FOTC 2015 Fertilizer Outlook & Technology Conference

John Fulton

Associate Professor
Food, Agriculture and Biological Engineering
The Ohio State University

Using Precision Data To Improve Soil Health

The Fertilizer Institute
Nourish, Replenish, Grow

Fertilizer Industry Round Table

Using Precision *Data* To Improve Soil Health

John Fulton

The Ohio State University

Fertilizer Outlook & Technology Conference, Jacksonville, FL


SOIL HEALTH
• Bulk Density
• Carbon
• Nutrient stratification
THE OHIO STATE UNIVERSITY

Modern Corn & Soybean Planter…

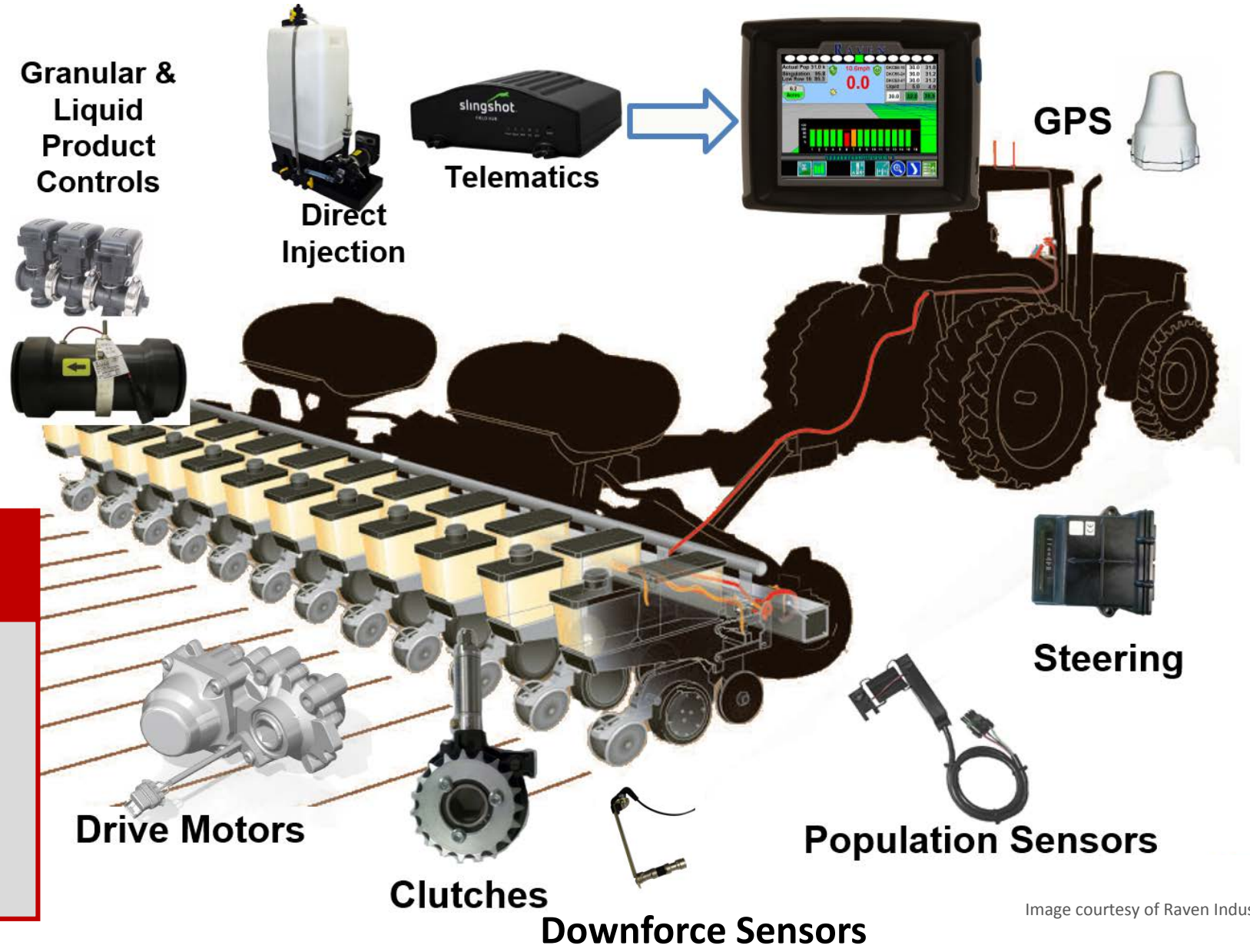
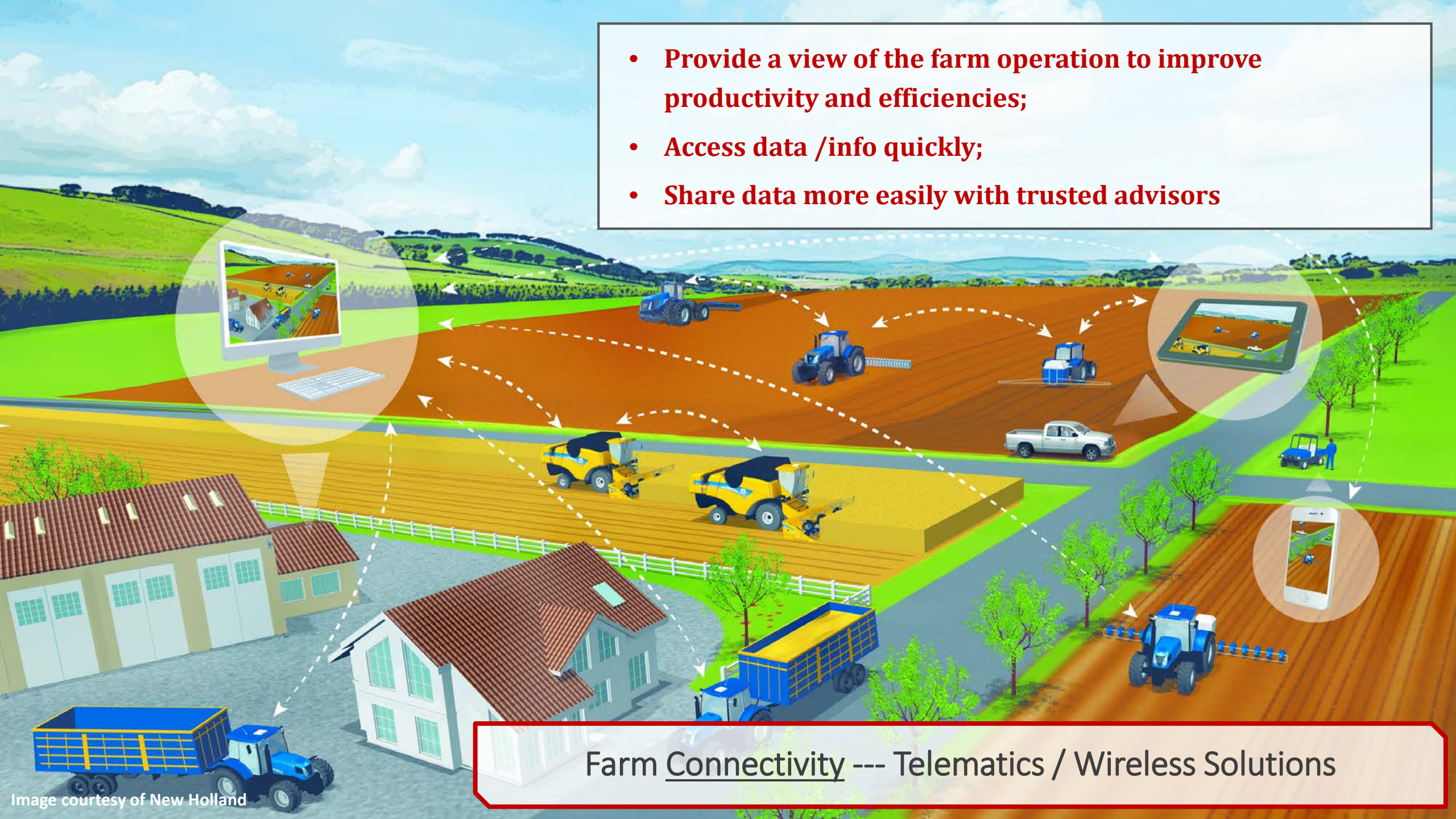


