EMERGING & EVOLVING TECHNOLOGY

NAICC

2019 NAICC Annual Meeting

Savannah International Trade and Convention Center
Savannah, Georgia

Ambient Breeze Tunnel for Field Drift Studies

Joshua Arnold, PhD
Director Business Development – AgriFood
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Jan. 17th, 2019

Ambient Breeze Tunnel for Wind-Controlled Drift Field Studies

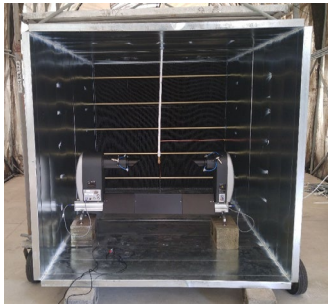
Author: Josh Arnold
Battelle Memorial Institute, 505 King Ave. Columbus, OH 43201
EVOLVING

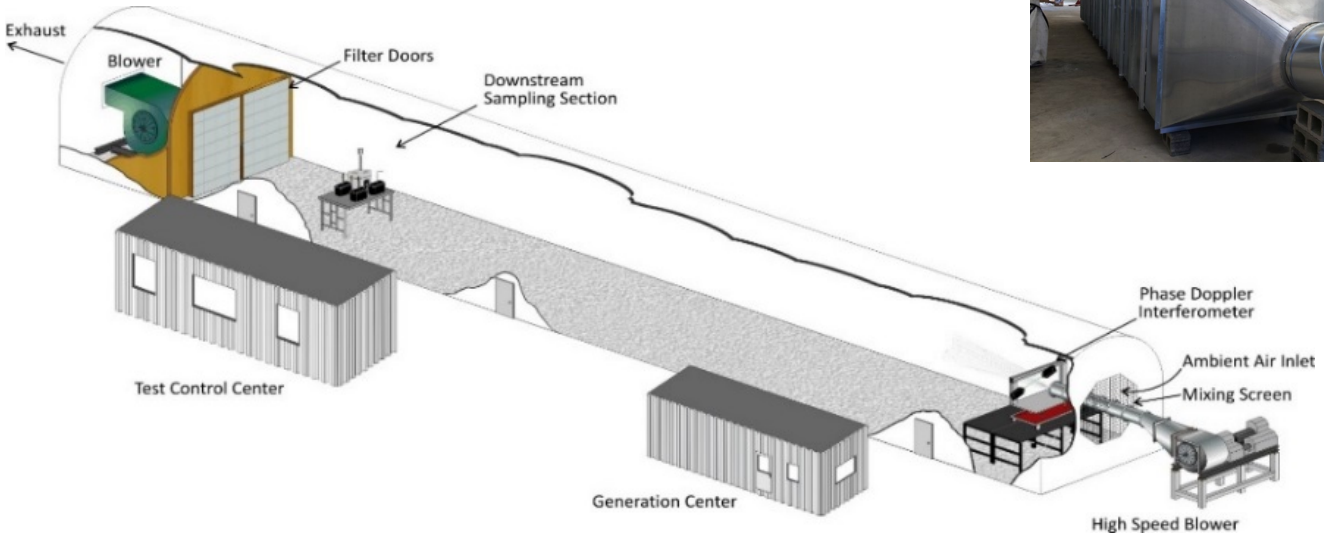
Drift studies performed in-field are time consuming, weather dependent, and costly. When conducting field trials in an ambient breeze tunnel (ABT), wind speeds and direction can be controlled through the duration of the study. The tunnel can achieve wind speeds up to 10 mph and can measure downwind distances up to 110 feet from the nozzle. Drift trials can be accurately tested under various conditions (wind speeds, temperatures, RHs, boom heights, application rates, etc.). Both air and deposition samples can be collected in the tunnel during/after the application. The ABT provides fast, accurate, and inexpensive field study results under controlled wind speeds and directions.

Ambient Breeze Tunnel (ABT)

- Utilizing Battelle's diversity to enhance Agricultural technology advancement

- **Ambient Breeze Tunnel (ABT)**
  - Full-scale, weather-independent testing facility
  - length 150ft (110ft. test area), width 20ft, height 20ft.
  - Suitable for conducting agricultural spray drift studies under GLP compliance
  - Can active ingredients
    - Onsight analytical





BATTELLE

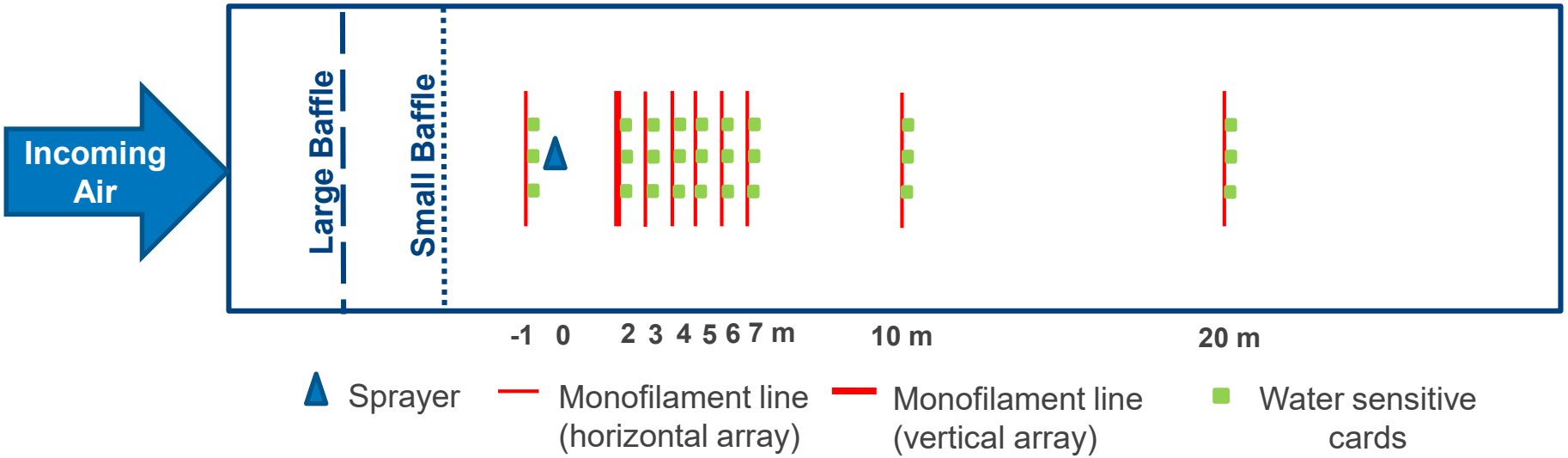
Establish and Exercise A Spray Drift Test Protocol

- Field studies
  - Time consuming and costly
  - Weather dependent (rain, wind speeds, temp/RH, etc.)
- Pseudo field studies in Ambient Breeze Tunnel (ABT)
  - Small/Large tunnels both able to measure 110 ft downwind of boom
    - Small: 14 ft wide by 7.5 ft tall, max wind speed = 10 mph
    - Large: 20 ft wide by 20 ft tall, max wind speed = 4.5 mph
  - Quick turn around, inexpensive
  - Constant wind speed
  - Rain does not interfere with a test (other than increasing RH)

- Reference nozzle: Flat Fan SS11003
- Spray material: water + 0.003% Triton + 0.264 g/L fluorescein
- Droplet size: Artium Phase Doppler Interferometer (PDI)
- Mass deposits (airborne and fallout):
  - Collector: 0.46 mm monofilament line
  - Ethanol diluent for extraction
  - SpectraMax i3 imaging cytometer
- Water sensitive cards (% coverage)

Test No.	Temp. (°C)	RH (%)	Wind Speed (m/s)	Press. (PSI)	Liquid Temp. (°C)	Flow Rate (L/min)	Spray Time (s)
1	18.1	78.9	0.91	40	18.6	1.19	10
2	18.6	76.4	0.98	40	18.8	1.19	10
3	18.9	74.8	0.96	40	18.8	1.30	10

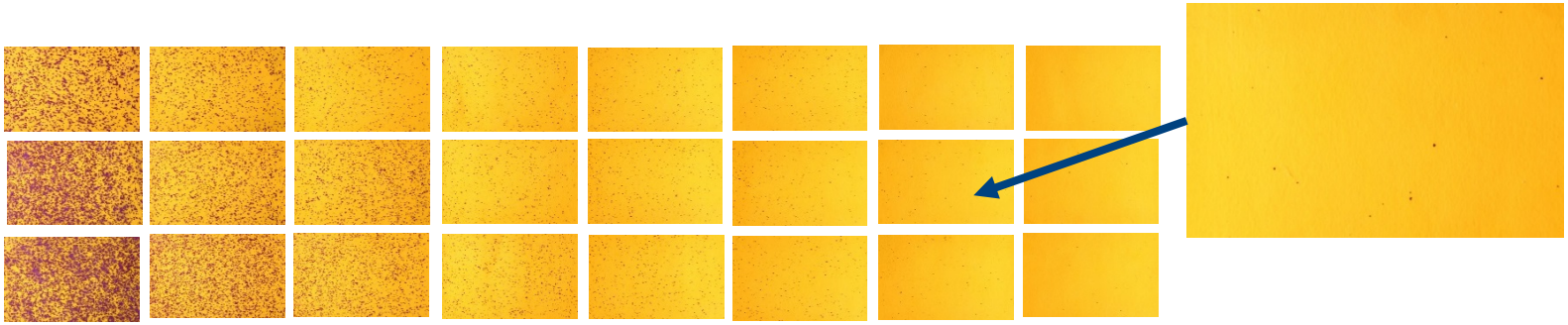
Airborne and Fallout Samples Collected



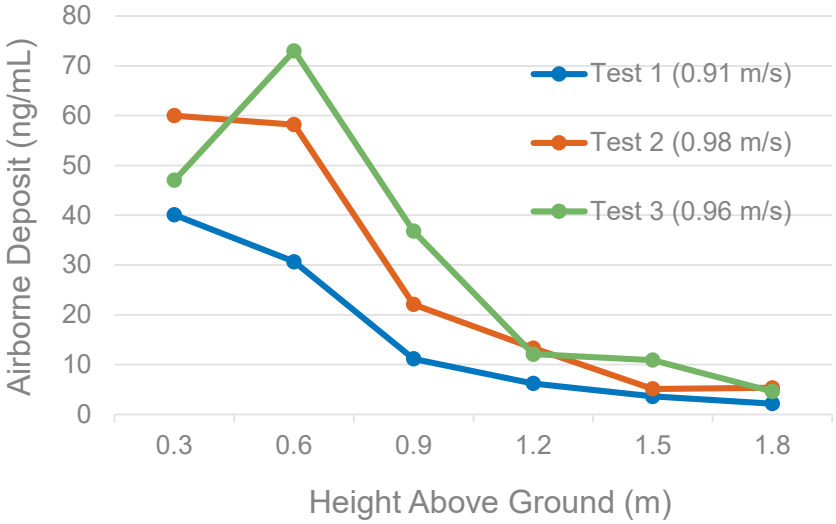
- Vertical (2 m downwind)
  - 0.3, 0.6, 0.9, 1.2, 1.5, 1.8 m heights
- Horizontal (0.3 m height)
  - -1, 2, 3, 4, 5, 6, 7, 10, 20 m downwind

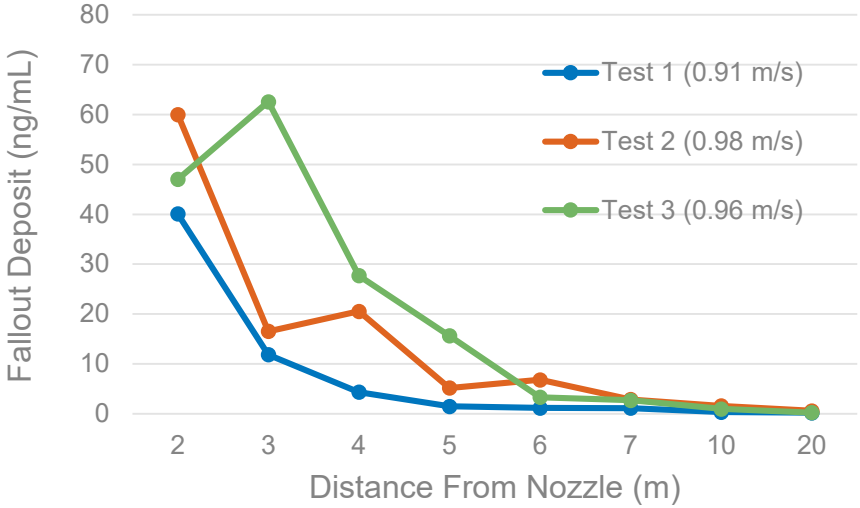
Airborne and Fallout Deposits Provide Useful, Repeatable Spray Drift Data

Test 2:
0.98 m/s



2 m 3 m 4 m 5 m 6 m 7 m 10 m 20 m





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Brandt's New Enzyme Starter "EnzUp-Zn"

Brad Walker, Regional Agronomist

Brandt Consolidated Inc.

2935 S. Koke Mill Rd.

Springfield, IL 62711

EVOLVING Technology

EnzUp-Zn is Brandt's new, patented enzyme nutrient technology that enhances plant nutrient uptake and utilization. Enzymes are small proteins made by plants, or other organisms in the soil. They act as catalyst to perform chemical reactions and perform very specific functions in the soil.

EnzUp-Zn contains two enzymes:

1) **Lipase enzymes**: converts organic matter into available nutrients. This activity is important for the overall health of soil. Enzymes are key to nutrient release from organic matter in the soil
2) **Mannanase enzymes:** affect the mucilage component of root exudates. This increases water and nutrient uptake by the roots.

BRANDT EnzUp® Proprietary Nutrient Efficiency Enhancer

Brad Walker - Regional Agronomist – Soil Scientist – CCA – CPCC-I

- First of its kind in agriculture.
- Breakthrough scientific discovery.
- Exclusive to BRANDT.
- Delivers a high concentration of enzymes that perform specific functions in the soil:
- Enzymes are soil stabilized by patented process
  - Prevents enzymes from degrading too fast in soil
- Enzymes are small proteins made by plants, or other organisms that accelerate chemical reactions.
- Enzymes acts as catalyst to unlocking the nutrient release of the organic matter.
- Enzymes are highly selective catalysts.
- Brandt has 3 specific Enzymes in our EnzUp line.
- EnzUp-Zn has 2 enzymes.

EnzUp-Zn contains two stabilized enzymes

1) **Lipase enzymes**: convert organic mater into available nutrients.

2) **Mannanase enzymes**: Affects Mucilage and Mucilage is a component of root exudate, it can modify the biophysical environment of the rhizosphere.

1. Increase root penetration
2. Improves soil aggregate formation
4. Nutrient turnover. Increases N mineralization.
5. Reduces soil surface tension, making water more plant available.
6. Reduces P adsorption on soil particles, making more P plant available

BRANDT®

Mannanase Enzyme Breaks Down Outer Layer of Root Tips to Draw in More Water and Nutrients

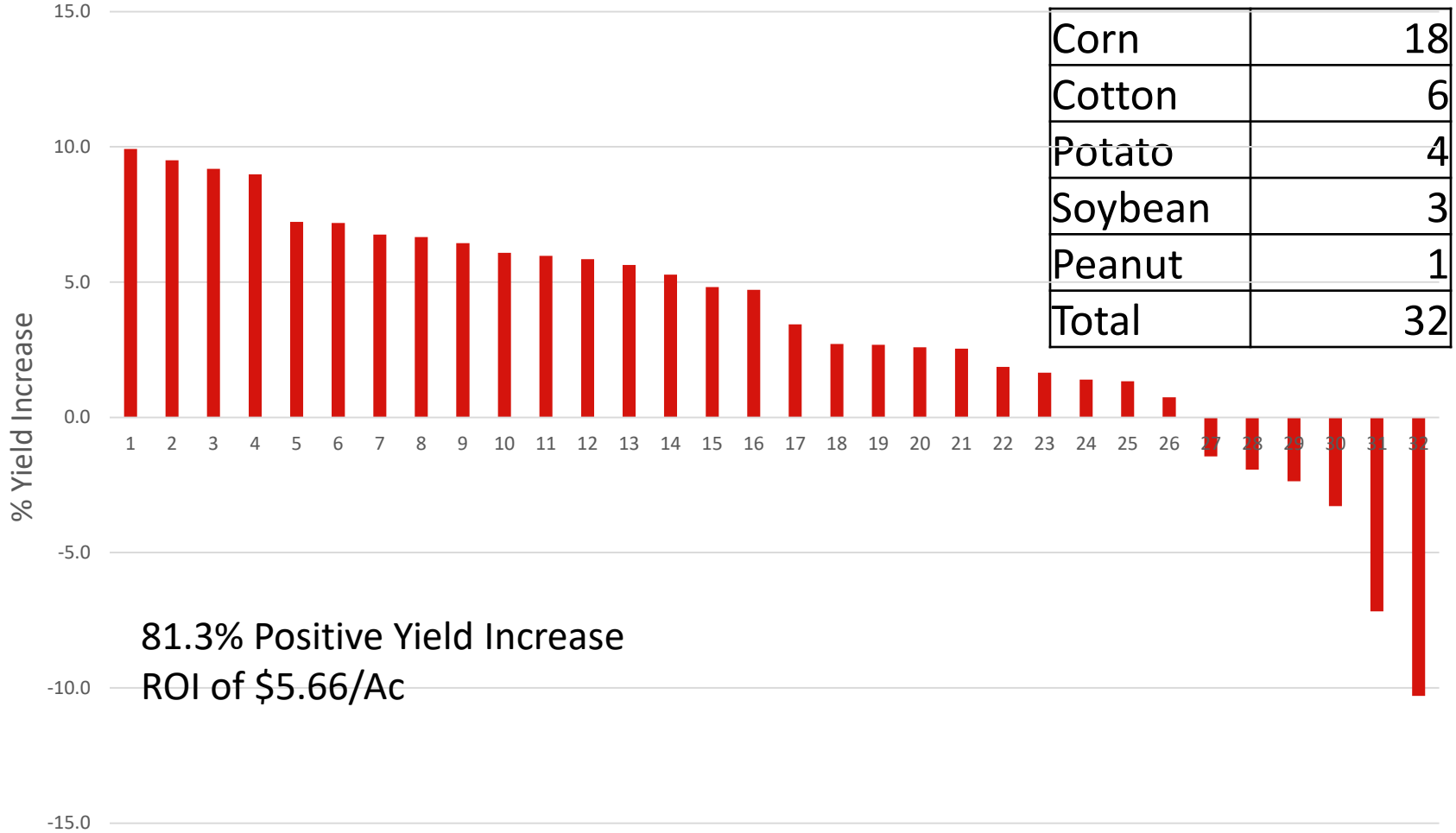
Mannans are complex polysaccharides and

Early Germination: Mannanases enzymes assist in weakening of endosperm cell walls.

