Cover Crops

Background & the Web-Based Decision Support Tool

Agenda

Dr. Shalamar Armstrong
Cover cropping practices

Dr. Rabin Bhattarai
DSSAT modeling capabilities

Sandeep Puthanveetil Satheesan
Web tool development

Jonathan Coppess
Web tool demonstration and discussion

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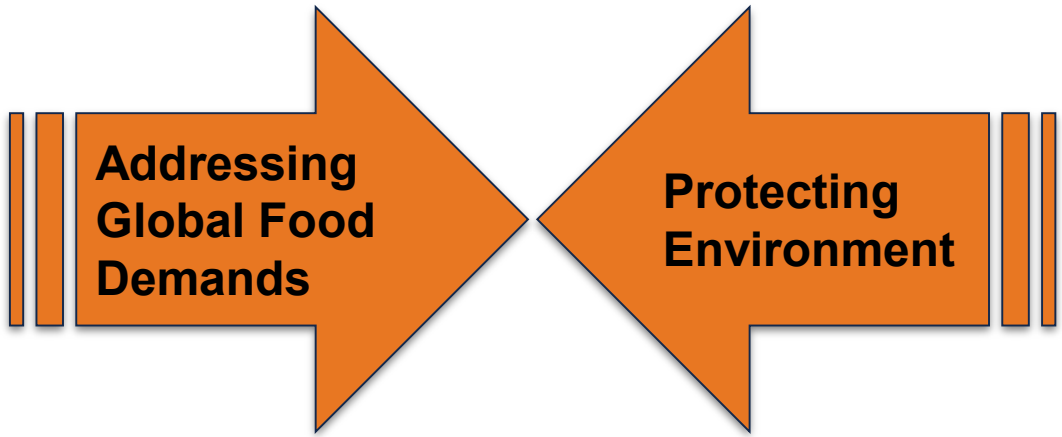
CoverCrop Analyzer Web-Tool

Role of scientific model-based simulations in present day agriculture



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Overview of Cover Cropping

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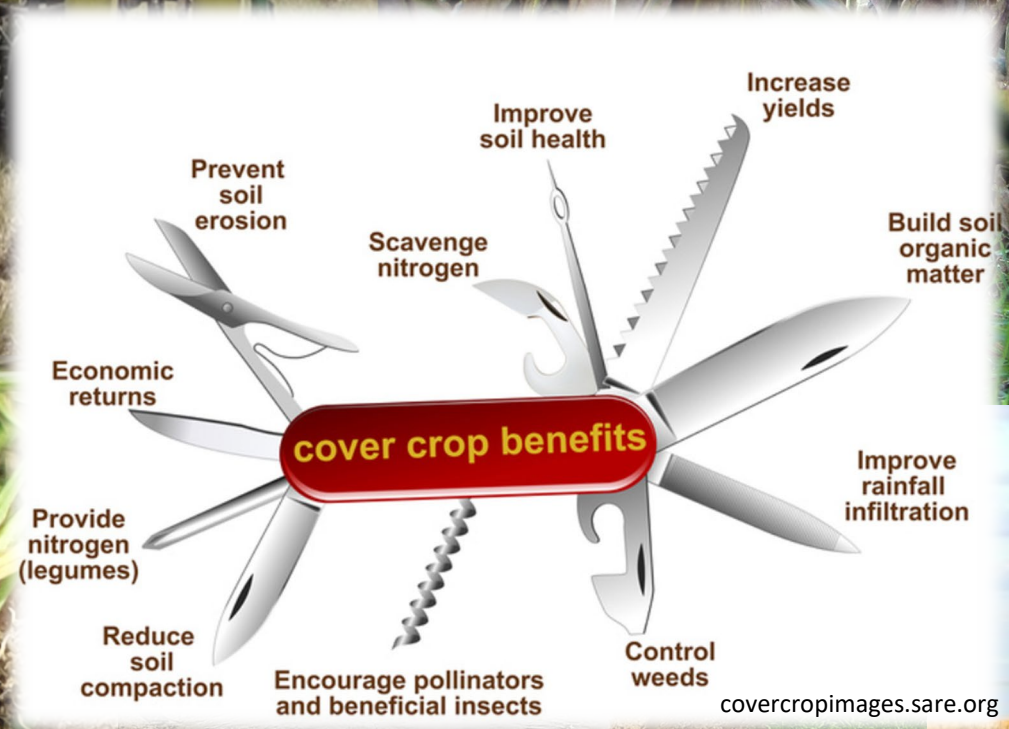
Dr. Shalamar Armstrong
Purdue University, Agronomy

Ultimately, the goal of most farmers is to operate in a *Sustainably Intensified Agriculture (SIA)* System

SIA Principles:

- Maximize Production and Profit
- Maximize Nutrient Use Efficiency
- Minimize Environmental Degradation

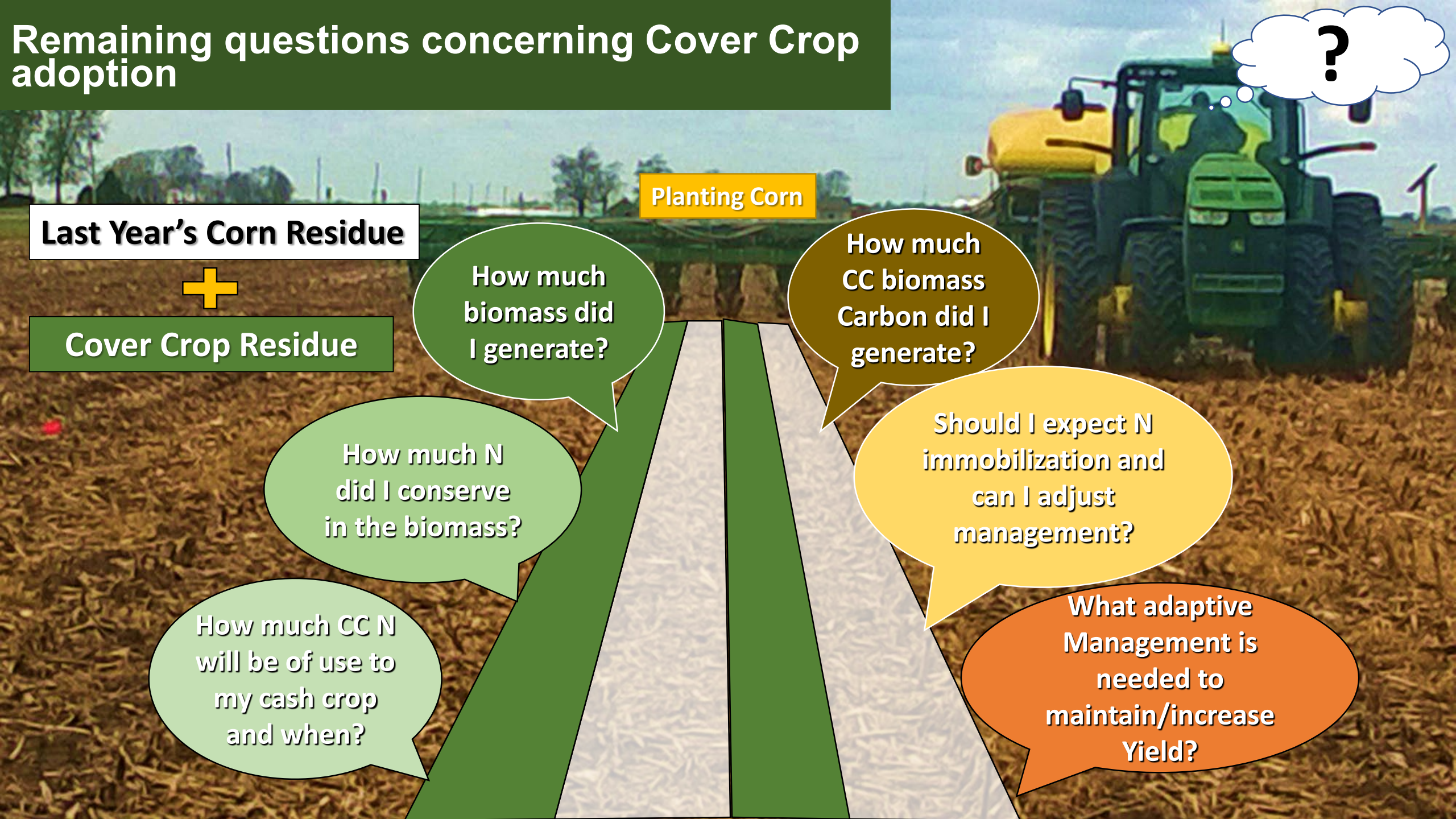
Cover crop inclusion within conventional cropping systems is an aggressive and obvious step towards SIA



