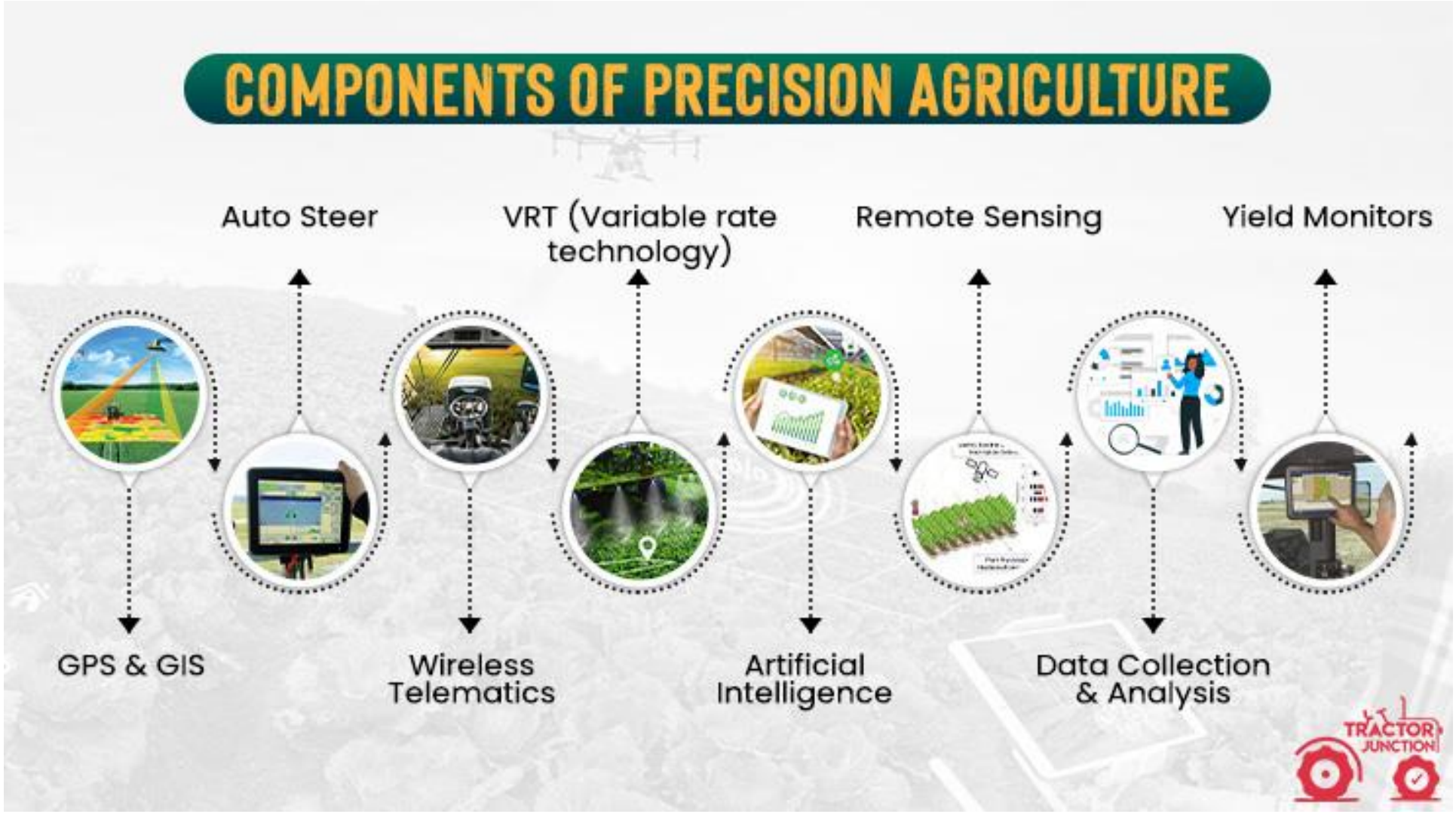
Role of Drones and Precision Agriculture in Improving Crop Management and Profitability

Simer Virk
Assistant Professor &
Extension Precision Ag Specialist
University of Georgia
@PrecAgEngineer

