

Satellite Data and Agronomic Decisions

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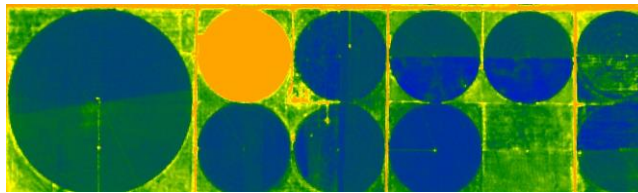
Team:

Luciana Nieto, Kansas State University

Rai Schwalbert, Kansas State University & University Federal of Santa Maria

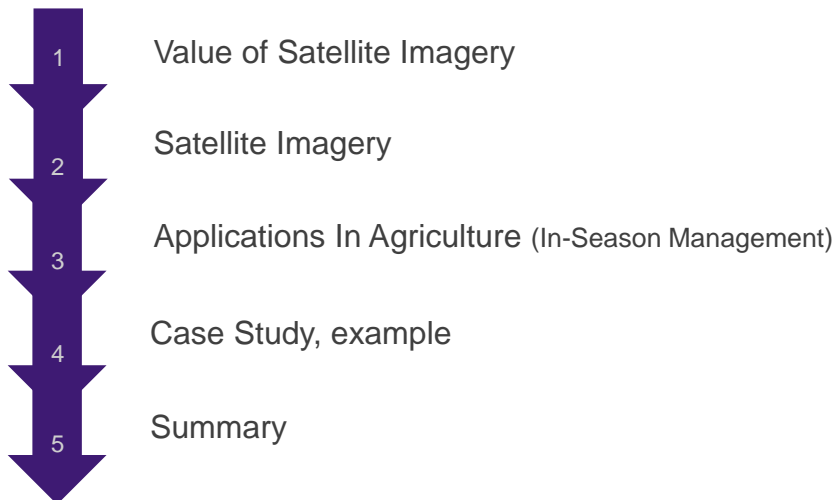
Guillermo Balboa, CSIRO Australia (former Kansas State University)

Sebastian Varela, University of Illinois (former Kansas State University)



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Outline



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Value of Satellite Imagery

Innovation Series **VISION** Conference Learning Center

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Back On The Map: Satellite Imagery Emerges As A Valuable Tool

“Remote sensing utilizing drones is very labor intensive at the moment, and that’s not likely to change in the near future”

In-season, on-demand imagery was often hampered by cloud cover and a dearth of available satellites for taking images. Until recently, as a stand-alone tool it hadn’t carved itself a stable and consistent place in the crop production regimen.

Over the past decade, the number of satellites has increased significantly, improving the quality and frequency of the images available to agriculture. Planet Labs, which purchased BlackBridge and its RapidEye satellite constellation, is supplying Wilbur-Ellis and Crop Production Services with imagery to support their precision programs.

Planet also delivers satellite imagery to agronomy/technology consulting firm Farmers Edge. Ron Osborne, Vice President of Innovation, says that while they’re doing some work with UAV imagery — specifically with Canadian drones-as-a-service

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Satellite Imagery “101”

Temporal Resolution indicates the frequency (time interval) for obtaining imagery from the same point.

Spatial Resolution refers to the level of detail visible in an image: the smaller the area by each pixel, the greater the details that can be captured.

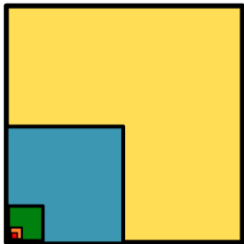
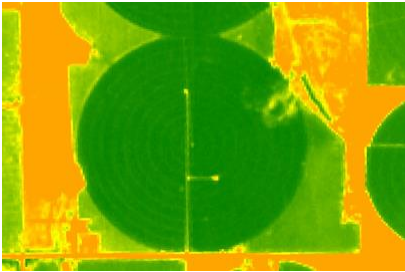
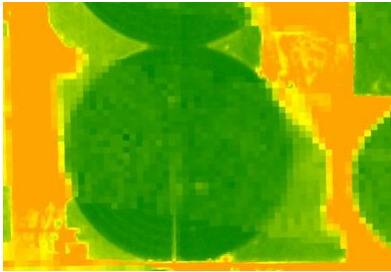
Spectral Resolution denotes to the number and width of the spectral bands in a sensor. The narrower these bands, the higher the spectral resolution.