covercropimages.sare.org

However, <5% of row crop acres in the UMRB receive cover crops

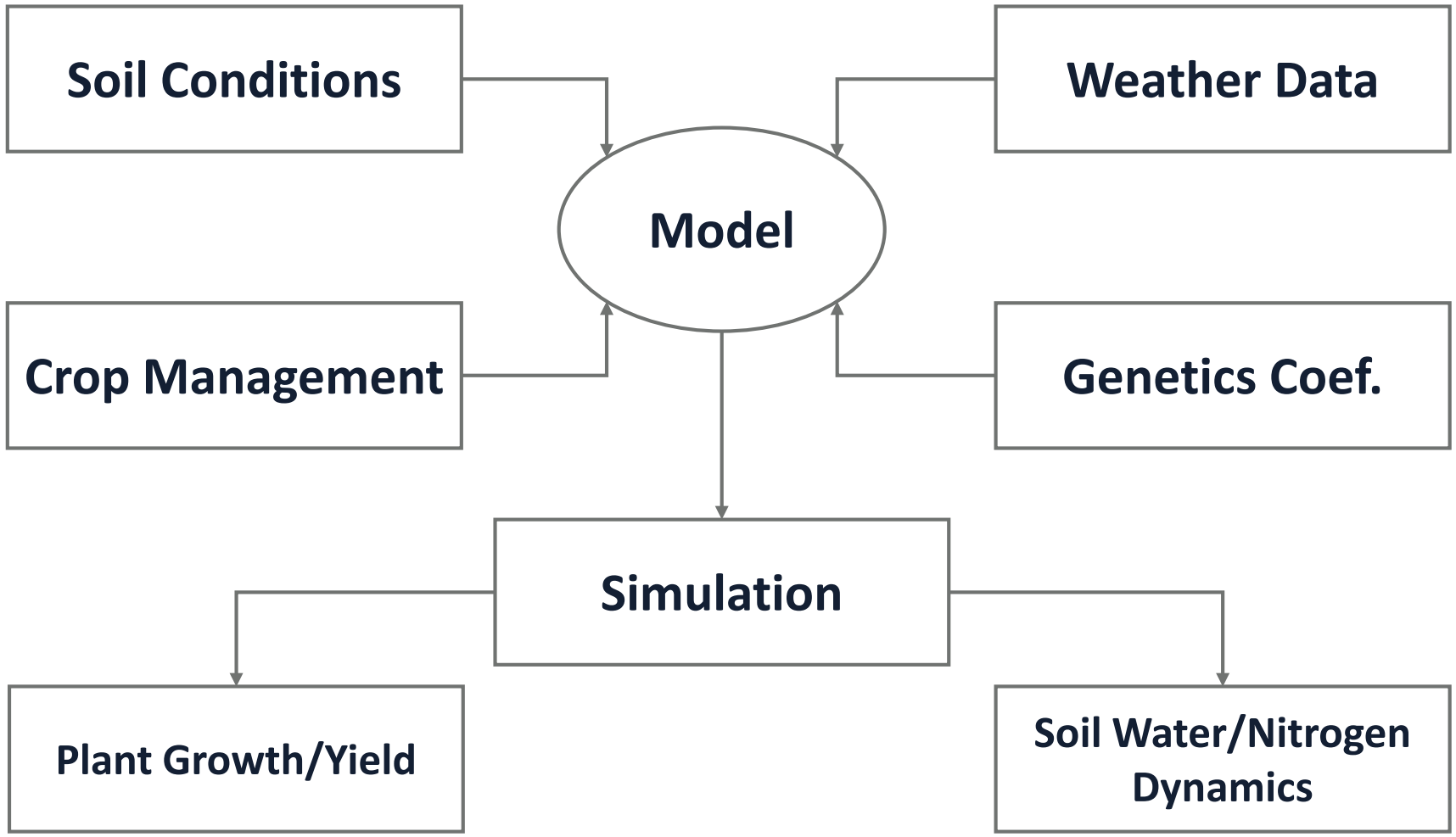
Remaining questions concerning Cover Crop adoption



Background Modeling Capabilities

Dr. Rabin Bhattarai
University of Illinois, ABE

Decision Support System for Agrotechnology Transfer (DSSAT): Model Structure



Open-source crop simulation software package; over 42 crops

Simulates growth, development and yield based on soil, plant and weather information

