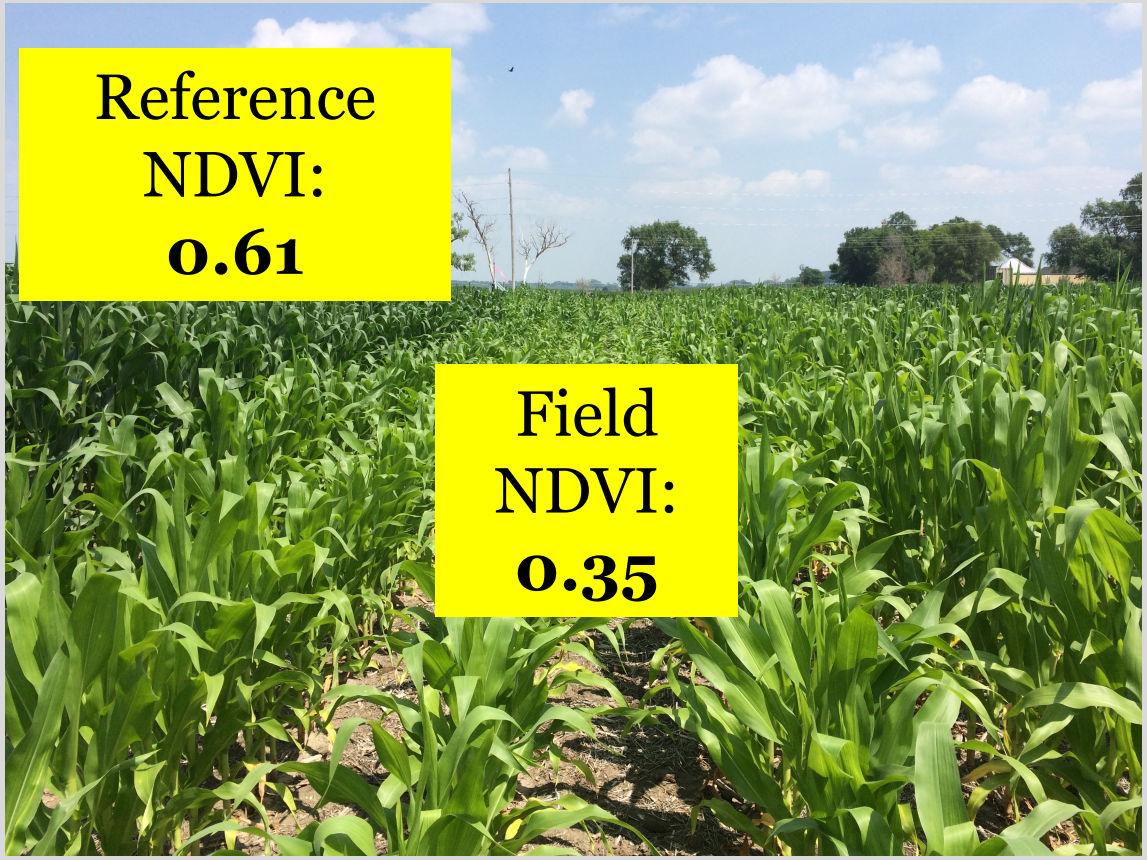
What if on same field we have different

✗ varieties ✗ planting dates ✗ pre-plant nitrogen rates

Even at similar N nutrition, different **varieties, planting dates, etc.** will look different to a sensor.

How to fix these issues and ensure that differences are only due to N status?

Variable rate nitrogen components: **Algorithm**
Normalizing with an in-field reference



Have a **high-N reference** strip in the field for each genetic and management

Sufficiency Index (SI)

$$SI = \frac{VI_{field}}{VI_{reference}}$$

For example,

$$SI = \frac{0.35}{0.61} = \mathbf{0.57}$$

By normalizing with a high-N reference, the effects of VI, growth stage, and variety are neutralized

Variable rate nitrogen components: **Algorithm**

Algorithm types: 2. SI-based

Holland-Schepers algorithm

$$N_{app} = (EONR - N_{credits}) \, x \sqrt{\frac{(1 - SI)}{\Delta SI}}$$

N_{app} = sensor-recommended N rate (lbs/ac)

EONR = economic optimum N rate (lbs/ac)

$N_{credits}$ = pre-applied fert, irrigation water N, legume (lbs/ac)