Mannanase can reduce the viscosity of the mucilage.

BRANDT®

2017-18 EnzUp-Zn Trials



Corn	18
Cotton	6
Potato	4
Soybean	3
Peanut	1
Total	32

EnzUp-Zn Vs Growers Starter

BRANDT®

EMERGING & EVOLVING TECHNOLOGY

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PHYTOGEN TRAIT DEVELOPMENT:

ROOT-KNOT NEMATODE RESISTANCE

Bobby Haygood and Bruce Steward

CORTEVA™ agriscience

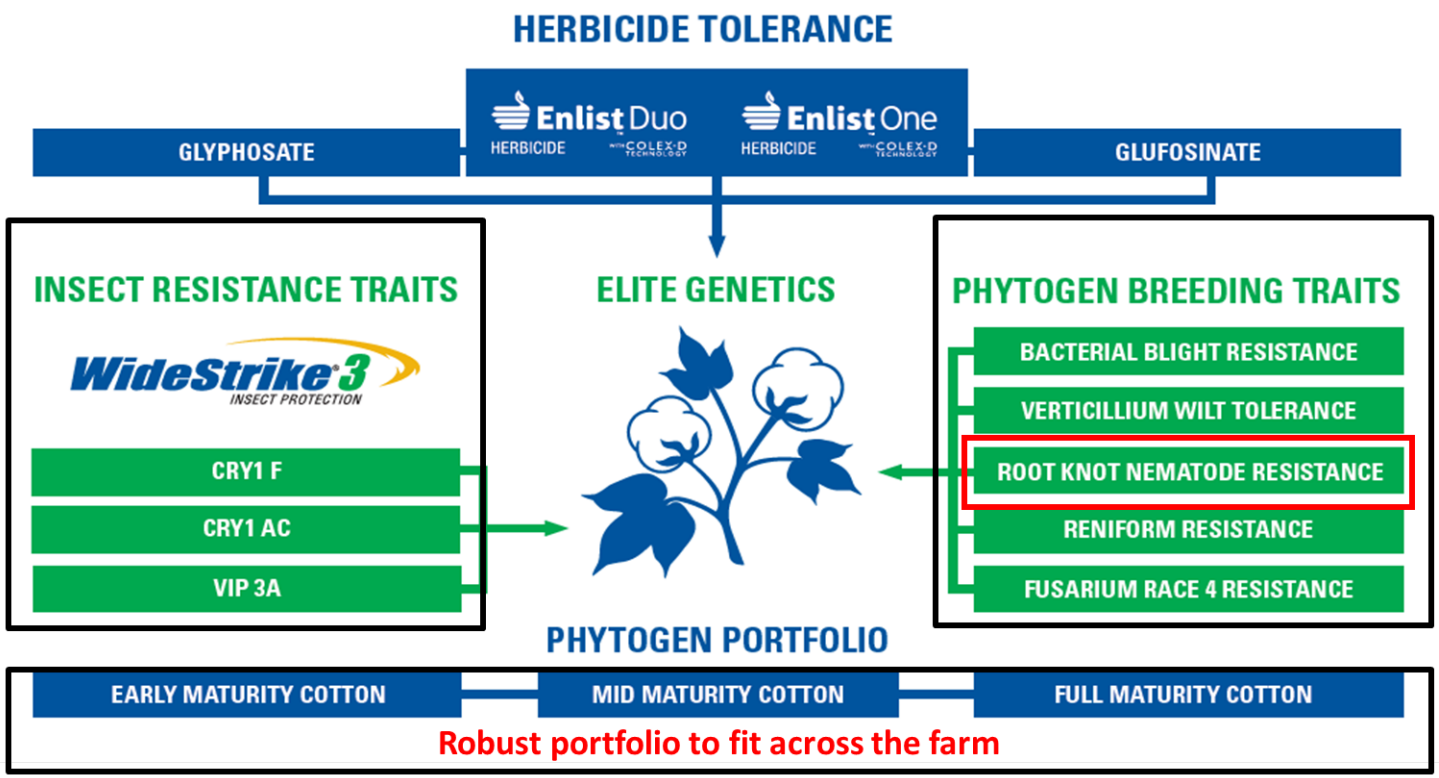
Agriculture Division of DowDuPont™

PhytoGen® COTTONSEED

Submitted by Bobby Haygood, Ph.D. Corteva

PhytoGen varieties with RKN resistance

Once the presence, species and economic thresholds of nematodes have been identified, growers have several options for reducing their spread. Native genetic resistance or tolerance is quickly evolving as a go-to solution for growers who plant cotton on nematode-infested acres. PhytoGen® brand varieties containing PhytoGen breeding traits to manage RKN-infested fields are a great solution. PhytoGen brand varieties with RKN resistance reduce nematode galling, feeding and reproduction by disrupting the host/parasite relationship. RKN-resistant varieties reduce the number of nematodes in the soil similar to a nonhost rotational crop, such as grain sorghum.



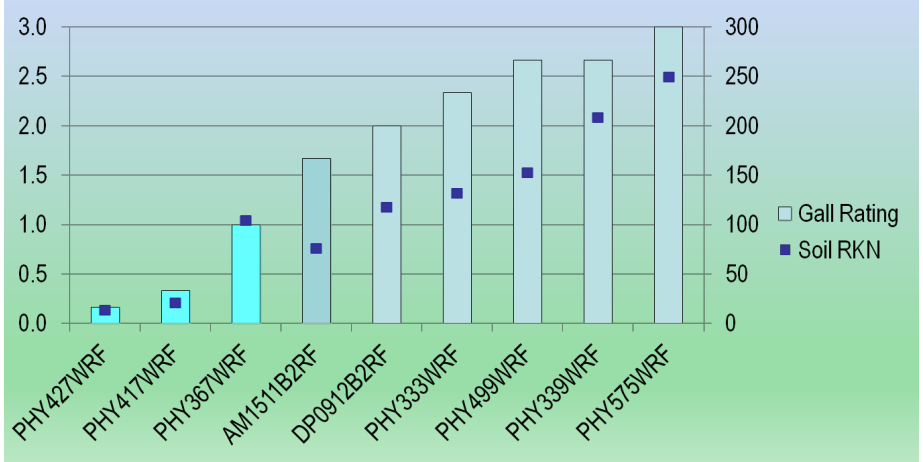
PhytoGen® COTTONSEED

RESISTANT COTTON LINES/VARIETIES

- Moderately resistant varieties (Clevewilt 6-1 source)
  - ST LA887, ST5599BR, ST4288B2RF, ST5458B2RF, PM1560, PM1560BR, DP174RF, PHY367WRF
- Highly resistant germplasm (Auburn 623RNR source)
  - M240-RNR, M315-RNR, MS-01RKN, MS-37RKN
- Highly resistant varieties (Auburn 623RNR source)
  - PHY417WRF, PHY350W3FE, PHY480W3FE

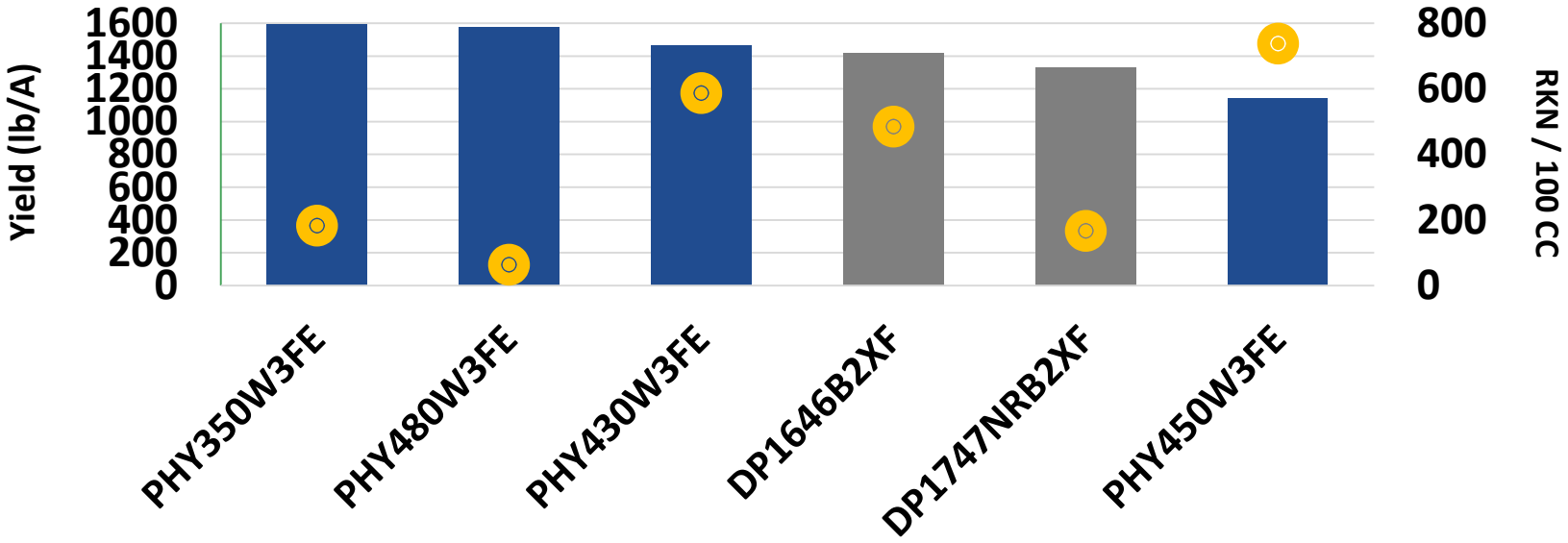
- Reduced galling
- Reduction in nematode reproduction

PhytoGen - Gall Rating and RKN/100cc Soil



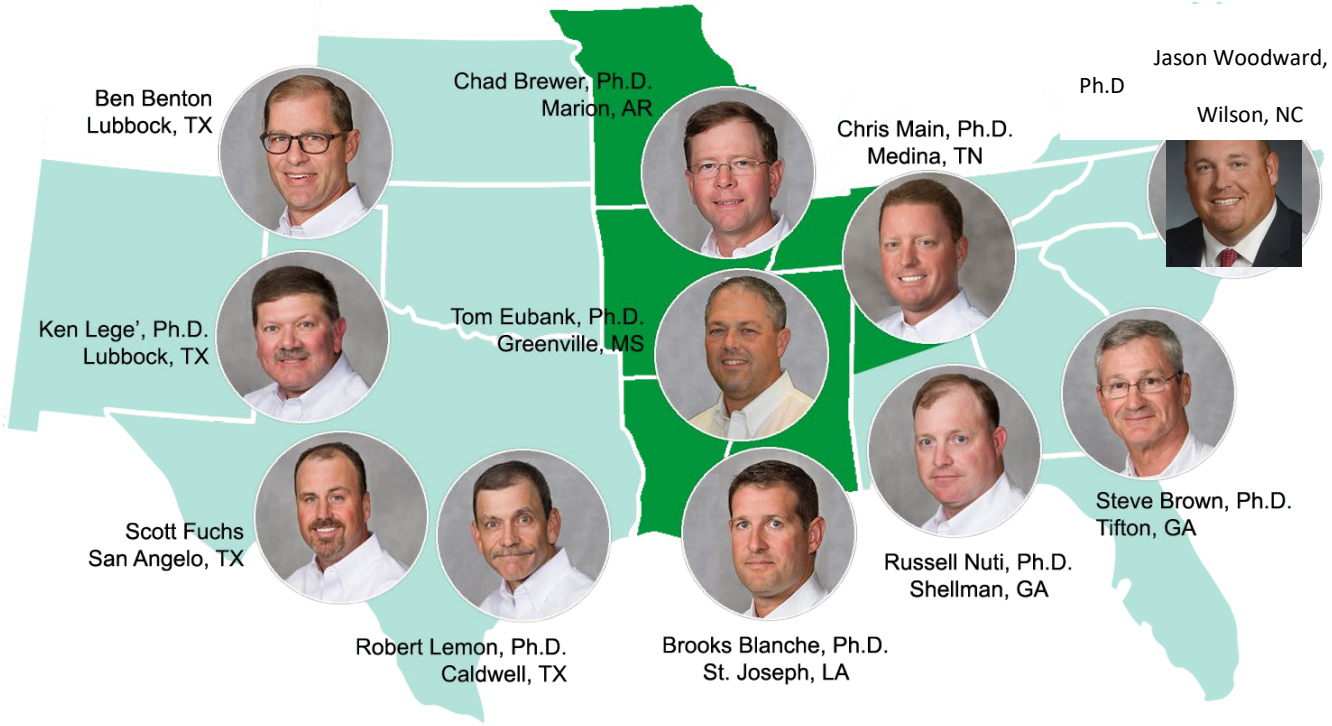
PhytoGen COTTONSEED

LINT YIELD AND FALL SOIL RKN (AL, AR & 4 GA LOCS WITH RKN)



PhytoGen COTTONSEED

2018 Cotton Development Specialists



Appr. 65 total years experience

PhytoGen COTTONSEED

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FARM DOG

Seamless integration between in-field recommendations and automated sprayers

2019 NAICC National Convention
Savannah, Georgia
January 17, 2019

farmdog.ag liron@farmdog.ag @farmdogag

Seamless integration between in-field pest and disease recommendations and automated sprayers

Liron Brish

Farm Dog Technologies, 150 Main St. #130, Salinas, CA 93901

Emerging

Farm Dog and John Deere have developed a solution to empower consultants and retailers that allows them to create an in-field pest and disease treatment recommendation in the Farm Dog mobile platform that integrates automatically with John Deere sprayers. Through this seamless experience, consultants and retailers save considerable time getting from recommendation to treatment fulfillment, reduce errors inherent in manual communication between them and spray operators, and enjoy more oversight over the end-to-end pest and disease management process. The solution is currently being piloted across several crop types and geographies in the United States and Canada.