Image courtesy of Raven Industries

Technology

- Product control
- Array of sensors
- Displays / Data Visualization
- Wireless communication



- **Provide a view of the farm operation to improve productivity and efficiencies;**
- **Access data /info quickly;**
- **Share data more easily with trusted advisors**

Farm Connectivity --- Telematics / Wireless Solutions

Image courtesy of New Holland

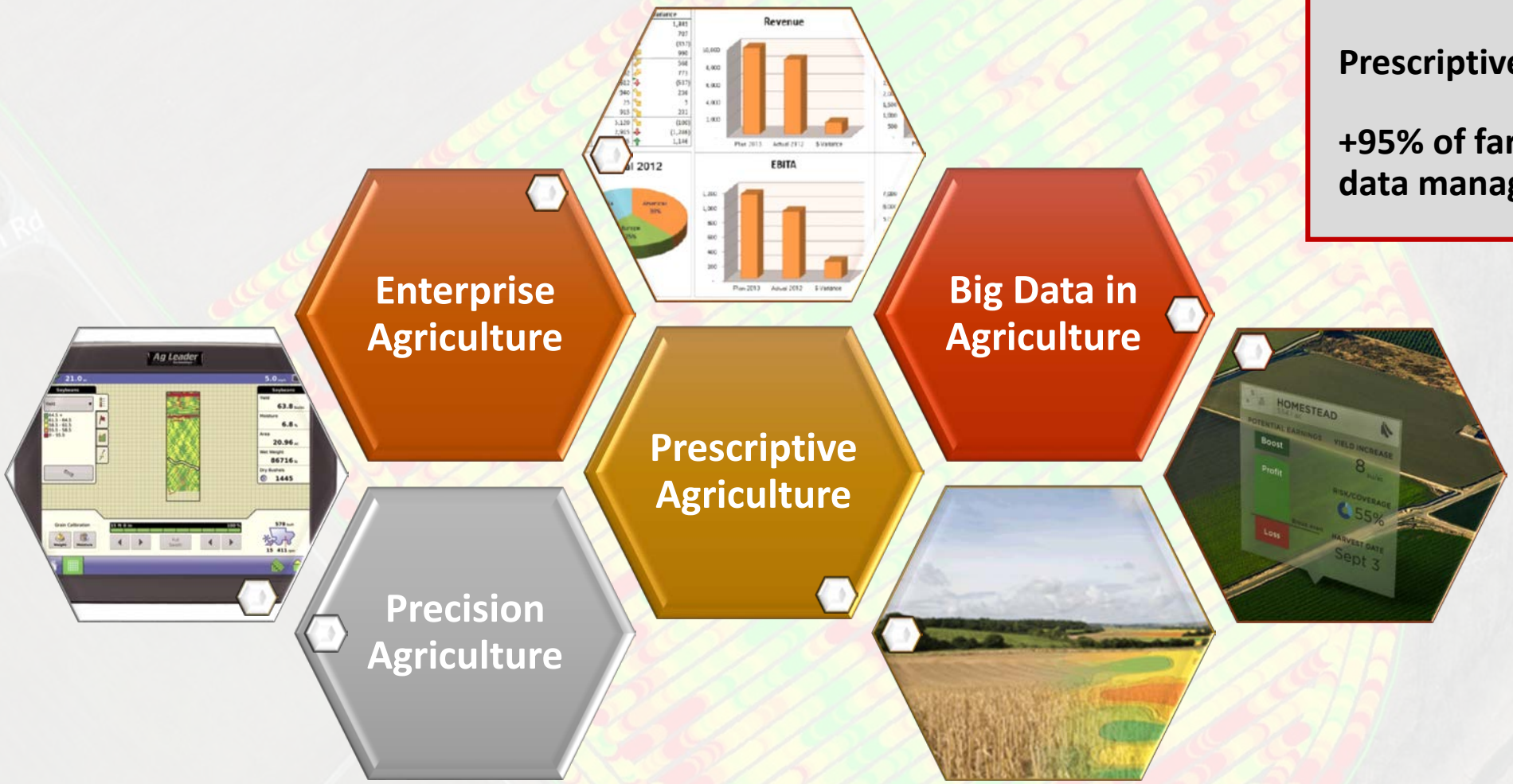
Digital Agriculture

Adoption

Precision Ag: 70% US acres

Prescriptive Ag: +15% of farms

+95% of farmers will outsource data management.



Based on information from an Iowa AgState / Hale Group report.

Future Data Exchange for Growers

Producer

Recommendations

- **Preseason Fertility Management**
  - Prescription P and K application (Precision Crop Services)
- **Tillage Management**
  - Prescription tillage maps (AGCO; CNH)
- **Multi-Hybrids**
  - Prescription seeding of multi-hybrids (Beck's; Pioneer)
- **SCN Management**
  - Prescription application/use of nematicides (FMC)
- **In-Season Fertility Management**
  - Prescription N application (DuPont Pioneer; Climate Corp)
- **Irrigation Management**
  - Prescription Irrigation (AgSmart)
- **Disease Management**
  - Prescription fungicide application (BASF)

Data will need to move through multiple organizations and each organization will need different data sources.

Data Service Scenario for a Grower

Producer

Primary Data Partner

Parallel Data Service

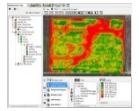
MONSANTO

FieldScripts

NEW HOLLAND AGRICULTURE

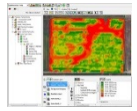
PLM CONNECT

SST Summit®



Data Analytics

FieldScripts



Data Analytics

Adoption

Prescriptive – +15% of farms and growing

95% of farmers will outsource data management.