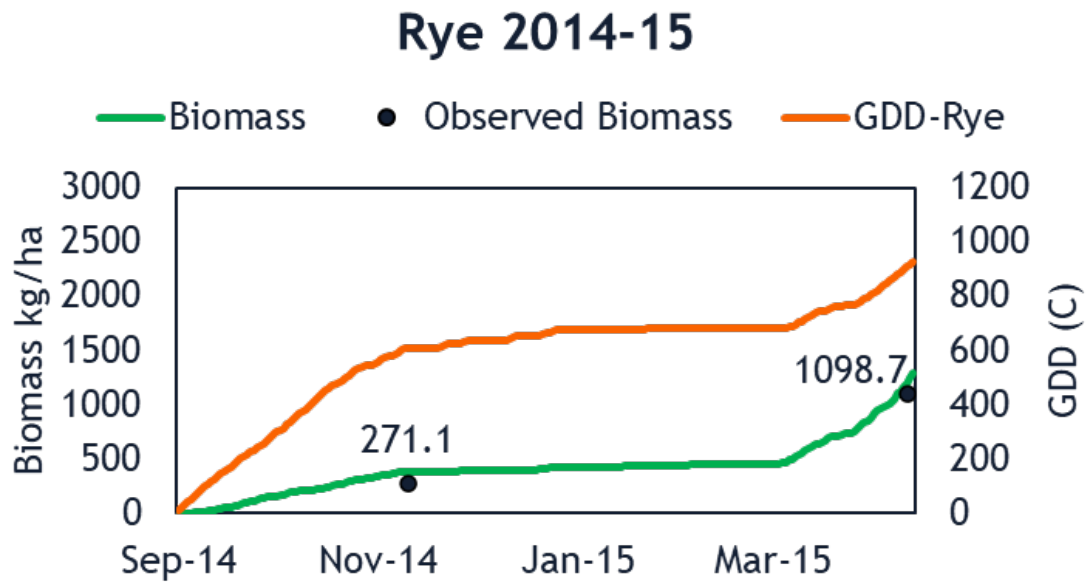
Separate simulation for soil nitrogen and water dynamics

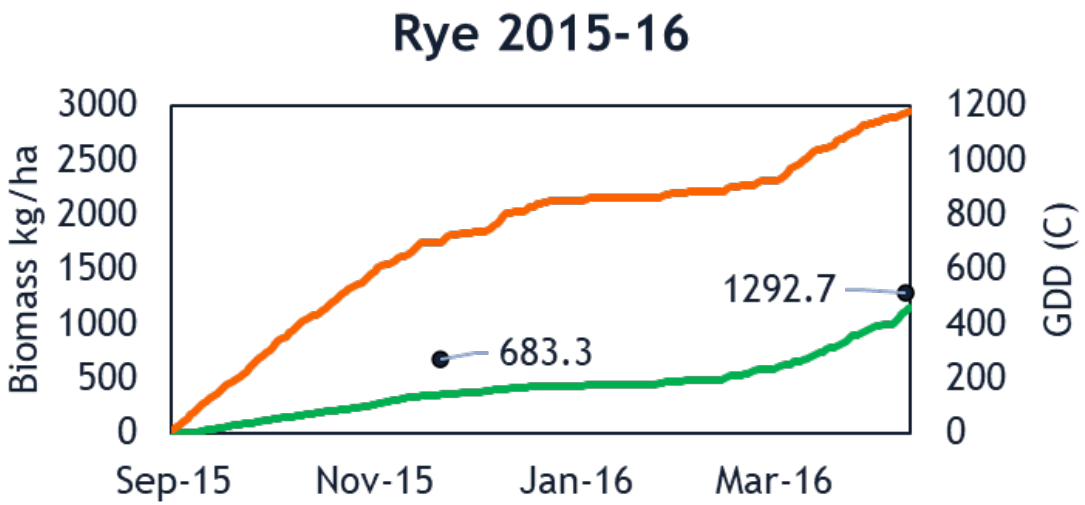
Cereal Rye as winter cover crop

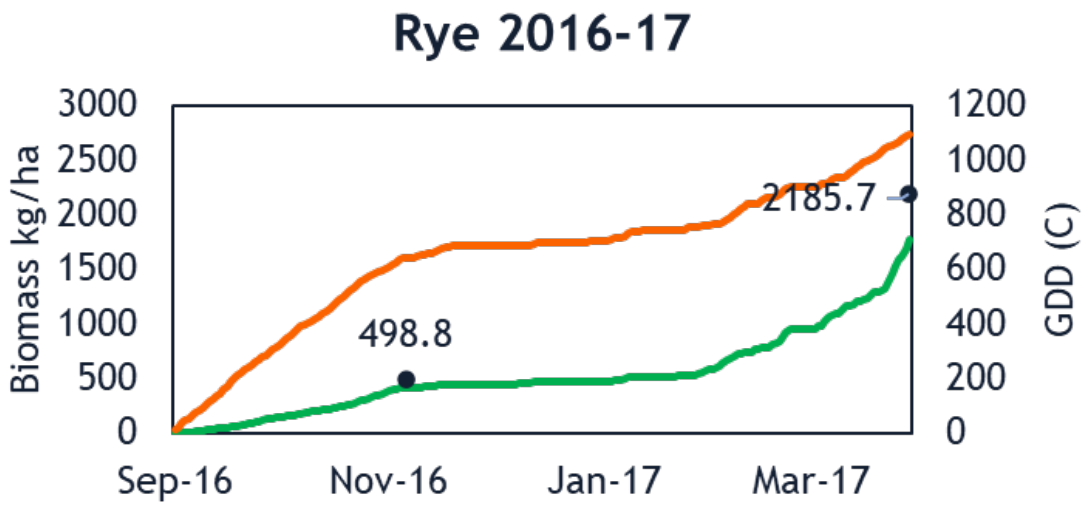
- CERES-Wheat model of DSSAT – used as a proxy model for cereal rye
- Lethal temperatures for both the crops are different:
  - Cereal Rye: -25 to -30°C (-13 to -22° F)
  - Winter Wheat: -10 to -15 °C (14 to 5° F)
- Lethal temperatures in DSSAT were adjusted to replicated the observed biomass

Coef.	Description	Wheat	Rye
TKFH	Temperature at which killed when fully hardened (°C)	-15	-25
TKLF	Temp.at which leaves start to be killed (°C)	-10	-25