SI = sufficiency index

ΔSI = 0.3

Variable rate nitrogen components: Algorithm

Entire workflow from imagery to Rx

Reflectance

Reflectance

Reflectance

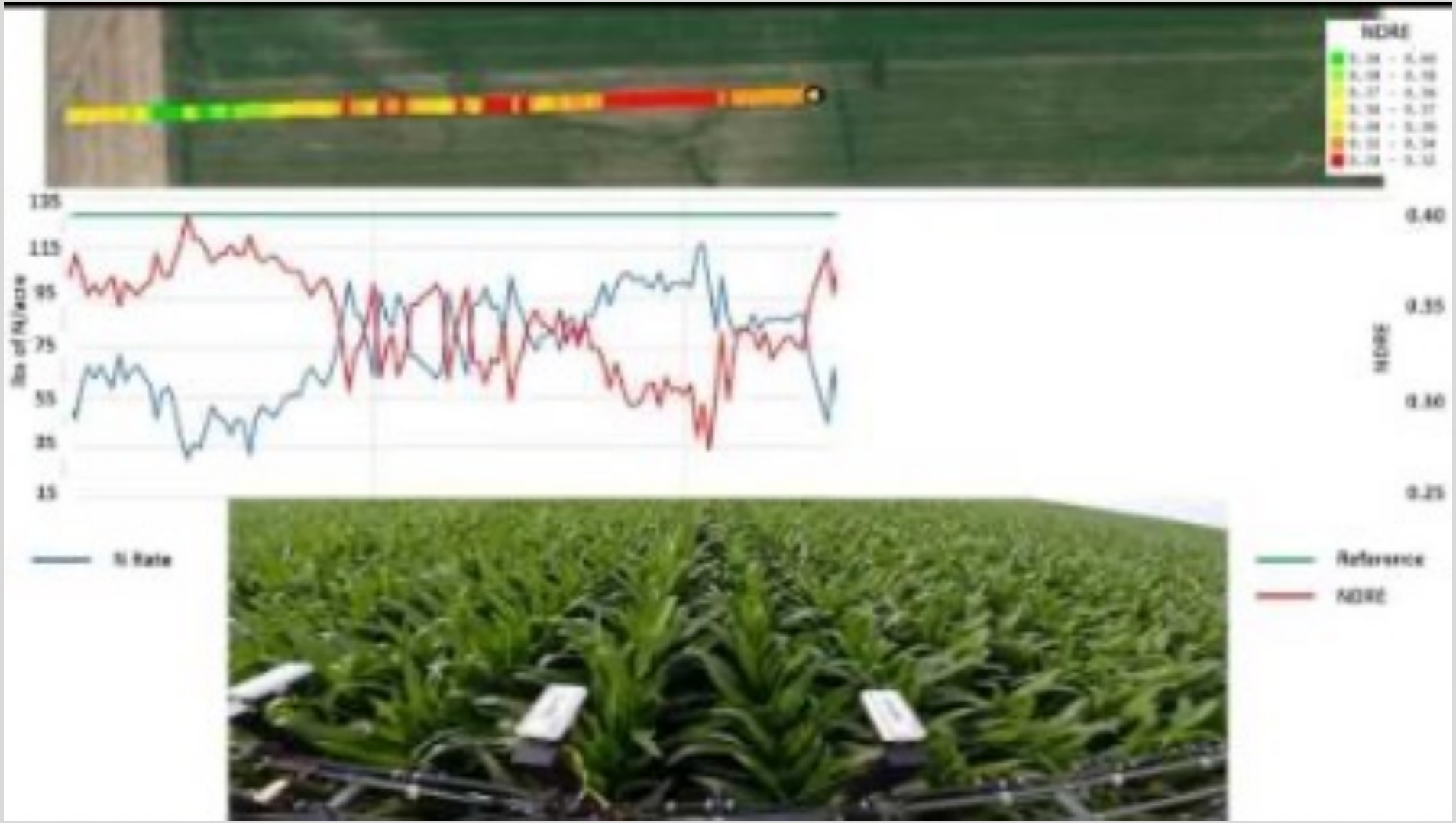
Vegetation Index (VI)

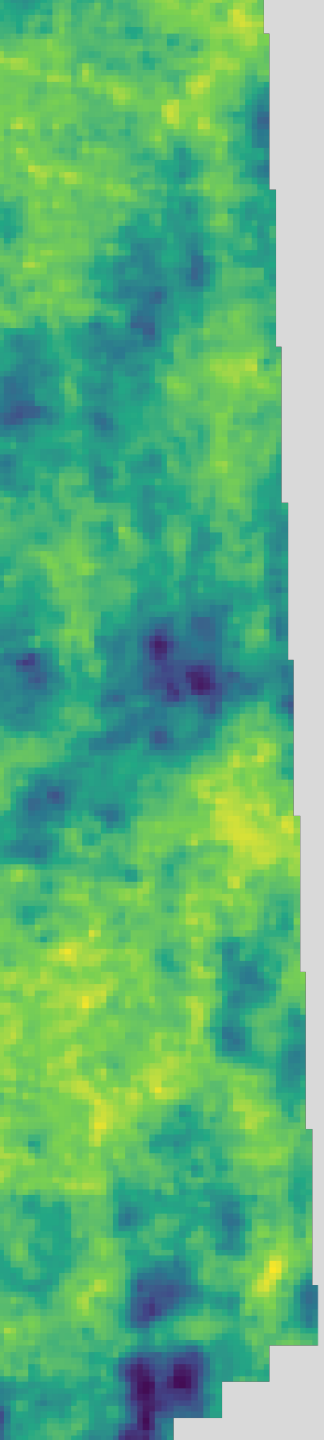
SI = Field VI / Reference VI

Algorithm

Variable Rate N

Variable rate nitrogen in practice: University of Nebraska Project SENSE





Summary

- In-season imagery can be used to
  1. Identify problematic areas for scouting
  2. Derive in-season variable rate recommendations

- Current research at UGA developing and testing variable rate algorithms under different conditions (tillage, cover cropping) for different crops

- In future, have an **online dashboard** where GA producers can automatically pull satellite data and create variable rate N prescriptions for their fields

Thanks!
lmbastos@uga.edu