Emerging Ag Data Exchange Scenarios

Producer

NEW HOLLAND AGRICULTURE

PLM CONNECT

Ag Leader Technology

AgFiniti

Producer-Centric
Ag Data Depository
(Third Party)

Standardization
File Permission
Cleaning
Certification
Anonymization
Aggregation

Ag Tech

SST Summit® Professional

FarmRite

Data Analytics

BECK'S HYBRIDS

FARMserver

DUPONT PIONEER

encirca

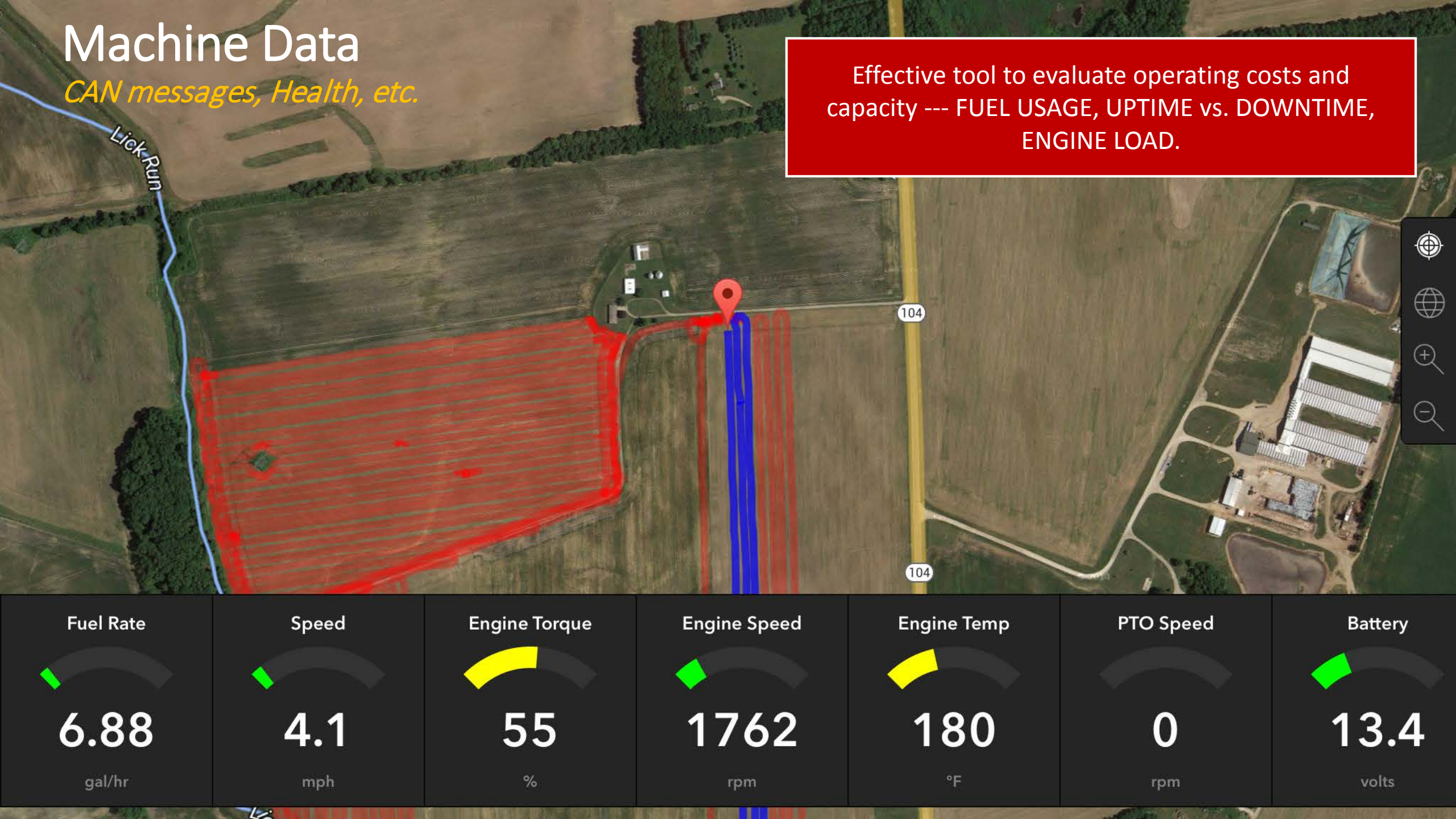
Data Examples Today


1) Dual Hybrid by individual row control for 2) population, 3) down force, and 4) starter fertilizer (*prescriptive agriculture*)
THE OHIO STATE UNIVERSITY

Machine Data

CAN messages, Health, etc.

Effective tool to evaluate operating costs and capacity --- FUEL USAGE, UPTIME vs. DOWNTIME, ENGINE LOAD.

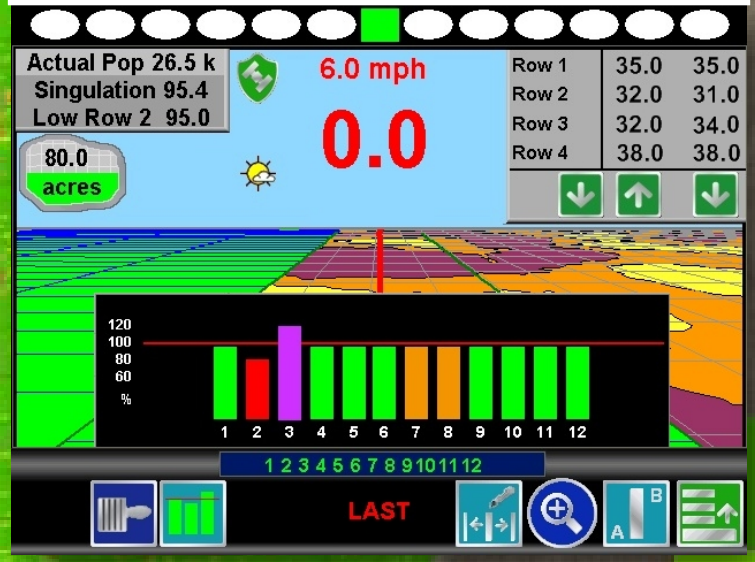


Fuel Rate	Speed	Engine Torque	Engine Speed	Engine Temp	PTO Speed	Battery
6.88	4.1	55	1762	180	0	13.4
gal/hr	mph	%	rpm	°F	rpm	volts