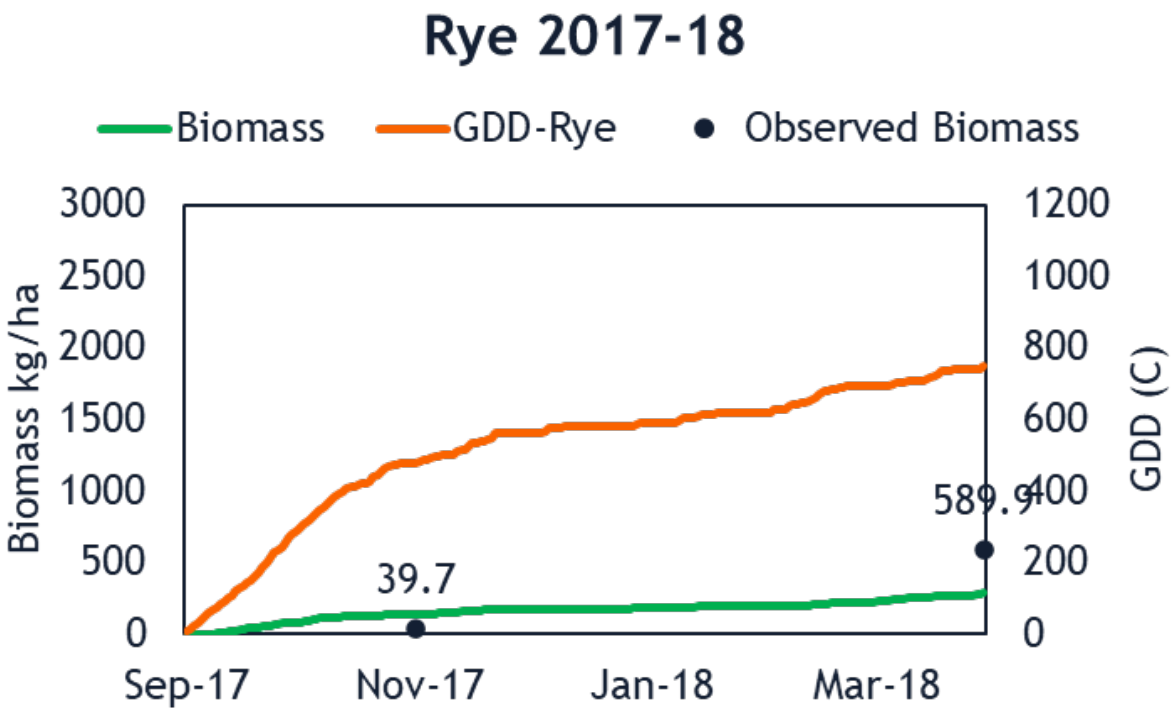
Biomass Validation (SCC)

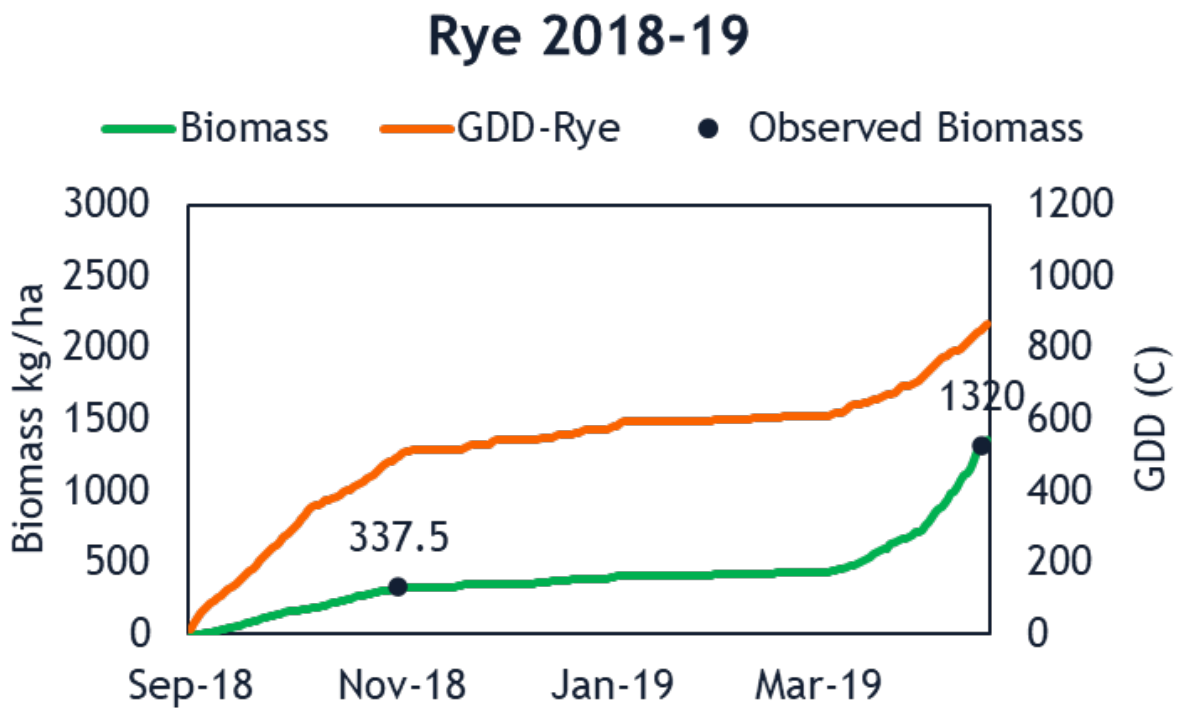






Biomass Validation (SCC)





