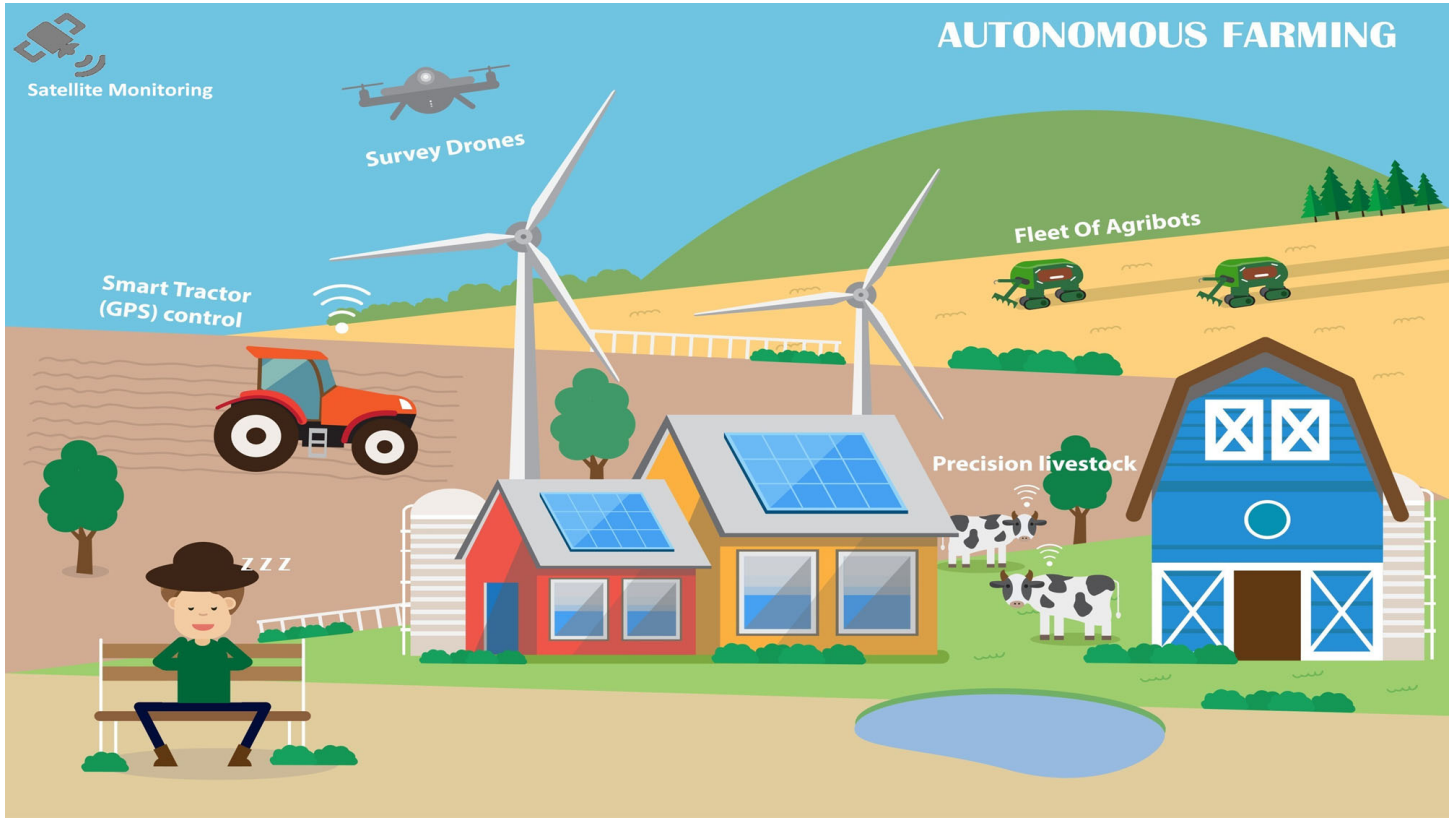
Forward Thinking Farming

PIONEER agronomy

SOUTHEASTERN FIELD **AGRONOMY**



Innovations for Tomorrow's Ag Landscape

Brewer Blessitt, PhD, CCA-CPAg
Pioneer Agronomy Manager-Southeastern US

Looking Forward…

- Consumer/End Users
- Cropping Systems
  - Crop Modelling
- Crop Inputs/Services
  - Detection/Sensing
  - Application
  - Control Measures

Consumers

- Environmentally Sensitive
  - Pesticides
  - Climate Change
  - Water Quality
- Safer Food
  - Organic/Non GMO
  - Meat Free Proteins
- Suppliers/End Users

- But <u>have</u> and will <u>spend $</u>

Consumers

- Walmart –
  - 1B metric tons by 2030
- General Mills
  - 28% reduction by 2025
- McDonald's
  - 31% by 2030

Significant amount of the emissions are happening at the farm level.

As the scientific evidence has pointed towards this growing challenge, governments and corporations worldwide have begun accounting for where their emissions come from and devising plans for how to reduce those emissions. Major consumer brands and retailers who source agricultural products from U.S. farms are among those responding to the global concern for the changing climate. For example, Walmart announced Project Gigaton, a challenge issued directly to its Tier 1 suppliers to collectively cut 1 billion metric tons of greenhouse gas emissions from their global supply chain by 2030 (Walmart, 2017). In 2015, General Mills committed to reducing the absolute greenhouse gas emissions from its supply chain by 28% by 2025 (General Mills, 2018). And McDonald's plans call for reducing greenhouse gas emissions from its supply chain by 31% from 2015 levels by 2030 (McDonald's, 2018). Many companies have found that a significant amount of the emissions associated with producing their products are happening at the farm level where their ingredients are grown, and thus they are looking to U.S. commodity crop producers to help them meet their corporate sustainability commitments on climate.

From : *Crops and Soils*: May-June 2019.

Consumers

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US Greenhouse Gas Emissions

- Agriculture 9%
  - Livestock 42%
  - Crop Production 58%
    - Fuel Combustion 8%
    - Biological Nutrient and Carbon Cycling 92%

The primary greenhouse gases emitted from farming are carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Common measurement frameworks, such as Field to Market's Fieldprint Platform, express values for all greenhouse gases as CO_2 equivalent (CO_2e), which accounts for the relative strength of the global warming potential of the different gases once they are mixed in the atmosphere (IPCC, 2001). In the United States, agriculture accounts for 9% of total greenhouse gas emissions, equaling 612 million metric tons of CO_2e in 2016. Crop production accounts for half of these emissions, with livestock contributing 256 million metric tons CO_2e (42%). Some may find it surprising that fuel combustion was the source of only 8% (49 million metric tons CO_2e) of agriculture's contribution to greenhouse gases (USEPA, 2017). The larger contributions from crop production come from biological nutrient and carbon cycling in the soil that can result in nitrous oxide and methane emissions. While these emissions are caused by natural processes, land management practices are very important in determining how much is emitted.

and Soils: May-June 2019.

INDIGO AG ANNOUNCES
THE TERRATON I
THAT PAYS FARM
CARBON SEQUES

Syngenta commits $2 billion and
sets new targe
tackle climate

Corteva Agriscience to Create
Challenge Grants to Advance
Climate Positive Agriculture

Cropping Systems

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- Carbon Sequestration/
  Soil Conservation
  - Cover Crops
  - Reduced/No-Till
  - Intensification

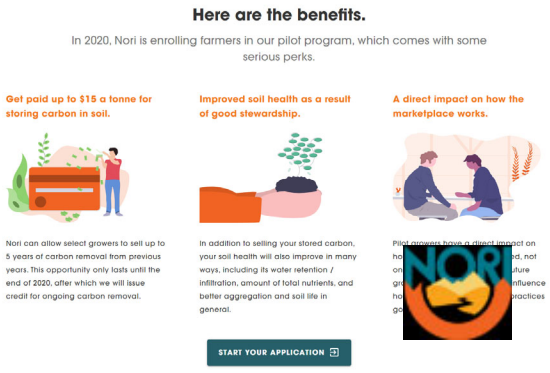
- ‘Beyond Meat’
  - Currently **soy/**potato proteins
  - Interest in other sources… **yellow pea**

- Fuels
  - Corn
  - **Canola**/Carinata

Revolutionizing the jet fuel industry with biofuel made from oilseed

by Susan Bell, University of Southern California

Canola can be processed into low-carbon biofuels, namely biodiesel but also renewable diesel and **aviation fuel**. It can also be utilized at petroleum refineries to lower the greenhouse gas (GHG) emissions of transportation **fuels**. These biofuels are made from **canola oil**, **a** natural and renewable resource.