As-Planted Data --- Ride Quality Map

Man- / Machine-made Vs. **Natural Variability**

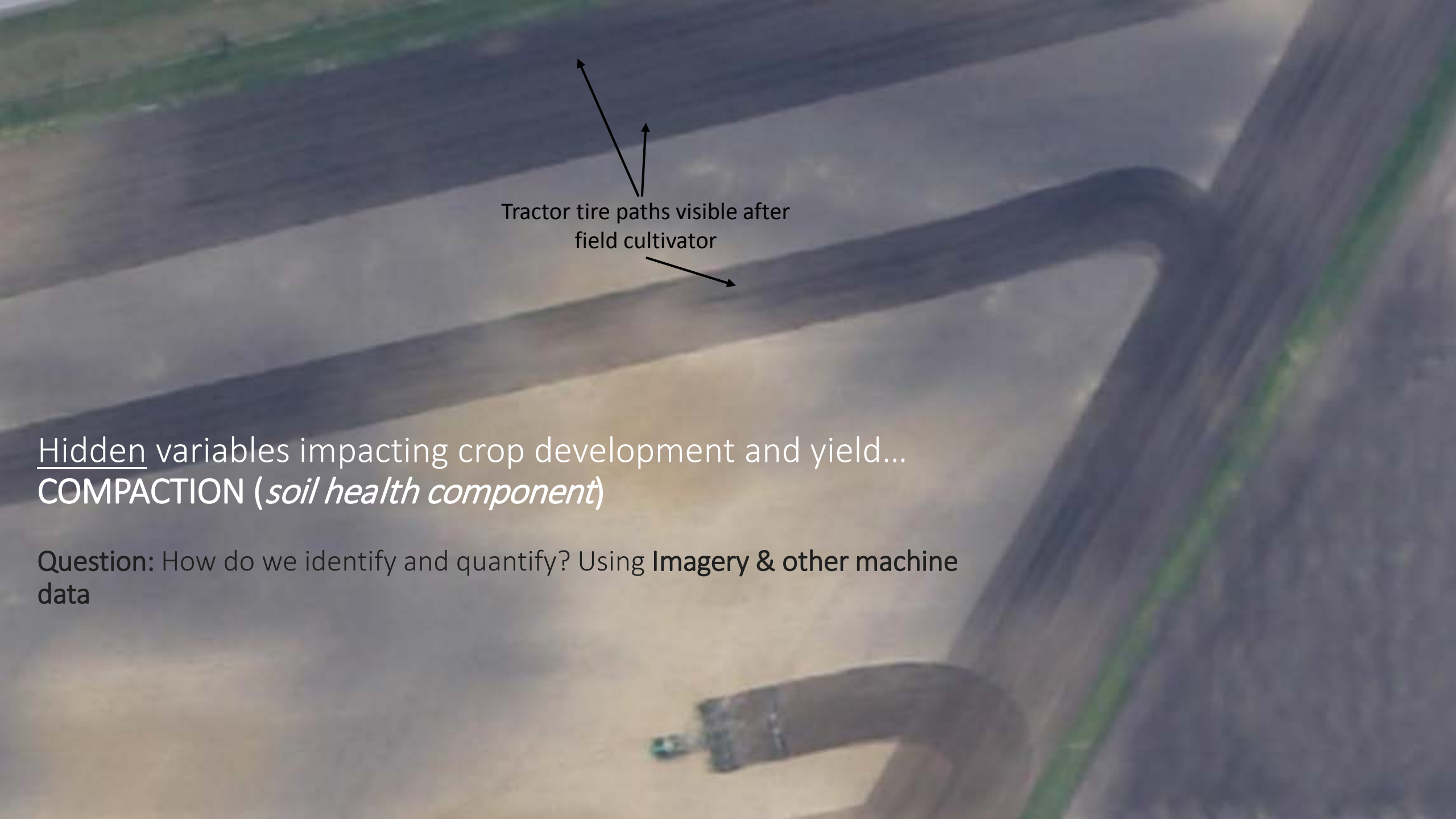
In-Cab Display Feedback



Producer Value

1) Identify equipment issues in real-time.; 2) Execute prescriptions; 3) As-Planted Data

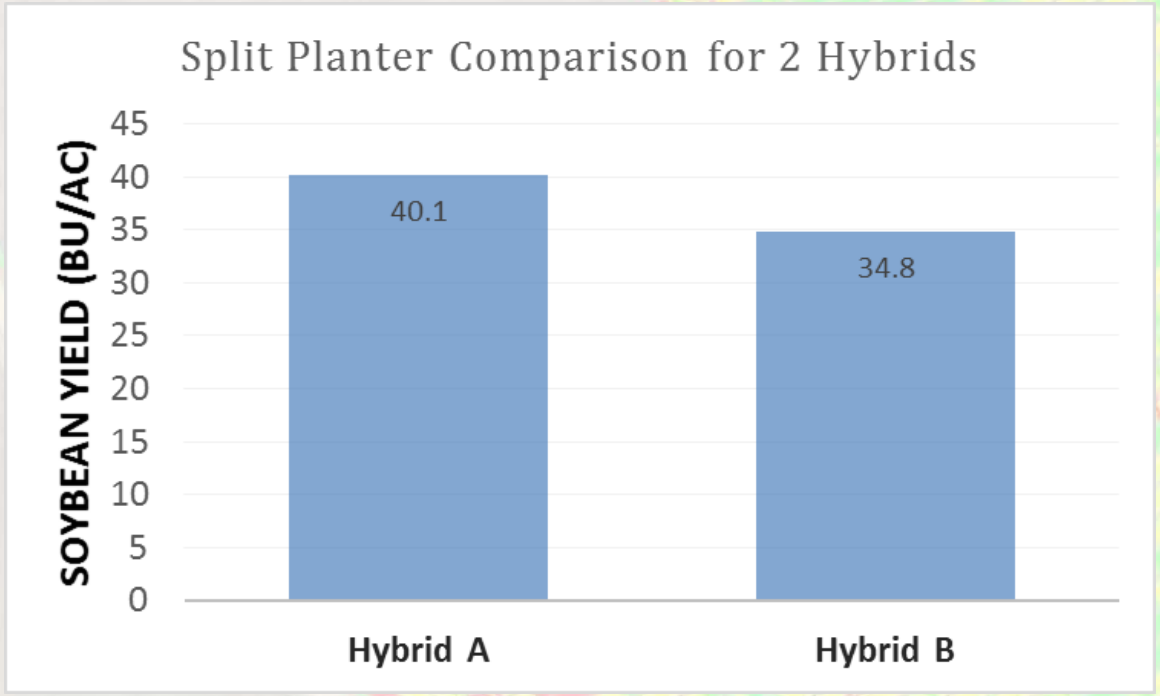
Correct issue(s) immediately & Post-harvest analysis