UNIVERSITY OF GEORGIA EXTENSION

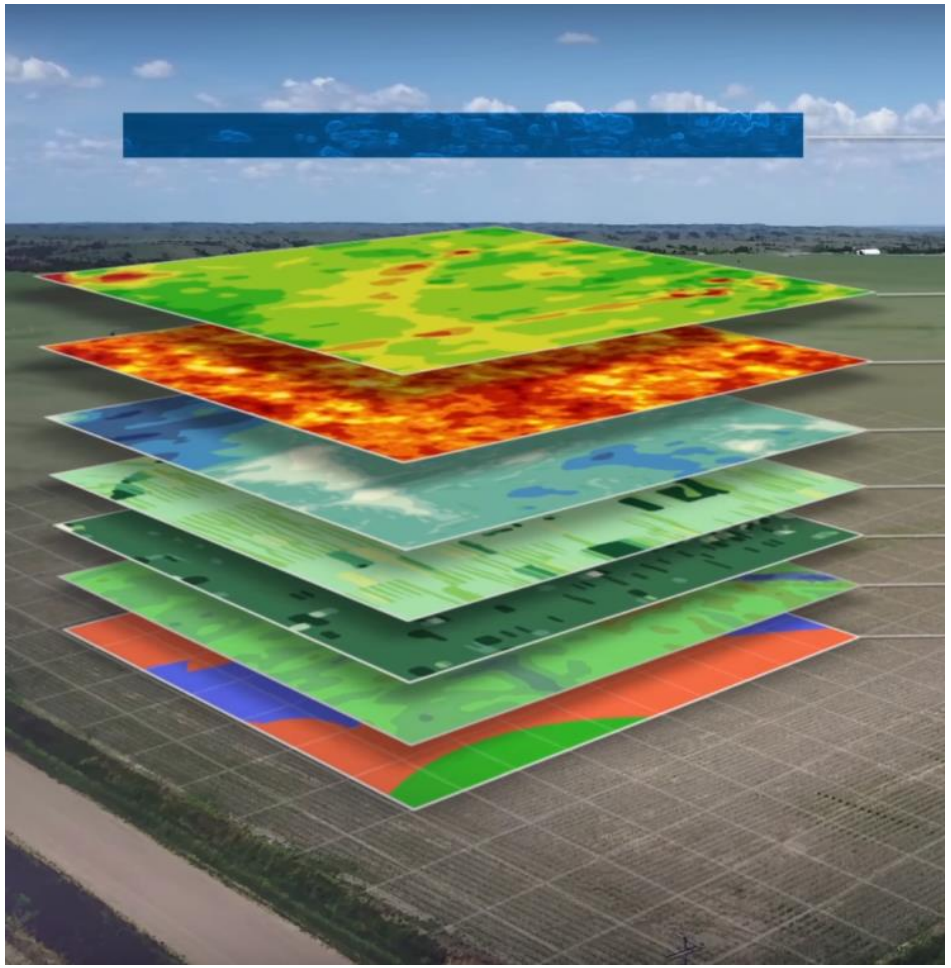
UNIVERSITY OF GEORGIA DIGITAL AG

Precision Agriculture

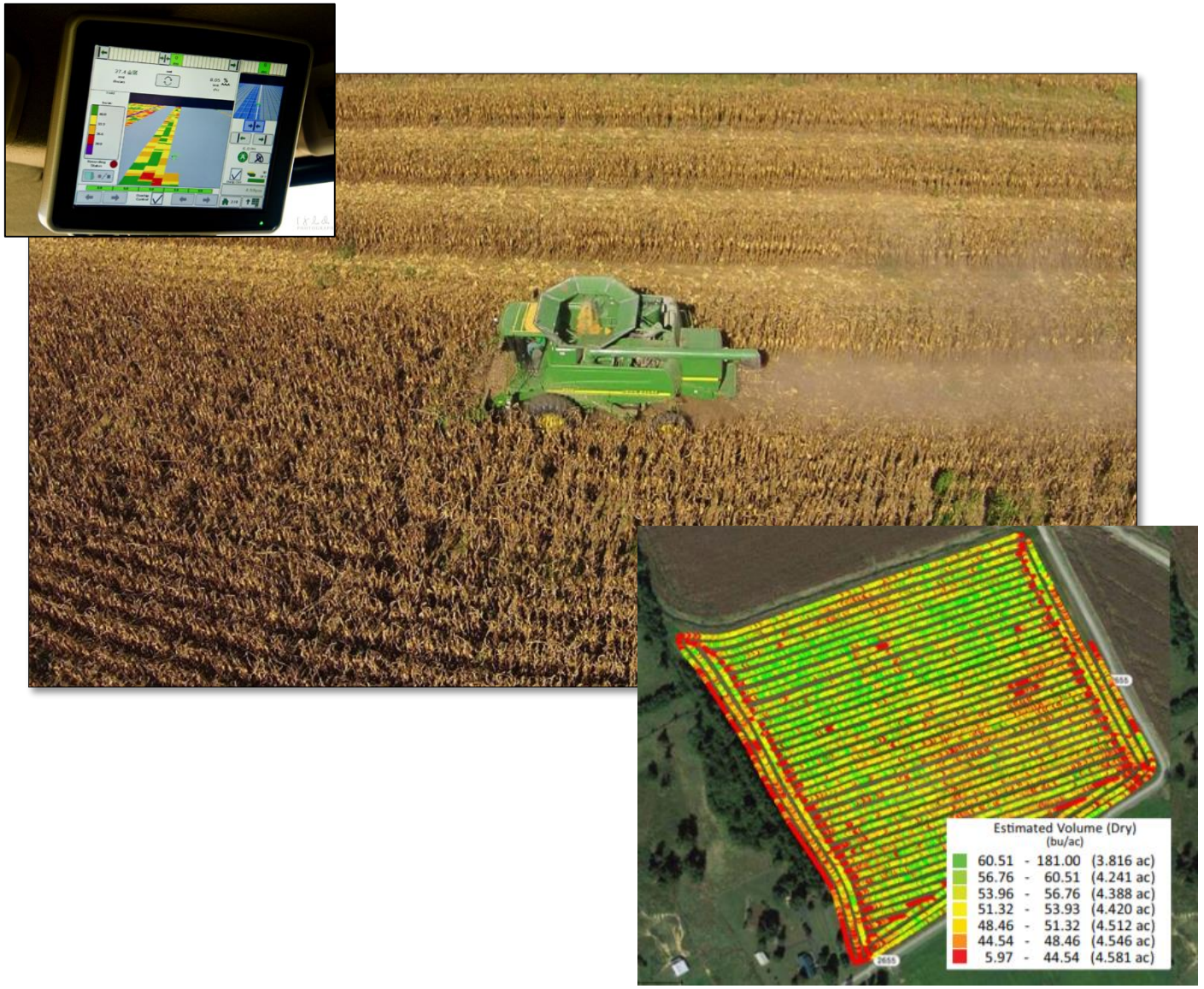


Precision Ag Technology Today

- Basic PA technology is the Norm
  - ✓ Auto-Guidance is standard
  - ✓ Section and Rate Control on Planters and Sprayers
  - ✓ Variable-Rate Application of crop inputs
  - ✓ Yield Monitor on Harvest Equipment
- Growing with technology
  - ➢ Telematics, Data Management & **Drones**
  - ➢ Smart Sensors, Connected Technology & Imagery
- Future technology potential
  - ❑ Robotics & Automation
  - ❑ Machinery Learning & Artificial Intelligence



How do drones fit into Precision Agriculture?



- Yield maps provide spatial yield variability within the fields which helps in changing management to improve productivity and profitability across the whole field.
- Yield maps are “after-the-fact” and only help prepare for next year.
- To better manage crops, we need tools and technologies for detecting and addressing variability within the season.

How do drones fit into Precision Agriculture?

- Drones allow rapid deployment of high-resolution sensors to detect spatial (and address) variability that helps in improved in-season crop management.
- Timely detection of variability to develop real-time “actionable information”.