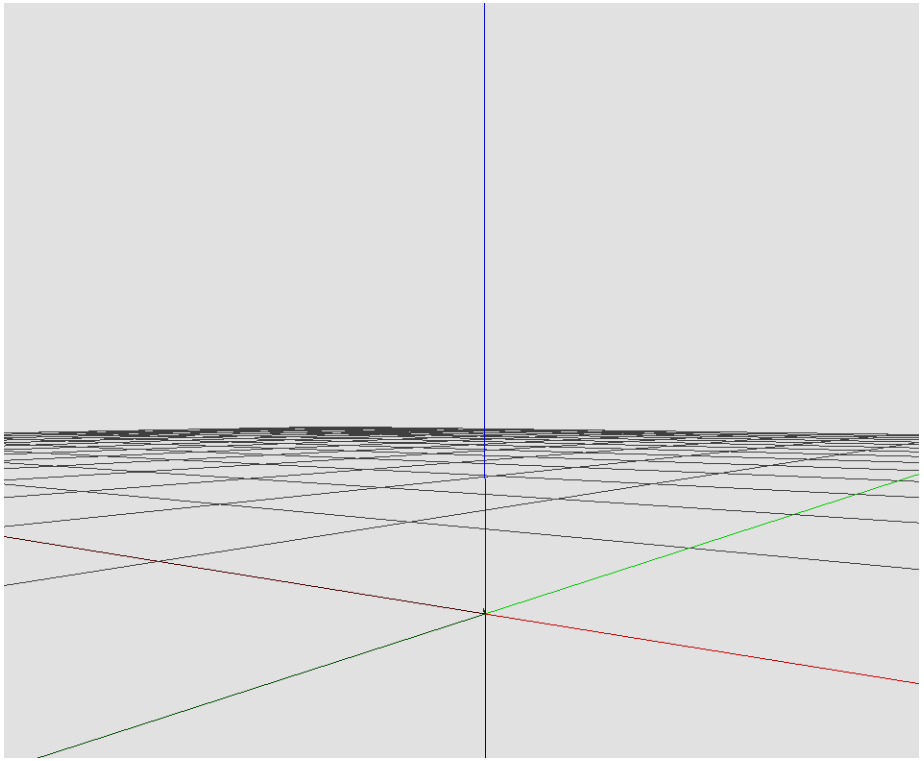
CORTEVA agriscience

Crop Growth Model

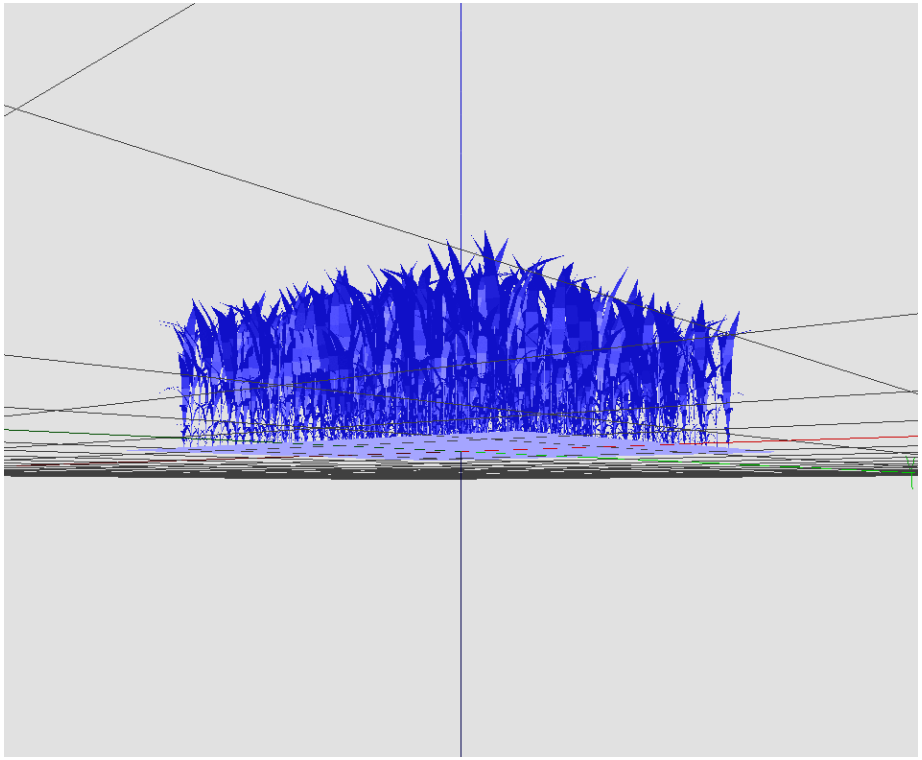
PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

Plant development – Life cycle



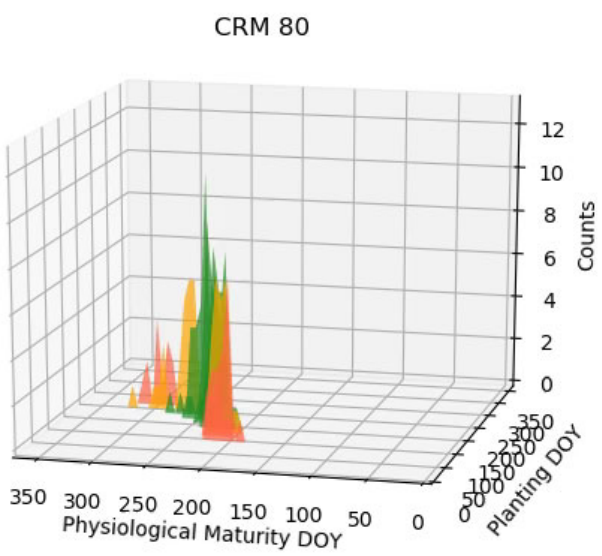
Light, water, CO_2, growth

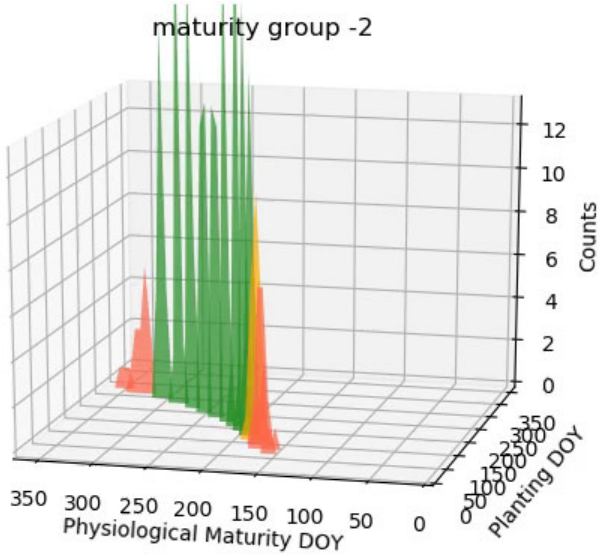


Crop Growth Model

PIONEER agronomy

SOUTHEASTERN FIELD **AGRONOMY**





Crop Growth Model

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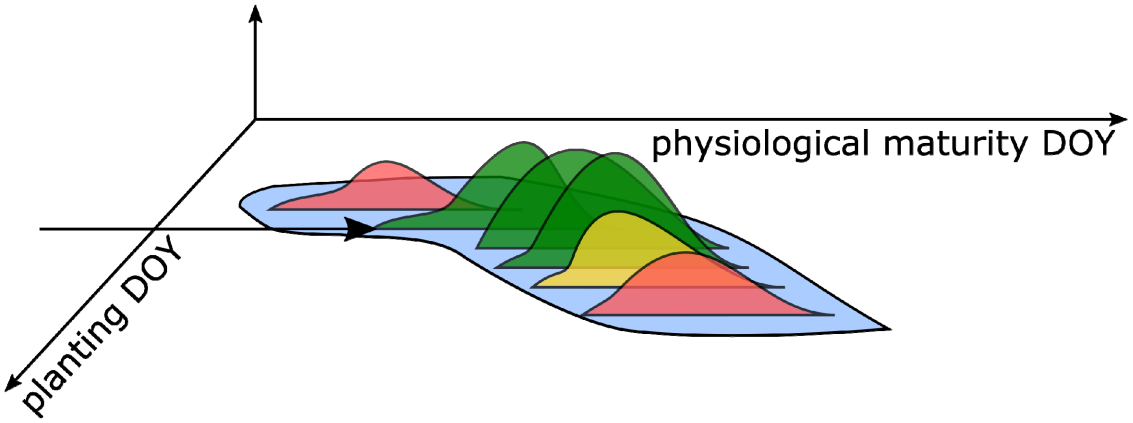
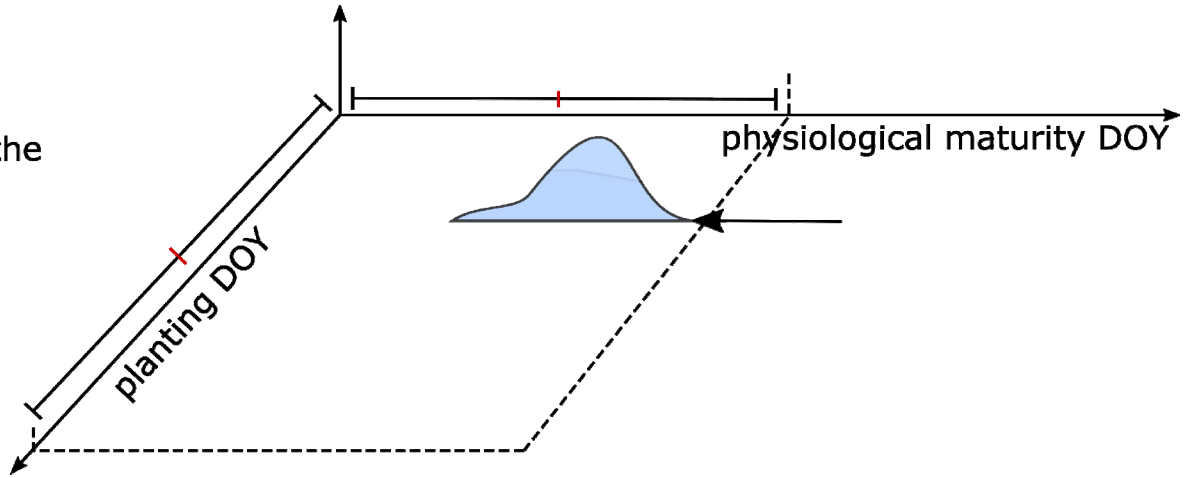
1. For each maize CRM there will be a distribution of physiological maturity determined by planting day of year from historical data.

Green is where all the environments reach physiological maturity. Orange represents 80% of environments, and red is anything below 80%.

The optimal planting date is the earliest.



2-4. The end of physiological maturity of the optimal maize planting date is the beginning of the soybean planting day of year.