MODIS Terra and Aqua  <p>Temporal resolution: 1-2 days Spatial resolution: 250m, 500m, 1000 m Spectral resolution: 36 bands Cost: Free</p>	LANDSAT 5 TM, 7 ETM+, 8 OLI TIRS  <p>Temporal resolution: 16 days Spatial resolution: 15m, 30m Spectral resolution: 7 bands (5TM) 8 bands (ETM+) 11 bands (OLI TIRS) Cost: Free</p>
SENTINEL 2A 2B  <p>Temporal resolution: 5 days Spatial resolution: 10m, 20m, 60m Spectral resolution: 13 bands Cost: Free</p>	RAPID EYE  <p>Temporal resolution: Daily Spatial resolution: 5m Spectral resolution: 5 bands Cost: \$</p>

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Satellite Imagery “101”

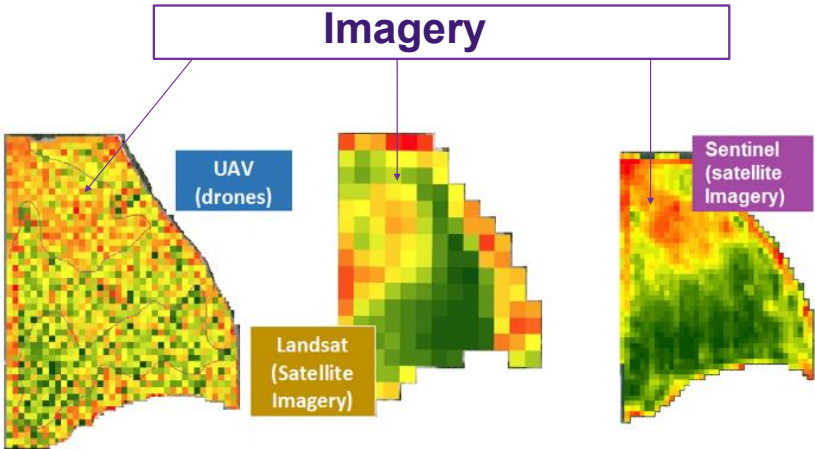


Satellite	pixel size (m)	area (acre)	revisit time
MODIS	250	15.4	daily
Proba-V	100	2.4	daily
Landsat	30	0.22	16-days
Sentinel	10	0.03	5 to 10-days
RapidEye	5	0.001	5.5 days

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Satellite Imagery “101”



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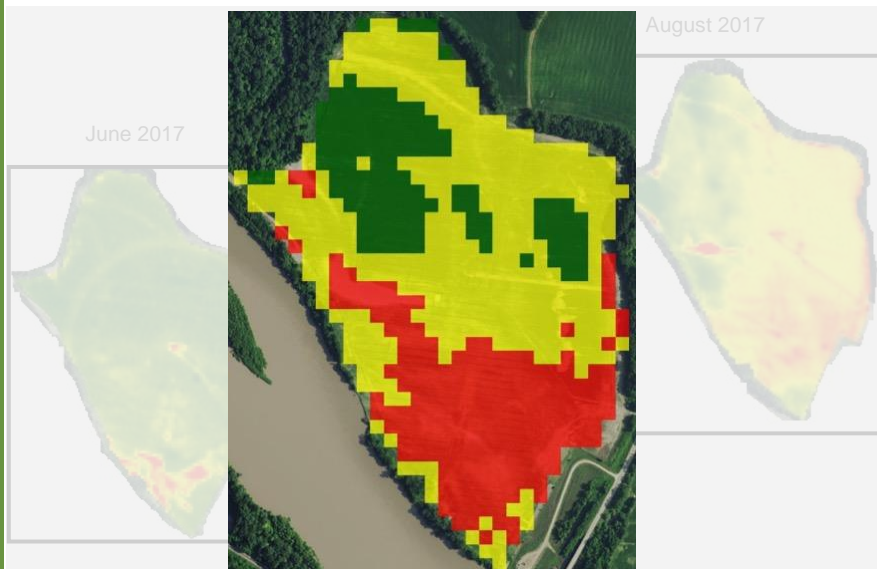
Applications of Satellite Imagery