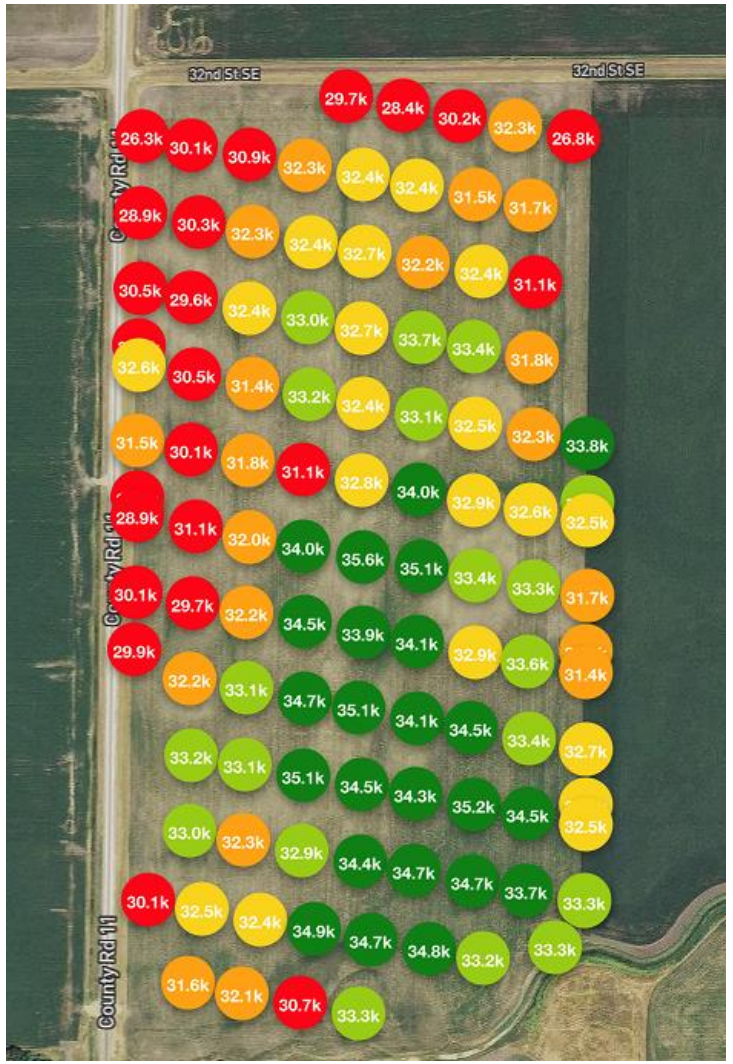
Drone Types – Rotary and Fixed Wing

Drone Sensors

Crop Scouting

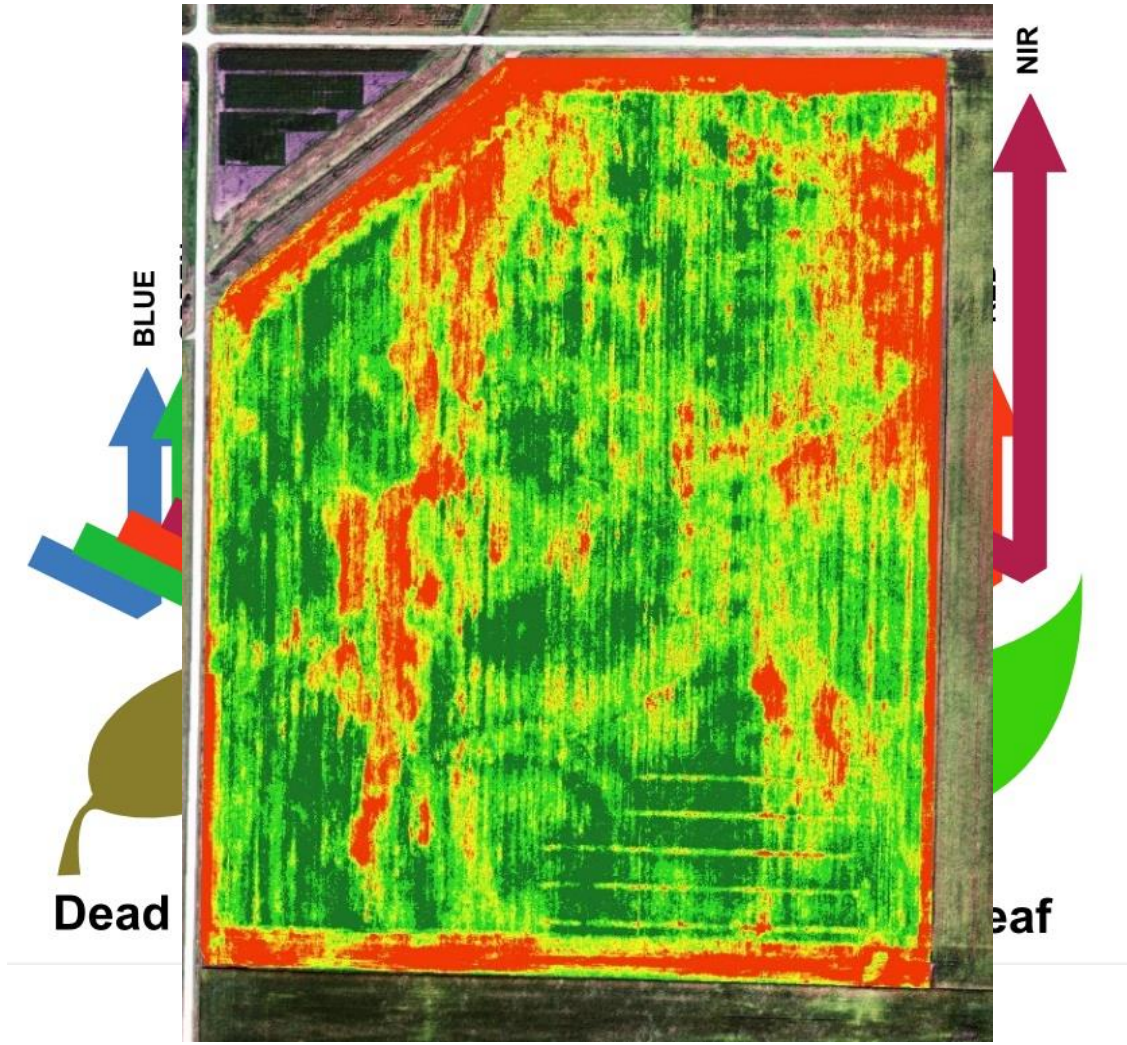
- One of the most common application of drones in agriculture
- Manual scouting – limited to small parts of the field
- Drone scouting – provides a better perspective of what's happening across the whole field
- Mapping and logging features makes it a very effective scouting tool