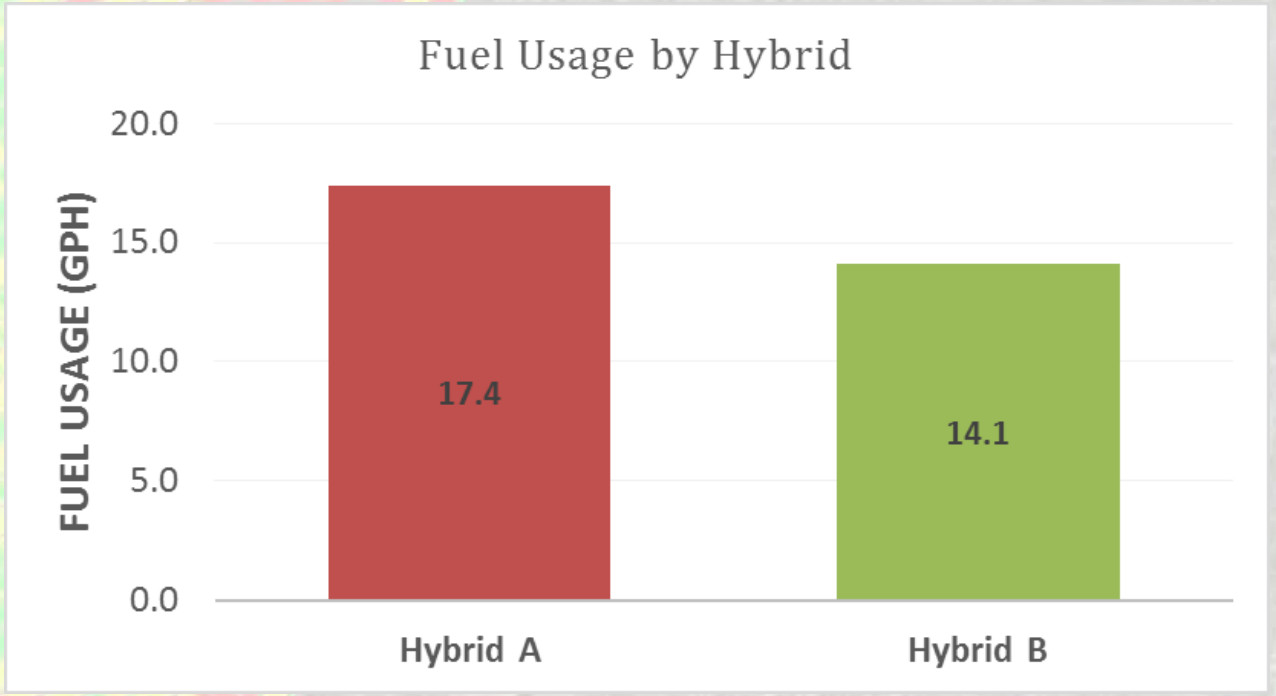


Hidden variables impacting crop development and yield…
COMPACTION (*soil health component*)

Question: How do we identify and quantify? Using **Imagery & other machine data**

Bridging Agronomic and Machine Data

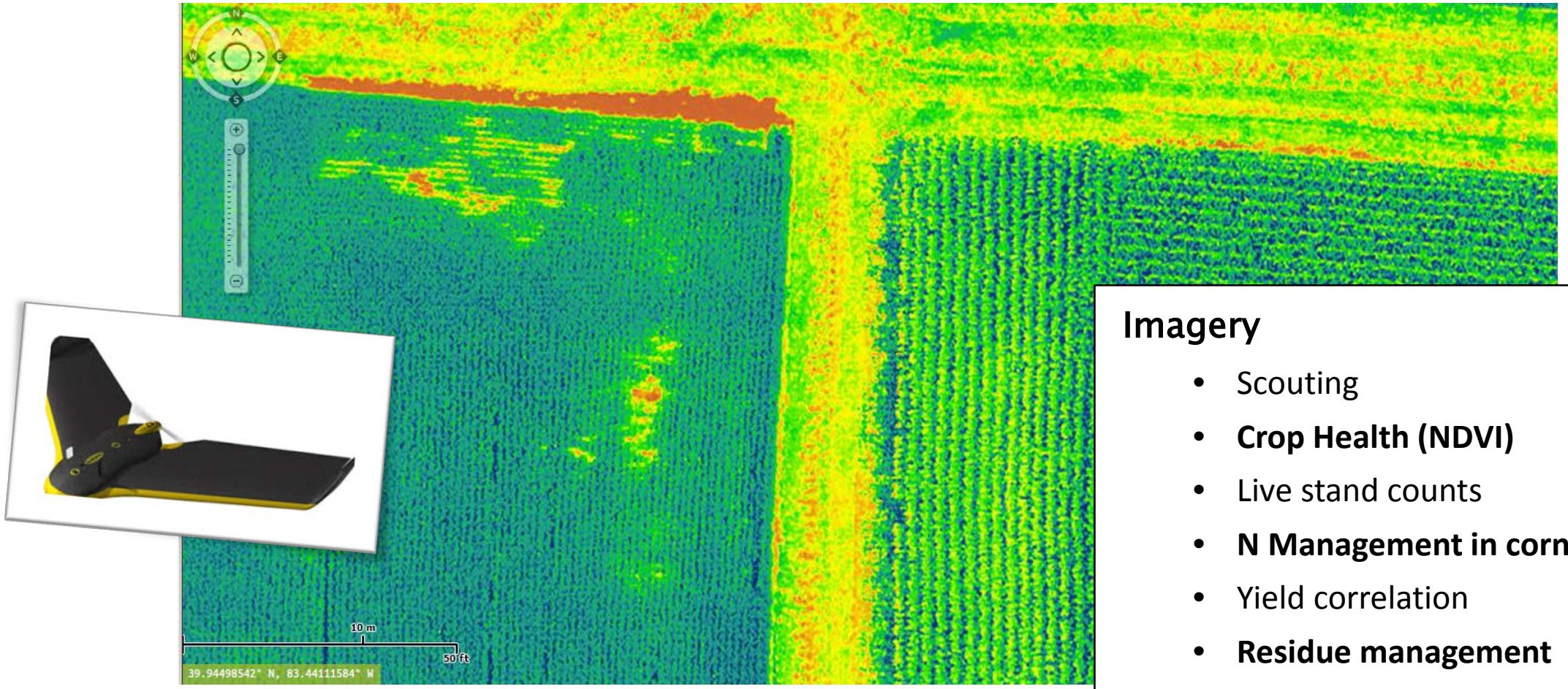




Big Data - Accelerate learning and thereby earlier selection of a favorable economic response.