1. Seasonal (within a season) and temporal (across seasons) monitoring of crop vegetation (evaluating stress factors such as drought, heat, nutrient deficiency, etc.).
2. Crop scouting, sampling and field trips according to the field dimensions and the potential targets.
3. Forecasting yields at varying scales: county, regional, & state.
4. Site-Specific Management (SSM) using prescription maps to variable seeding rate/fertilization, depending on differences in environments.
5. Environmental impact assessment, fires, floods, to tracking potential changes in land use, and the status of the fields.

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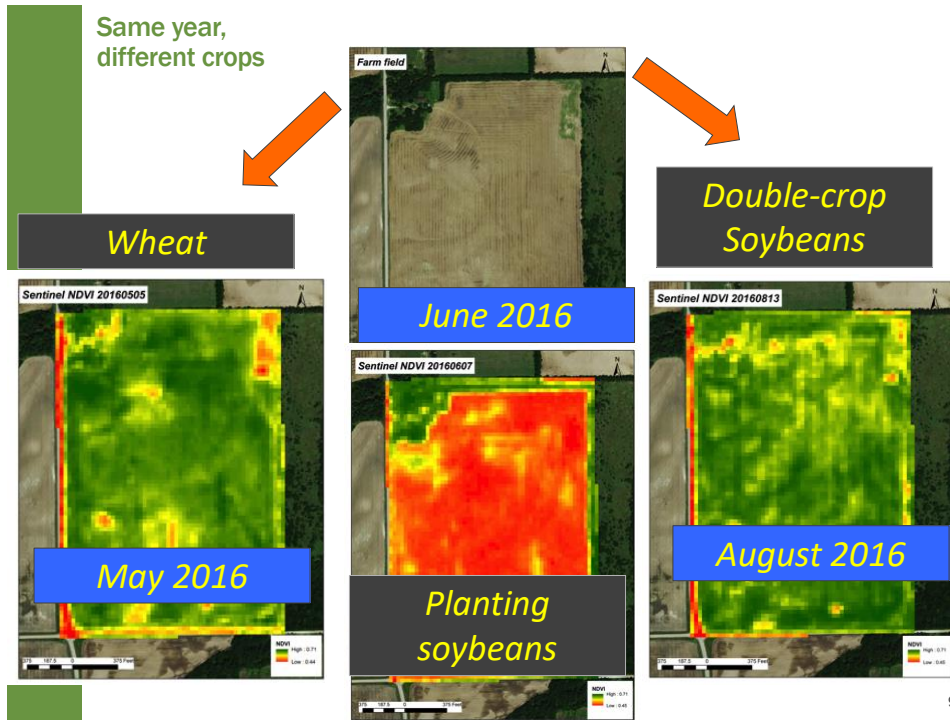
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Seasonal crop vegetation status, same crop same year



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Temporal changes, Looking to the Past

Satellite data Analysis:

NDVI:

2013-2015

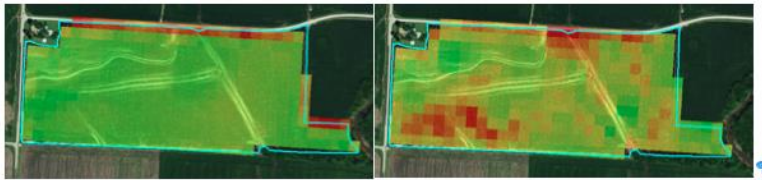


Figure: Left: NDVI L8 June 2013; Right: NDVI L8 June 2015.