Crop Growth Model

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SOUTHEASTERN FIELD AGRONOMY

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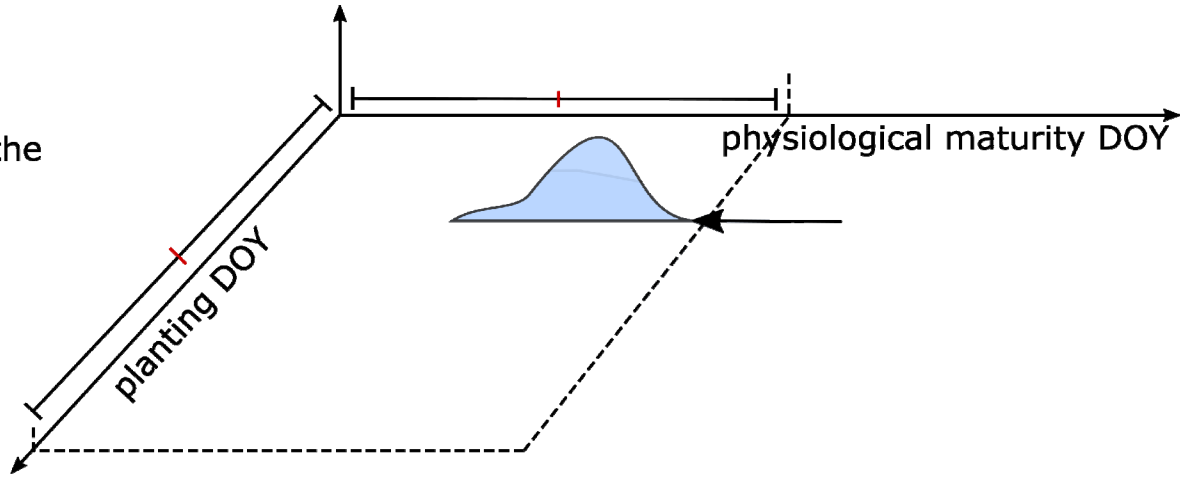
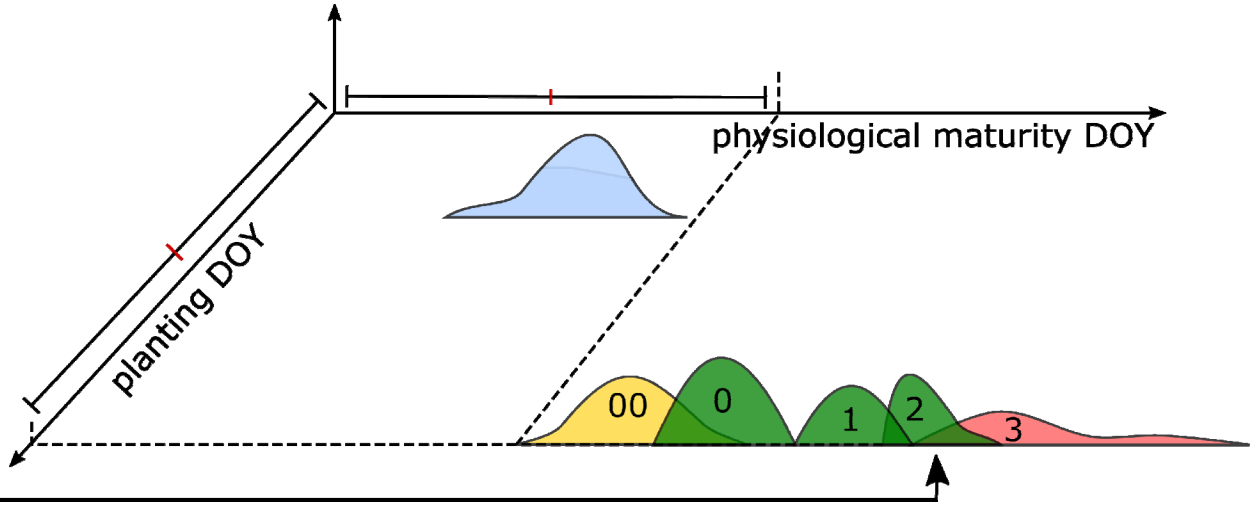


3. There should be an optimal soybean maturity group that has the longest season.



Crop Growth Model

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

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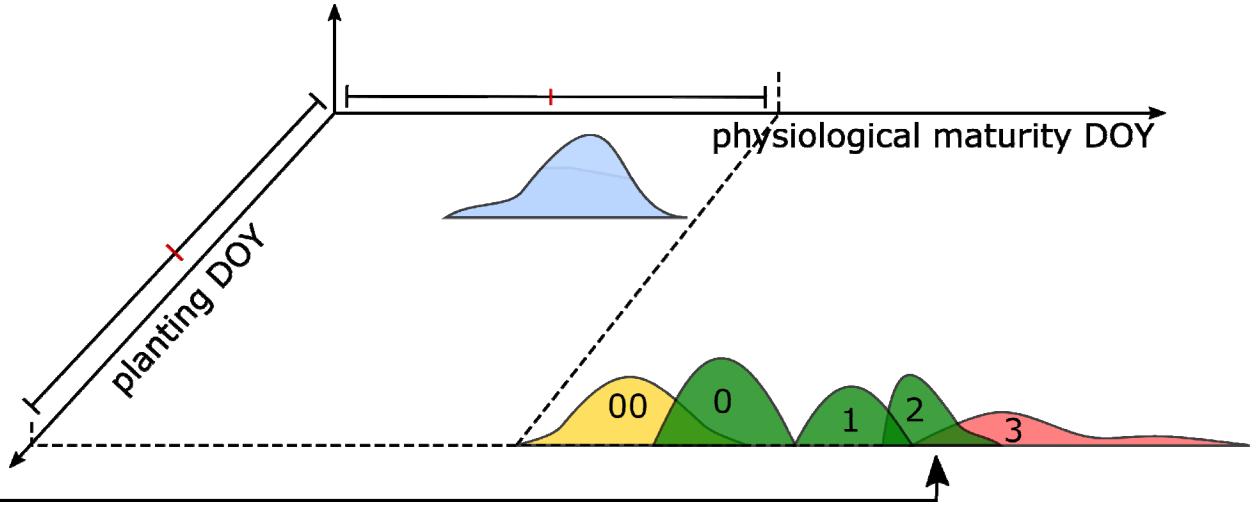
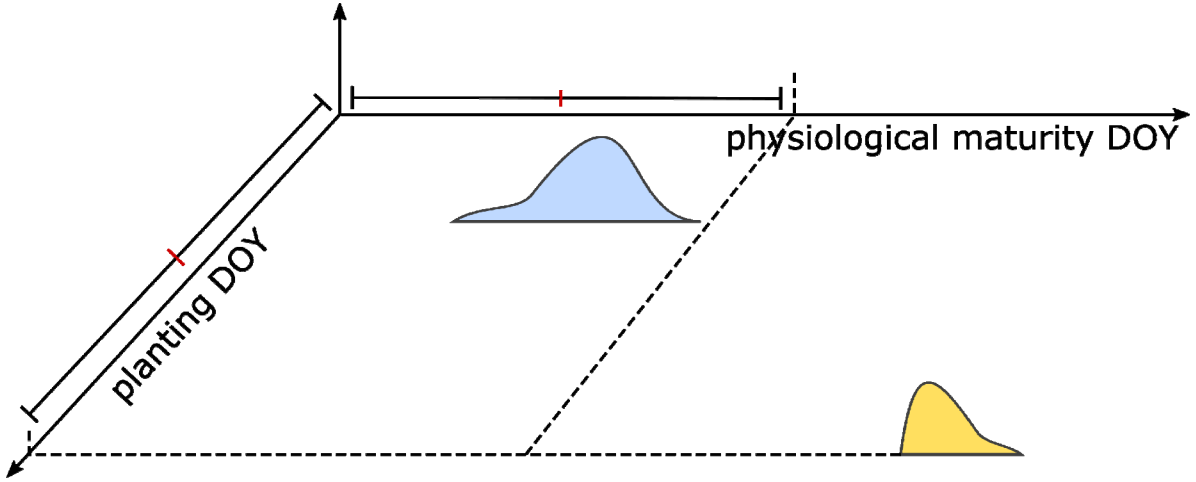
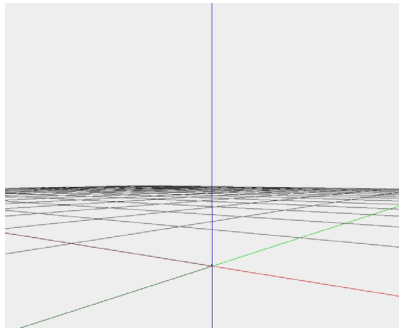


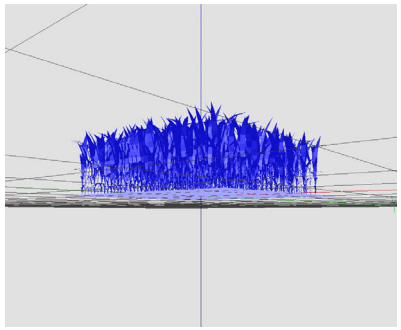
4. This is the soybean maturity group whose physiological maturity maximizes the growing season.

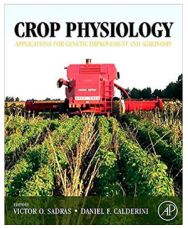


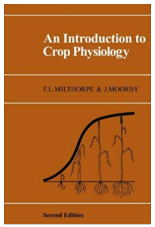
What is a crop model?

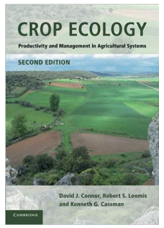
Quantitative synthesis of current scientific understanding
Crop Science