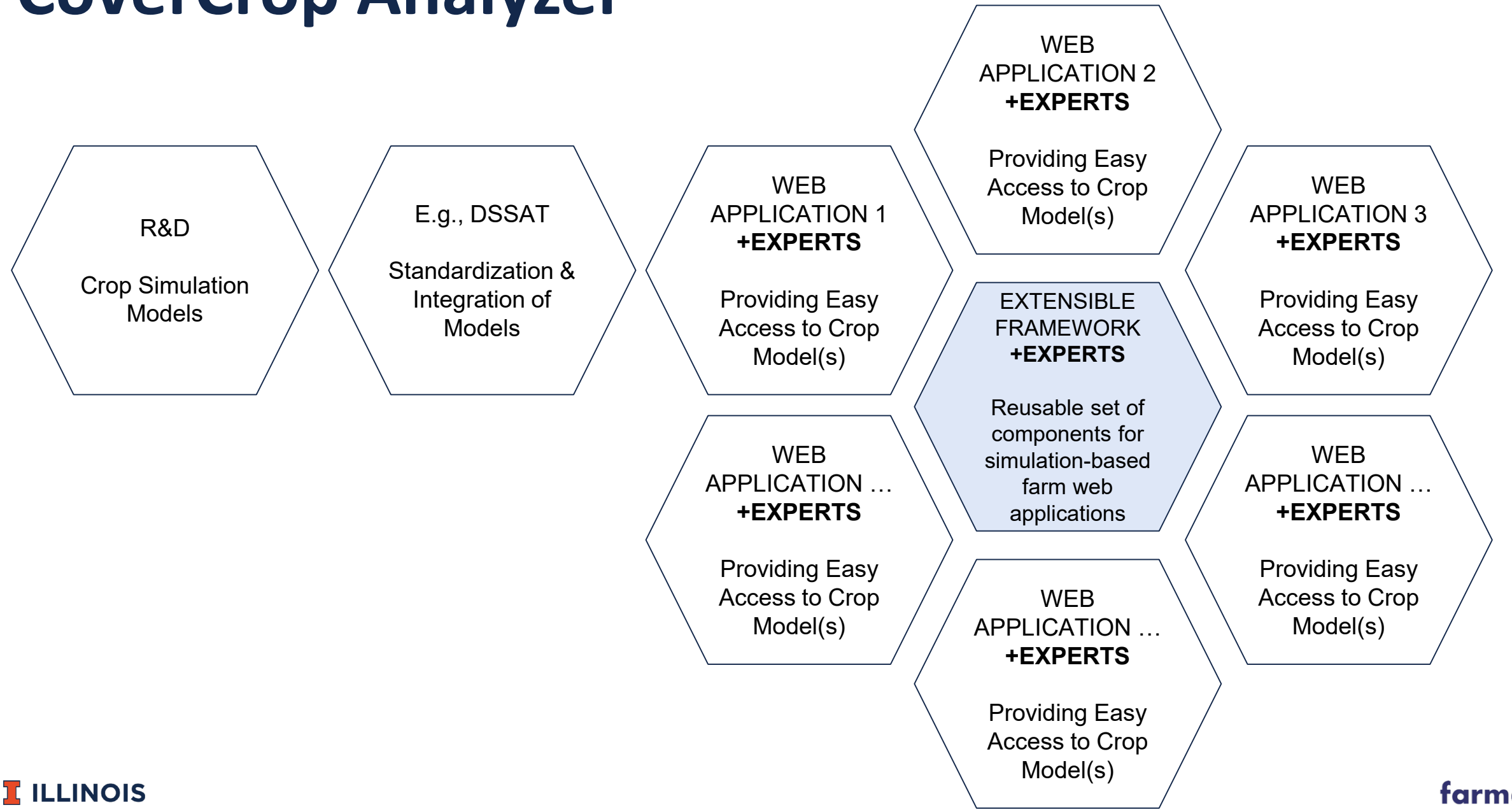
Background on Web-Tool Development

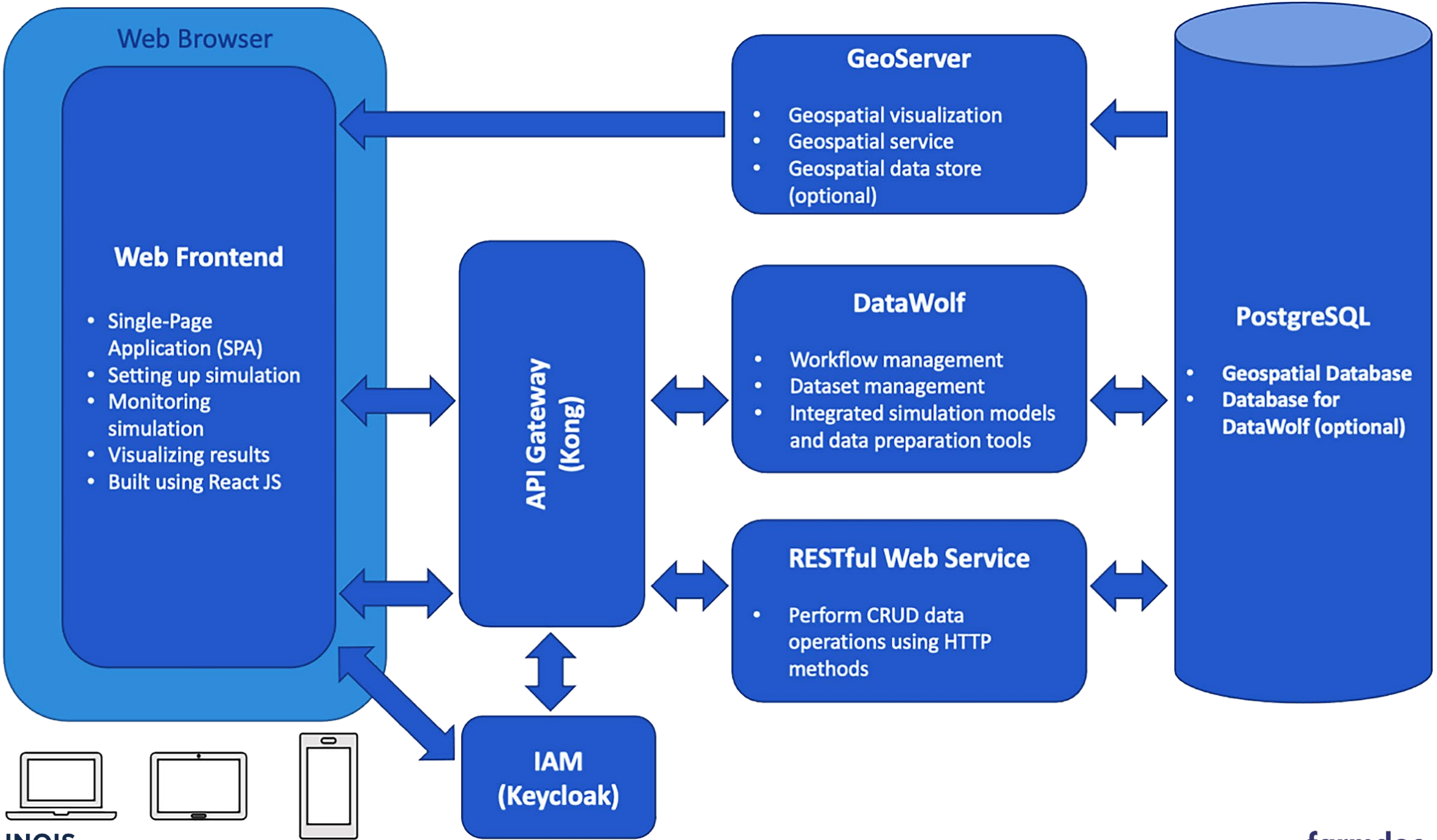
Sandeep Puthanveetil Satheesan

National Center for Supercomputing Applications (NCSA)