2012-2014-2016

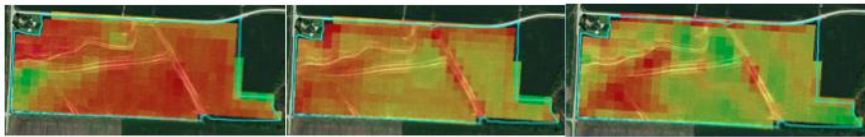


Figure: Left: NDVI L7 July 2012; Center: NDVI L8 July; Right: NDVI L8 June 2015.

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Temporal changes, Looking into NEW LAND (example CRP land)

SATELLITE DATA ANALYSIS

Summer crops 2012-2013-2014-2015-2016-2017

NDVI July

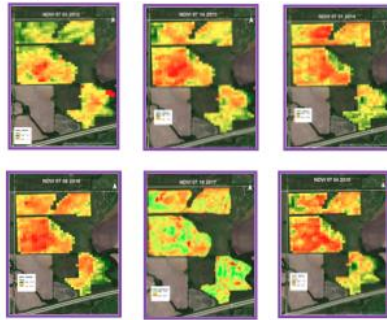


Figure 3: NDVI L7 July 2012

Figure 4: NDVI L8 July 2013

Figure 5: NDVI L8 July 2014

Figure 6: NDVI L8 July 2015

Figure 7: NDVI L8 July 2016

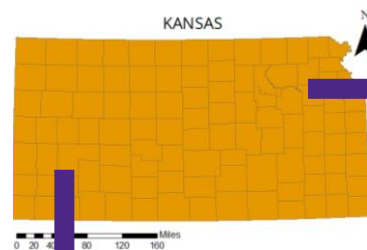
Figure 8: NDVI S2A July 2017



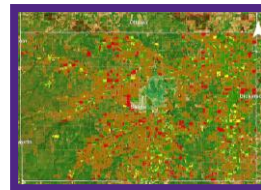
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Crop identification

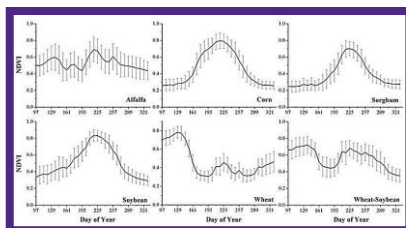
STATE AND COUNTY LEVEL



SALINE COUNTY



Soybean and corn area quantification via satellite imagery



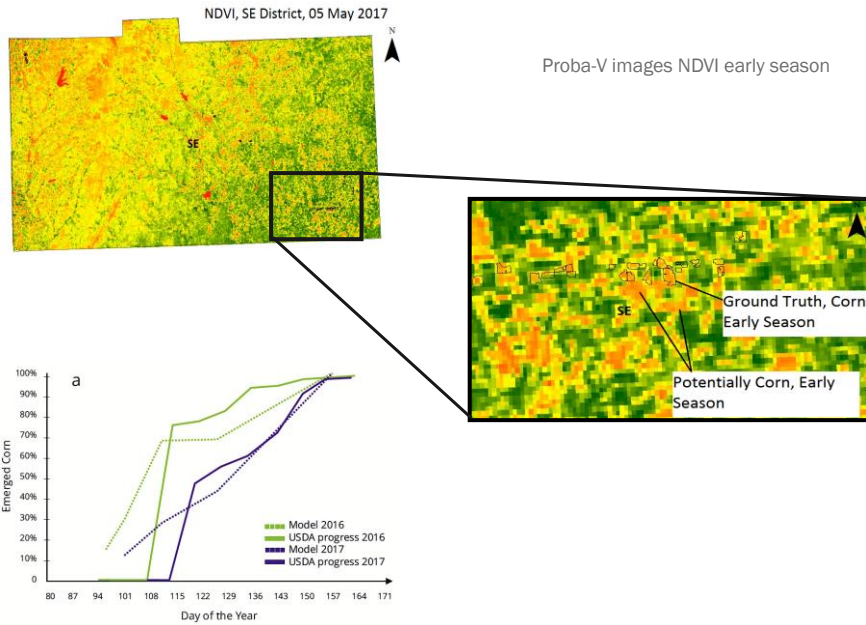
Year-based phenology and spectral response by crop type