	Moisture Content (%)	Ground Speed (mph)	Fuel Usage (gallons per acre)	Mean % Engine Load	Mean Field Capacity (ac/hr)
Hybrid A	14.8	2.8	1.71	**86**	**10.2**
Hybrid B	14.3	5.2	0.86	**44**	**18.9**

Remote Sensed Imagery (including UAV / UAS)



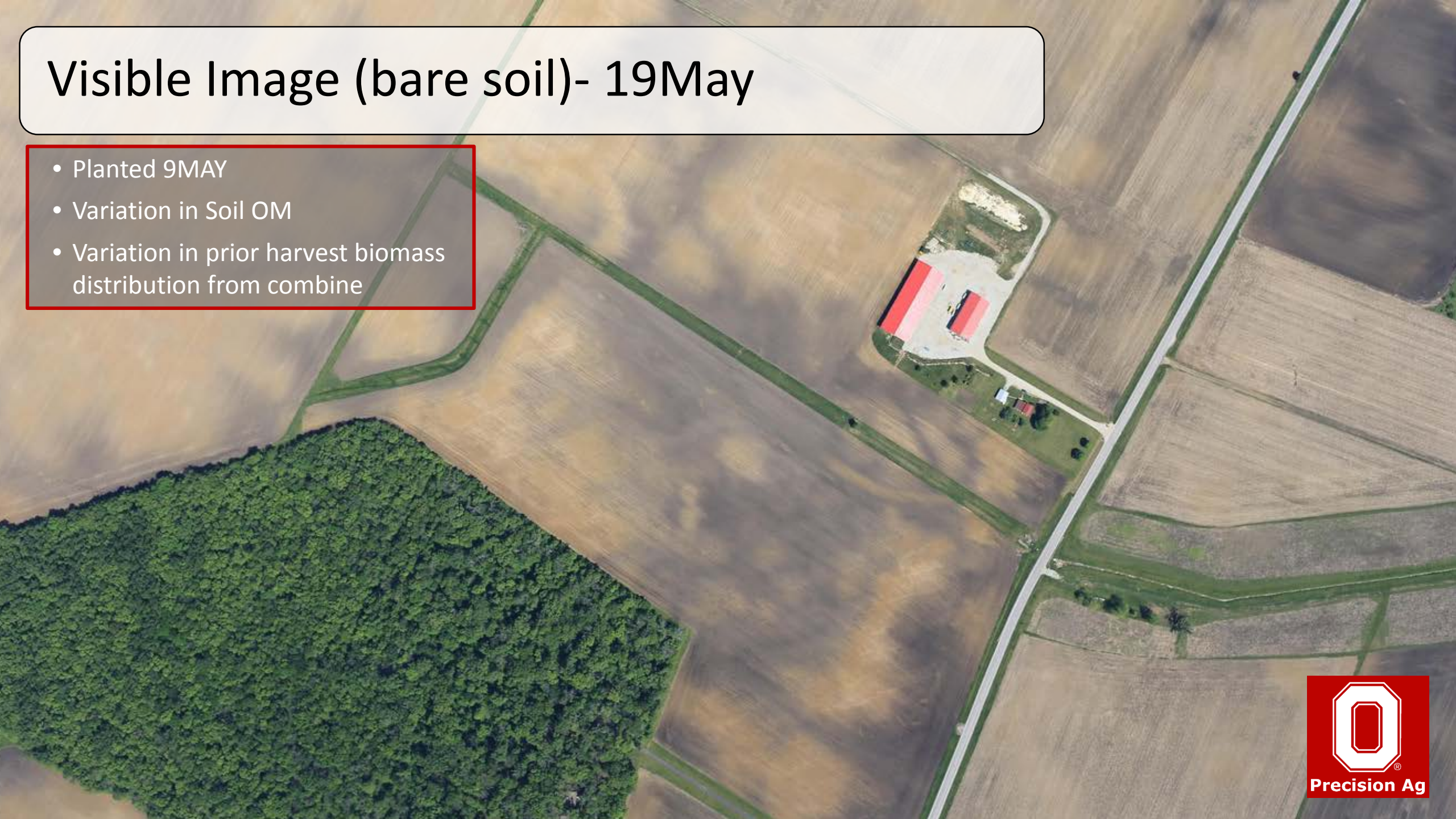
Ohio State University, Woolpert and the Air Force Research Laboratory.

Imagery

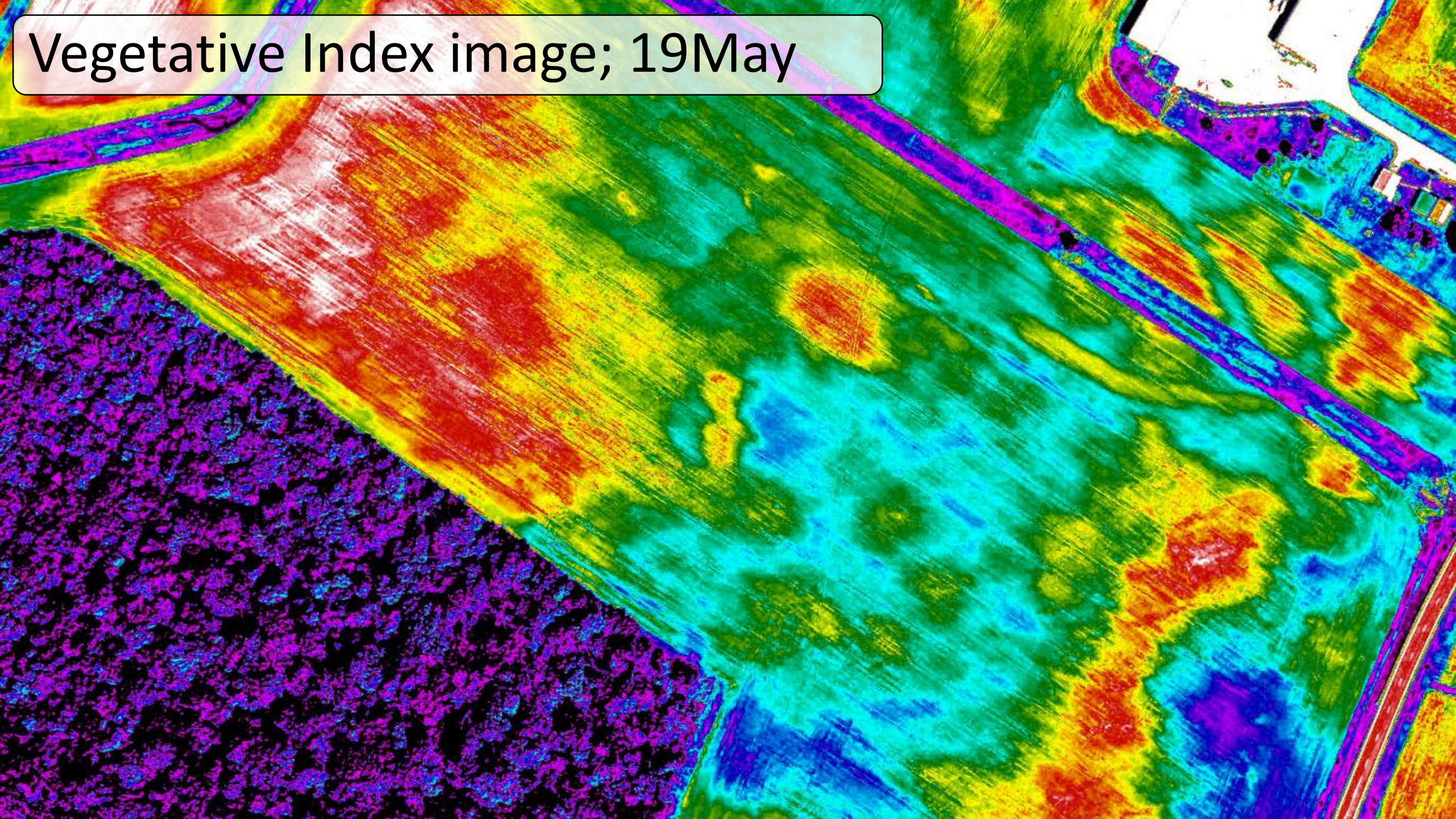
- Scouting
- **Crop Health (NDVI)**
- Live stand counts
- **N Management in corn**
- Yield correlation
- **Residue management**
- **Equipment / management issues**
- Much more…