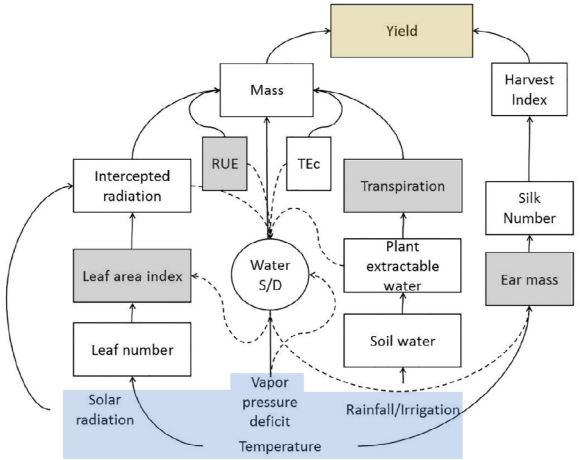


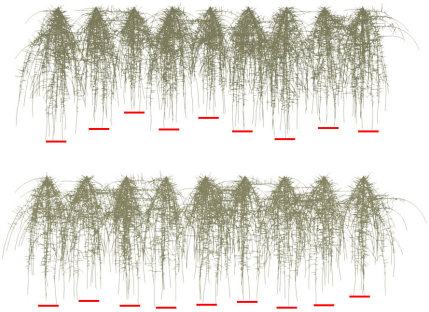


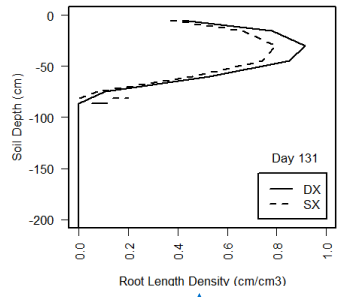


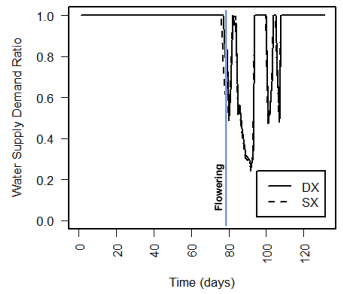












Cropping System Options

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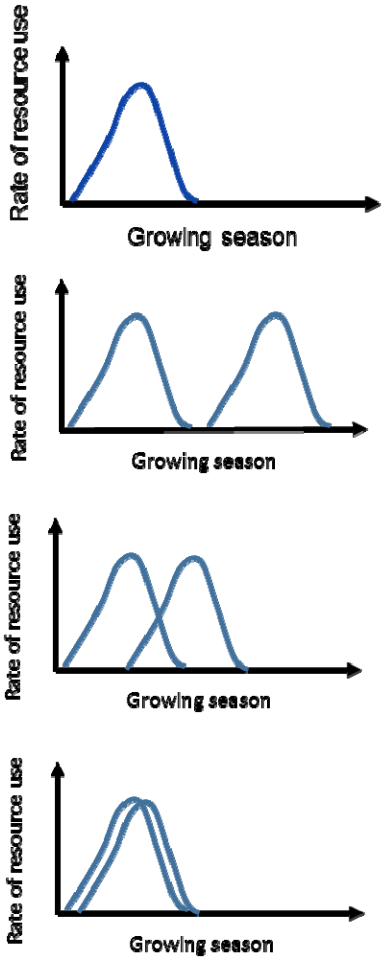
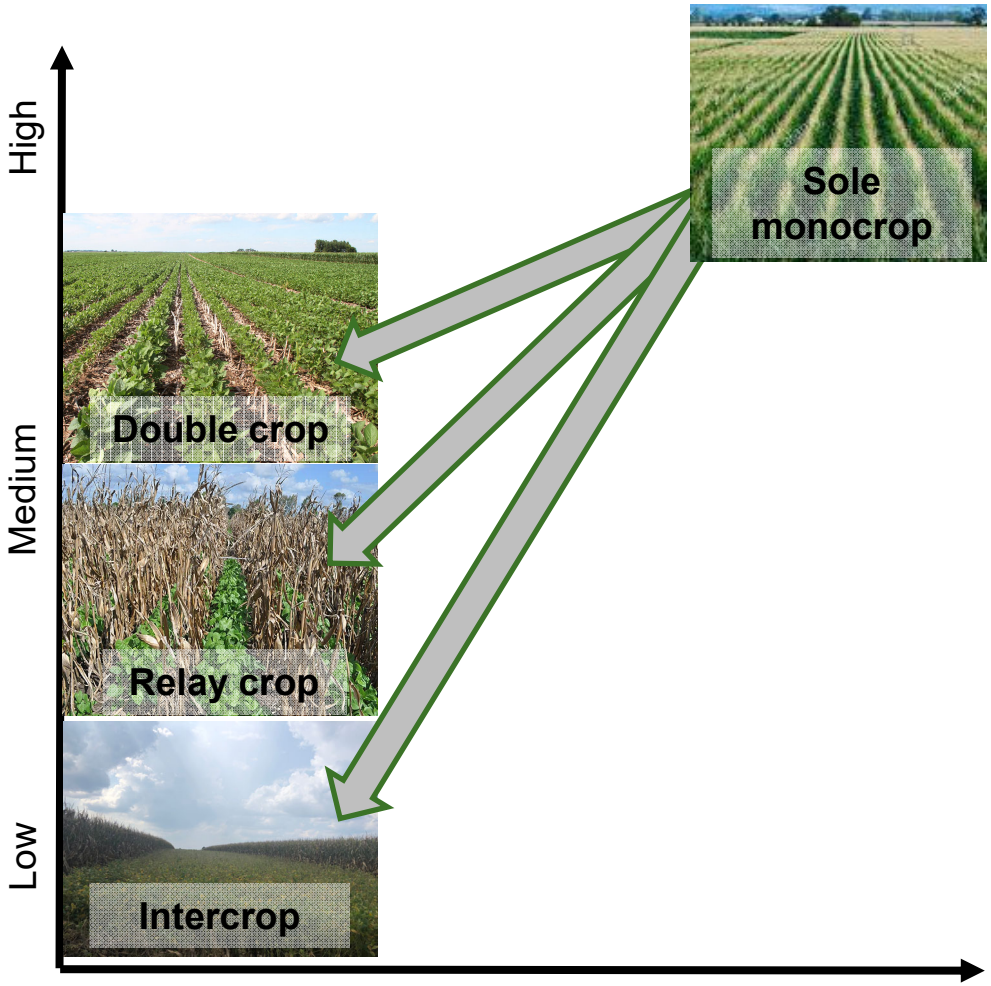
SOUTHEASTERN FIELD AGRONOMY





Of Particular Importance

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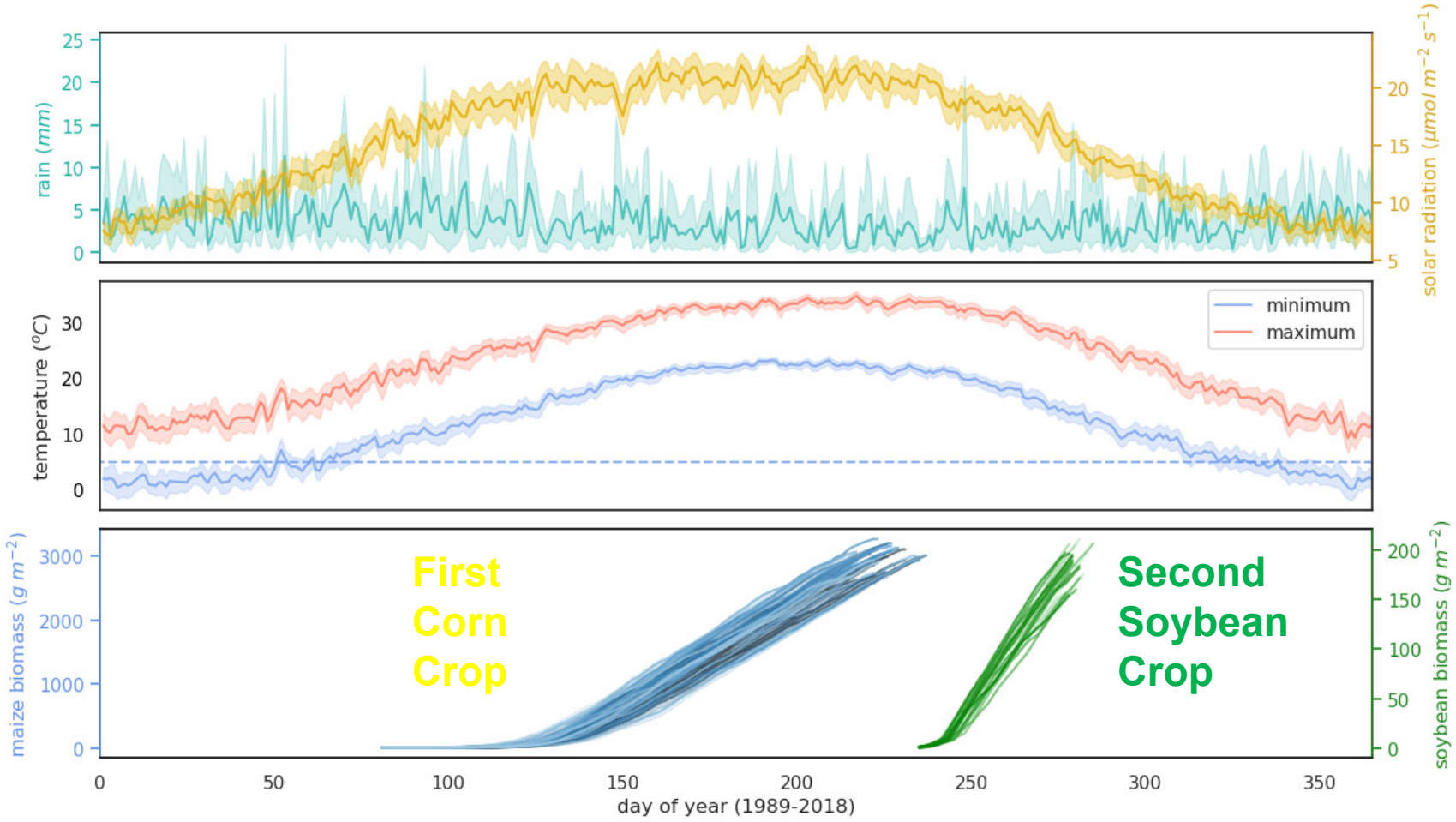
SOUTHEASTERN FIELD **AGRONOMY**



Cropping Systems

- Summer Double Cropping
  - Corn fb soy (short season)

- Canola fb Corn
  - Early RM (European/Spring Canola)
  - Short Season Corn Hybrids