Corn? DC/W? Soybean? Sorghum?



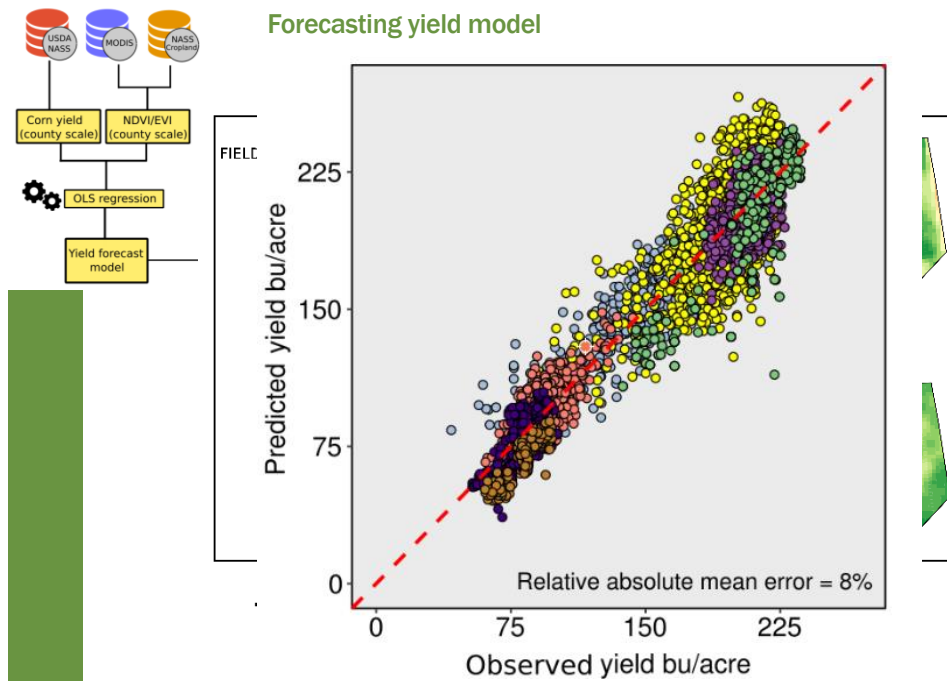
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"Real-time" Crop Progress Reports



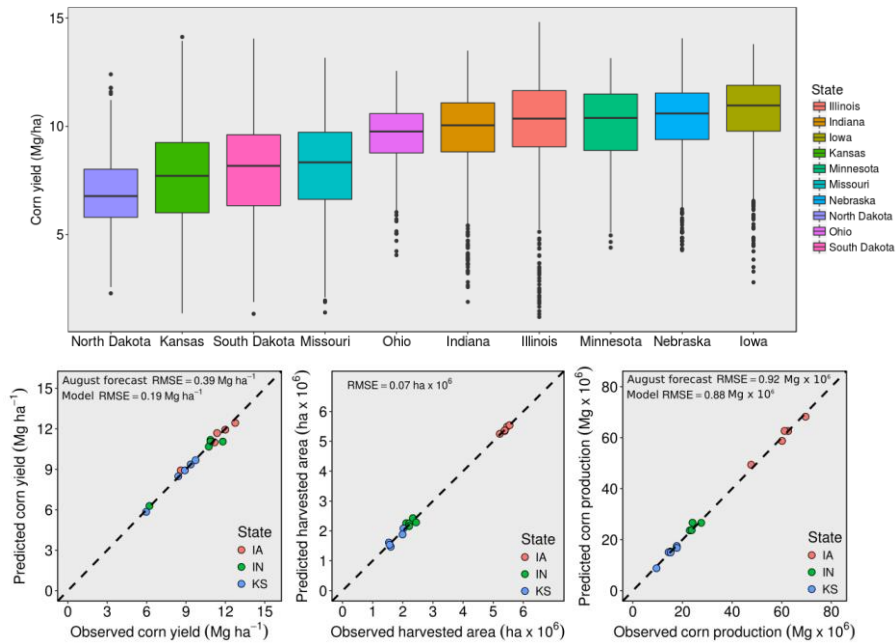
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Forecasting yield model