AGRICULTURE HAS MOVED TO DIGITAL

BUT OUR TOOLS ARE STILL SILOED

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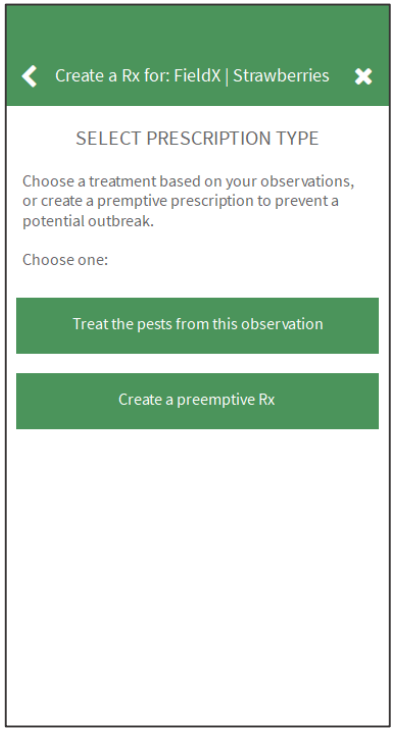
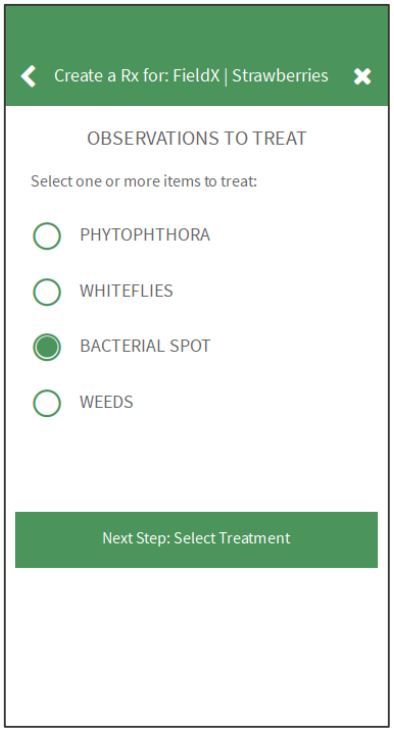
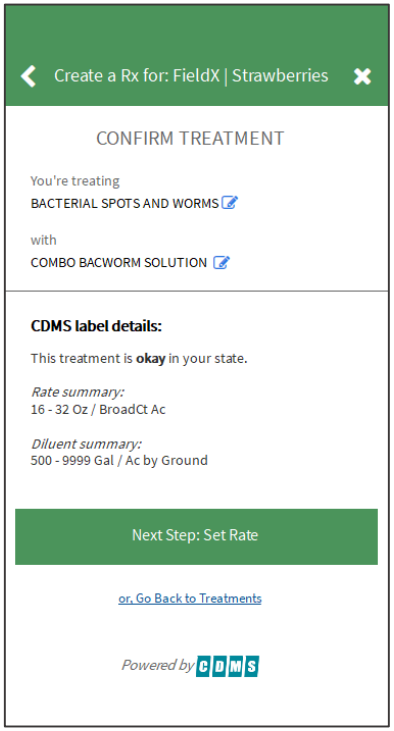
FARM DOG

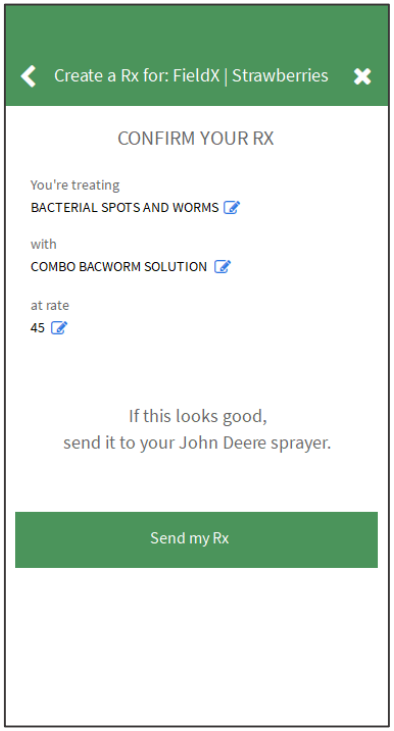
FARM DOG SEAMLESSLY CONNECTS SCOUTING TO SPRAY

APP INTEGRATED WITH JOHN DEERE VRA SPRAYERS









1/17/2018

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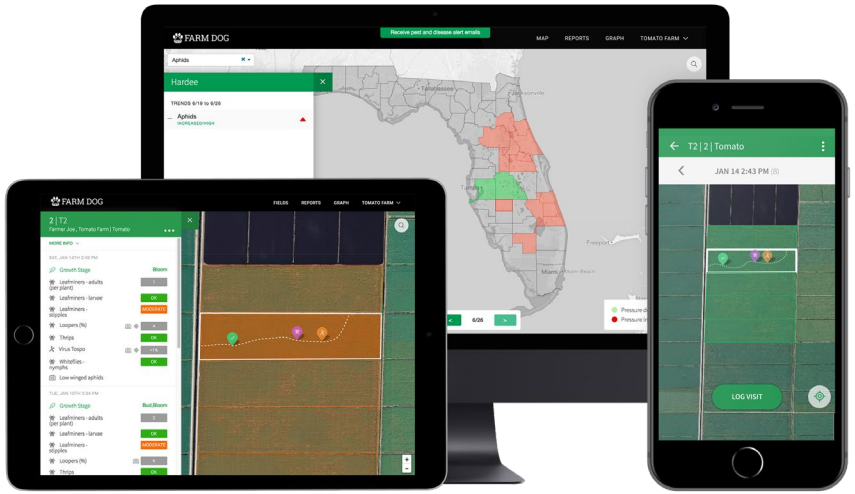
FARM DOG

PROVIDE INNOVATIVE SERVICES TO YOUR CLIENTS



- Save time with seamless equipment integration
- Eliminate “telephone game” mistakes
- Manage your teams and client communications professionally

Visit us at Booth 104 to learn more

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FARM DOG

1/17/2018

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LUCENTO™

FUNGICIDE

New Systemic Fungicide from FMC Corporation

Craig Heim, Ph.D., Technical Service Manager, Southeast US

Bruce Stripling, Ph.D., Regional Technical Service Manager, Horseshoe East

FMC

NAICC FMC Abstract:

In 2019, FMC will launch Lucento™ fungicide. This broad-spectrum fungicide contains two proven modes of action. Lucento™ combines the best in class, highly systemic and longlasting Group 3 fungicide, flutriafol, along with a broad-spectrum Group 7 SDHI, bixafen. Lucento ™ will be labeled on com, soybean, peanuts, sugar beets, and wheat. Lucento ™ manages disease resistance with two active ingredients with activity on key diseases that have developed resistance to strobilurins. Flutriafol offers industry leading performance on key leaf spot diseases, while bixafen increases spectrum and protection against other key diseases.

Lucento Fungicide

LUCENTO™ FUNGICIDE

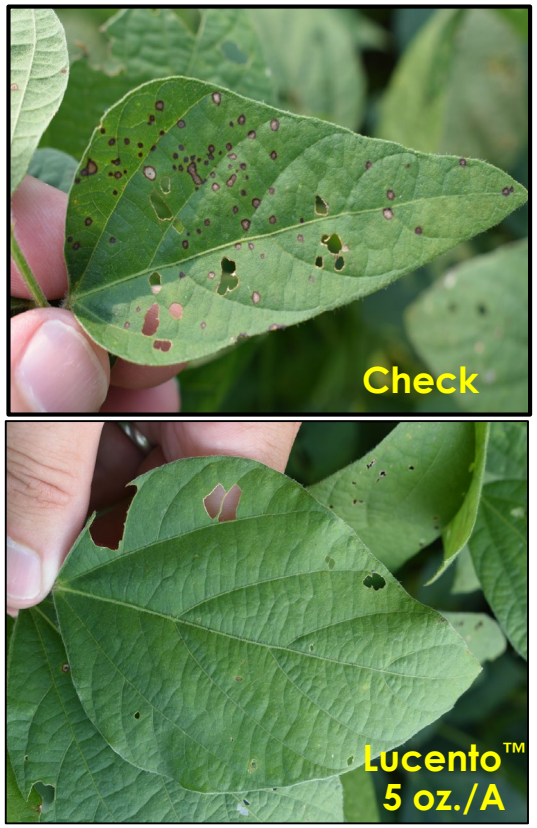
- Systemic SDHI fungicide of the chemical class pyrazole-carboxamides (FRAC Group 7) combined with flutriafol, one of the most systemic triazoles on the market (FRAC Group 3)
- Registration received December 2018 for use in corn, soybeans, wheat, and peanuts
- Helps to reduce overdependence of at-risk fungicide groups, including strobilurins, (FRAC Group 11)
- Crops and diseases controlled

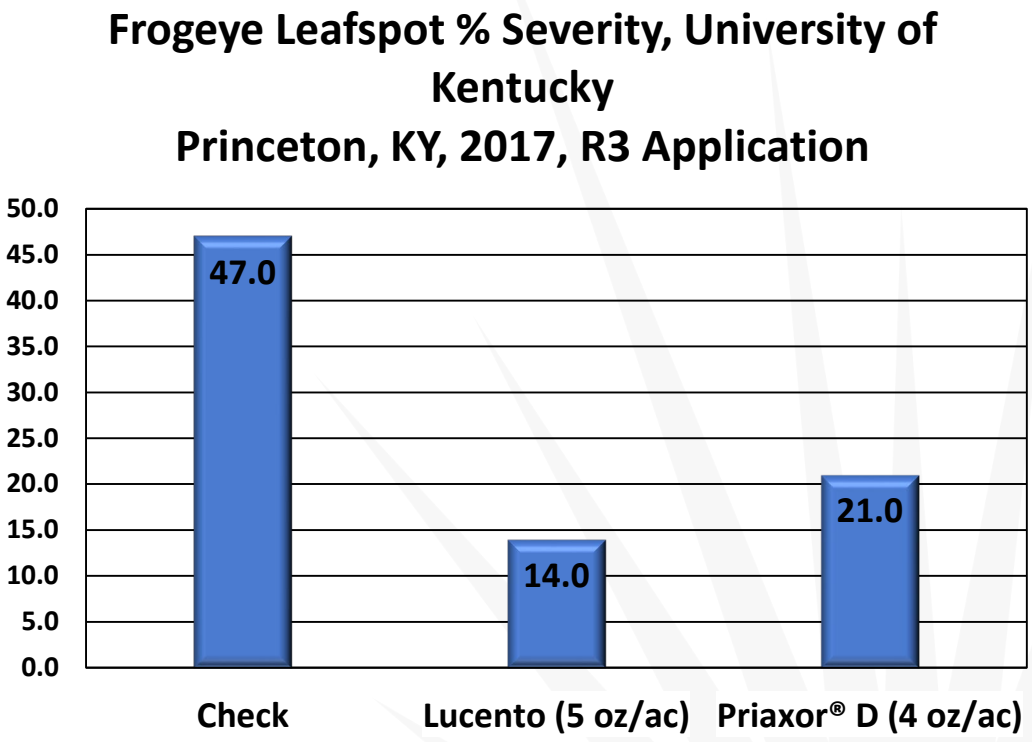
Corn	Soybean	Wheat	Peanuts
✓Gray Leaf Spot	✓Frogeye Leaf Spot	✓Powdery Mildew	✓White Mold
✓Common Rust	✓Asian Soybean Rust	✓Septoria	✓Stem Rot
✓Eye Spot	✓Septoria Brown Spot	✓Rust	✓Leaf Spot
✓Northern Corn Leaf Blight			
✓Southern Rust			

FMC

Frogeye Leaf Spot Control

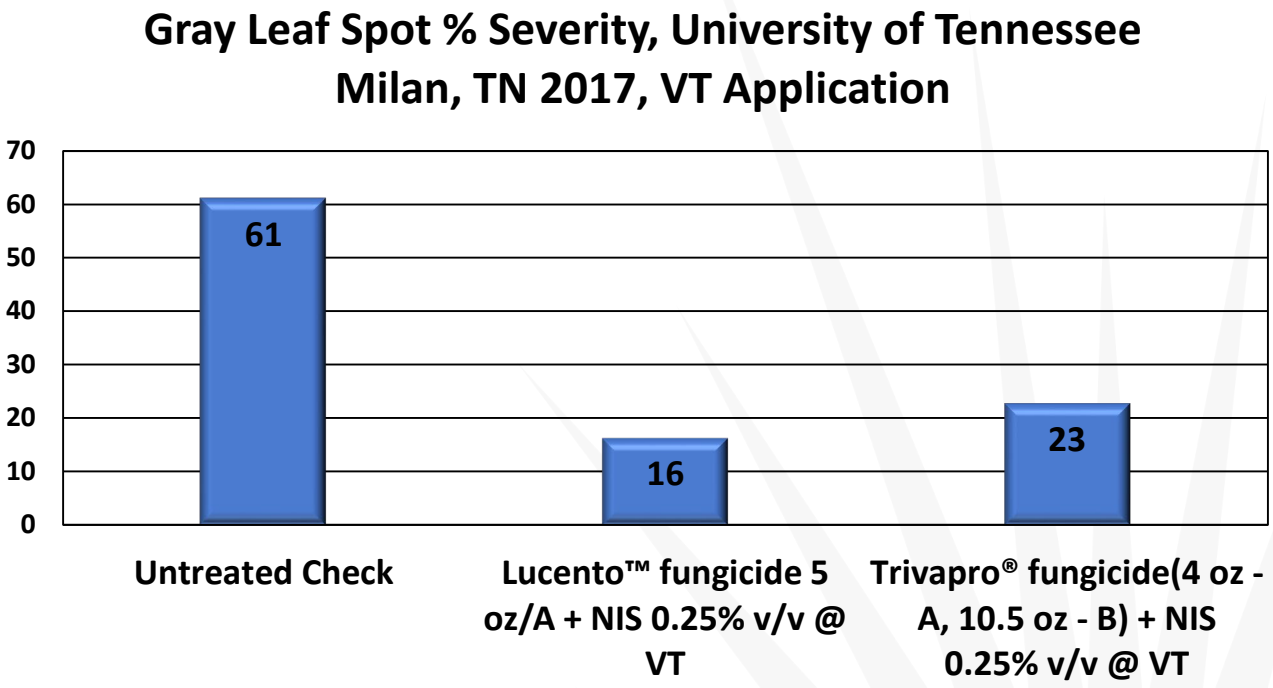
LUCENTO™ FUNGICIDE



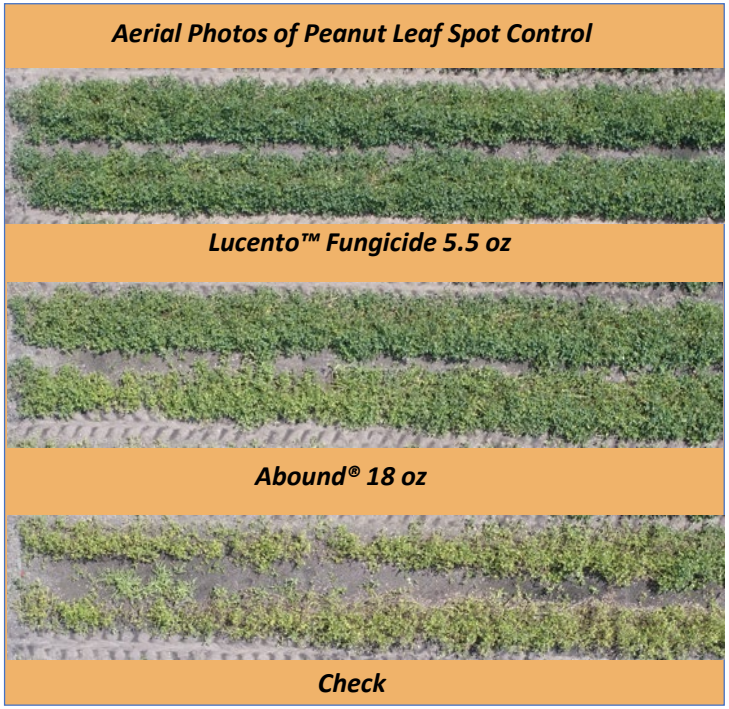


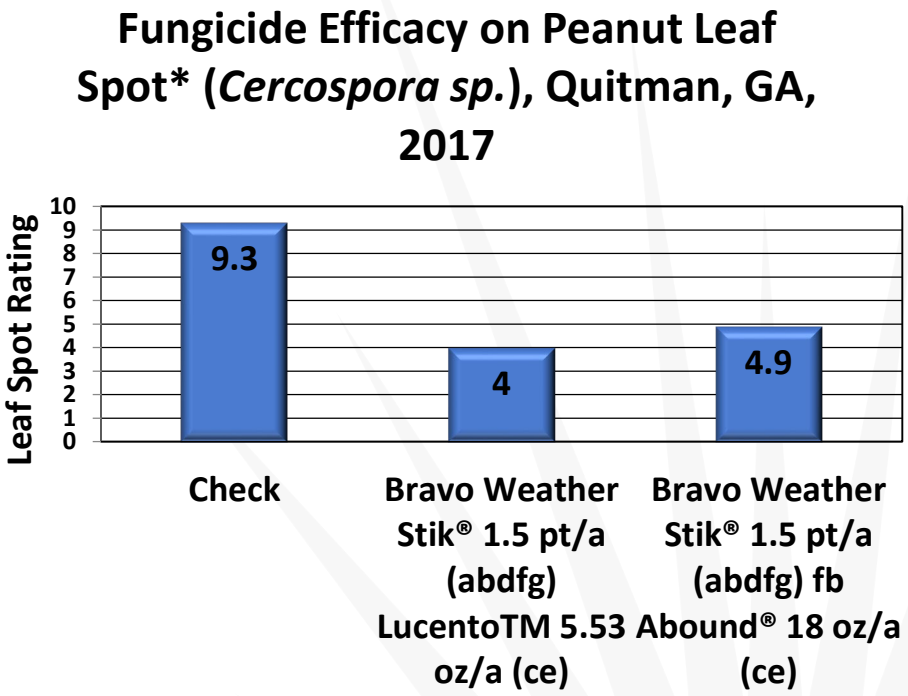
FMC

Gray Leaf Spot Control - Corn



Peanut Disease Control





*Disease severity measured on 1-10 scale; 1 = no severity, 10 = high severity

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GiSC Manages an Independent and Unbiased Data Collections Platform Built by Growers for Growers and Their Trusted Partners!

GiSC Does Not Sell Inputs or Advise Growers!

The GiSC Approach: A Data Cooperative for Growers, By Growers

Billy Tiller, CEO

Grower Information Services Cooperative | Lubbock, TX

Emerging Technology

GiSC, a farmer data cooperative, is an innovative and collaborative approach to bridge the information collection and data analysis gap in today's agriculture. Farm management ranges from broad field level to highly precision-managed--consultants must work with all. GiSC has tried to go "Beyond Precision Ag" and realized that details needed to analyze a field are usually missing. The basic elements (variety, plant date, etc.…) can be captured with independent and unbiased GiSC tools: AgHub, PaperRoute, or National Crop Registry for their records and to be shared with their advisors. Strategic partners include IBM and MainStreet Data.