- Incorporation of yellow pea

Relay Cropping

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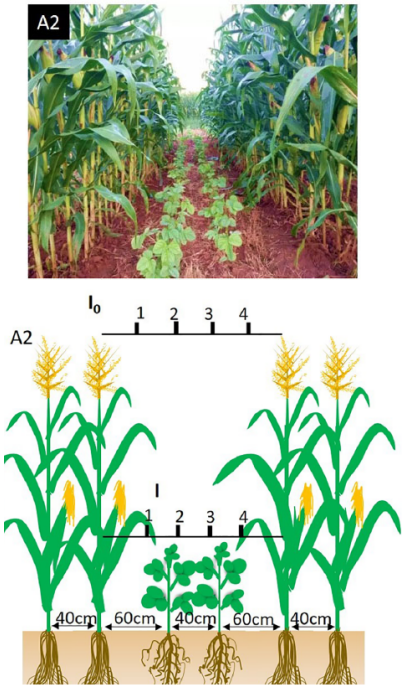
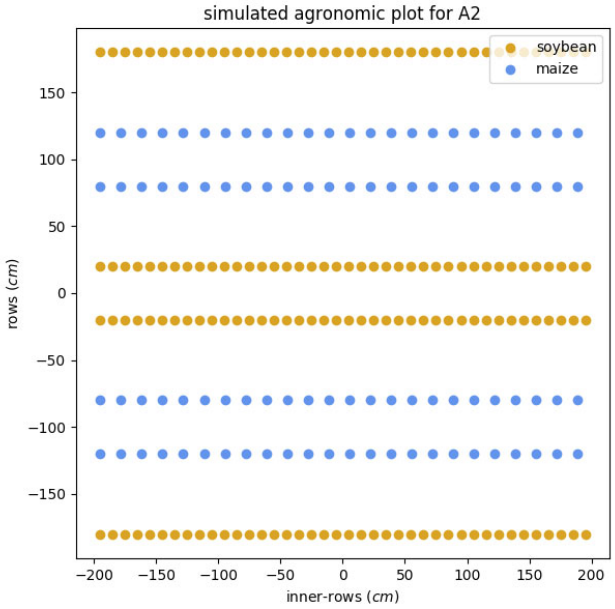
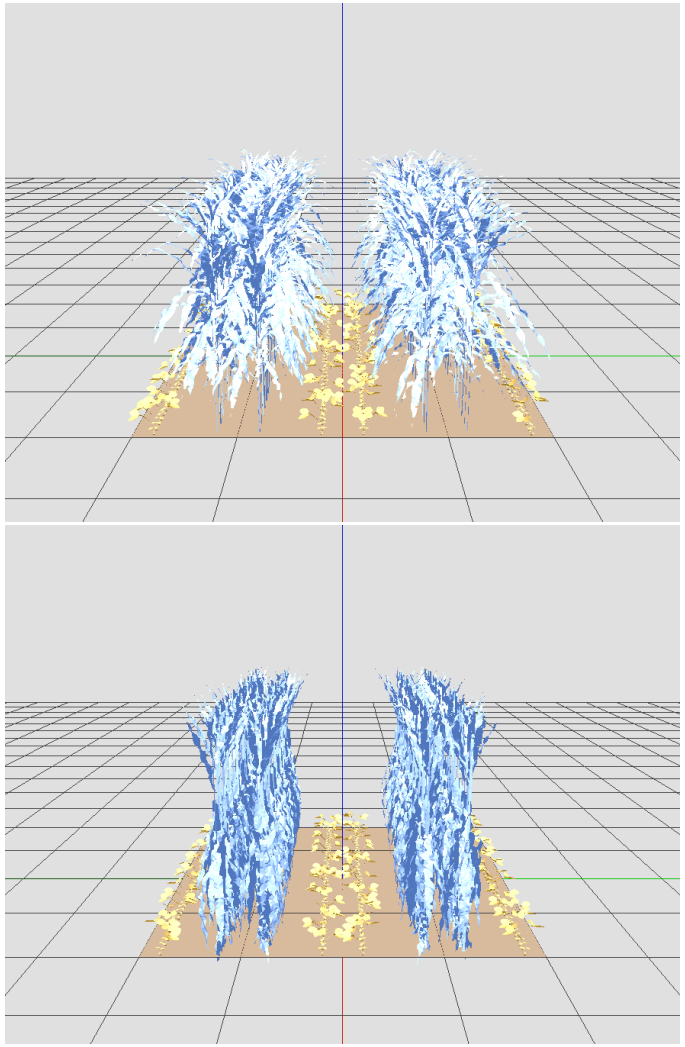
SOUTHEASTERN FIELD **AGRONOMY**







Fan et al., PLOS ONE (2018)

Summer Double Crop Results

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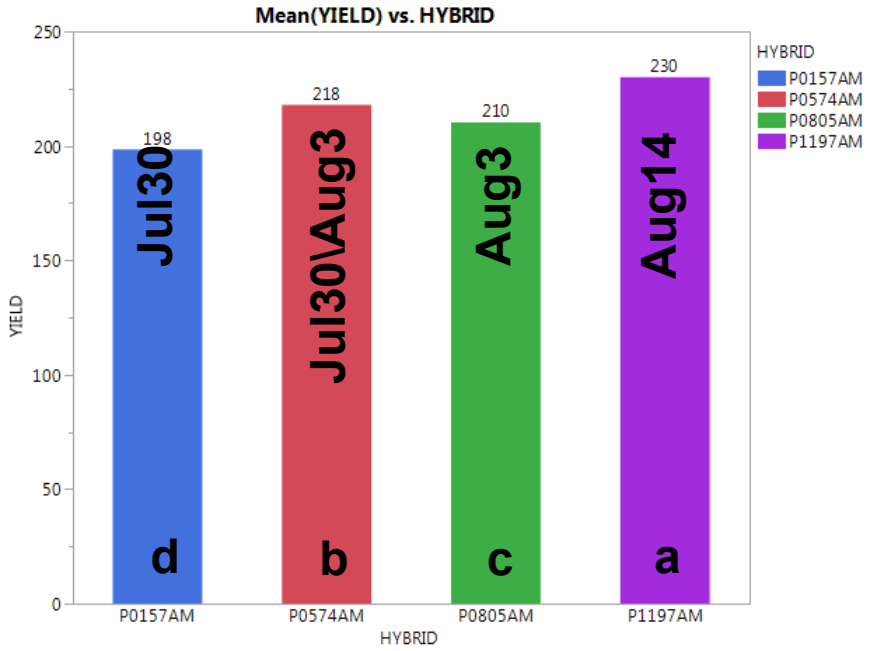
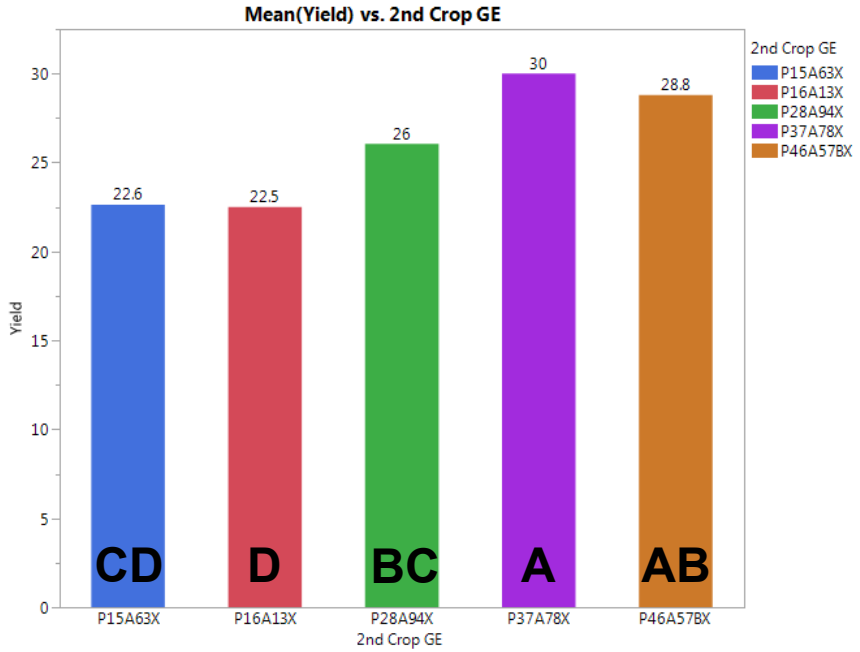
SOUTHEASTERN FIELD AGRONOMY

First Crop Corn



Second Crop Soy



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Metric for evaluation

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SOUTHEASTERN FIELD **AGRONOMY**

Land equivalent ratio *(LER) is the relative land area under sole crop that is required to produce the yield achieved in the multi-crop system*

$$LER = \frac{\text{Yield crop A in multiple CS}}{\text{Yield sole crop A}} + \frac{\text{Yield crop B in multiple CS}}{\text{Yield sole crop B}}$$

$$LER_{Wst} = \frac{45.1 \text{ bu}}{81 \text{ bu}} + \frac{67.2 \text{ bu}}{229 \text{ bu}} = 0.84$$

P16A13X fb P0157AM

$$LER_{Ave} = \frac{214 \text{ bu}}{229 \text{ bu}} + \frac{26 \text{ bu}}{81 \text{ bu}} = 1.25$$

P1197AM fb P37A78X

$$LER_{Best} = \frac{230 \text{ bu}}{229 \text{ bu}} + \frac{35 \text{ bu}}{81 \text{ bu}} = 1.43$$

Corn fb Canola

- Early RM Canola
  - Planted Oct
  - Harvest early to mid-May
- Early RM Corn
  - 105-110d Corn hybrids

Artificial Intelligence

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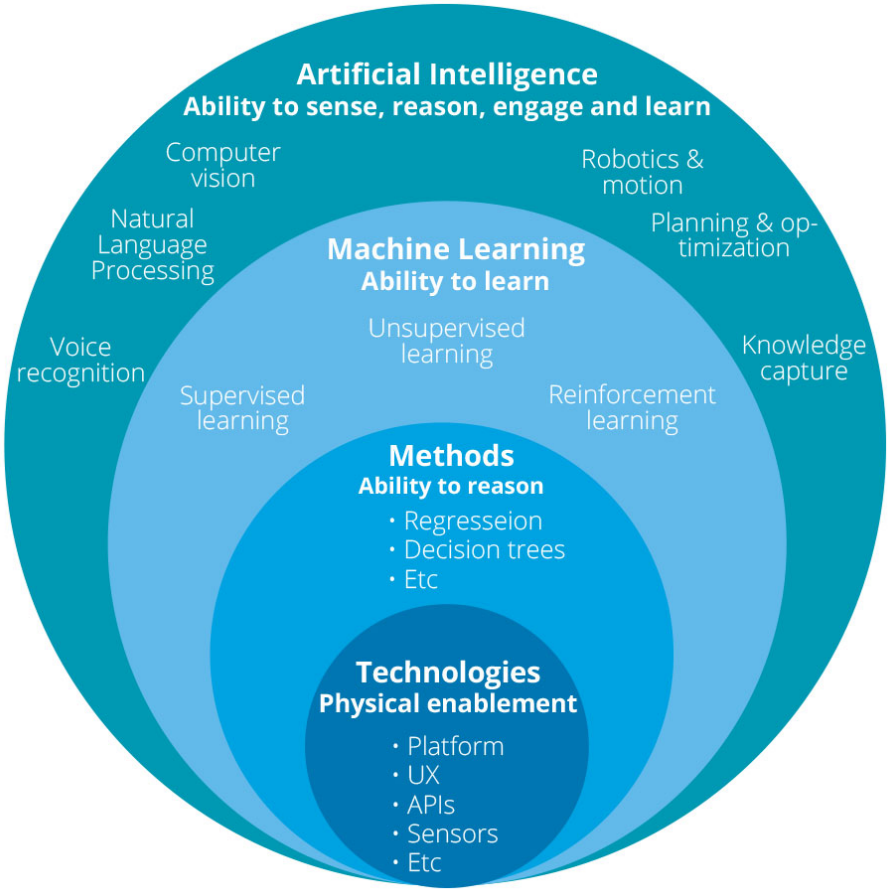
SOUTHEASTERN FIELD **AGRONOMY**