Visible Image (bare soil)- 19May

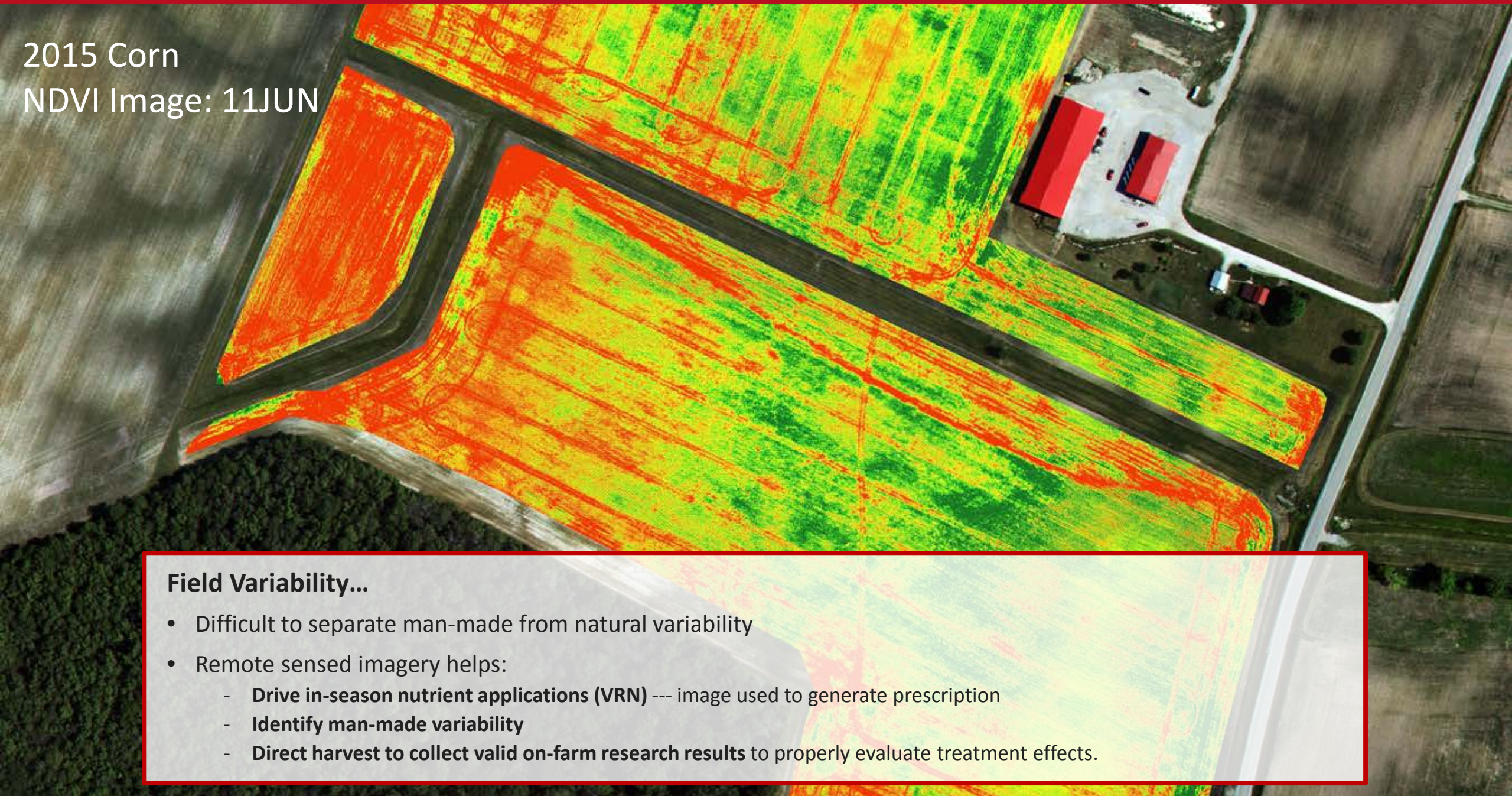
- Planted 9MAY
- Variation in Soil OM
- Variation in prior harvest biomass distribution from combine