Membership Benefits INCLUDED

GiSC
A Grower's Data Coop

$50.00
Monthly
Membership

IBM
Operations Dashboard With Watson Analytics & IBM-The Weather Co. (Addl. users-$20 each)

NCR
National Crop Registry - available for 2019

AgHub
Data collection & collaboration platform

Advocacy
Growers looking out for growers

News & Info
Grower's View
ag insights + news

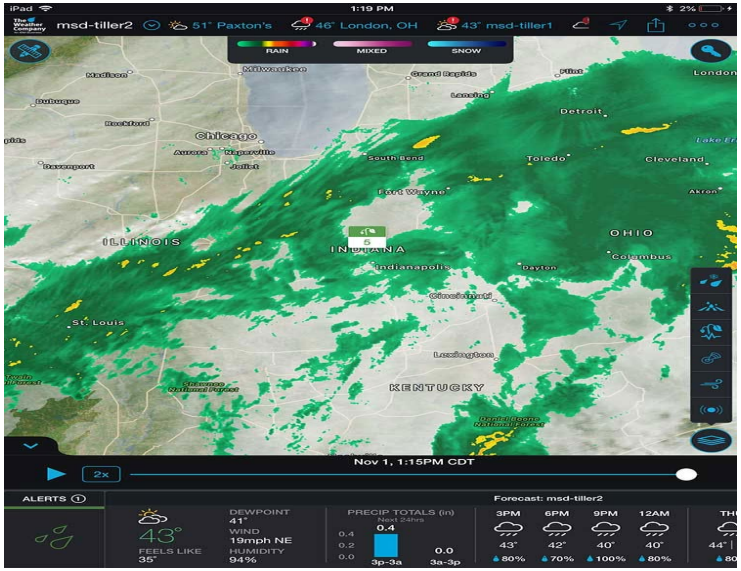
Exclusive Ag-Tech Tools

OPTIONAL ADD-ONS

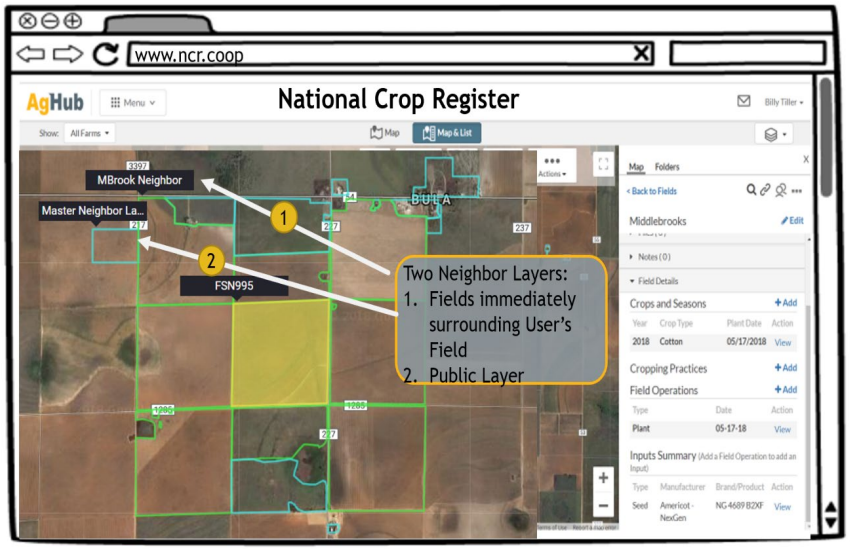
PaperRoute
Automated document management tool
$20.00/month
PaperRoute

MarketVision
Data-driven marketing advice
$100.00/month
available for 2019
MAINST DATA

VALIDATOR
Data-driven Production Benchmarks
5 Yr Analysis, '15 -'19,
$0.50/Acre/Yr
MAINST DATA



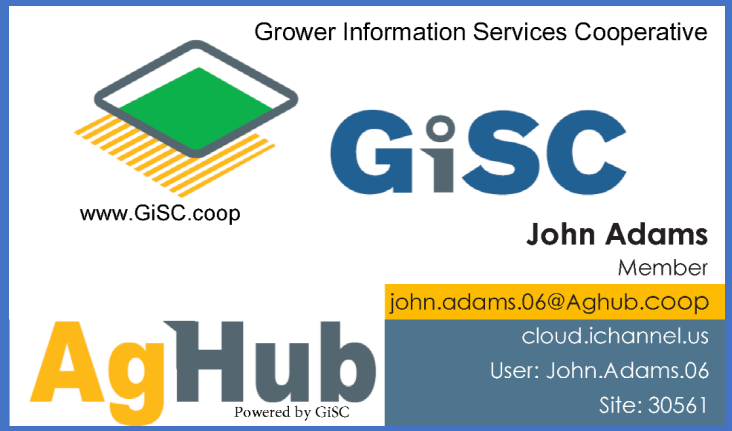
IBM Operations Dashboard



National Crop Register

PaperRoute

- Automated file collection and management tool Built on AgHub email account that every grower is issued
  - Common file structure for standardization
    - 27 Categories for Auto-Routing based on subject line.
    - All pdfs are Optical Character Recognition (seachable)
- GiSC provides a portal for the grower to share files with consultants at no cost!



Product and Platform Summary

- Products Bundled with Membership ($50/month)
  - National Crop Registry (Location and Identification)
  - IBM Operations Dashboard (Weather and Satellite)
  - AgHub (Any Farmer's Diary)

- GiSC PaperRoute ($20/month) (Organize the Madness!)

- Products from Main Street Data
  - MarketVision ($100/month) (Sell signals based on data science)
  - Validator ($0.85 /acre for 1 year or $0.50/acre/year for 5 years and must include 3 years in reverse) (Data Driven Benchmarking)
    - Money Back Guarantee in April of 2019 if not satisfied

www.GiSC.coop

GiSC

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Savannah, Georgia

Permeate: A New NPE-Free Non-Ionic Surfactant with UV Protection

WINFIELD® UNITED

Ryan Edwards*, Thomas A. Hayden, Greg K. Dahl,
Jo A. Gillilan, Lillian C. Magidow, Joe V. Gednalske,
Annie D. Makepeace

Permeate: A New NPE Free, Non-Ionic Surfactant AND WinField United Innovation Center Virtual Tour

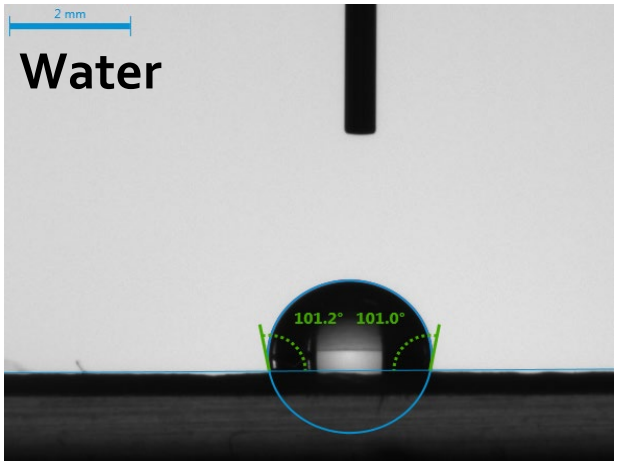
Ryan Edwards
Winfield United / 3336 Casey St, River Falls, WI 54022
Emerging and Evolving

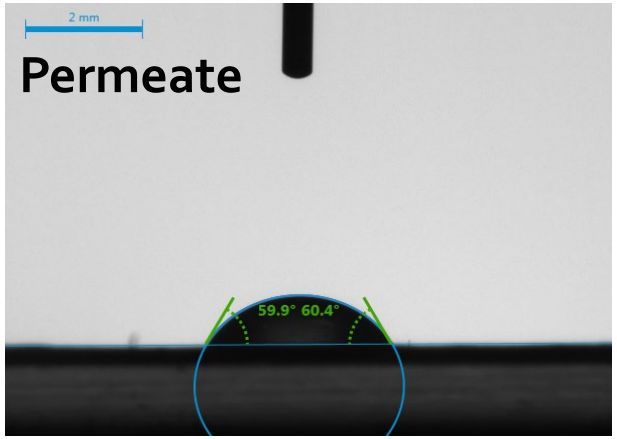
Introducing Permeate™ (NPE free, non-ionic surfactant-based adjuvant) from Winfield® United, a next generation surfactant that will help optimize application coverage. Permeate™ has been shown to maximize pesticide performance by improving droplet spreading through decreased contact angles with minimal expected crop injury. Permeate™ also provides patented UV protection, which protects herbicides, insecticides and fungicides from photo degradation. Permeate™ can be applied whenever a pesticide label allows for the addition of a non-ionic surfactant. The Winfield United Innovation Center features 21,000 ft^2 of lab space, 5,000 ft^2 of greenhouse space and one of the most advanced wind tunnels in the world.

Permeate™ (AG16134)

Adjuvant
NON-IONIC SURFACTANT

- **What is Permeate™:**
  - Permeate™ is a next generation non-ionic surfactant that will optimize application coverage.
  - It can be applied whenever a pesticide label allows for the addition of a non-ionic surfactant
- **Product Attributes:**
  - No NPE: NPE is not used in the Permeate formulation.
  - Droplet spreading and efficacy improvement: improves the contact angle of the spray solution for better coverage and surface area contact for improved pesticide activity.
  - UV Protection and odor control: patented UV protection prevents pesticides from photodegradation. May also suppress odors from pesticides





Permeate improves contact angle for droplet spreading and leaf coverage

USE RATE: 0.25% v/v or 1qt/100 gal

WINFIELD UNITED

Permeate™:
Why does this matter?

Adjuvant
NON-IONIC SURFACTANT

- **NPE (nonyl-phenol-ethoxylate):**
  - Contained in many NIS adjuvants
  - Shown to be a endocrine disruptor, estrogen mimic, carcinogen and environmental degradation issues
  - Prohibited in the EU
  - EPA supporting voluntary phase out in industry
- **Permeate is a greener chemistry:**
  - Permeate contains EM63
  - More bio-friendly compared to many other NIS containing NP9, which biodegrades into a estrogen mimicker

NPE linked to arrested ear in corn

WINFIELD UNITED

Permeate™:
Why does this matter?

Adjuvant
NON-IONIC SURFACTANT

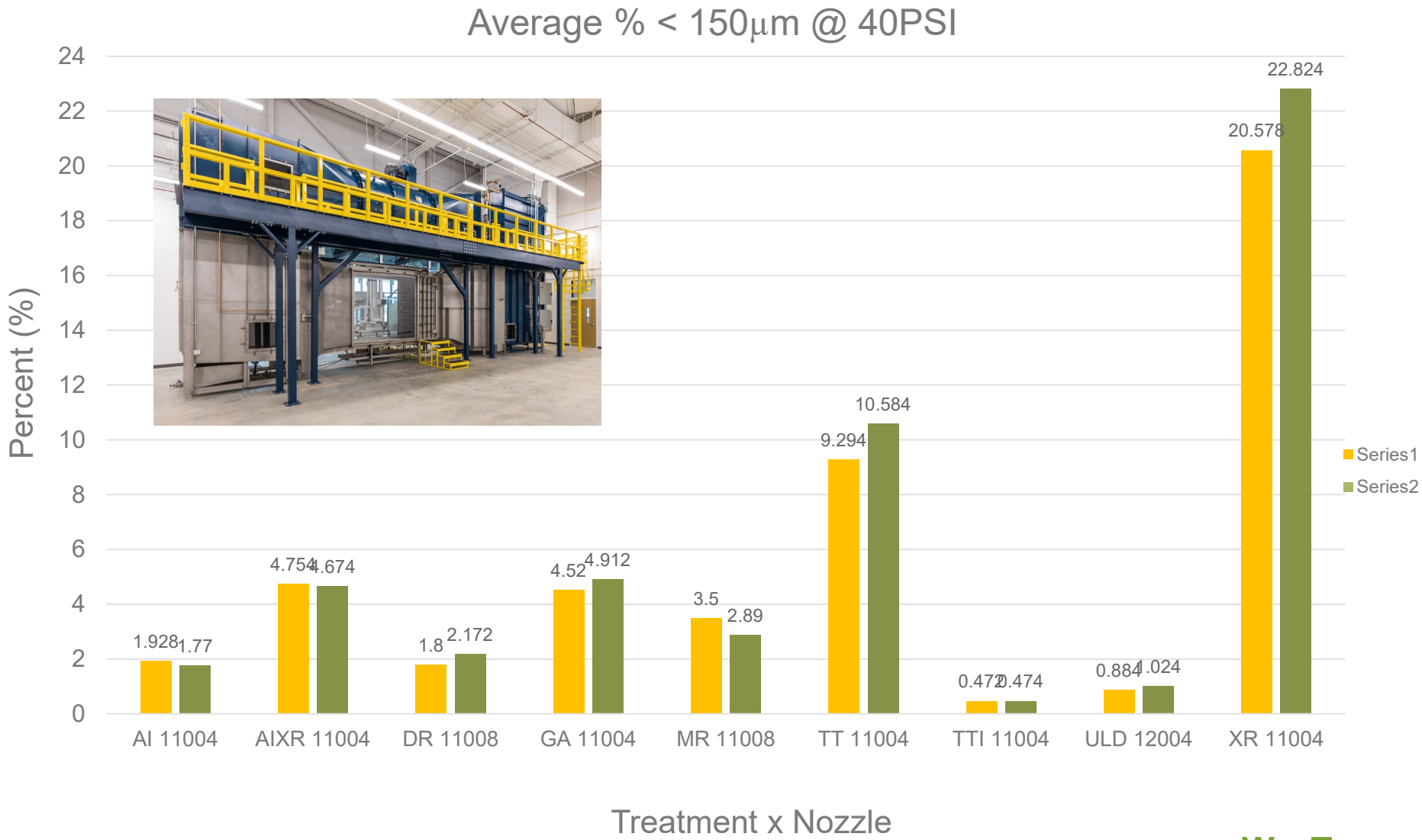
- How does permeate differ from Preference® ?
  - Same patented UV protection
  - Permeate is a greener chemistry (more bio-friendly compared to Preference®)
  - Permeate is more cold water stable than Preference®
  - Increased mixability with Permeate compared to Preference
  - Permeate is not combustible (Preference® has a lower flash point and is FLAMMABLE for transport)
  - Permeate positioned for new markets and geographies with it's greener attributes

	Herbicide Alone	Preference® 0.25% v/v
# Weed Species	45	47
# Trials	53	58
	Percentage Across all Comparisons	
Permeate Better	50	10
Permeate Equal	46	81
Permeate Worse	4	9

WinField United

Permeate ™: Overview

Adjuvant
NON-IONIC SURFACTANT



WINFIELD UNITED

EMERGING & EVOLVING TECHNOLOGY

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2019 NAICC Annual Meeting

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Savannah, Georgia

What's New in ARM 2019

Kyle D Kepner
Gylling Data Management, Inc. 426 3rd Street, Brookings, SD 57006

EVOLVING Technology

The ARM software version 2019 includes several major new features including repeated measures analysis, a sophisticated standard evaluation structure and enhanced tracking of trial progress. Highlights: Analyze repeated assessments across time to investigate the interaction between treatment and time effects. Graph treatment means over time to visually identify the impact of time on repeated assessments. Properly assign and structure standard evaluations within a protocol or trial, building a system of success for assessments across locations. Track the progress of ARM trials through new fields that record the dates of data entry of applications, crops and pests, and assessment data.

What is New in ARM 2019

Repeated Measures Analysis

- Assessments repeated at regular intervals during the trial season

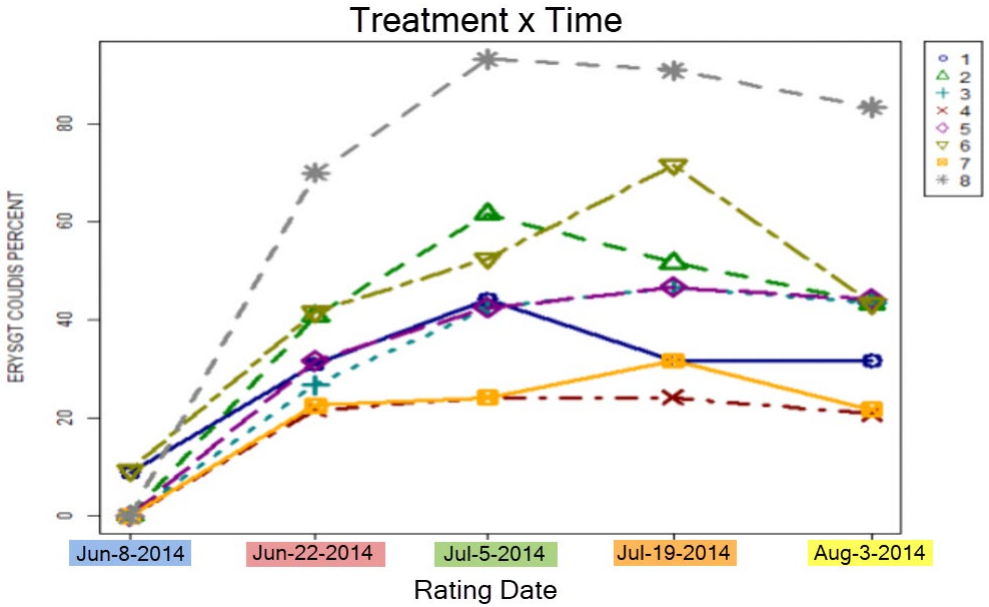
Assessment Data - Line 17

Column Number	1	2	3	4	5
Pest Name	Powdery mildew	Powdery mildew	Powdery mildew	Powdery mildew	Powdery mildew
Crop Name	Winter wheat	Winter wheat	Winter wheat	Winter wheat	Winter wheat
Rating Date	Jun-8-2014	Jun-22-2014	Jul-5-2014	Jul-19-2014	Aug-3-2014
Part Rated	PLANT P	PLANT P	PLANT P	PLANT P	PLANT P
Rating Type	COUDIS	COUDIS	COUDIS	COUDIS	COUDIS
Rating Unit	PERCENT	PERCENT	PERCENT	PERCENT	PERCENT
Trt-Eval Interval	38 DA-A	52 DA-A	65 DA-A	79 DA-A	94 DA-A

Sub	Rep	Blk	Col	Plot	Trt	1	2	3	4	5
1	1	1	1	101	1	10	30	45	30	30
1	1	1	2	102	2	0	40	60	50	45
1	1	1	3	103	3	0	25	40	45	45
1	1	1	4	104	4	0	20	25	25	20
1	1	1	5	105	5	0	30	40	45	45
1	1	1	6	106	6	10	40	50	70	45
1	1	1	7	107	7	0	25	25	30	20
1	1	1	8	108	8	0	70	90	90	85

Repeated Measures Analysis

- Powerful statistical report
- Provide an analysis of treatment means over time
- Determine if there is an overall time effect on the treatments' performance



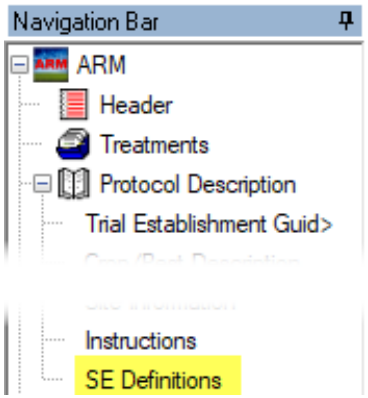
REPEATED MEASURES AOV For D ERYSGT Blumeria graminis tritici Powdery mildew of wheat TRZAW
PLANT P COUDIS PERCENT 1

Source	DF	Sum of Squares	Mean Square	F	Prob(F)	HSD (.05)	Variance
Total	220.0	[illegible]					
Replicate	5.0	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
Treatment	7.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Treatment Error	35.0	[illegible]	[illegible]				[illegible]
Rating Date	3.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Treatment x Rating Date	25.1	17909.441667	639.622917	117.821	0.0001	5.35	
Error/Residual	143.6	[illegible]	[illegible]				[illegible]

Powered by GDM

SE Definitions

Plan and define standard evaluations (SEs) and tasks to use in the study.