AI and Identification

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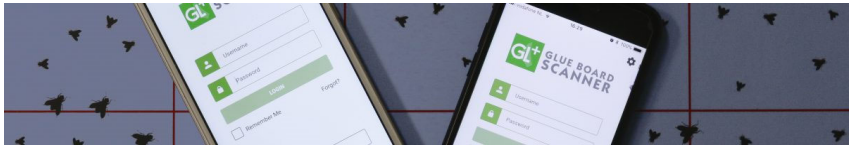
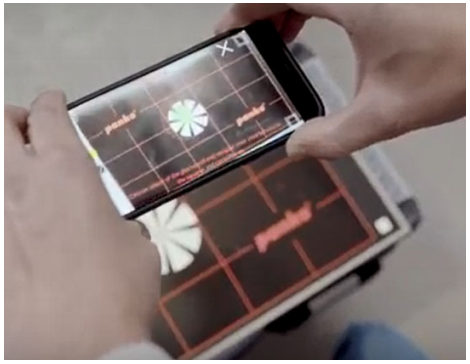
SOUTHEASTERN FIELD AGRONOMY

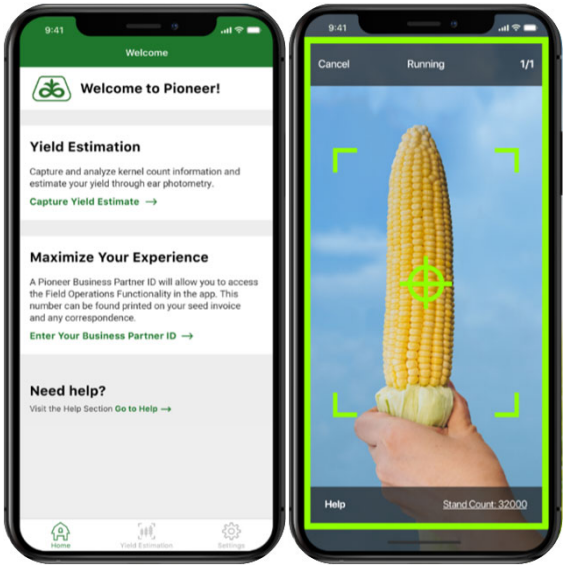
- AI offers tremendous capacity into visual recognition of

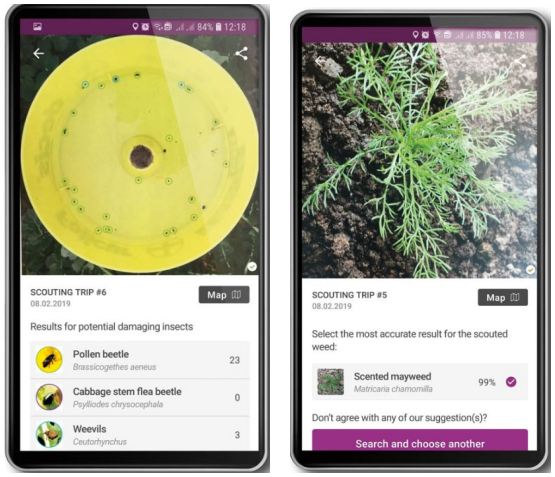


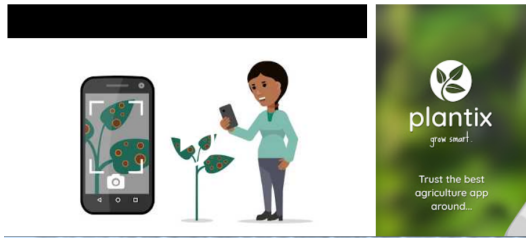


Neuronic™

Active Insect Recognition







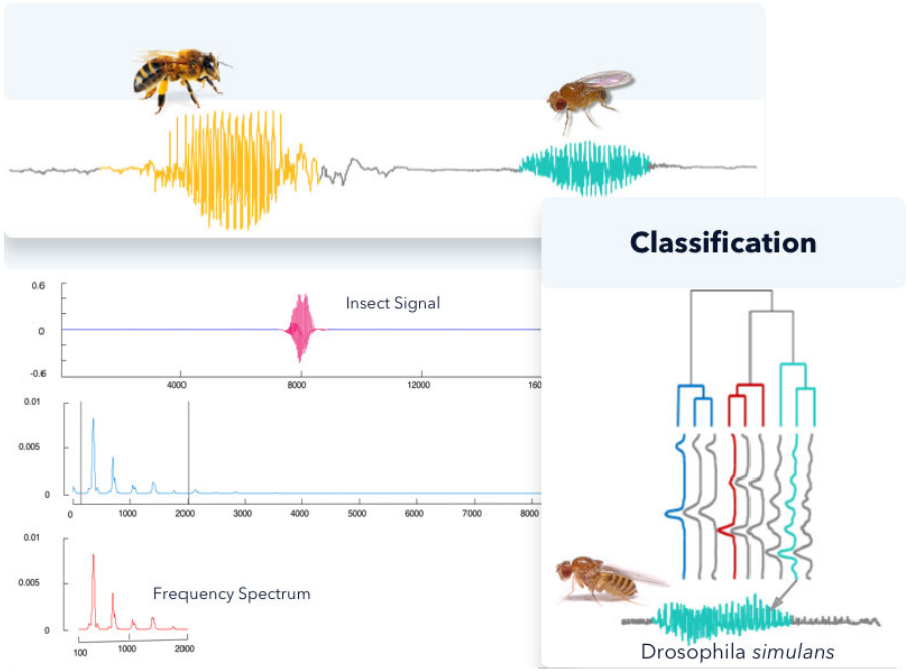
AI and Detection

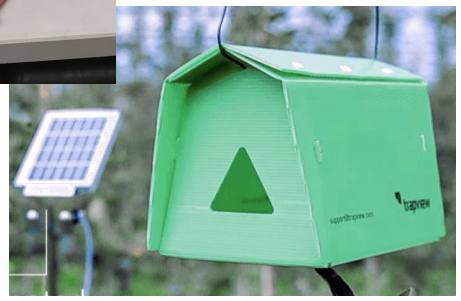
- Insect Detection

FARMSENSE

FaunaPhotonics

trapview





AI and Predictions

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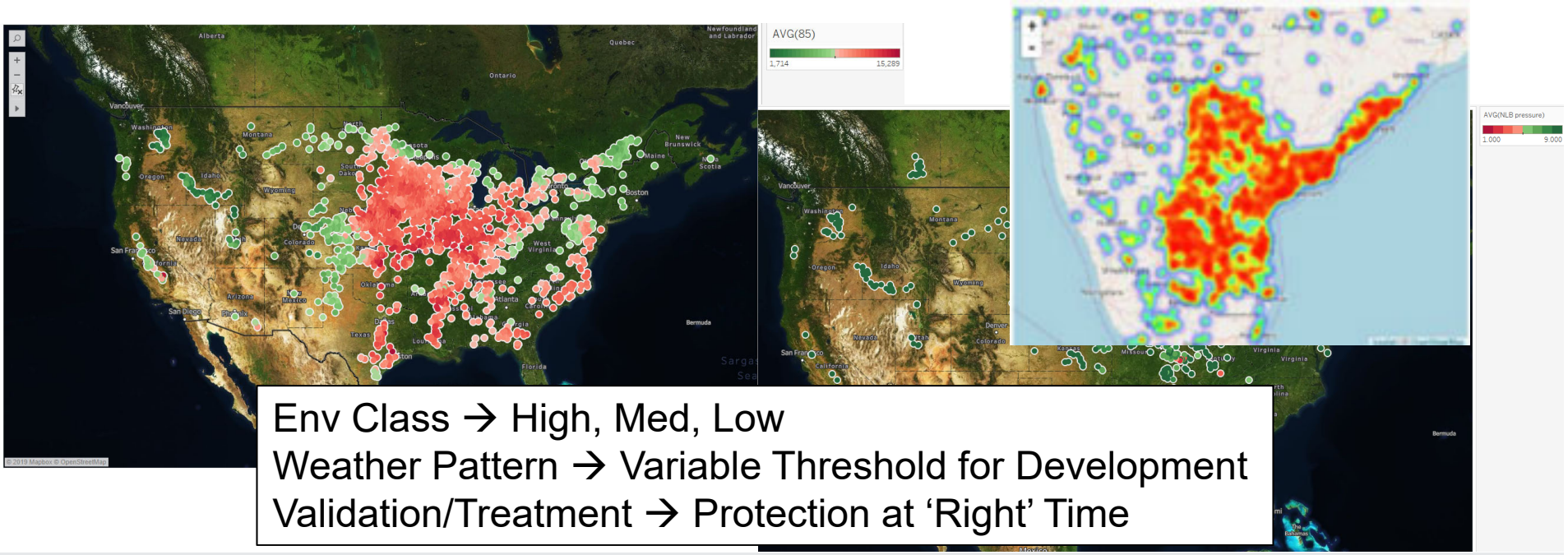
SOUTHEASTERN FIELD **AGRONOMY**

- Create Disease Models
- Weather + Crop Phenology + Disease Model
- Delivery Interface – Digital Space



Env Class → High, Med, Low
Weather Pattern → Variable Threshold for Development
Validation/Treatment → Protection at 'Right' Time

UAS (Drones)