Plant Stand Counts and Emergence

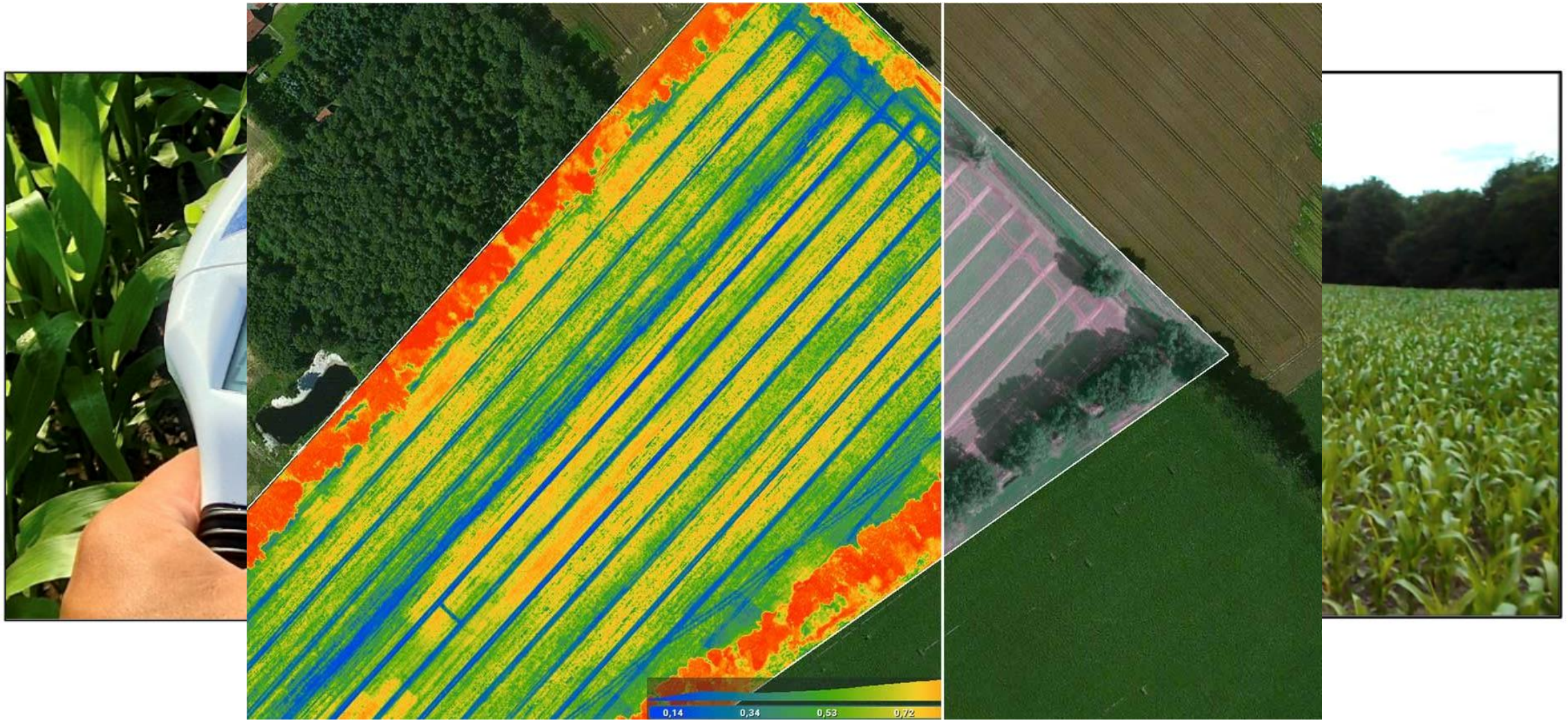


Crop Health Monitoring

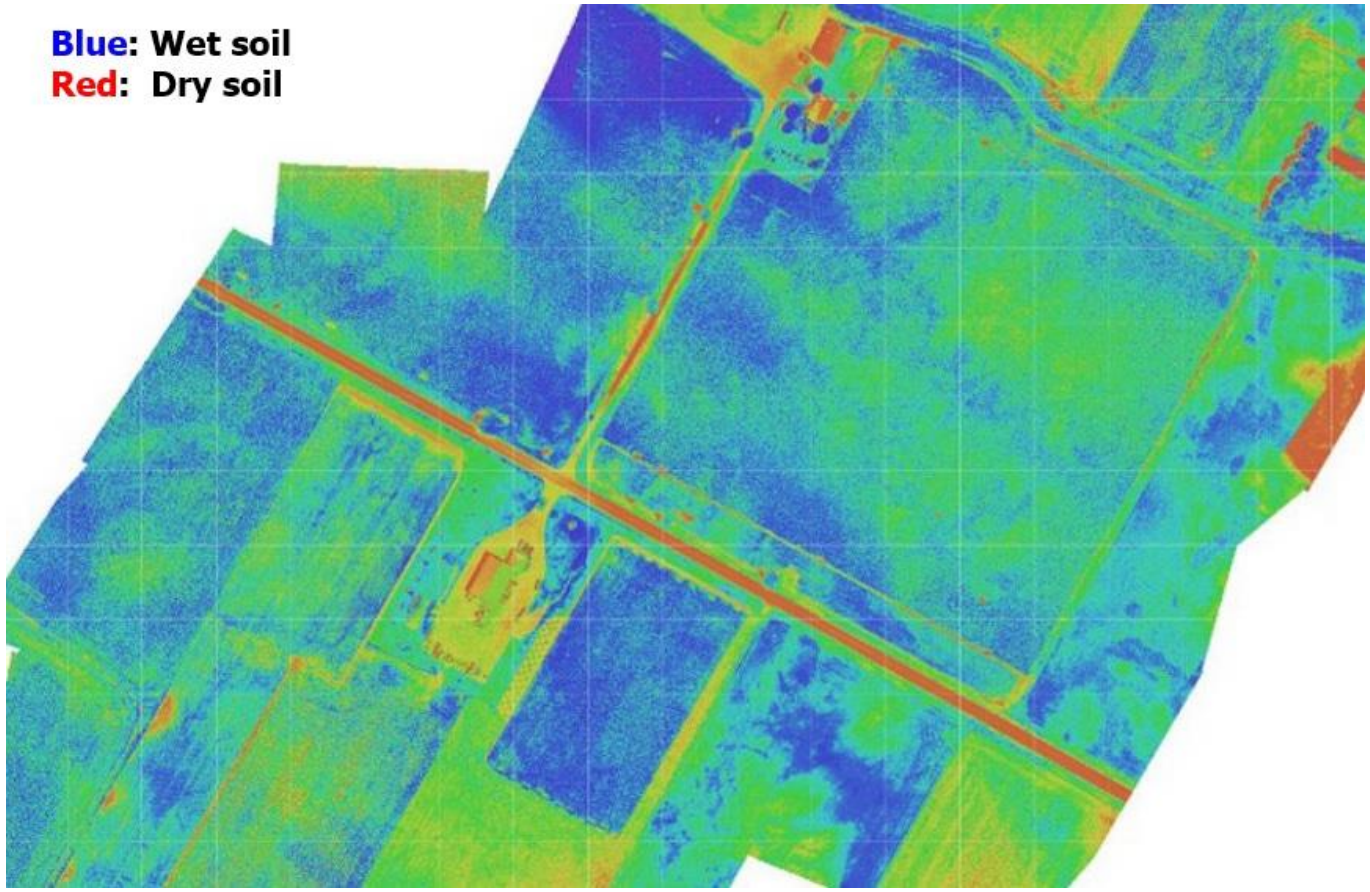
- The second most used application of drones in agriculture today
- Relies on using a vegetative index to assess crop health such as NDVI or NDRE
- Enables delineation of areas/zones for site-specific management of crop inputs (e.g. variable-rate nitrogen)
- Major ag companies are integrating it into their farm data management software's.