SE Definitions

Insert SE Definition with Shift+F7, Delete current SE Definition with Shift+F8

	1.		2.	
Assessment Timing	A1-A3		H1	
SE Name	F097_C2		Y085	
SE Description	% of infected leaves (N leaves). TIO[x]* (note: *x = column nb of infected leaves in F097A)		Fresh yield grain in kg / ... m2	
Part Assessed	LEAF		GRAIN	
Assessment Type	PESINC		WEIFRE	
Assessment Unit	%		KG	
Sample Size		LEAF		M2
Collection Basis		SHOOT	1	PLOT
Reporting Basis		LEAF		M2
Number of Subsamples				
ARM Action Codes	TIO[1]			
Pest Type, Code				
Crop Code				

Powered by GDM

Track Trial Progress

- New fields track the status and progress throughout the season
- Provides visibility and credibility to timely data entry

Assessment Data - Line 1		
Column Number	1	
Rating Date	Dec-10-2018	
Part Rated	LEAF	C
Rating Type	PHYGEN	
Rating Unit	%	
Data Entry Date	*Dec-18-2018*	
Trt-Eval Interval	7 DA-A	

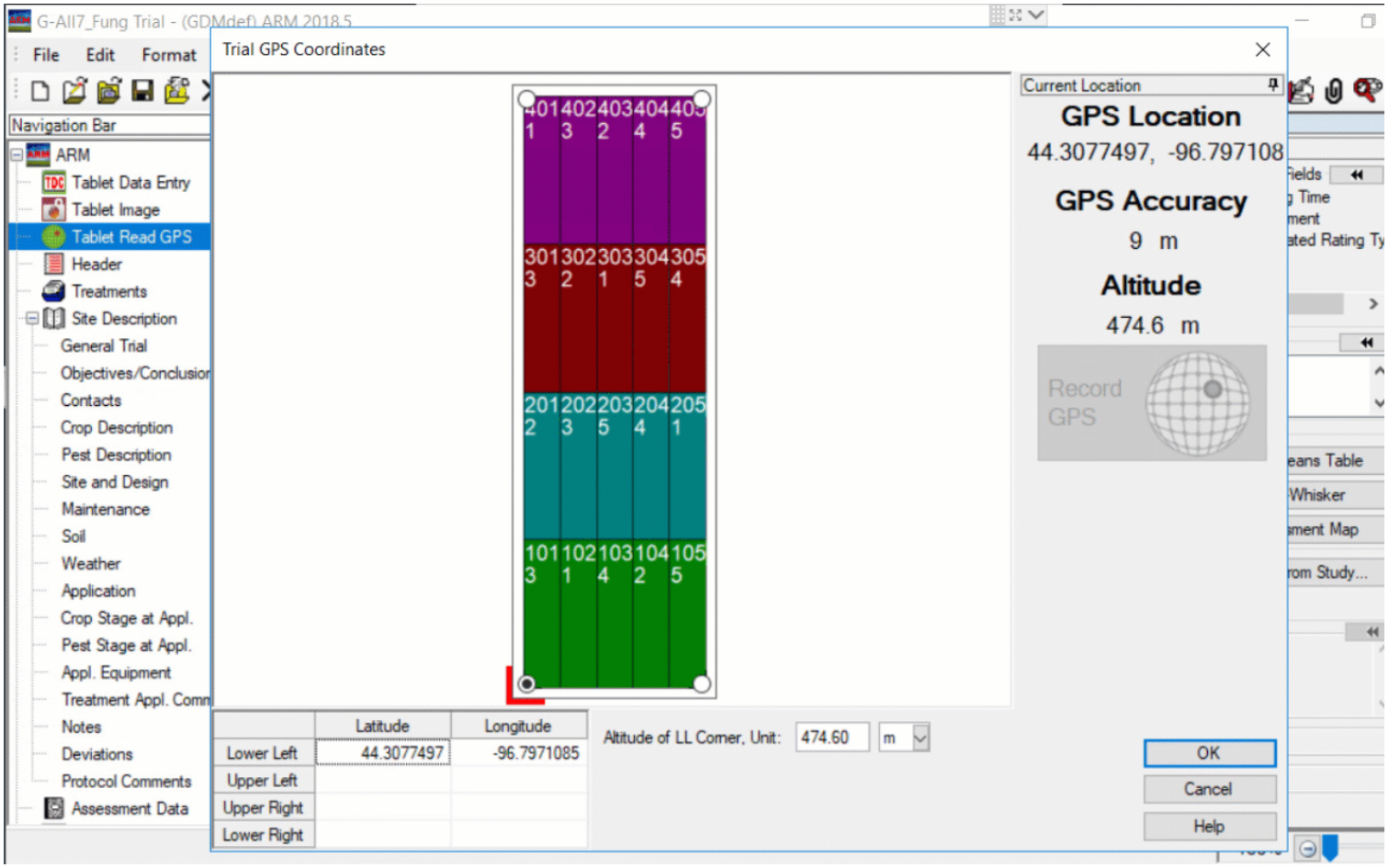
General Trial Information

Discipline:	H	*herbicide*
Trial Status:	E	*established*
Trial Usage/Type:	SCR	*Screening/Exploratory*
Initiation Date:	Sep-19-2018	

Data Location	
Trial Reliability:	
ARM Trial Created On:	*Sep-19-2018*
Planned Completion Date:	Aug-19-2019

Tablet Data Collector - Record GPS

Display the current position information in real-time



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Indigo Microbial Seed Treatments

Harnessing Nature to help Farmers Sustainably Feed the Planet

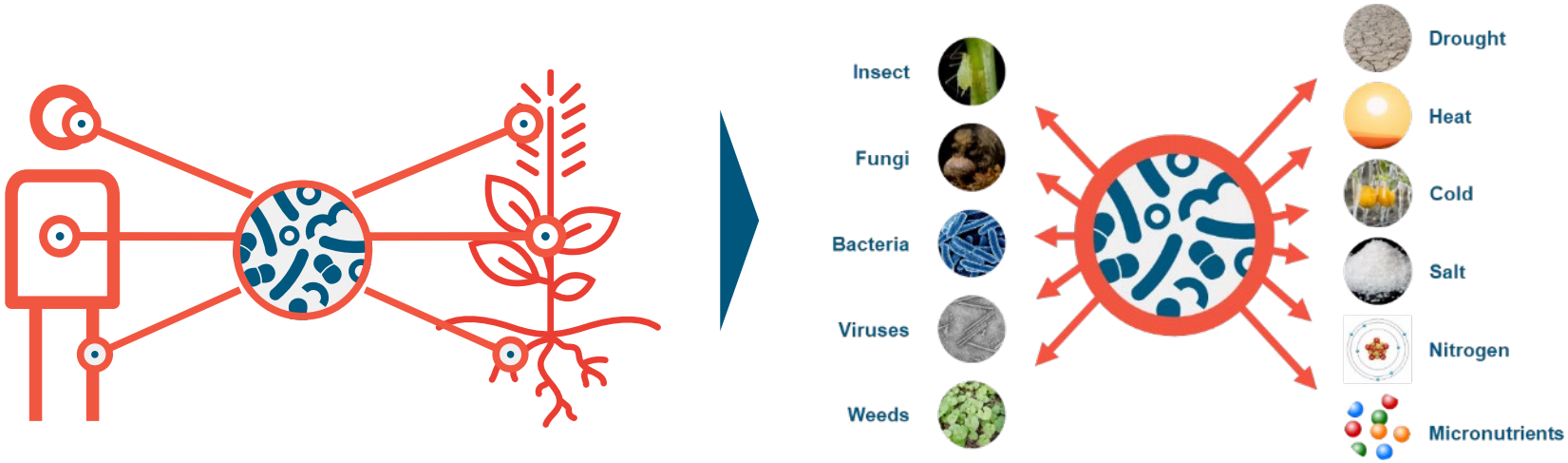
Chandler Mazour

Indigo Ag, 175 Toyota Plaza, Suite 400, Memphis, TN 38103

Emerging Technology

Like humans, plants have microbiomes, which are found on leaves, soil, and inside the plant itself. The microbes found inside plants work in harmony with the plant to fight diseases, increase nutrient intake, and improve water use efficiency. However, plant microbes can be impacted by their environment, including heat and drought, chemicals, and even soil conditions. Indigo identifies which of these microbes are most beneficial to a plant's health through application of algorithms and machine learning. Our resulting seed treatment products complement the plant's natural process to improve health and development across each phase of life, while boosting crop yields.

Like humans, plants also have microbes within them, and those microbes also impact their ability to fight stress



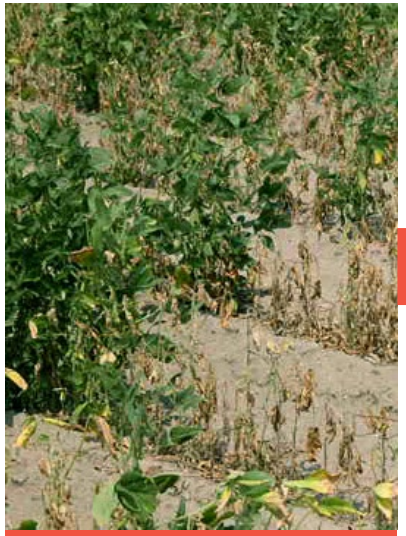
We source our microbes from nature, identifying plants that are thriving in stressed conditions

We collect microbes from elite germplasm grown under stress conditions around the country and under true field conditions

This allows us bring thousands of microbes into our R&D pipeline

Black Cutworm Stressed Corn

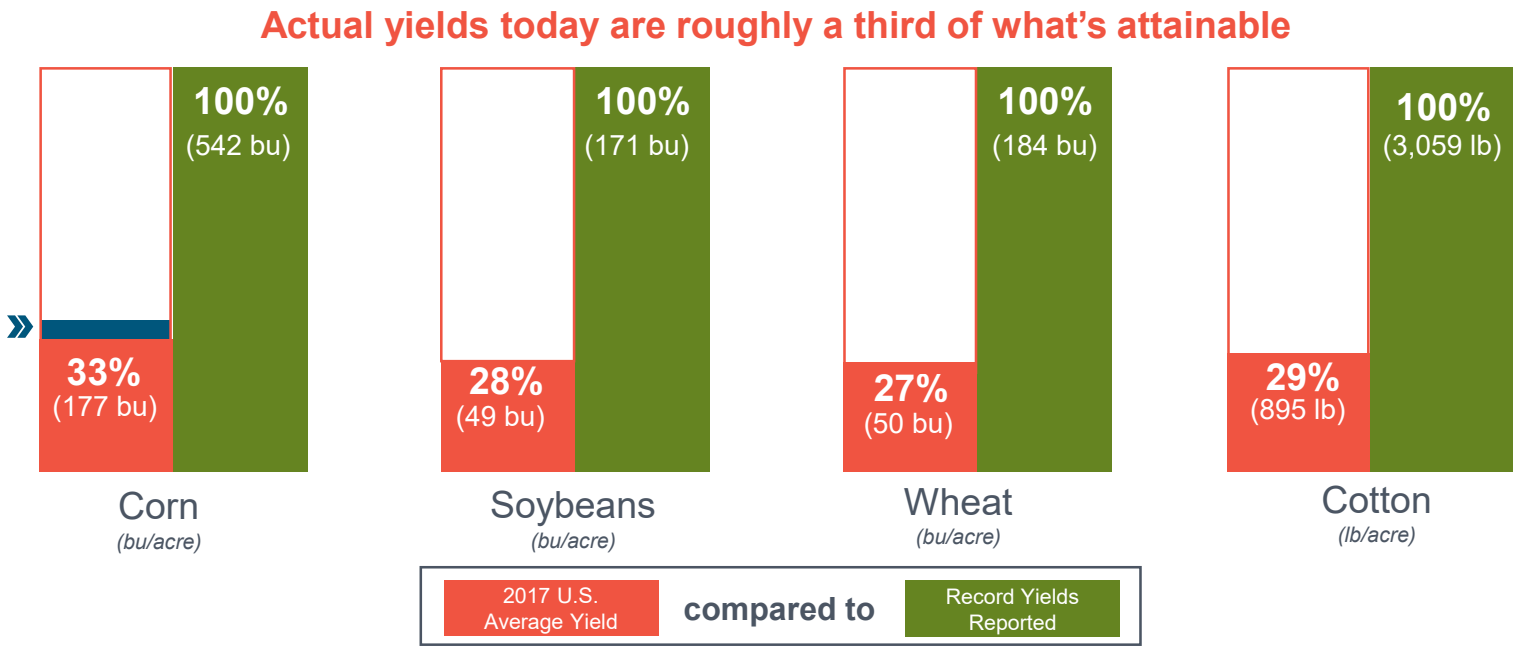
Verticillium Wilt Stressed Cotton



Drought Stressed Soybeans

We're constantly improving our products by targeting the biggest drivers of yield drag

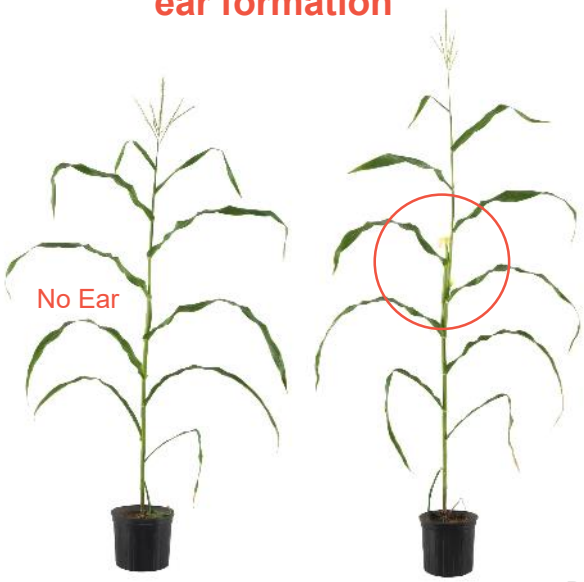
A **10% yield uplift** brings us to only 36% of potential. We're constantly improving our product to reduce this gap by targeting the biggest drivers of yield drag.



Record yield data from commercial growers competing in recent nationwide and state-level yield contest
Corn. USDA 2017 Average U.S. Yield Compared to Charles City, Virginia-based Winner of 2017 National Corn Growers Association Yield Contest. Pioneer P1197AM, No-Till/Strip-Till Irrigated category.
Soybeans. USDA 2017 Average U.S. Yield Compared to Brooks County, Georgia-based Winner of 2016 Georgia Soybean Production Contest. UniSouth Genetics 74A74.
Cotton. USDA 2017 Average U.S. Yield Compared to Lakeview, Texas-based Winner of 2016 Bayer FiberMax Yield Contest.
Wheat: USDA 2017 Average U.S. Yield Compared to Adams County, Washington-based Winner of 2017 National Association of Wheat Growers Yield Contest. Limagrain Jet..

Indigo Corn™ demonstrates greater biomass, earlier ear formation and improved N utilization

Earlier ear formation



Untreated

indigo

Increased leaf nitrogen content*

46% Increase in dry root biomass

6% Yield increase in water stress

Earlier ear formation

27% Increase in leaves per plant

Increase in dry root biomass

Untreated

indigo

Root Biomass increases observed in 3wk old plants at >80% Bayesian confidence level, N = 10
Leaf count increase observed in 7wk old plants at >80% Bayesian confidence level, N = 13
Ear formation is from visual inspection of 3 replications
*Early results indicate effect – field trials in process to confirm effectiveness

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MCCruise Supports Precise Speed Control in Autonomous ATVs & Side-By-Sides
- Current Projects

New Technology
From
MotorCycle Cruise Controls
Australia

Precise Speed Control is a Game-Changer in Continuous, Slow-Speed Applications using ATVs and Side-By-Sides

Tony Guymer
Director, MotorCycle Cruise Controls
6 Kingston St, Mount Waverley, Victoria, 3149 AUSTRALIA
Ph +613 9808 2804
Fax +613 9808 2445
Email: sales@mccruise.com
Web Site: www.mccruise.com

EVOLVING Technology

Applying the right amount of consumable, at precisely the right speed over extended periods of time and terrain- with repeatable accuracy, is vital for both mainstream agricultural applications and Ag Research. MotorCycle Cruise Controls has been delivering ergonomic, economic and environmental benefits to key players in Ag Research for over a decade using their precision speed controls on ATVs - called QuadCruise.