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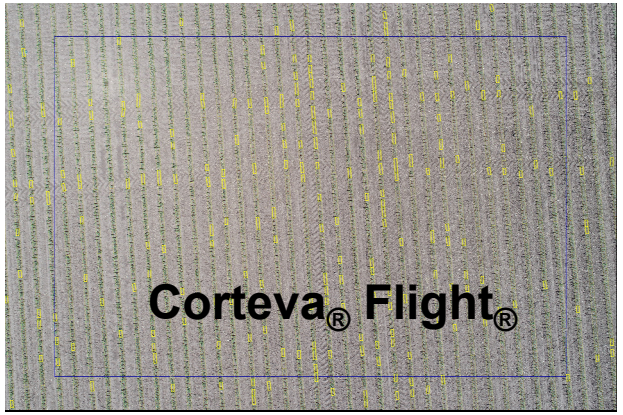
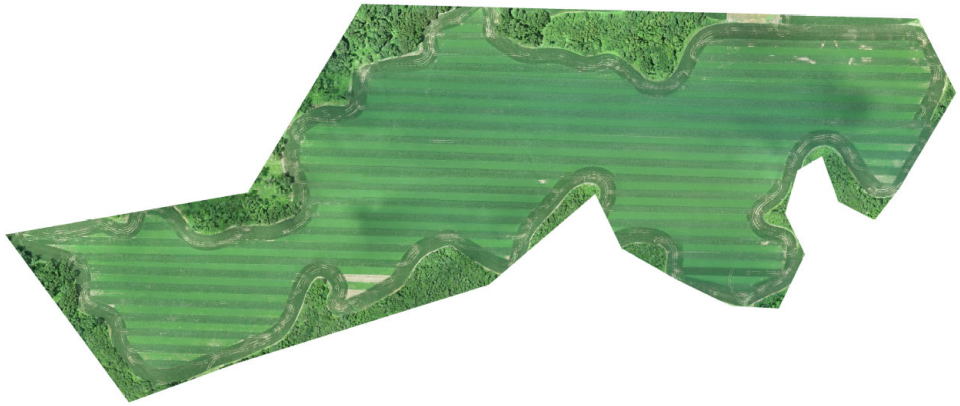
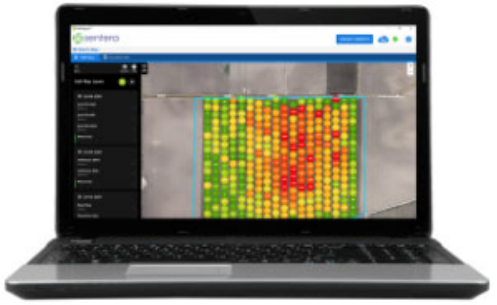
SOUTHEASTERN FIELD **AGRONOMY**

- Stand
- Weed Threshold
- Crop Health/Growth
- Damage Estimates





DroneDeploy



sentera

UAS (Drones)

- Application
  - Battery Powered
  - 30 min flight time
  - Low App Height
    - Tree lines, corners, etc
  - Cost < Air Tractor
  - Not manned
    - FAA rules differ*
      - Night application?

Kiwi Aero

Tactical Robotics' Ag-Cormorant

John Deere's Volocopter

Sensing, AI, CGM, and Mgmt

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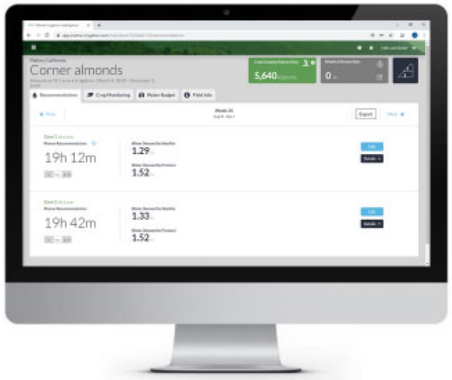
SOUTHEASTERN FIELD AGRONOMY

Manna Irrigation Intelligence

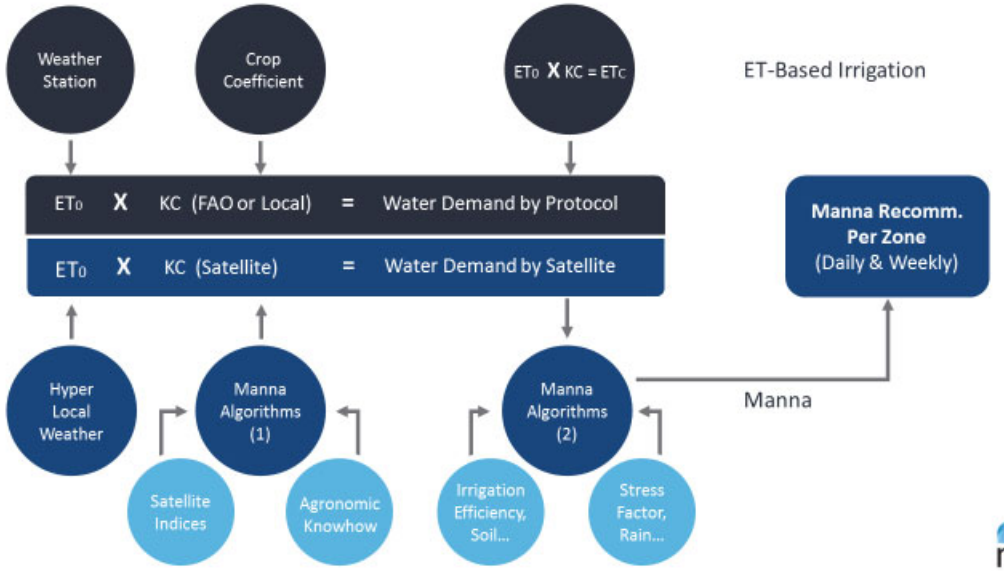
- Hardware free, Sensing-based

What We Do

Provide a sensor-free, site specific, dynamic irrig



How it Works



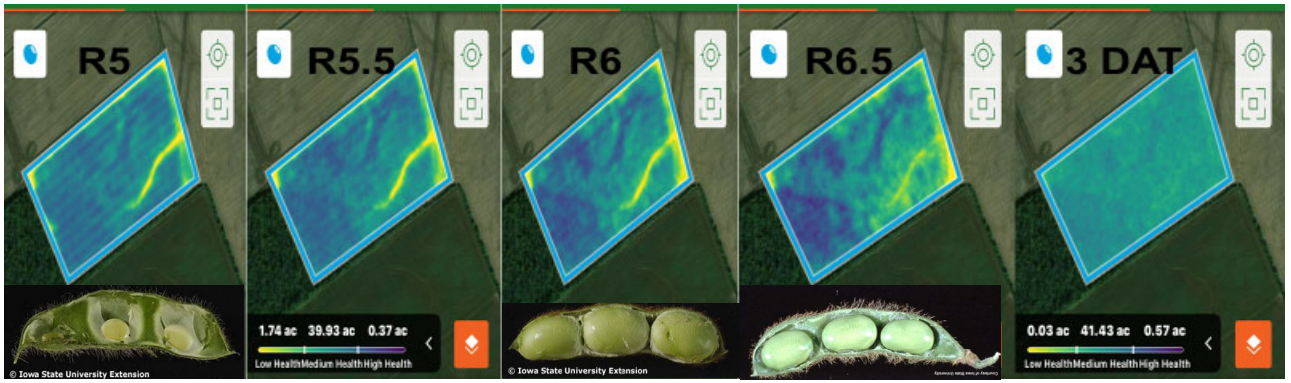
CORTEVA agriscience

Sensing, CGM, & Management

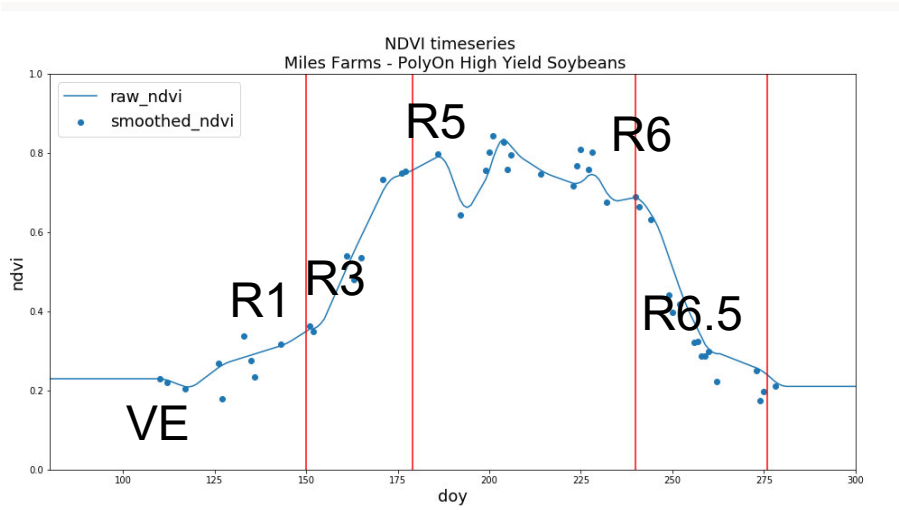
PIONEER agronomy

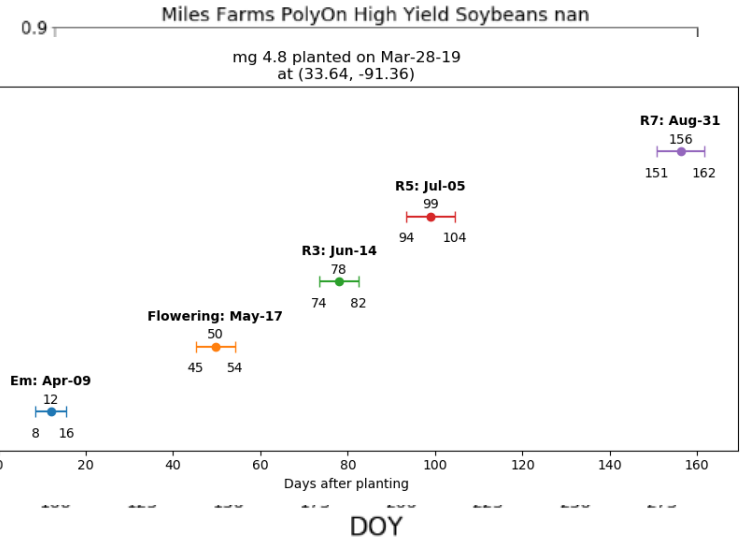
SOUTHEASTERN FIELD **AGRONOMY**

- Planet
- MODIS



- Esp. effective with CGM running in background





CORTEVA agriscience

CGM, AI, Sensing, and Mgmt

PIONEER agronomy

SOUTHEASTERN FIELD **AGRONOMY**

- Digital platforms capture genetics, planting date, georeferenced
- Weather data continues to improve*
- Accurate Phenology Models
- Remote sensing application

- In time → **Harvest Scheduling**

Pest Management

- Conventional
  - Pest → Axn TH → Insecticide
- Heligen (NPV)
  - Pest → Axn TH → Heligen
  - Crop become attractive → Heligen
- Noctovi (Attract and Kill)
  - Peak Moth Flight → Noctovi (→ Evaluate)