University of Illinois

CoverCrop Analyzer

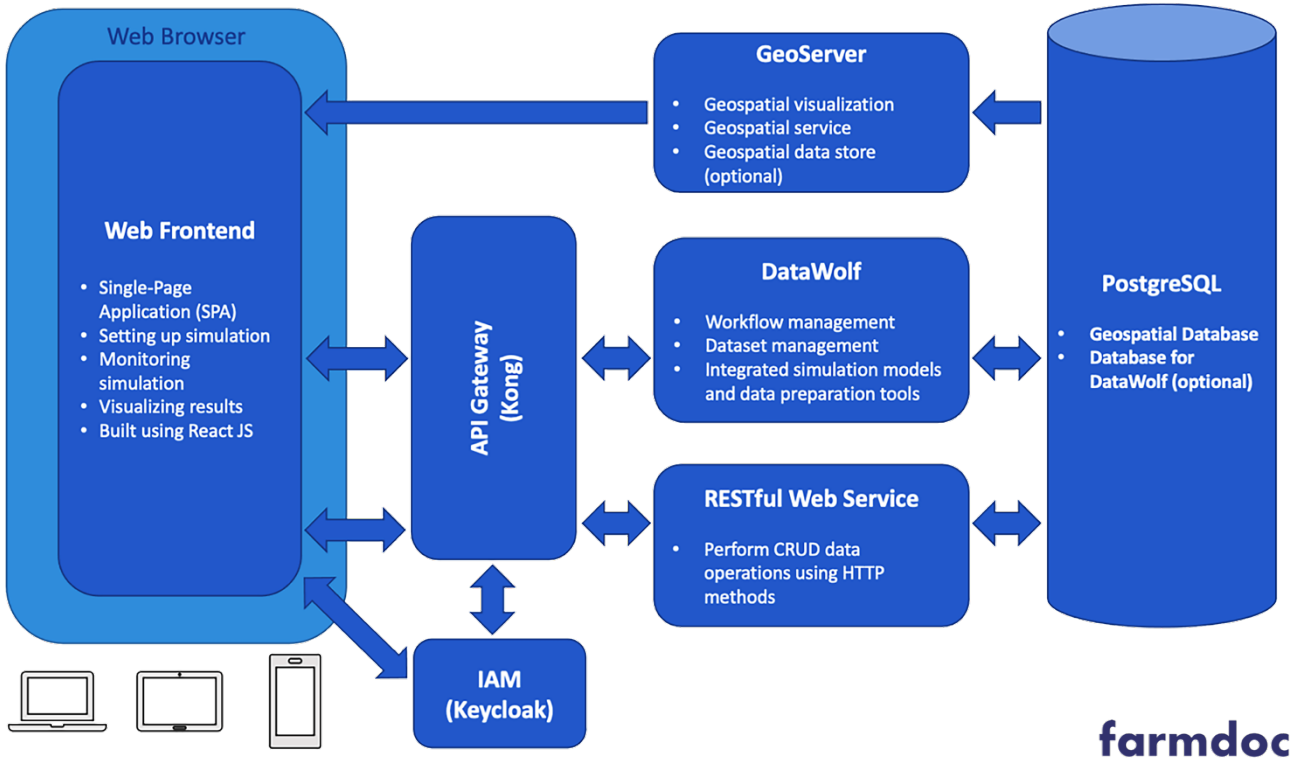



Web Browser
Web Frontend
• Single-Page Application (SPA)
• Setting up simulation
• Monitoring simulation
• Visualizing results
• Built using React JS
GeoServer
• Geospatial visualization
• Geospatial service
• Geospatial data store (optional)
API Gateway (Kong)
DataWolf
• Workflow management
• Dataset management
• Integrated simulation models and data preparation tools
RESTful Web Service
• Perform CRUD data operations using HTTP methods
PostgreSQL
• Geospatial Database
• Database for DataWolf (optional)
IAM (Keycloak)

Web-Tool: Architecture and Components

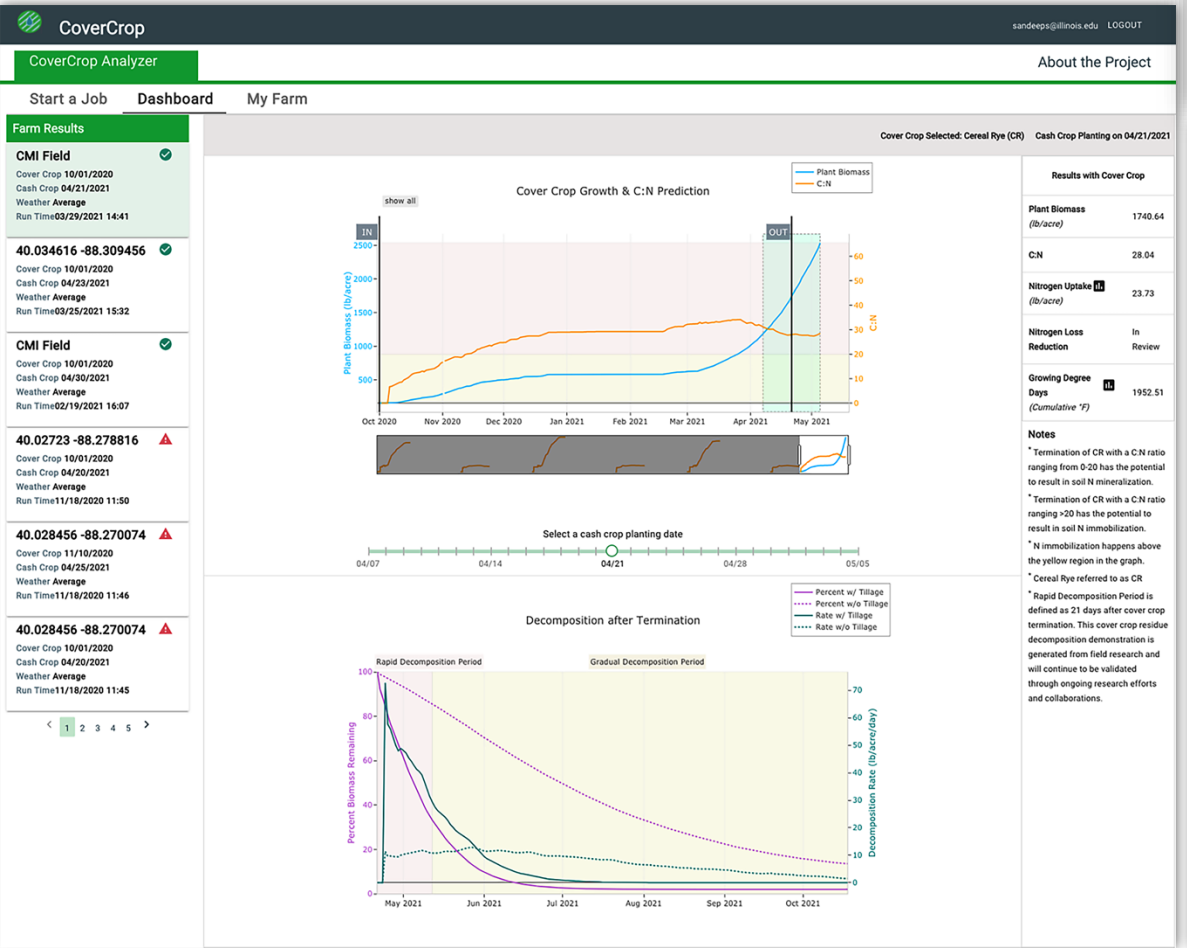
Publication: *Sandeep Puthanveetil Satheesan, Rabin Bhattarai, Shannon Bradley, Jonathan Coppess, Lisa Gatzke, Rishabh Gupta, Hanseok Jeong, Jong S. Lee, Gowtham Naraharisetty, Michal Ondrejcek, Gary D. Schnitkey, Yan Zhao, and Christopher M. Navarro. 2019.* ***Extensible Framework for Analysis of Farm Practices and Programs****.*