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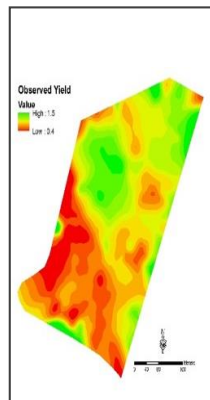
MODEL APPLIED TO OTHER STATES



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Yield forecast, mid-season satellite imagery in corn and harvest yield monitor information

Observed Yield

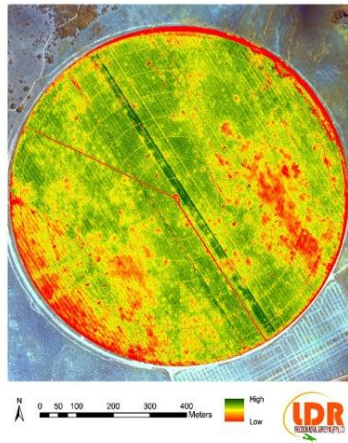


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Crop Scouting

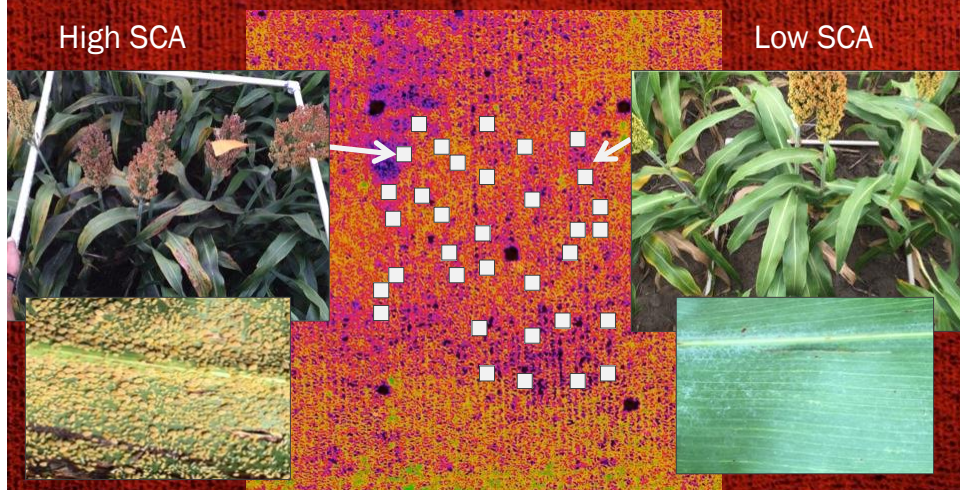
Tracking spider mite infestation
by comparing two time points (2-week interval)