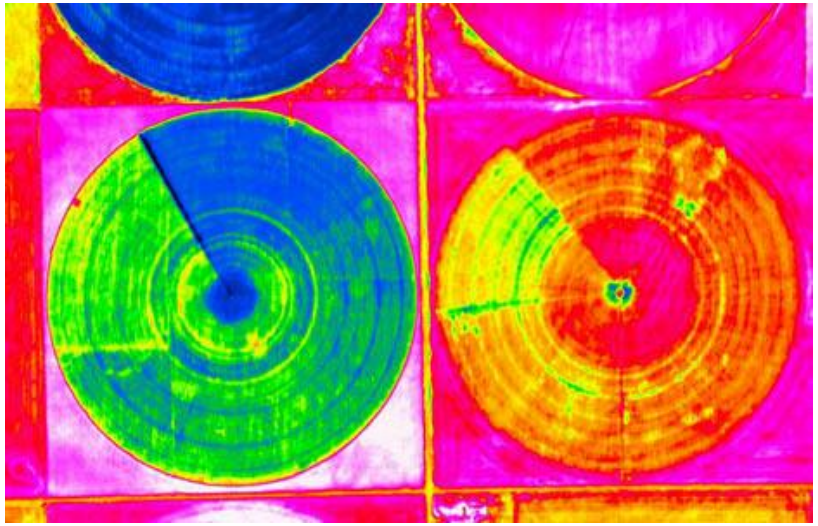


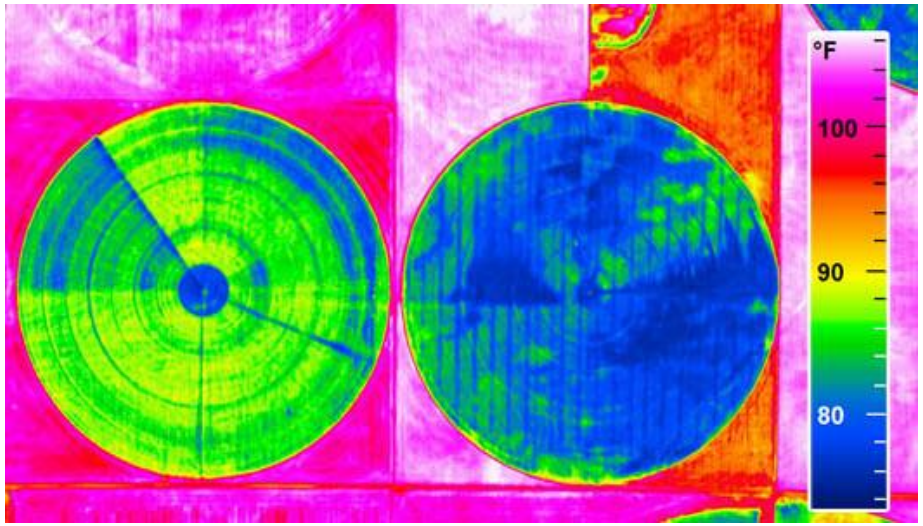
Variable-Rate Nutrient Management



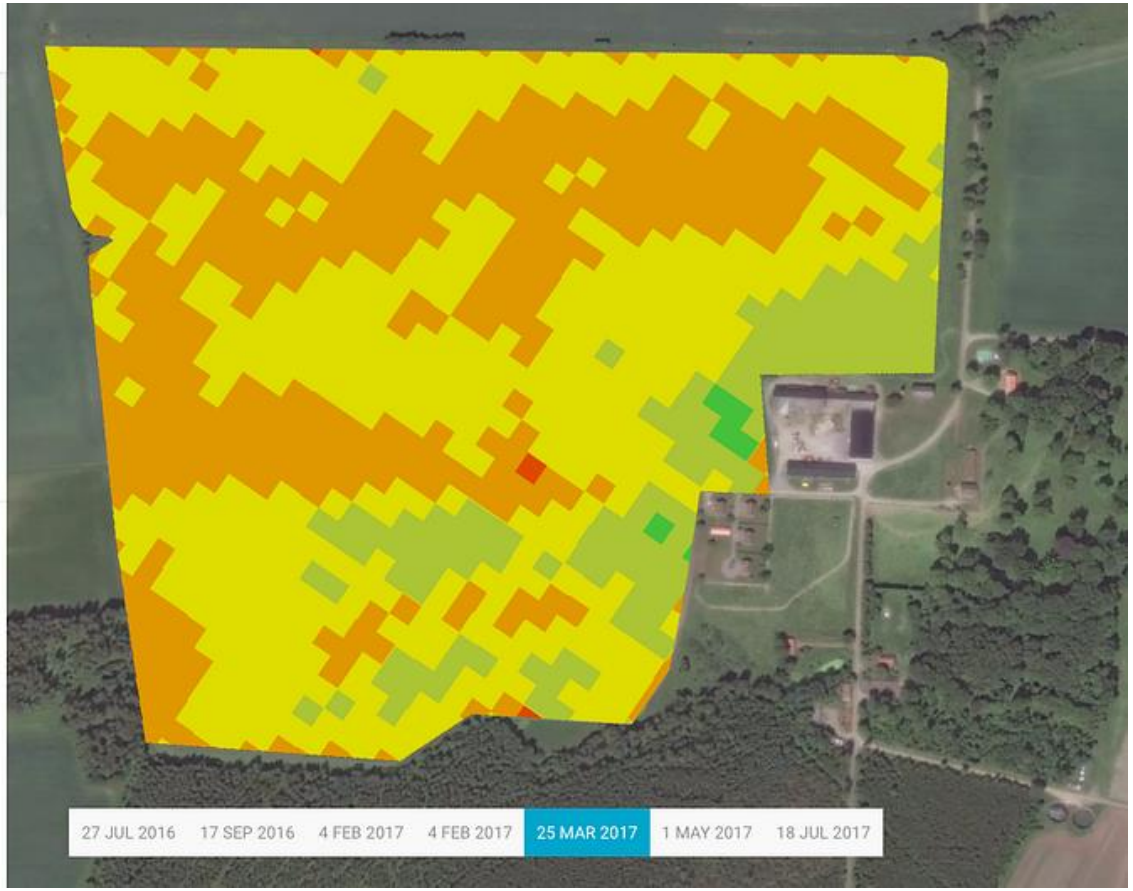
Irrigation Management



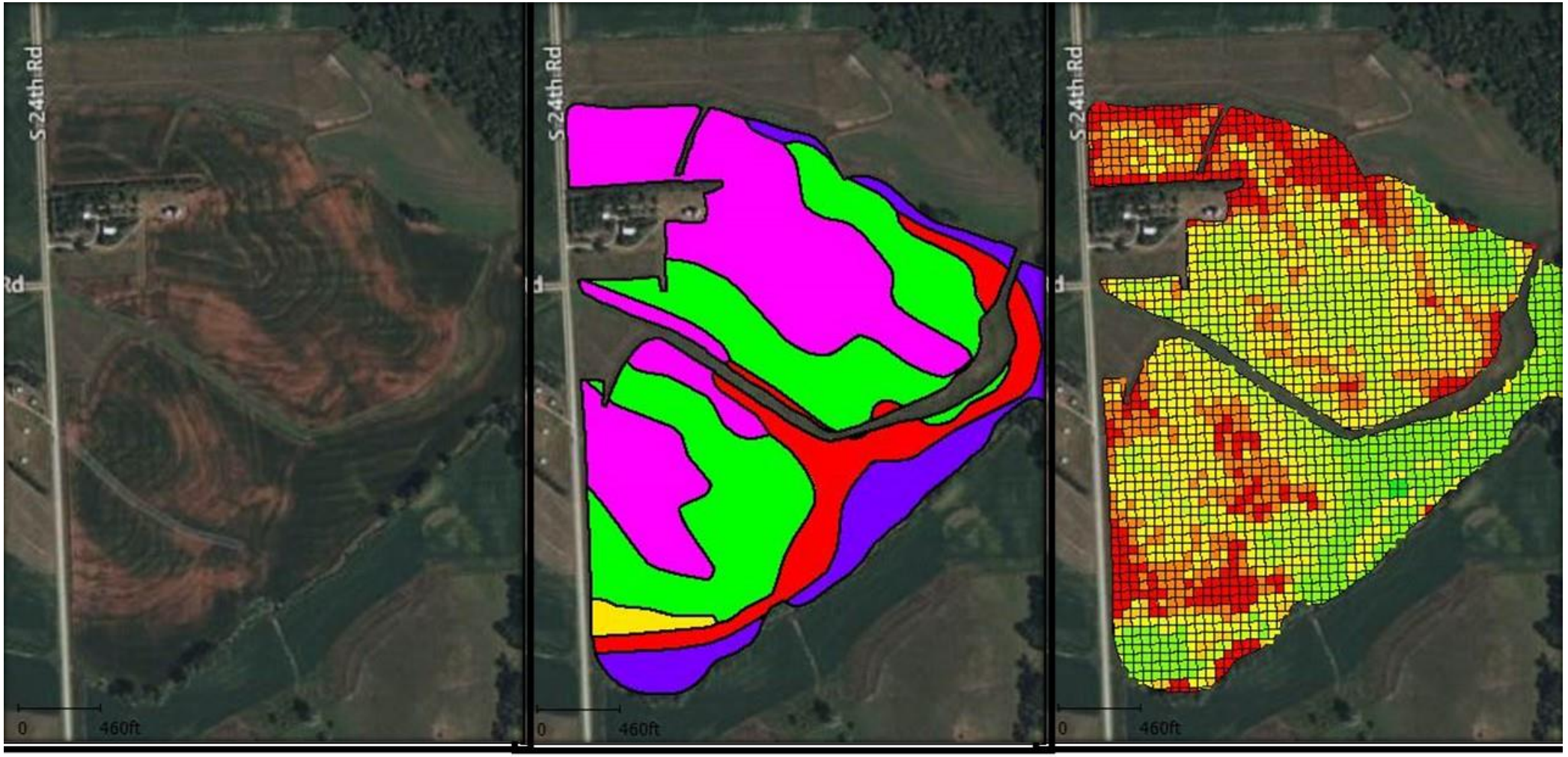




Replant Decisions



VR Seeding using Drone Imagery



2022 image of soybeans, drought stress on soils with low water holding capacity

Soil Type boundaries for the same field. Green soils are Morrill glacial till. Purple and Red are Nodaway and Judson soils. Pink is Wymore.

Variable Seeding Rx using normalized yield data from 2013-2021 corn harvest data.