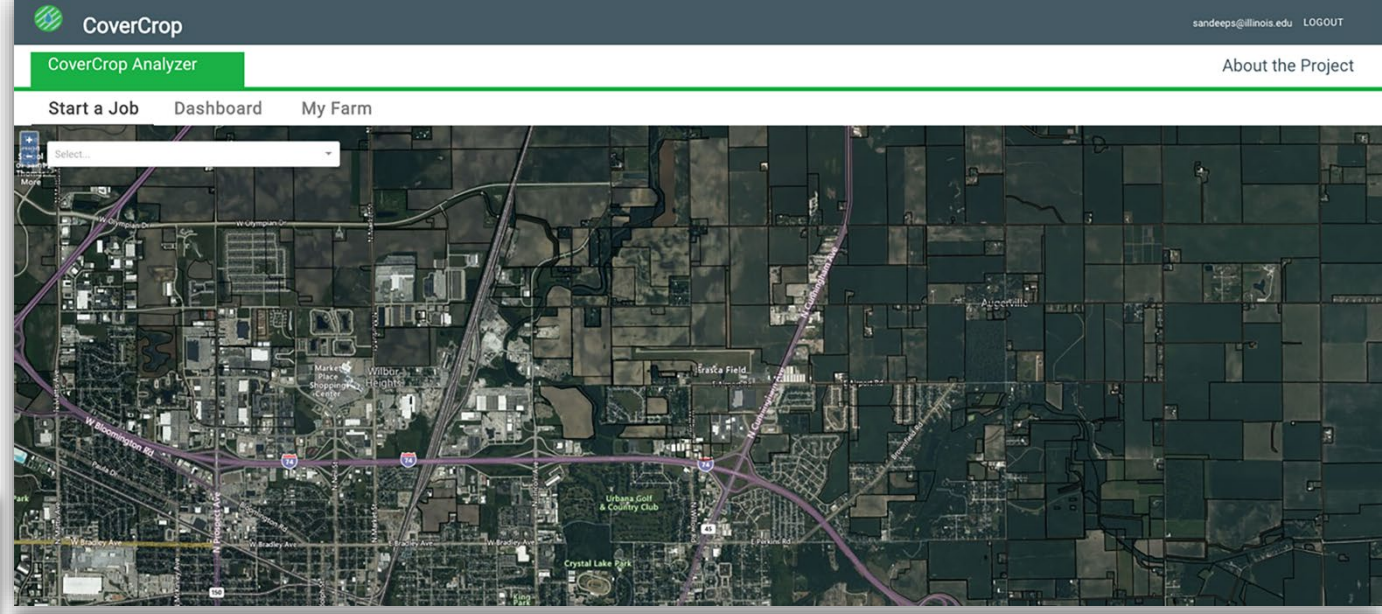
In Proceedings of the Practice and Experience in Advanced Research Computing on Rise of the Machines (learning) (PEARC '19). Association for Computing Machinery, New York, NY, USA, Article 11, 1–8. DOI: https://doi.org/10.1145/3332186.3337063