The imminent release of the all-new Throttle-By-Wire QuadCruise for the Polaris Ranger XP1000 looks set to enhance market penetration in North America in particular. Concurrently, MCCruise' sophisticated Speed Limiter and all-new Bluetooth Phone App were installed and reviewed.

MCCruise – precision cruise control for high power to weight ratio vehicles

- Software and hardware, developed in-house, has evolved over twenty years
- Fully tested - product has been in production and in the field since 1999
- Longevity – product sold in 2000 is still operational in many cases
- Accuracy – contract sprayers in Australia indicate the purchase and installation costs are recovered consumable savings in only six weeks of continuous operation
- Documentation and Support – MCCruise offers world-class documentation for their products, intelligent software for setup and fault diagnosis and unbeatable technical support

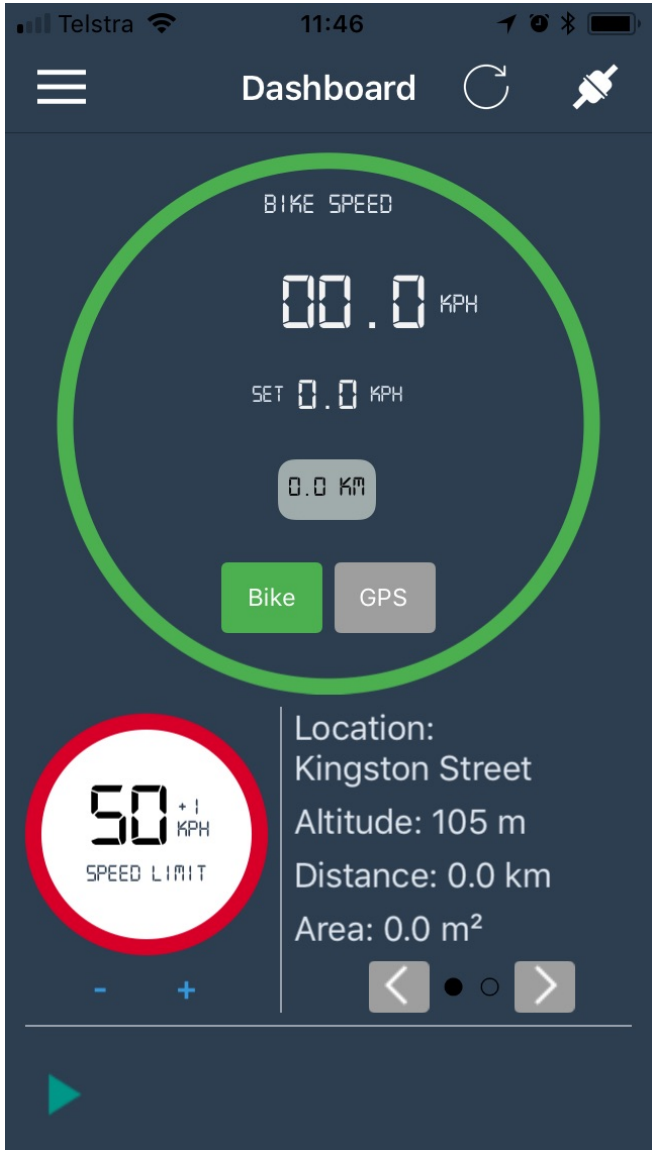
- Delivering smooth, precise speed control on high power to weight ratio vehicles like ATVs and Side-By-Sides is far from trivial
- QuadCruise provides the perfect platform for development of autonomous agricultural (and other) vehicles, by-passing the need for speed control development, minimizing development time and costs and thereby maximising productivity

AgJunction Project

- ***MCCruise*** controls the speed
- ***MCCruise*** is CanBus controlled
- CanBus settings are flexible

Davis University Project

- ***MCCruise*** controls the Honda TRX420 ATV's speed
- Bluetooth speed control comes from the ***MCCruise*** Phone App.



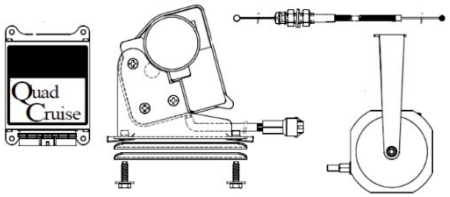
James Cook University Project

- ***MCCruise*** controls the speed

Acceleration

Implemented MCCruise's YFM700 QuadCruise for acceleration control. [11]

- Provides pushbutton cruise control for manual operation.
- Allows interfacing with electronic signal for autonomous control.



[11] Liam Woods, "Accelerator Control System," *Honours Thesis*, James Cook University, Townsville, Australia, 2018.

Project overview

2017	2018	2019	2020
Proof of concept	Manned prototype	Remotely controllable	Fully autonomous

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Bio-Solutions Product Update by Isagro USA, Inc.

Julie Miranda Longland

17 January 2019

2019 NAICC

Annual Meeting

BIO-SOLUTIONS PRODUCT UPDATE BY ISAGRO USA, INC.

Julie Miranda Longland
Isagro USA, Inc., 430 Davis Drive, Suite 240, Morrisville, North Carolina, 27560.

Evolving Technology

Isagro USA (http://www.isagro-usa.com/) has been focused on developing and growing its bio-solutions portfolio designed to serve growers seeking to meet consumer demand for more natural and organic food production. The proprietary portfolio has been expanding with products that can fit within an integrated pest management (IPM) approach such as DOMINUS®, a broad-spectrum soil biofumigant; BIO-TAM® 2.0, an OMRI-listed biorational fungicide on fruit and vegetable crops; SPEAR® T, a bio-insecticide for greenhouse vegetables and ornamentals; and VENTUS™, a foliar fungicide with broad spectrum control.

BIO-TAM® 2.0 bio-fungicide

- BIO-TAM 2.0 is the next generation bio-fungicide used in the management of soil-borne diseases.
- Active ingredients: combination of *Trichoderma asperellum* (ICC 012) and *Trichoderma gamsii* (ICC 080), working in broader temperature range
- Crops include: vegetables, fruits, turf, ornamentals, herbs, and row crops
- BIO-TAM® 2.0 can be applied through conventional spray equipment and irrigation systems
  - Field rates: 2.5-5.0 lbs/a
  - Greenhouse rates: 2.5-7.5 oz./100 gal
- OMRI listed for organic production
- REI: 4 hours
- PHI: 0 days

ISAGRO USA

VENTUS™ fungicide

- VENTUS™ is a combination of a systemic and a contact fungicide that provide broad spectrum control of foliar plant pathogens.
- Active ingredients: tetraconazole (5.31%) + chlorothalonil (21.22%)
- Crops include: soybean, peanut, corn, cucurbits, and fruiting vegetables
- Spectrum includes: anthracnose, leaf spots, powdery mildew, downy mildew, Septoria, rust
- Use as an IPM rotational partner for conventional and biological products
- Rainfast 2 hours after application
- REI: 12 hours

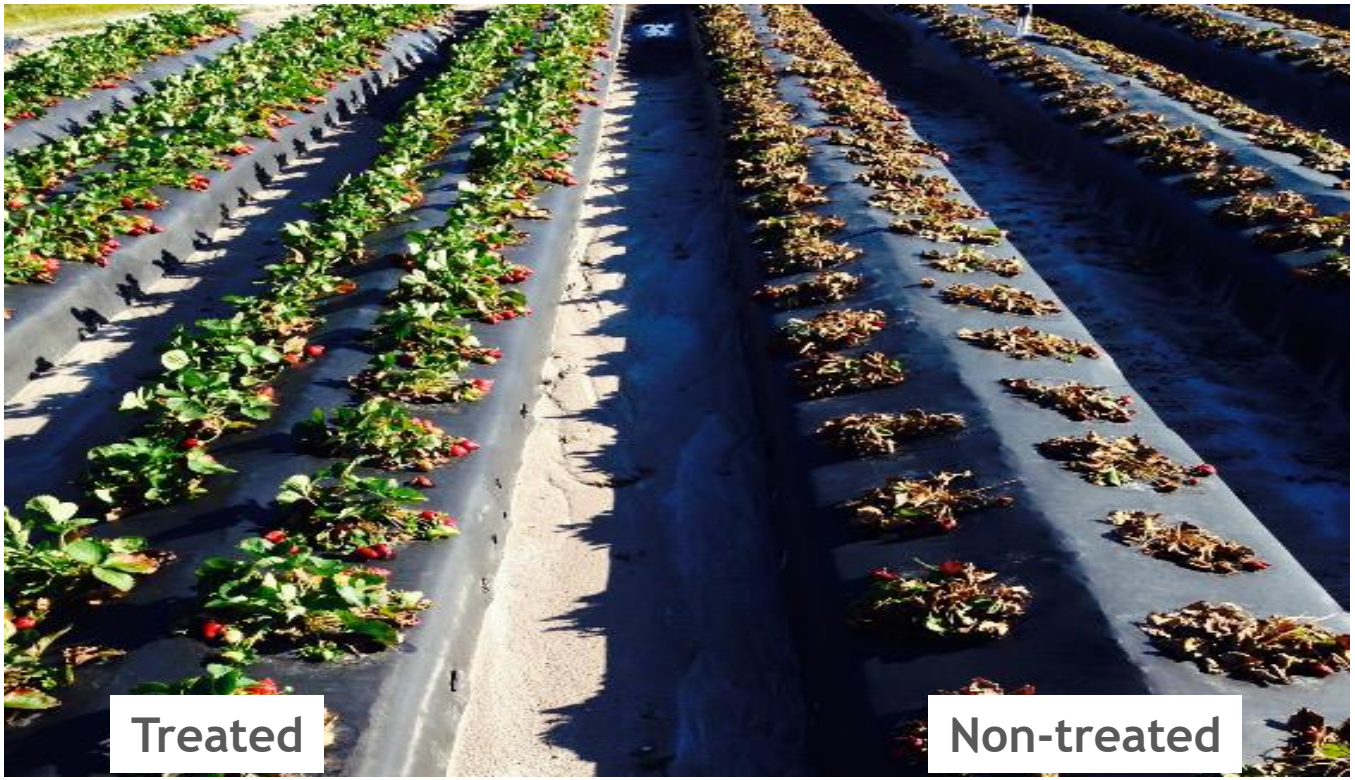
ISAGRO USA

DOMINUS® bio-fumigant

- DOMINUS® is a biologically-based soil treatment that effectively controls soil-borne fungi, nematodes, weeds, and insects.
- Active ingredient: 96% allyl isothiocyanate (AITC), a synthetically produced biopesticide based upon a naturally occurring, plant-derived chemical defense mechanism commonly found in the Brassicaceae family
- Apply using conventional soil injection methods and equipment at pre-plant and postharvest field crop termination.
- Wide range of crops: fruits, vegetables, turf, ornamentals
- Registered by US EPA in 2013 as a biopesticide
- MRLs: Tolerance Exemption
- REI: 5 days
- Environmentally-favorable profile

ISAGRO USA

Crop termination application of DOMINUS®
Nematodes and soil diseases in strawberry



Please visit us at http://www.isagro-usa.com/

ISAGRO USA

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STONE ENVIRONMENTAL

Farm-P Reduction Planner (Farm-PREP) A Web Based Tool for Optimizing Field Agronomic Practices for Farm Water Quality Improvements

2019-01-17

Barbara Patterson

NAICC 2019 Annual Meeting

A New Tool for Quantifying the Environmental Benefits of Producer Conservation Practices

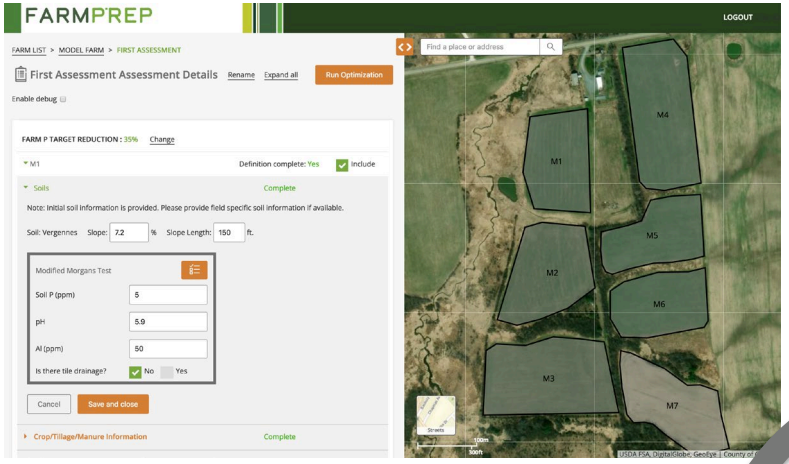
Kim Watson

Stone Environmental

EVOLVING Technology

The Farm-P (phosphorous) Reduction Planner (Farm-PREP) represents a monumental leap forward in the technology available to crop consultants for evaluation of the environmental benefits provided by their producer's conservation practices. This web-based technology utilizes the USDA's state-of-the-art Agricultural Policy/Environmental eXtender model (APEX) to optimize field-level agronomic practices to achieve a farm-scale water quality improvement objective. Users provide current crop rotations and agronomic practices, and Farm-PREP generates model simulations of multiple combinations of field practices to arrive at a farm-level plan that meets pre-determined farm phosphorous reduction targets. Farm-PREP provides a consistent, defensible approach to decision-making and quantifying environmental sustainability benefits.

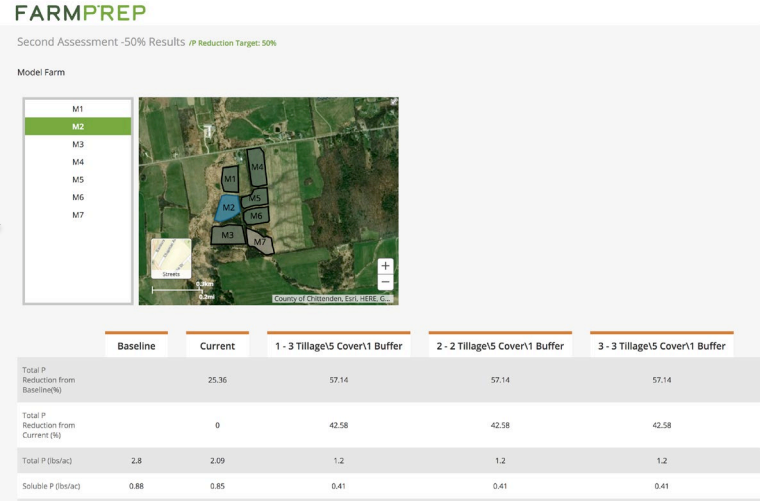
Farm-PREP's Integration with USDA's APEX Model



APEX

Agricultural Policy Environmental eXtender model

Optimization algorithm to meet Farm P reduction targets



	Baseline	Current	1 - 3 Tillage\5 Cover\1 Buffer	2 - 2 Tillage\5 Cover\1 Buffer	3 - 3 Tillage\5 Cover\1 Buffer
Total P Reduction from Baseline(%)		25.36	57.14	57.14	57.14
Total P Reduction from Current (%)		0	42.58	42.58	42.58
Total P (lbs/ac)	2.8	2.09	1.2	1.2	1.2
Soluble P (lbs/ac)	0.88	0.85	0.41	0.41	0.41

Easy Creation or Upload of Farm Fields

FARMP'REP

Welcome admin | LOGOUT

FARM LIST > MODEL FARM

Model Farm

Delete farm Return to Farm List >>

FIELD LIST

Upload Fields Add field

M1	View in map	Rename	Delete
M2	View in map	Rename	Delete
M3	View in map	Rename	Delete
M4	View in map	Rename	Delete
M5	View in map	Rename	Delete
M6	View in map	Rename	Delete
M7	View in map	Rename	Delete

ASSESSMENTS

Add Assessment

Assessment	P Target Reduction	Status	Action
First Assessment	35%	Complete	Results Duplicate Delete Debug
Second Assessment -50%	50%	Complete	Results Duplicate Delete Debug
Second Assessment -70%	70%	Complete	Results Duplicate Delete Debug

STONE ENVIRONMENTAL

Fast, Intuitive Data Entry of Farm Operations and Practices

Crop/Tillage/Manure Information — Complete

Select agronomic practices associated with the primary crop in rotation:

Crop: Corn silage — Years in Rotation: 4

Operations Information — Clear form

Spring Operations		Fall Operations	
Tillage	Reduced	Tillage	Reduced
Manure Application Method	None	Manure Application Method	Incorporated
Manure Application Rate (lbs P_2O_5/ac)		Manure Application Rate (lbs P_2O_5/ac)	54
Commercial P Fert (lbs P_2O_5/ac)		Cover Crop Variety	None
Commercial N Fert (lbs N/ac)	135	Cover Crop Planting Date	None

Field Level Results and Comparison of Scenarios

	Baseline	Current	1 - 3 Tillage\5 Cover\1 Buffer
Total P Reduction from Baseline(%)		25.36	57.14
Total P Reduction from Current (%)		0	42.58
Total P (lbs/ac)	2.8	2.09	1.2
Soluble P (lbs/ac)	0.88	0.85	0.41
Sediment P (lbs/ac)	1.92	1.24	0.79
Tile P (lbs/ac)	0	0	0
P Input Reduction (%)	0	0	0
Crops/Tillage/Manure			
Crop	Corn silage: 4 years	Corn silage: 4 years	Corn silage: 4 years
Tillage	Conventional and Reduced\Reduced	Conventional and Reduced\Reduced	Reduced\None
Row Crop Spring Manure Application	None	None	None
Row Crop Spring Manure Rate (lbs P_2O_5/ac)	--	--	--
Row Crop Fall Manure Application	Incorporated	Incorporated	Surface

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Emerging & Evolving Technology

National Alliance of Independent Crop Consultants

Savannah, GA.
January 17, 2019

Spear-T
Spear- Leprotec

Vestaron Corporation
Tim Ksander
VP, Product Development

Email: tksander@Vestaron.com
Cell: 530 218 5208

Spear® Peptide Technology for Insect Management

Tim Ksander, VP Product Development

Vestaron, 4717 Campus Drive, Kalamazoo, MI 49008

EMERGING Technology

Vestaron is dedicated to improving the safety, efficacy and sustainability of crop protection through migration from chemical pesticides to biological peptides. Chemical pesticides provide great efficacy, but can also have downsides. Such as environmental damage, harm to beneficial's, safety concerns to consumers and farm labor. As well as, increasing development costs, late stage failures and increasing regulatory hurdles. Vestaron has overcome these concerns by developing a new class of compounds with a new MOA starting with their Spear® peptide technology. Two new products have just recently been registered for use in greenhouses and another showing synergy with Bt for field use against Lepidopterans.