Weed Mapping and Prescriptive Spraying

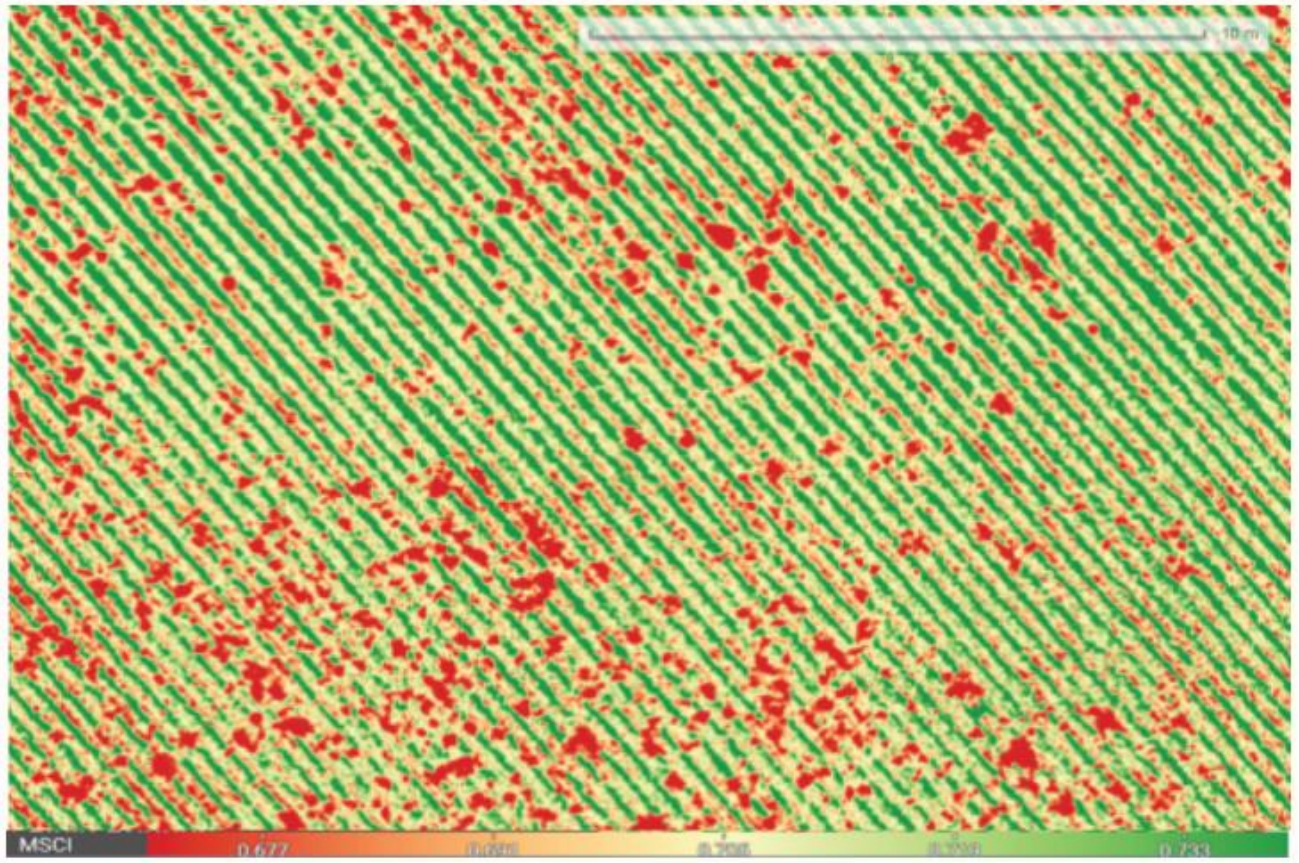


Figure 2. A proprietary index, MicaSense Chlorophyll Index (MSCI), calculated from multispectral sensor imagery, depicting weeds (dark red) in a soybean field.

Drones and Artificial Intelligence

solvi

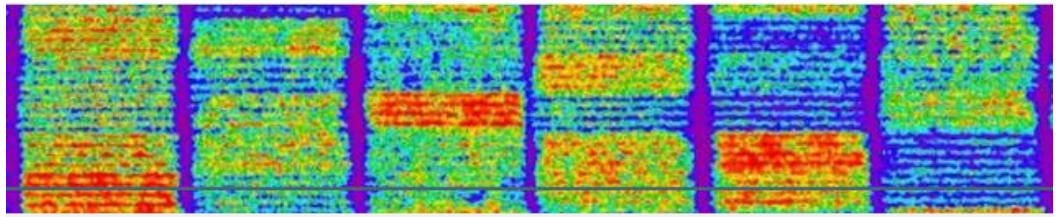
FEATURES PRICING ABOUT BLOG LOG IN SIGN UP

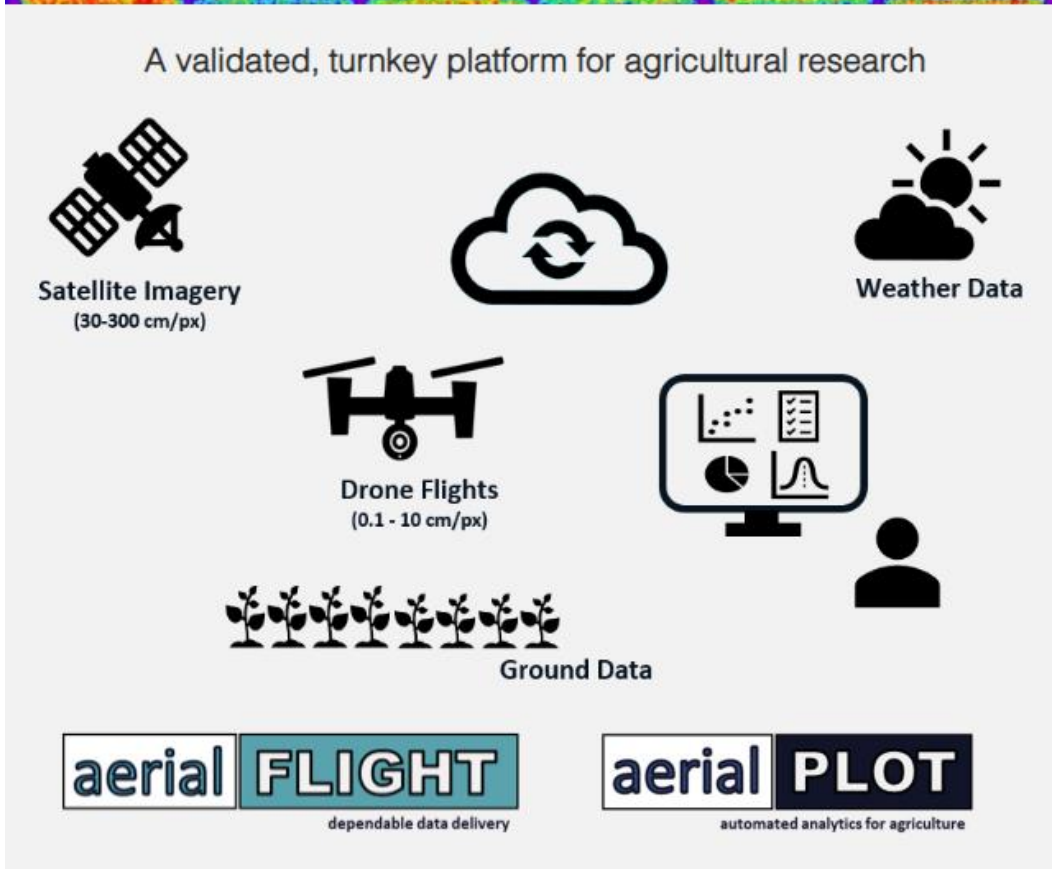
Plant-Level Insights for Your Entire Field

Precise crop management means peak field performance. Plant AI™ translates plant-level drone data into actionable management insights. Layer valuable metrics onto your Plant Counts map to assess crop establishment variables or gauge optimal plant maturity for harvest. Visually monitor every plant in the field to make timely decisions where needed most.

