Drones and Data in Agriculture

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Nationwide, Ohio State University “green” light AgTech Innovation Hub

Nationwide to provide $2 million in funding to new collaboration designed to tackle climate change challenges
Drones and Data in Agriculture

What technology are you most optimistic about for improving your farming operation?
Drones and Data in Agriculture

**Battle for the Belt**
- Plot Design / Field Layout
- Weekly agronomy field visits
- Harvest measurements

**Drones and Data in Agriculture**
- Drone Flights (85 total)
- In-field sensing
- Data processing
- AI models

Horticulture and Crop Science (HCS)

Food, Ag, and Biological Engineering (FABE)
Computer Science and Engineering (CSE)
AI Applications in Agriculture

Ground Truth Data
(high cost to collect, valuable to understand)
- Growth stage classification
- Weed pressure
- Disease incidence and severity
- Harvest measurements
- In-field sensors

Input Training Data
(lower cost to collect)
- Drone Flights
- Weather data
- Time-lapse imagery

Use Cases
- Emergence Uniformity
- Yield Estimation
- Crop Phenotypes
- Soil Moisture
- Plant Disease

New Input Data
(lower cost to collect)
- Drone Flights
- Weather data
- Time-lapse imagery

Inference
- Emergence Uniformity
- Yield Estimation
- Crop Phenotypes
- Soil Moisture
- Plant Disease
Drones and Data in Agriculture

Research question
How can we use data from drones and in-field sensors combined with artificial intelligence that would benefit farmers?

Emergence  Phenotyping  Soil Moisture  Kernel Weight
Emergence

The "Flag" Test (field visits every 12 hours)

An early predictor of yield potential!

What if we could measure emergence with time-lapse cameras?
Emergence

Western 106 Corn Emergence Plot

% emergence

Hours since first emergence

0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00

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### Phenotyping

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[Image of drone and corn field]
Emergence

Phenotyping

Soil Moisture

Kernel Weight

Northwest Agricultural Research Station

Western Agricultural Research Station

Wooster Snyder Farm

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Phenotyping

Emergence  Phenotyping  Soil Moisture  Kernel Weight

Deviation of corn growth stages from the actual observations

Raccoon damage
Soil Moisture

Our question
From rainfall and temperature data, could we predict soil moisture? How might it vary across different soil textures and organic matters? Could this be useful for understanding nitrogen mineralization?

Meter Teros 12 Soil Volumetric Water Sensor (Ground Truth)
Kernel Weight

Research question
Could we use weather data to predict kernel weight of corn?

At Northwest the kernels per bushel ranged from 70,000 to 90,000 kernels per bushel, equivalent to about 50 bushels/acre difference!
We are exploring ways to visualize the various types of data from the project.
Conclusion

1. We think our work from 2023 in growth stage, soil moisture, and yield estimation could be applied towards improved nitrogen recommendations.

2. Your feedback would be extremely valuable to us:
   - We will be putting out a survey in the next few months regarding innovation and technology in agriculture. Consider responding to it.
   - I would welcome your comments on anything you saw in this presentation.
   - If you are interested in improving your nitrogen use efficiency, I’d be very interested in discussing with you.
Contact Info

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