The Power of Synthetics
The Safety and Sustainability of Biologicals.

A Shift Is Needed in Crop Protection

Chemical pesticides provide great efficacy, but can also have downsides:

Environmental damage

Harm to beneficial insects

Safety issues for consumers and field labor

It is increasingly difficult to commercialize new chemical active ingredients:

Increasing development costs

Late stage failures

Increasing regulatory hurdles

Existing solutions are facing resistance challenges

Peptides Are The Answer

Safe

…for humans and mammals

…for fish and birds

…for beneficial insects

No pre-harvest interval

Sustainable

Renewable

Environmentally friendly

Enabling sustainable ag through rescue of Bt

Same efficacy as small molecule synthetics

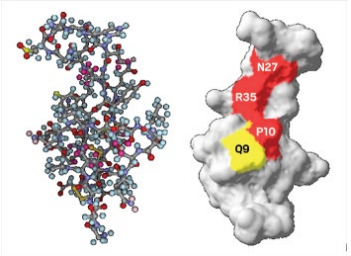
Chemical interaction of peptide and target

May be harder for resistance to develop

Larger binding site may mean that single point mutations are insufficient to generate resistance

The Power of Synthetics
The Safety and Sustainability of Biologicals.

Our First Product Family

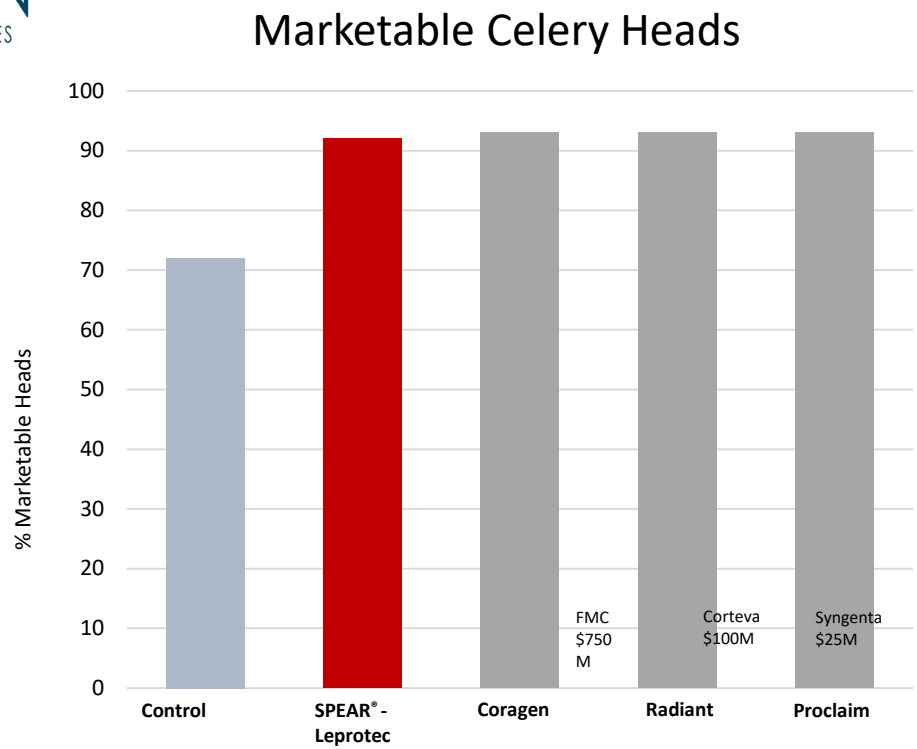


- Natural ICK-type peptide, 40 amino acid, new mode-of-action
- IRAC Code 32
- Broad pest spectrum (Contact and Ingestion)
- Designed to be safe for humans, mammals, birds, fish, honeybees & Beneficial's
- Certified sustainable
- 0 days Pre-harvest interval, 4 hours re-entry interval
- No phytotoxicity observed, no toxic residues (MRL)

Greenhouse version SPEAR®-T launched in July 2018

Field version Spear®-Leprotec available in Q1/2019

Spear®-Leprotec
Head-to-Head with Synthetics on Celery



- 3 consecutive sprays with SPEAR®-Leprotec or industry standards at label rates followed by harvest and evaluation of marketable heads.
- Primary pest – Beet Armyworm

Arizona Grower Trial

Spear-Leprotec = Spear + Btk

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How to Scale Your Agronomy Business with Advisor Prime

Elliott Marsh, North America Sales Manager, Trimble Ag Software

1-800-282-4103 or TABS_Sales@Trimble.com

How to Scale Your Agronomy Business with Advisor Prime

Megan Belohrad

Trimble
10368 Westmoor Dr
Westminster, CO 80021

Evolving Technology

One of the biggest challenges facing ag professionals today is moving data between software platforms, adjusting or creating large volumes of prescriptions, and sharing data back with their farmer customers. Advisor Prime is an evolving technology that simplifies workflows for zone creation and prescription management, allowing ag professionals to scale their business.

Pain Points Preventing Business Growth

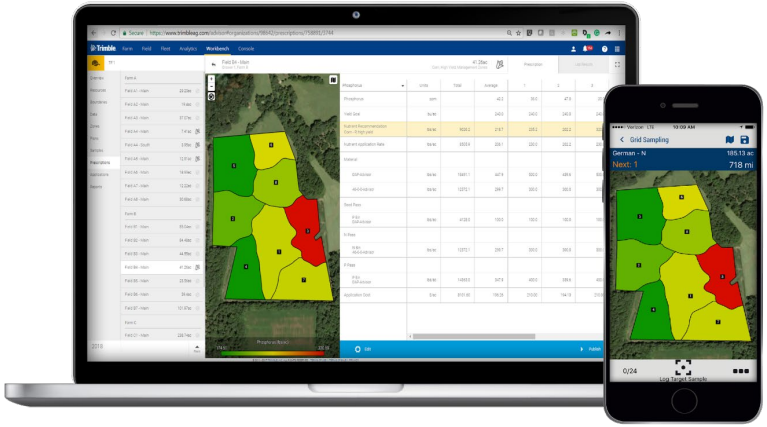
- **Proving an ROI to your customers:** They want to know how using software will save them money.
- **Time spent on managing data:** I have to collect 250 samples today! How can I get anything else done?
- **Repetitive processes:** Doing the same steps in each farm and field is time-consuming.
- **Software lacks flexibility for my business:** The software you're using now isn't perfect, but you aren't sure what other options are out there. Or, you aren't using software and want to start!

3 Ways to Scale Your Crop Advisor Business

- Show them why and how to track their expenses so you can demonstrate a return on investment.
- Don’t get stuck doing the same things over and over. Let software automate repetitive processes like formulas and prescriptions.
- Expand your office into the field – don't be limited to doing office work at a desktop computer at the end of the day.

Advisor Prime Key Features

- Manage client data online from any location, anytime
- Process yield data with yield cleaning tool
- Create management zones and prescriptions with flexible configuration parameters by field or batch
- Eliminate data entry errors associated with repetitive field-by-field procedure



Key Takeaways

Track expenses. Know how much they're spending, where, and use planning and budgeting tools to make adjustments.

Use software to allow you to do repetitive processes only once and then share that data across all of your growers.

Don't wait to create records. No need to jot notes and enter them in a computer later. Use the mobile app and online platforms and sync data to easily access records no matter where you are.

EMERGING & EVOLVING TECHNOLOGY

NAICC

2019 NAICC Annual Meeting

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www.my-ecobiome.com

INNOVATE AND DISCOVER®

EcoBiome Innovation Center™ is Sentinel's innovative environmental microbiology service testing lab that utilizes the EcoBiome Platform to characterize and identify all microorganisms from any environmental sample.

There is a microorganism for every nutrient and mineral in the soil.

Integrating EcoBiome science into your program will ensure lasting superior innovation and results!

WHAT THE ECOBIOME OFFERS THAT NO OTHER TESTING SERVICE CAN

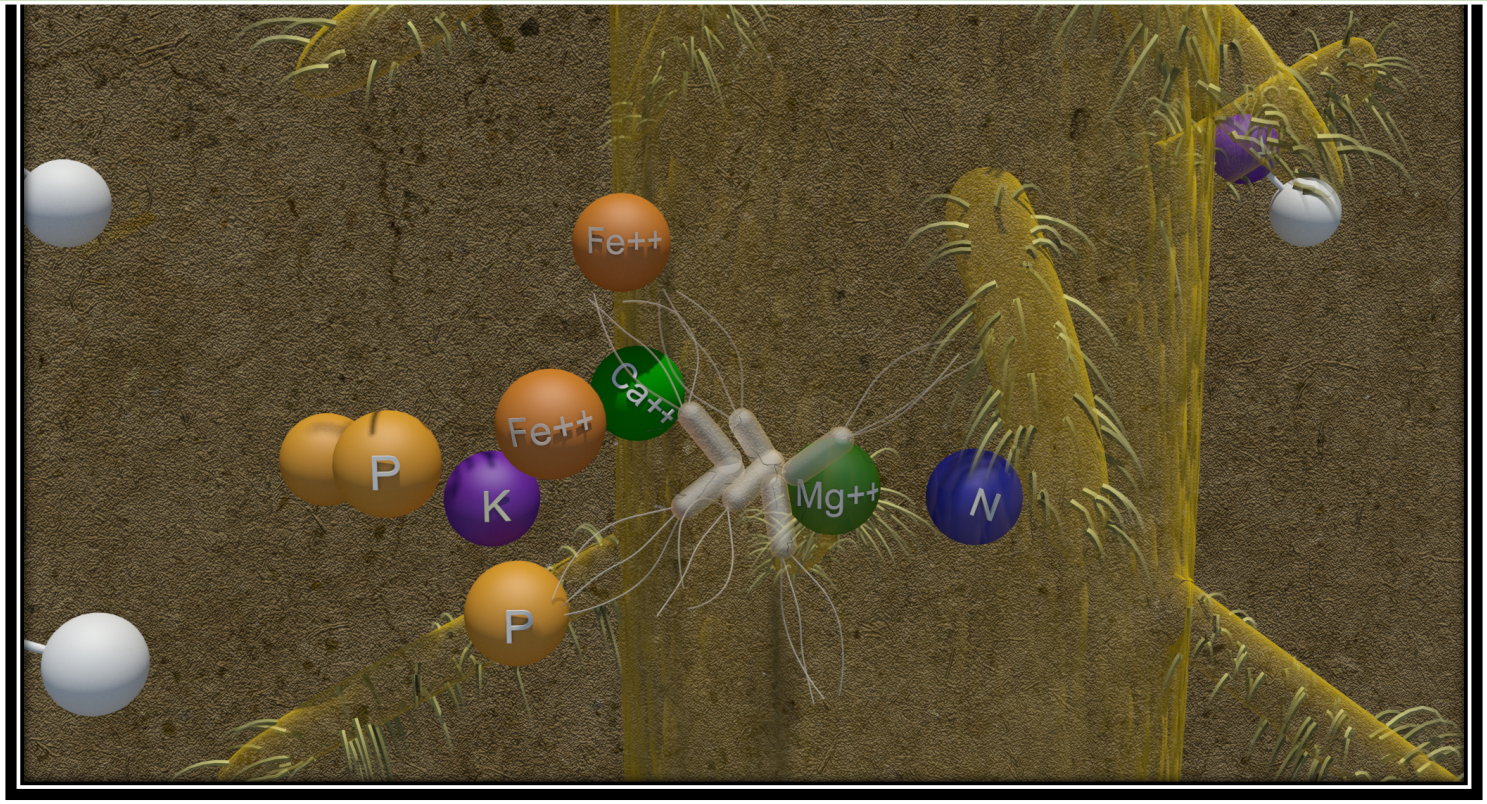
Currently, only 5% of all microorganisms from the environment can be cultured and identified – an issue termed the "Great Plate Count Anomaly". As a result, over 95% of all microorganisms have yet to be cultured and identified that can be critical to solving major industrial and medicinal problems and diseases. The EcoBiome has overcome this barrier by allowing the – first of its kind – isolation, identification, characterization and production of novel microorganisms and their bio-extracts from any environmental sample.

MICROBIAL TESTS	MICROBIAL TESTS
Nitrogen Cycling Microorganisms	Boron Cycling Microorganisms
Phosphorus Solubilizing Microorganisms	Copper Cycling Microorganisms
Potassium Cycling Microorganisms	Zinc Cycling Microorganisms
Calcium Cycling Microorganisms	Heterotrophic Microorganisms
Iron Cycling Microorganisms	Chemical Remediating Microorganisms
Sulfur Cycling Microorganisms	Petroleum Bioremediation Microorganisms
Silicone Cycling Microorganisms	Wastewater Microorganisms
Manganese Cycling Microorganisms	Hydrogen Sulfide Microorganisms
Magnesium Cycling Microorganisms	Pathogen Inhibiting Microorganisms

There is a Microorganism for Every Nutrient and Mineral in the Soil

The EcoBiome isolates, detects and identifies your strains for the best soil microbial health program optimization possible.

Gatekeepers at the Roots – Bacteria are responsible for shuttling nutrients into the roots from the environment



SOIL HEALTH AND BIOLOGY
There is a Microbe for Every Nutrient – Meet Your Microbial Cultures.

Our soil analysis will provide colony counts of specific microbes capable of releasing locked up nutrients and minerals in the soil in a format that is easy to read and interpret.

Bacteria Breaking Ionic Bonds
Sentinel nutrient and mineral solubilizing bacteria actively break ion bonds to release nutrients for plant use.

Biological R&D, Innovation and Custom Formulation

The EcoBiome Innovation Center can work with your group to isolate novel microorganisms to deliver biological solutions to solve customer specific challenges.

We welcome the opportunity to be contracted for consulting or R&D in order to apply our expertise to your challenge through an eco-friendly and efficient biological approach.

Benefits of the EcoBiome Innovation Center

* Ability to isolate novel soil health and growth promotion microbes.
* Able to culture from bench to large scale production.
* Novel, patent-pending screening and culture quality control technology.
* Ability to stabilize and lengthen the shelf life of all varieties of microbes for an extended period of time through our proprietary process.

DISCOVERY PORT

Exciting upgrade that allows for the isolation of novel, never before isolated microbes that the customer will own.