- Fast and efficient scouting of the whole field
- Accurate total number of plants
- Per-plant size measurements
- Health estimate for each individual plant

Drones and Field Research





Advanced Analytics for Agriculture

Aerial data collection & analytics:

- Validated standard operating procedures
- Standardized, state-of-the-art equipment
- Radiometric calibration
- Accurate data collection
- Streamlined data delivery
- Full growing season aerial data anything

Visualize & manage crop metrics

- Emergent vigor
- Plant health
- Canopy growth
- Plant height
- Stand counts
- Stress/Fertility response
- Senescence and maturity ratings

Application Drones

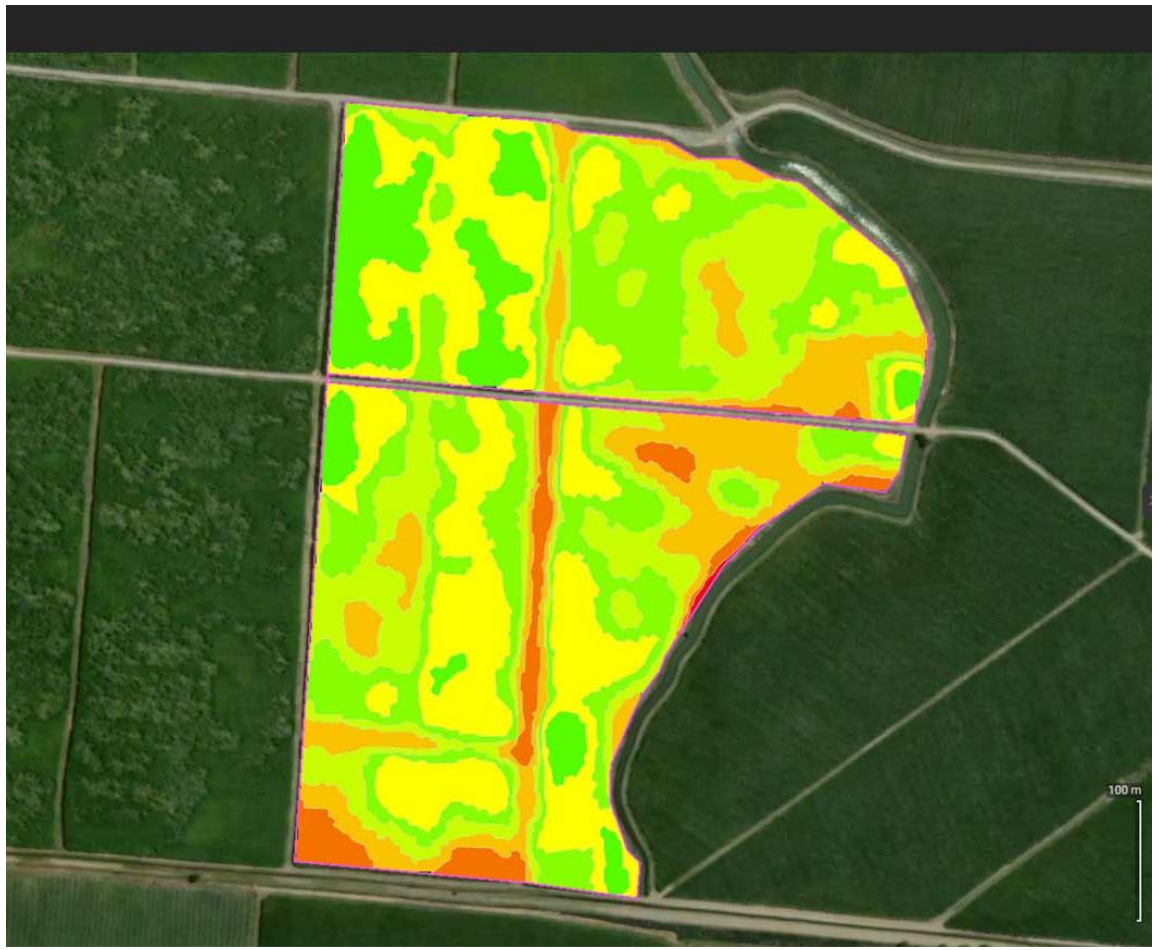
DJI Agras T30 Spray Drone

DJI Agras T10 Spreader System

Spray Drone Applications

- **Spot-spray herbicide applications** – where it is efficient and economical to treat with a drone sprayer.
- **Fungicide applications** – when a timely fungicide application with a ground sprayer or crop duster is not feasible.
- **Awkward acres or small fields –** fields or parts of the fields that makes applications with ground and/or crop duster challenging.

Spray Drones and VR Pesticide Applications



Spray Drones and Artificial Intelligence

PRECISION AI

Drone Seeding

What's the future of drone technology & applications in precision agriculture?

- Sensor and mapping resolution will continue to increase with change in focus from **site-specific to by-plant management.**
- **Machine learning and artificial intelligence** integration will enable more (precision) applications of drones for in-season crop management.
- Change (ease of) in regulations will improve adoption and usage of **drones among growers** (specialized applications will still be offered as a service).
- Improvements in automation, battery life and hardware will enhance the capabilities for **real-time and data-driven applications** on the farms.

Thanks!

Simer Virk
Extension Precision Ag Specialist
University of Georgia – Tifton
Email: svirk@uga.edu
Phone: (229) 386-3552
Website: https://agtechdata.uga.edu/
Twitter: @PrecAgEngineer