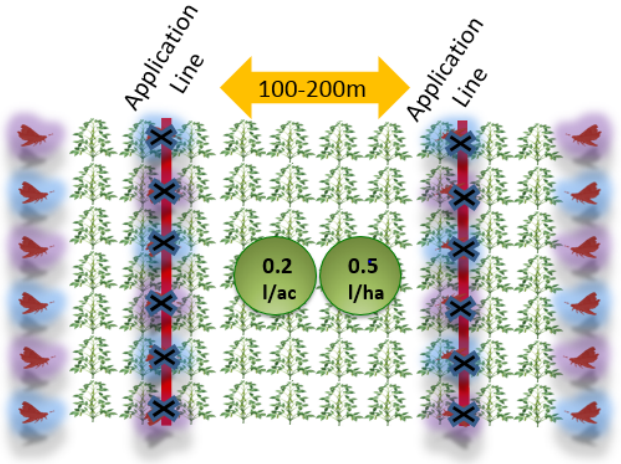
Pest Management

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

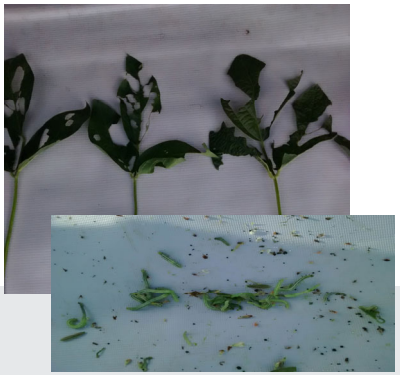
NOCTOVI®

The Amazing Adjuvant for Insecticides™



Conventional

NOCTOVI®



CORTEVA agriscience

Biologicals

- Promising New Products
  - Nitrogen Suppliers
    - PivotBio Proven
    - Sound Ag Source
    - Azotic Envita
  - P uptake promoters
    - Valent MycoApply Endoprime
  - Insecticides/Fungicides/Nematicidess
    - Lumialza™, Aveo, others
  - Soil Health Additives

Soil Testing Advances

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

- Microbiome
  - Trace Genomics
  - Pattern

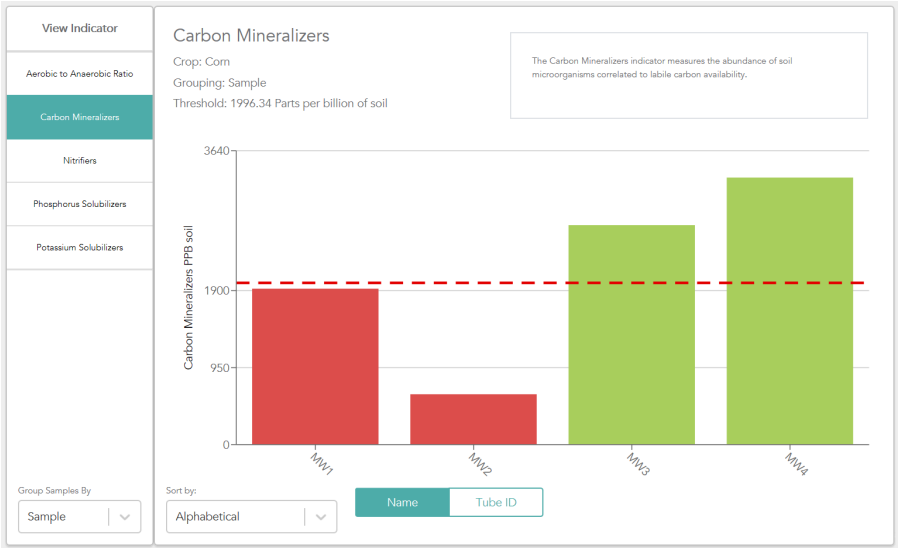
TRACE GENOMICS

PATTERN

- Nutrient Detection
  - Spectroscopy
  - In-Field
  - In-Plant

LASERAG

teralytic



CORTEVA agriscience

Fertilizers

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

- Nitrogen Stabilizers
  - Urease and nitrification inhibitors
- Mixed Fertilizer Options
  - Biocatalysts – Titan XC
  - Micro Impregnated Macros
  - Slow Release Coatings
  - Controlled Release Coatings*

YARA

Mosaic

Aspire

Compass Minerals

OMEX

PERfuze

Harrell's Growing a Better World

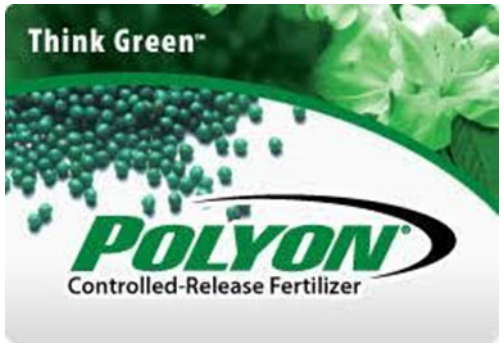
ANALYSES: PERFUZE MG: 5-5-5 WITH 35% MG / PERFUZE B: 5-5-5 WITH 15% B
PERFUZE ZN: 5-5-5 WITH 50% ZN / PERFUZE CU: 5-5-5 WITH 50% CU
PERFUZE BZN: 5-5-5 WITH 12.5% B + 22% ZN / PERFUZE MN: 5-5-5 WITH 25% MN
PERFUZE ZNBMN: 5-5-5 WITH 25% ZN + 10% B + 16% MN / PERFUZE FE: 5-5-5 WITH 20% FE

Controlled Release Coatings

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

- Many nutrients susceptible to environmental loss, not just N



- Customize coating for prescriptive release

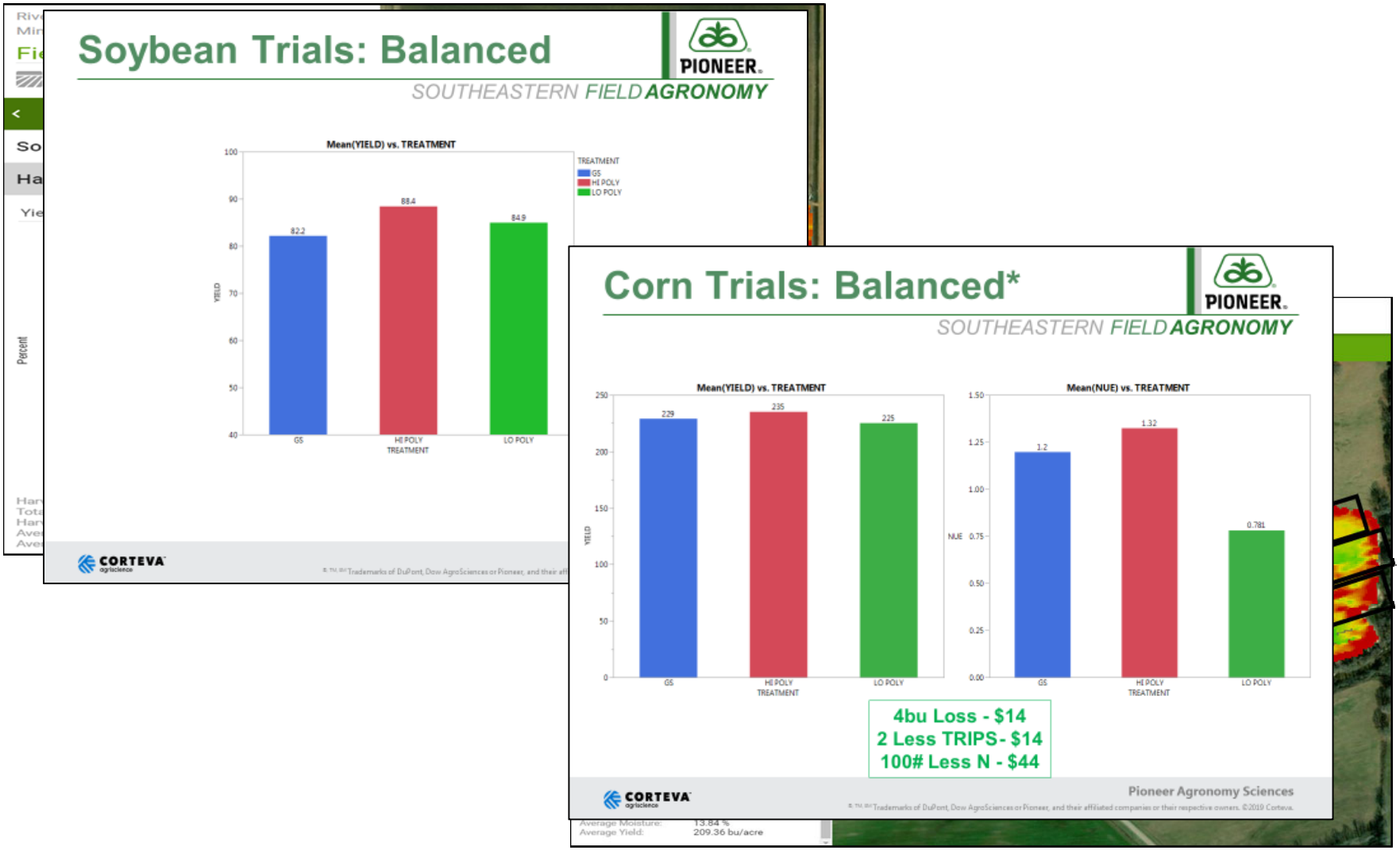
- Reduce environmental loss, reduce application rate, convenience in application, peace of mind

Harrell's
Growing a Better World®

Controlled Release Coatings

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY



Sources of Information

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

- Participate in Product Evaluation
  - FarmerTrials – IN10T
  - Premier Crop Systems (Many Digital Platforms)
    - Benchmark
    - Product Validation
    - Learning Block (Enhanced Learning Block)

IN10T® FarmerTrials

Follow the Money

PIONEER agronomy

SOUTHEASTERN FIELD AGRONOMY

- Corporate Sponsorships
- Investment Groups
- Incubators
- Popular Press

STARTUPS

Market Watch January 25, 2020

Deere Announces Four Companies Set to Join 2020 Startup Collaborator Program

By Deere & Co.

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NEXT ARTICLE

7 Top Agtech Startups Defining the Future of Agriculture

April 30, 2019 Sponsored Post

AgriFood tech is a maturing market, as evidenced by the swell in investing activity last year. Startups in the space attracted nearly $17 billion in investment capital–a 43% increase from the previous year, according to data from AgFunder. But as companies grow, and the deal sizes grow with them, it pays to keep an eye on what new innovations are coming down the pipeline.

For that, early agrifood tech investor Anterra Capital pays attention to trends outside of the food and ag space. “We look at other verticals to understand what else is [happening], because food and ag are usually late to the party,” Anterra’s founder Maarten Goossens tells *AFN*.

AgLaunch

Ag-Tech Incubator Lures Sponsors, Startups With Unusual Model