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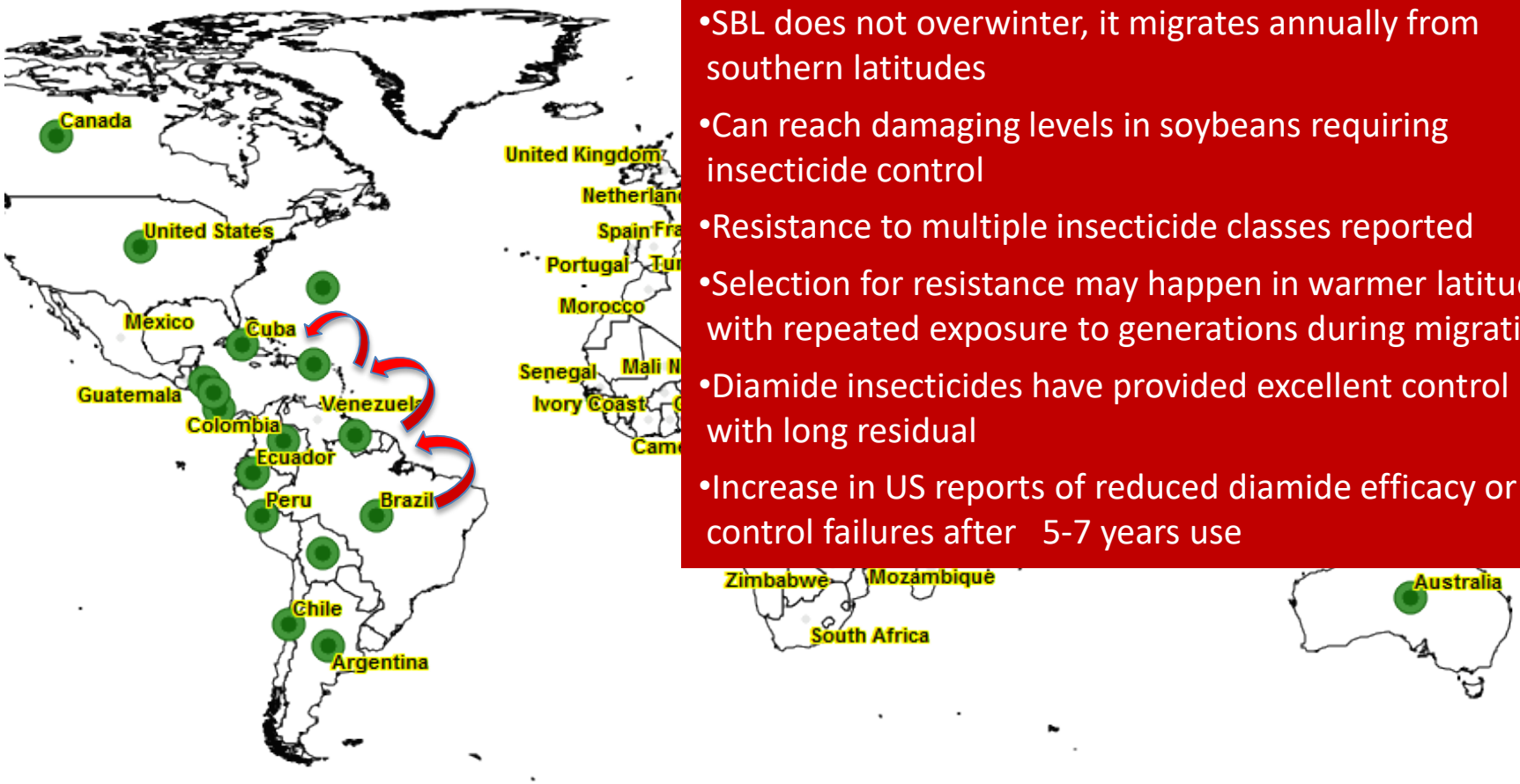
IRAC

Insecticide Resistance Action Committee

Pesticide resistant migratory soybean looper, a growing control problem US in soybeans and vegetable crops

During 2018 corn earworm was the most expensive pest in soybean followed closely by soybean looper and stink bugs

Distribution of Soybean Looper, *Chrysodeixis includes*, Around the World



- SBL does not overwinter, it migrates annually from southern latitudes
- Can reach damaging levels in soybeans requiring insecticide control
- Resistance to multiple insecticide classes reported
- Selection for resistance may happen in warmer latitudes with repeated exposure to generations during migration
- Diamide insecticides have provided excellent control with long residual
- Increase in US reports of reduced diamide efficacy or control failures after 5-7 years use

Source: Plantwise knowledge bank www.plantwise.org

IRAC-US Soybean Looper Insecticide Resistance Research Sponsored Projects

- Funded bioassays with diamides and other chemistries to track changes in the susceptibility of soybean looper populations collected in the US.
- Worked with NAICC consultants in LA to locate fields where inadequate SL control occurred to collect larvae for bioassay.
- Funded studies to understand the genetic relationship of SBL populations collected in the US and Puerto Rico that may help explain migrating patterns
- Working with PRABIA (Puerto Rico Agriculture Biotechnology Association) soy and corn seed production members on an area wide insecticide resistance monitoring and rotation program to mitigate resistance to SBL and fall armyworm

Puerto Rico MOA rotation program based on treating

Programa de aplicación por ventanas. Cultivo: Soya

Mes	Modo de acción	Aplicaciones foliares: Productos	Máximo número de aplicaciones	Dosis (oz/A)
Octubre	28	Coragen®	2	4.0
	3A	Permethrin	3	4.0
	1A	Lannate® SP	3	8.0
Noviembre	6	Proclaim®	3	4.8
	18	Intrepid® 2F	4	16.0
	1B	Lannate® SP	2	32.0
	BIO	Capsanem®	3	*
Diciembre	5	Radiant® SC	3	4.8
	22	Steward® EC	4	11.0
	3A	MustangMax®	4	4.0
	BIO	Capsanem®	1	*
Enero	28	Coragen®	4	4.0
	6	Proclaim®	3	4.8
	18	Intrepid® 2F	4	8.0
	BIO	Capsanem	1	*
Febrero	5	Radiant® SC	3	4.8
	3A	Asana® XL	4	9.6
	22	Steward® EC	4	11.0
	BIO	Capsanem®	1	*
Marzo	15	Diamond®	4	4.0
	18	Intrepid® 2F	4	3.0
	6	Proclaim®	3	4.8
	BIO	Capsanem®	1	1.0

Programa de aplicación por ventanas. Cultivo: Soya

Mes	Modo de acción	Aplicaciones foliares: Productos	Máximo número de aplicaciones	Dosis (oz/A)
Abril	5	Radiant® SC	4	4.8
	1A	Lannate® SP	3	3.0
	3A	MustangMax®	2	4.0
	BIO	Capsanem®	2	2.0
Mayo	18	Intrepid® 2F	3	3.0
	22	Steward® EC	3	11.3
	BIO	Capsanem®	2	2.0
Junio	3A	Asana® XL	4	9.6
	15	Diamond®	3	9.0
	BIO	Capsanem®	1	*
Julio	1B	Lorsban®	3	32.0
	28	Coragen®	4	4.0
	BIO	Capsanem®	1	*
Agosto	3A	MustangMax®	4	4.0
	5	Radiant® SC	3	4.8
	BIO	Capsanem®	1	1.0
Septiembre	15	Diamond®	3	9.0
	22	Steward® EC	4	11.3
	BIO	Capsanem®	1	*

Goals for 2019

Continued interest in working with NAICC to obtain SL from locations where control failure or less that expect control was observed for bioassay.

If you encounter a situation of less that expected control contact -for instructions to collect and ship larvae for bioassay.

For more information contact Chris Philips or Jim Steffel in AG PRO EXPO

THANK YOU

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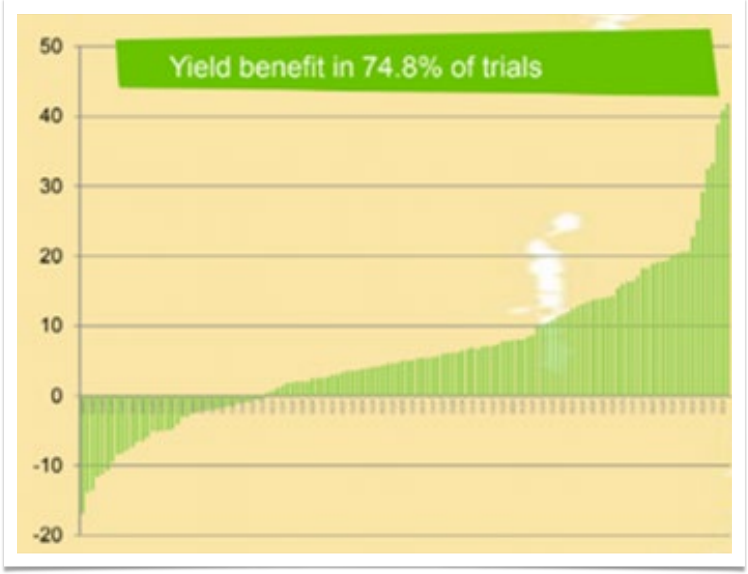
Predict Yield and Control Input Cost with Machine Learning and AI in Agriculture

Jay McEntire, CEO of Arva Intelligence, Manager of Glennoe Farms
Arva Intelligence, 2750-H Rasmussen Road, Suite 201, Salt Lake City UT 84098
Emerging Technology

As growers and agronomists, we are inundated with more data than ever before. Converting that data into actionable intelligence can be time-intensive. Leveraging emerging third-wave machine learning, Arva Intelligence aggregates remote sensing, biogeochemical, and topological data into understandable insight empowering growers to predict yield, reduce costs and risks, and improve land stewardship. Arva explains not only if an amendment works, but why and where it is most effective, along with what constraints exist in soil microbiomes affecting crop health. Arva is an outgrowth of a multiyear collaboration between Lawrence Berkeley National Laboratory, the University of Arkansas, and Glennoe Farms (www.AR1K.org).

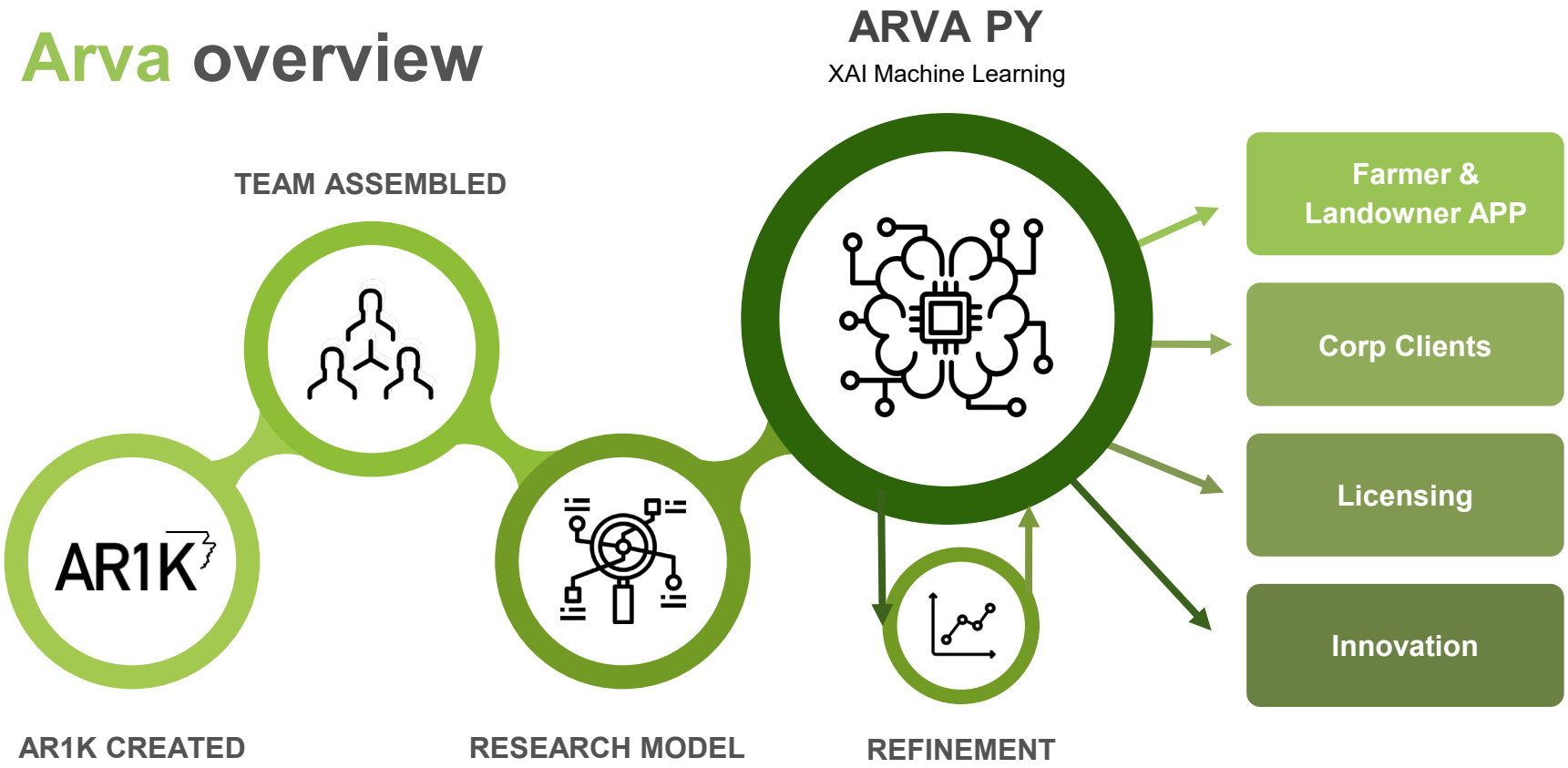
The challenge

Randomized field trials were not built to integrate and utilize rich data

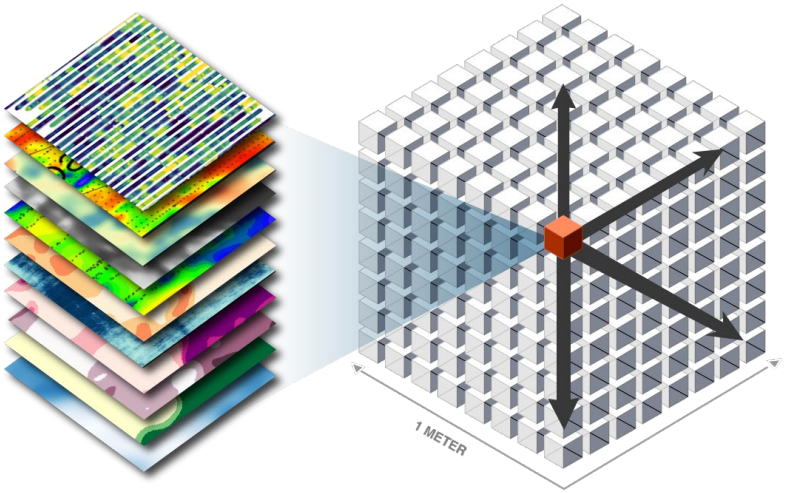


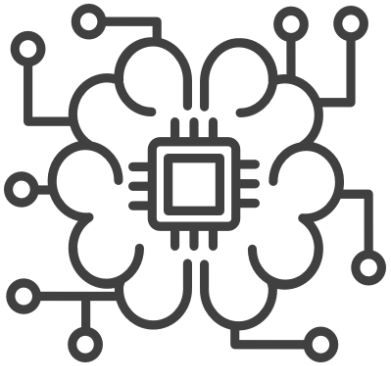
Weak statistical power	Up to 20% variability over 20 meters	Reliance on word-of-mouth
Lack of context	Small test sizes	Testing interference
Low insights from tests	Non-actionable charts	Lack of predictable efficacy

Arva overview



We are the missing the brain behind the data





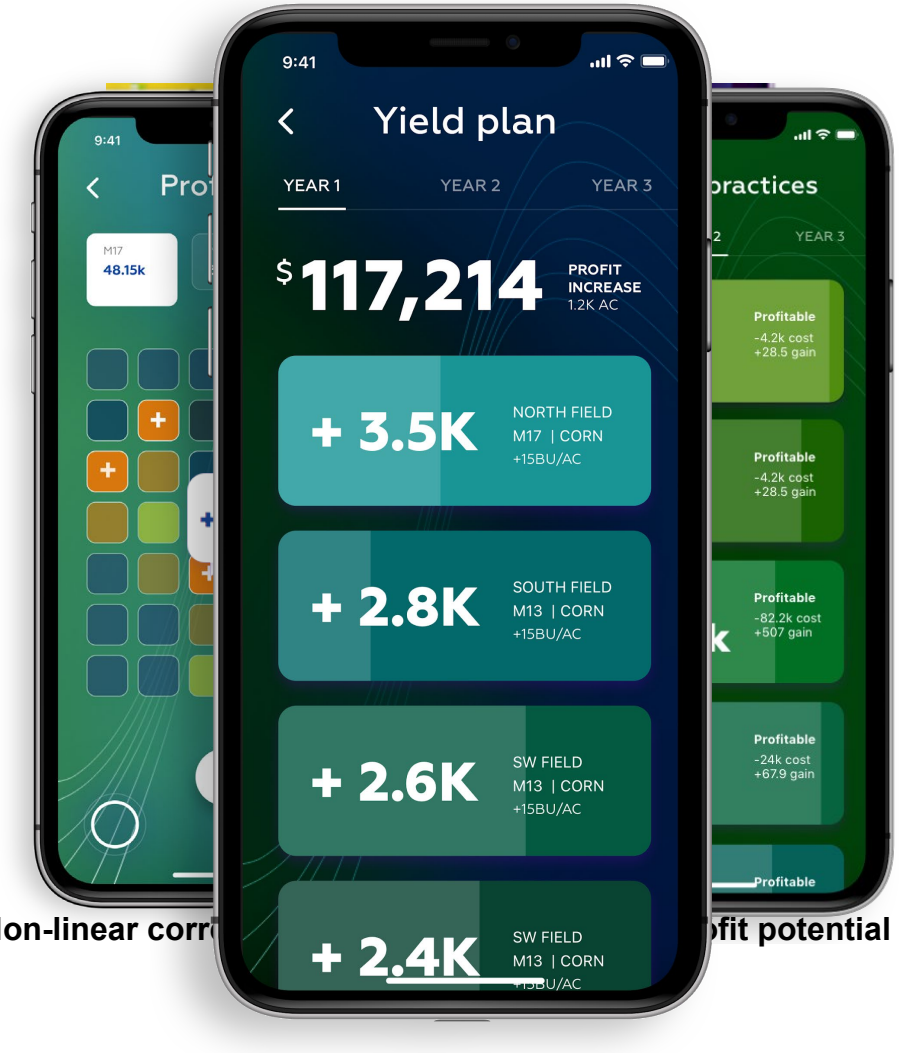
Actionable Game Plan

Data fusion of sparse and dense data > Nonlinear combinations and emergent phenomena > What works where

Science meets simple

Actionable, profitable insights

- Targeted improvements for fields with the greatest profit potential.
- Shopping lists and tractor application files easily exported for use.
- Translation of the data farmers already have into useful information they can act on.



Non-linear corr

fit potential

Products

Arva Research

Amendment & Bio/Chem Companies

- Transparent breakdown of how much and why an amendment worked
- Mapping of interactions due to amendment
- Output of results in a user-friendly format to help with marketing and sales of innovative products

Arva Insights

Farmer/Land Owners/Consultants

- Free & paid plans
- Integrative platform
- Data hub
- Inclusive data mapping
- Cross Compatibility

Arva Certified

Corporate Consumer/Ecosystem Services Markets

- Carbon savings shown for corporate buyers
- Unbiased third party certification of sustainability
- Developed after Insights & Research plans

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