Precision Ag


Vegetative Index image; 19May

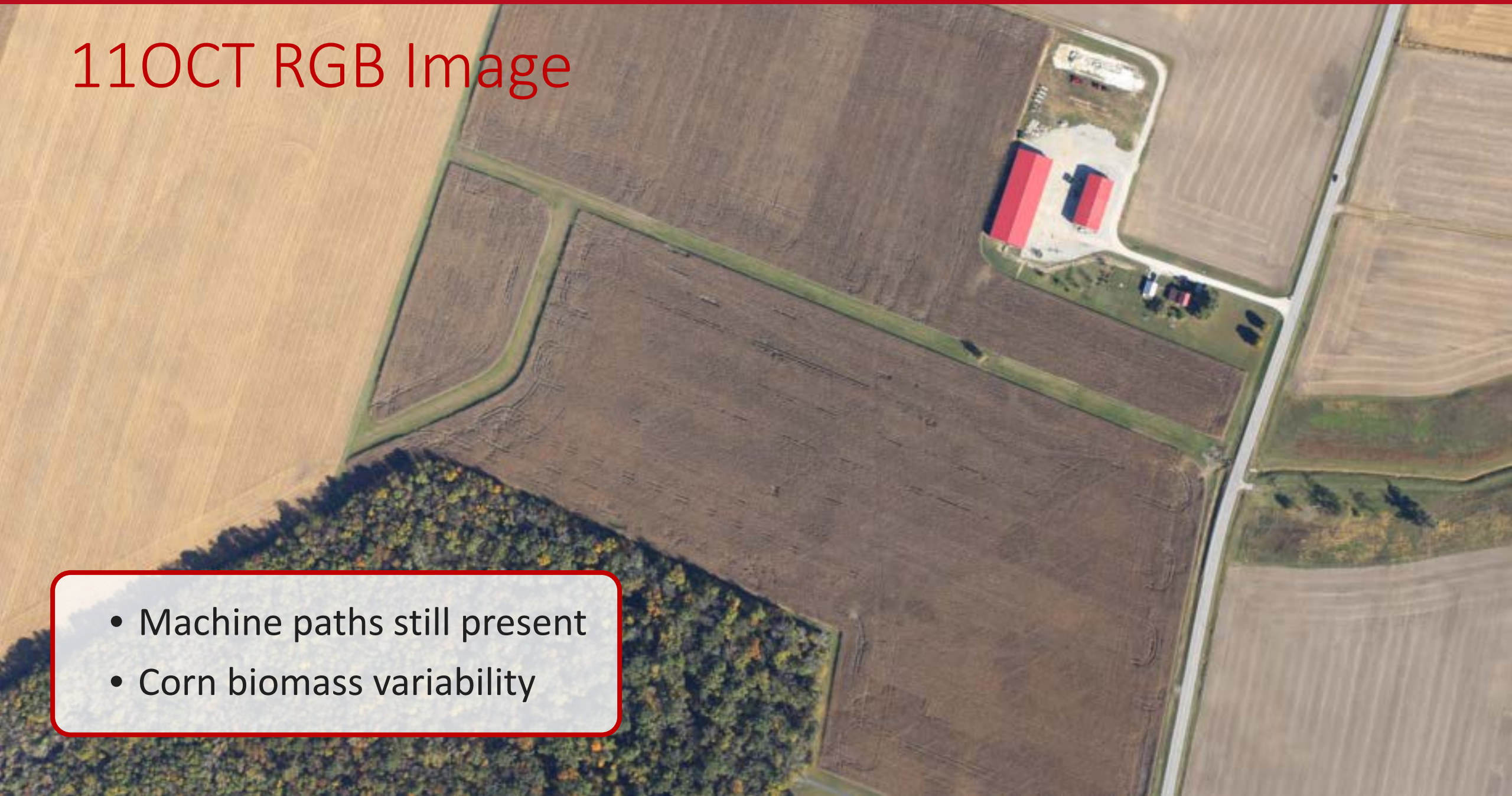
2015 Corn
NDVI Image: 11JUN



Field Variability…

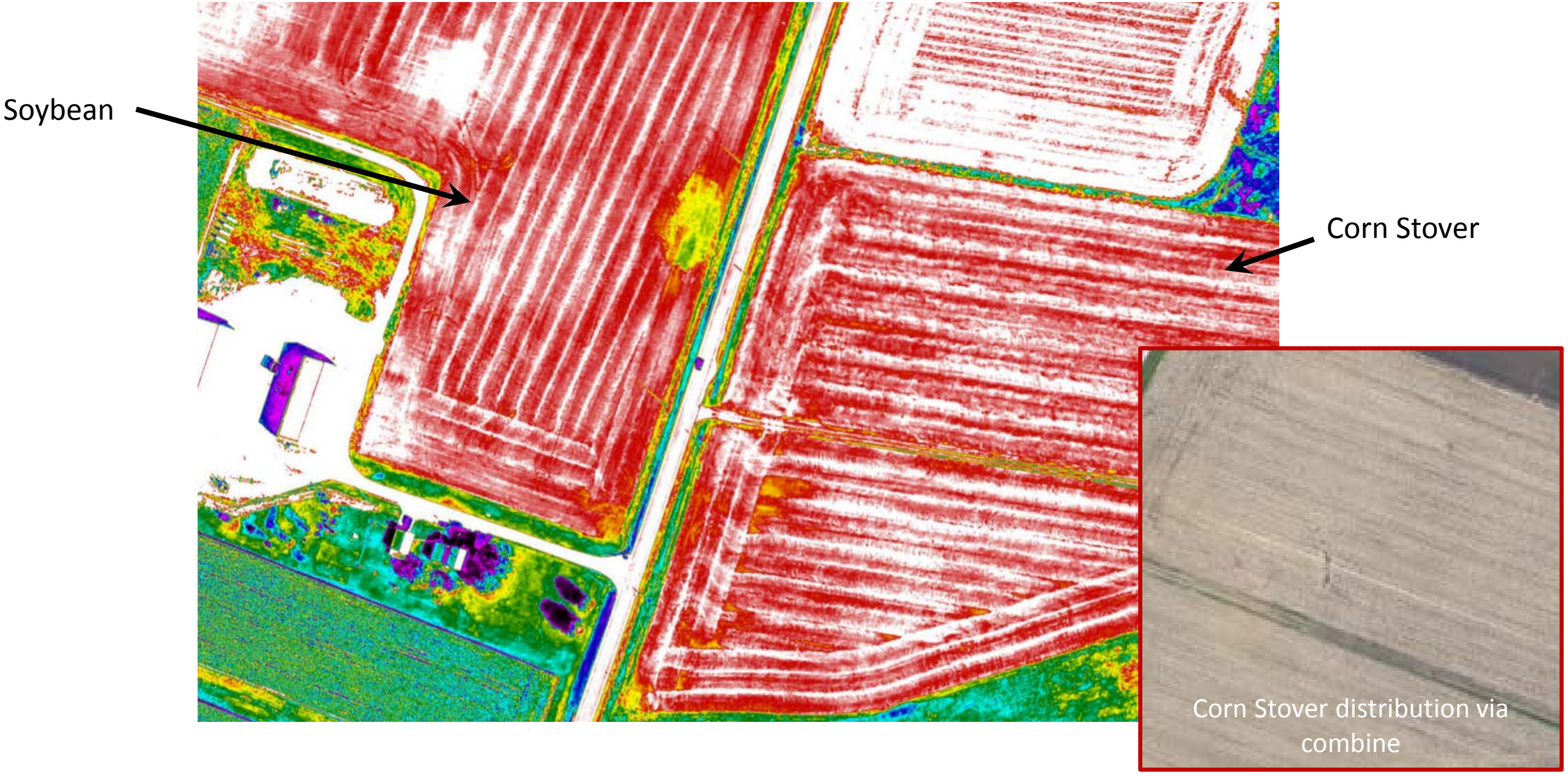
- Difficult to separate man-made from natural variability
- Remote sensed imagery helps:
  - **Drive in-season nutrient applications (VRN)** --- image used to generate prescription
  - **Identify man-made variability**
  - **Direct harvest to collect valid on-farm research results** to properly evaluate treatment effects.

11OCT RGB Image



- Machine paths still present
- Corn biomass variability

Post-harvest crop residue – 11OCT



By-row prescription (Rx)

- Hybrid
- Population
- Starter fertilizer
- Down force
- Seeding depth
- Row-cleaner

FINAL COMMENTS…

- ***Soil Health:*** *bulk density, carbon, & nutrient stratification*
- **Technology & Prescriptive Services continue to advance rapidly.**
- **Remote sense imagery providing new insights to manage soil health and fine-tune nutrient management.**
- **Data quality needs to be an industry focus to achieve “Big Data”**

Digital Agriculture

Providing solutions to meet world demand

John Fulton
Fulton.20@osu.edu
334-740-1329
@fultojp

Ohio State Precision Ag Program

www.OhioStatePrecisionAg.com

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