Deon van der Merwe, College of Vet Med¹⁸

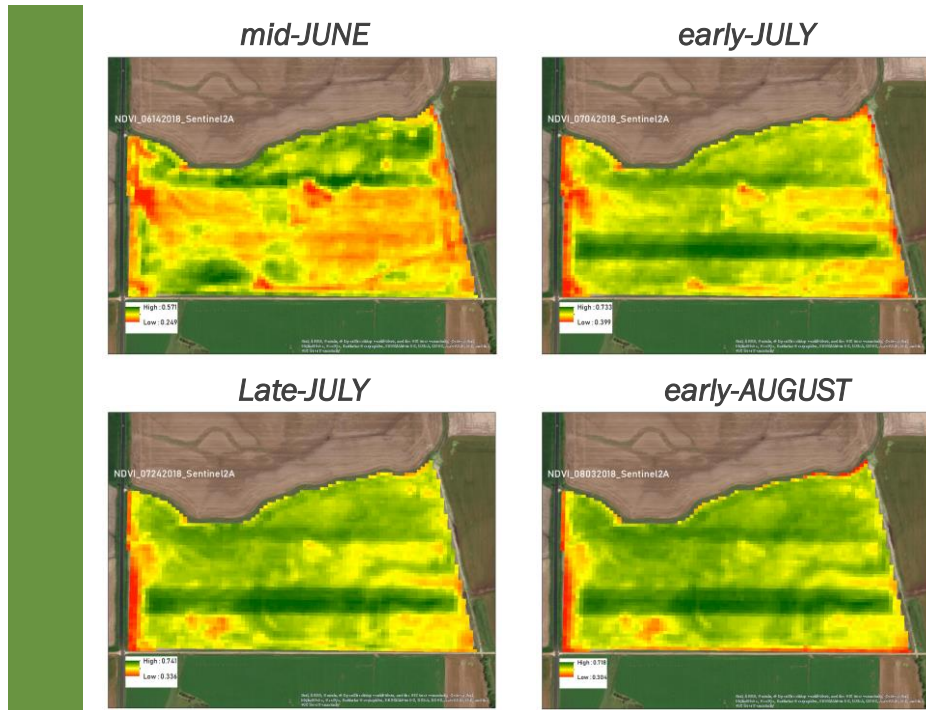
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Crop Scouting: relating biology to sensor data



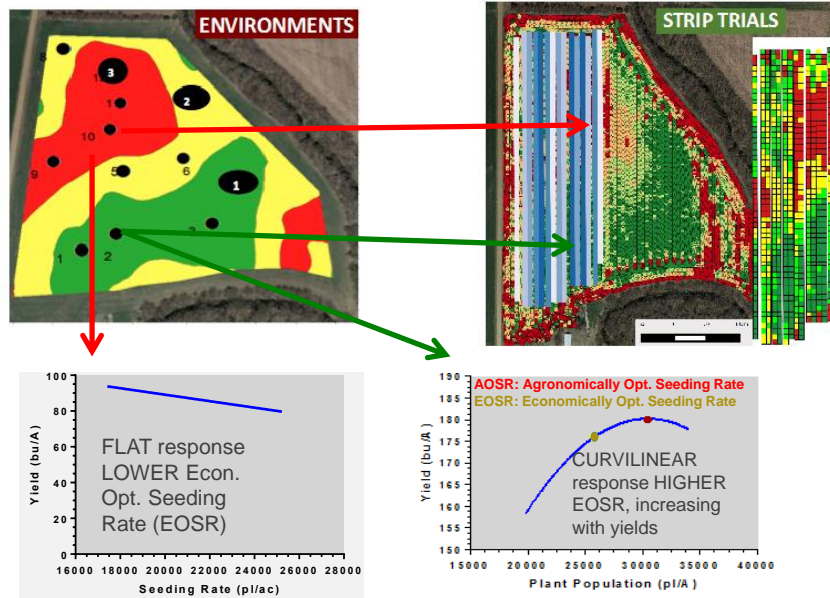
NDVI Elliott et al. 2015 (JEE)

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Use of Satellite Imagery for On-Farm Research: Interpretation



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Thank you! Questions?

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