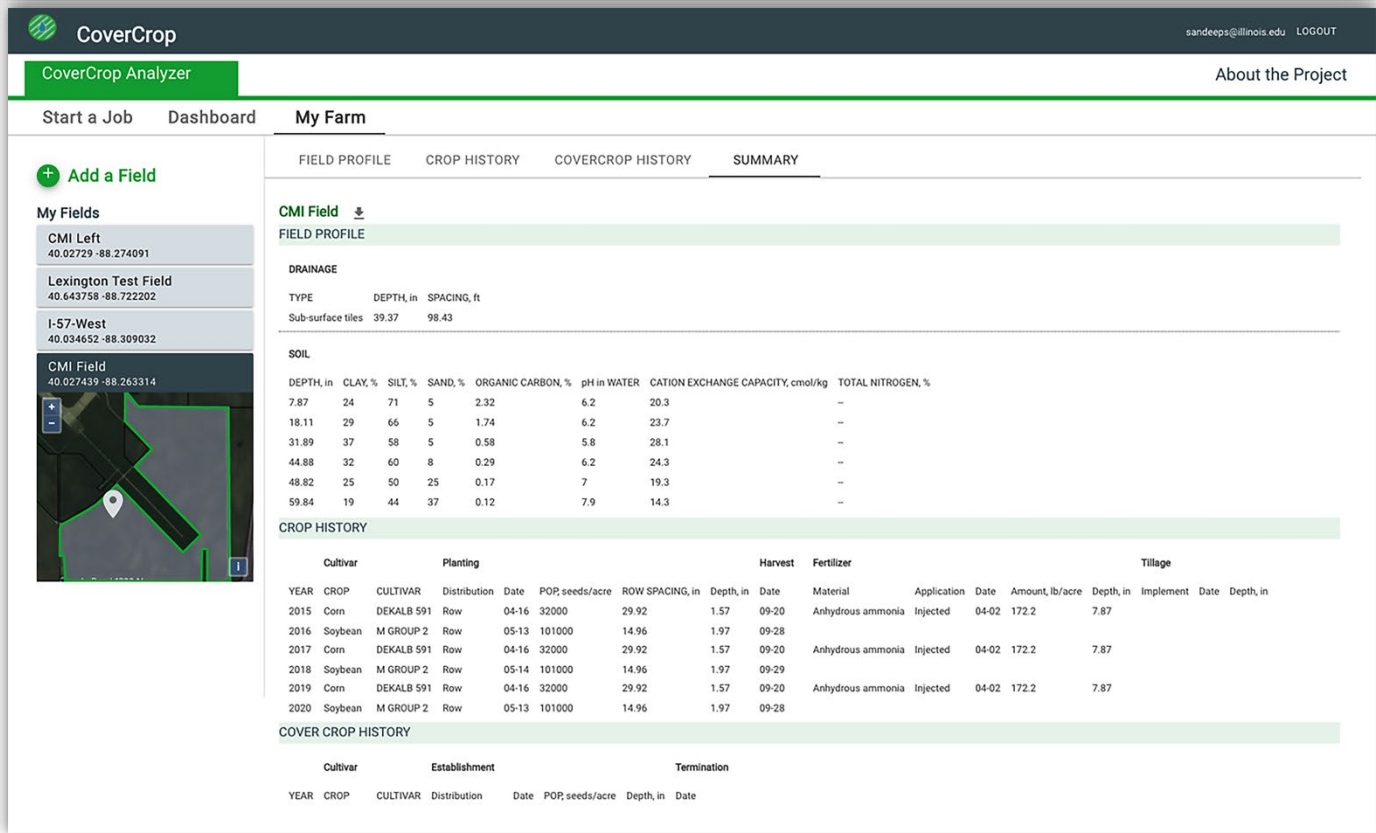


CoverCrop Analyzer

covercrop.ncsa.illinois.edu







CoverCrop Analyzer Demonstration

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Jonathan Coppess

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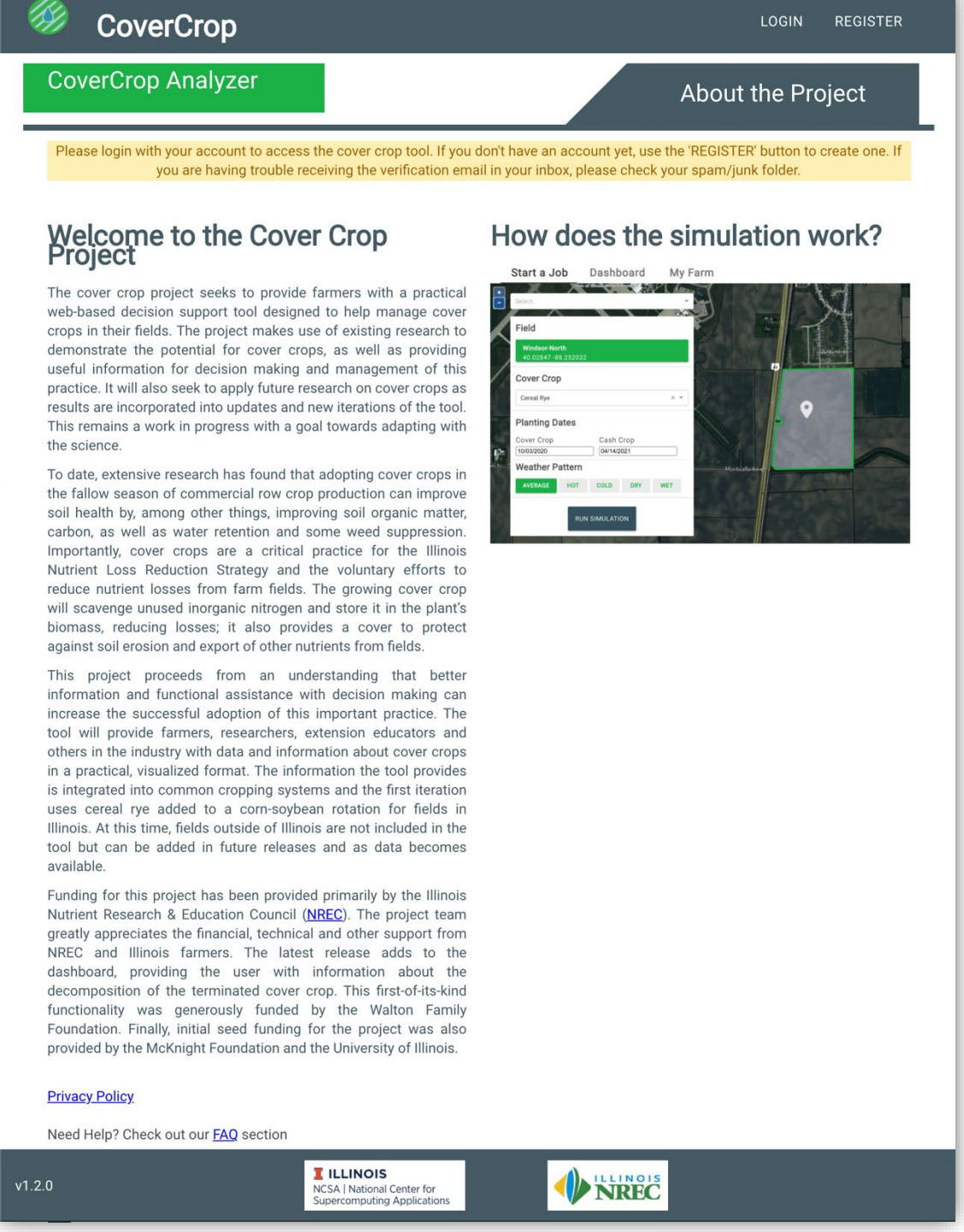
Agricultural & Consumer Economics
COLLEGE OF AGRICULTURAL, CONSUMER & ENVIRONMENTAL SCIENCES



AIFARMS
Artificial Intelligence for Future Agricultural Resilience, Management, and Sustainability

Thrust 5:
Technology Adoption

- Researchers with the AIFARMS Institute at the University of Illinois Urbana-Champaign are inviting a diverse set of farmers to join a small-group meeting on April 5, 6, 7, 8, or 9
- During this event, we would like to hear from you on whether you plant cover crops on your fields and what factors played a role in planting or not planting cover crops.
- We want to learn from you and build more “tools” to address your challenges.
- Email: ndbowman@illinois.edu for information or to sign up.

Thanks to

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CoverCrop

LOGIN REGISTER

CoverCrop Analyzer

About the Project

Please login with your account to access the cover crop tool. If you don't have an account yet, use the 'REGISTER' button to create one. If you are having trouble receiving the verification email in your inbox, please check your spam/junk folder.

Welcome to the Cover Crop Project

The cover crop project seeks to provide farmers with a practical web-based decision support tool designed to help manage cover crops in their fields. The project makes use of existing research to demonstrate the potential for cover crops, as well as providing useful information for decision making and management of this practice. It will also seek to apply future research on cover crops as results are incorporated into updates and new iterations of the tool. This remains a work in progress with a goal towards adapting with the science.

To date, extensive research has found that adopting cover crops in the fallow season of commercial row crop production can improve soil health by, among other things, improving soil organic matter, carbon, as well as water retention and some weed suppression. Importantly, cover crops are a critical practice for the Illinois Nutrient Loss Reduction Strategy and the voluntary efforts to reduce nutrient losses from farm fields. The growing cover crop will scavenge unused inorganic nitrogen and store it in the plant's biomass, reducing losses; it also provides a cover to protect against soil erosion and export of other nutrients from fields.

This project proceeds from an understanding that better information and functional assistance with decision making can increase the successful adoption of this important practice. The tool will provide farmers, researchers, extension educators and others in the industry with data and information about cover crops in a practical, visualized format. The information the tool provides is integrated into common cropping systems and the first iteration uses cereal rye added to a corn-soybean rotation for fields in Illinois. At this time, fields outside of Illinois are not included in the tool but can be added in future releases and as data becomes available.

Funding for this project has been provided primarily by the Illinois Nutrient Research & Education Council (NREC). The project team greatly appreciates the financial, technical and other support from NREC and Illinois farmers. The latest release adds to the dashboard, providing the user with information about the decomposition of the terminated cover crop. This first-of-its-kind functionality was generously funded by the Walton Family Foundation. Finally, initial seed funding for the project was also provided by the McKnight Foundation and the University of Illinois.

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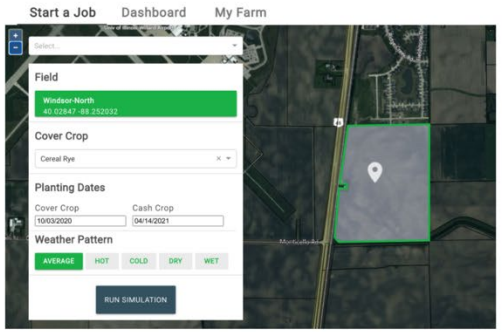
How does the simulation work?



v1.2.0

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