

# Advancement of Prescriptive Ag and Big Data

John Fulton







“You can't manage what you don't measure!”

*(W. Edwards Deming)*

Data / information to enhance input decisions during tight times.







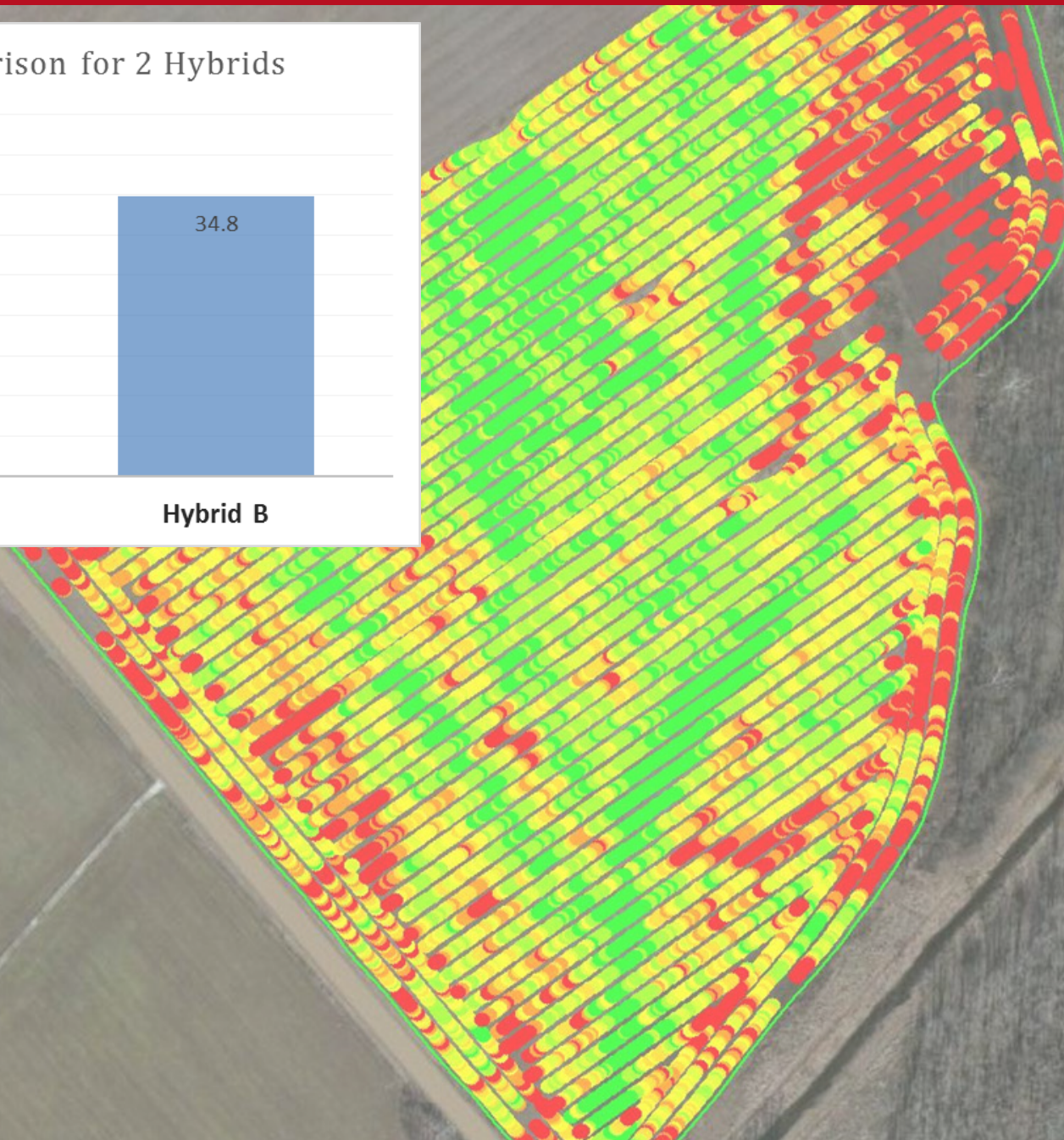
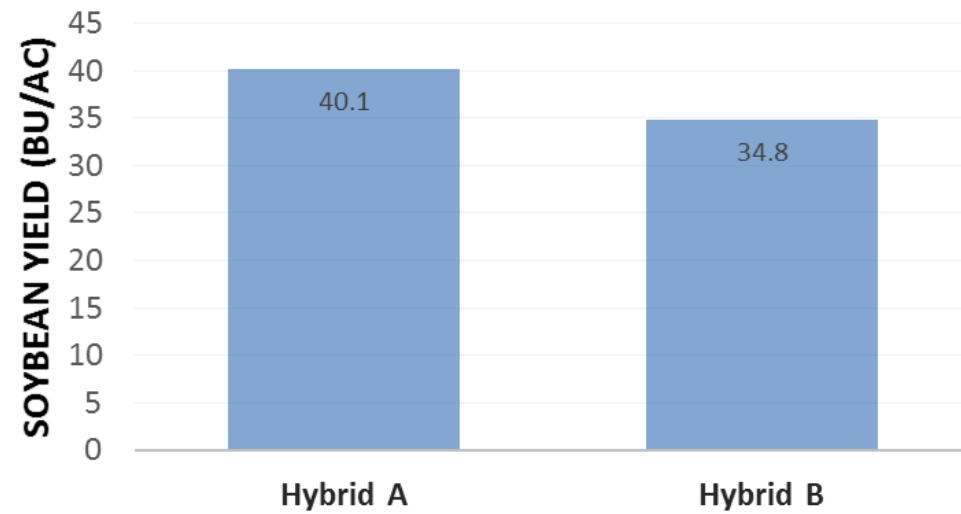
## By-row Prescription (Rx)

- Hybrid
- Population
- Starter fertilizer
- Down force
- Row-cleaner





Split Planter Comparison for 2 Hybrids

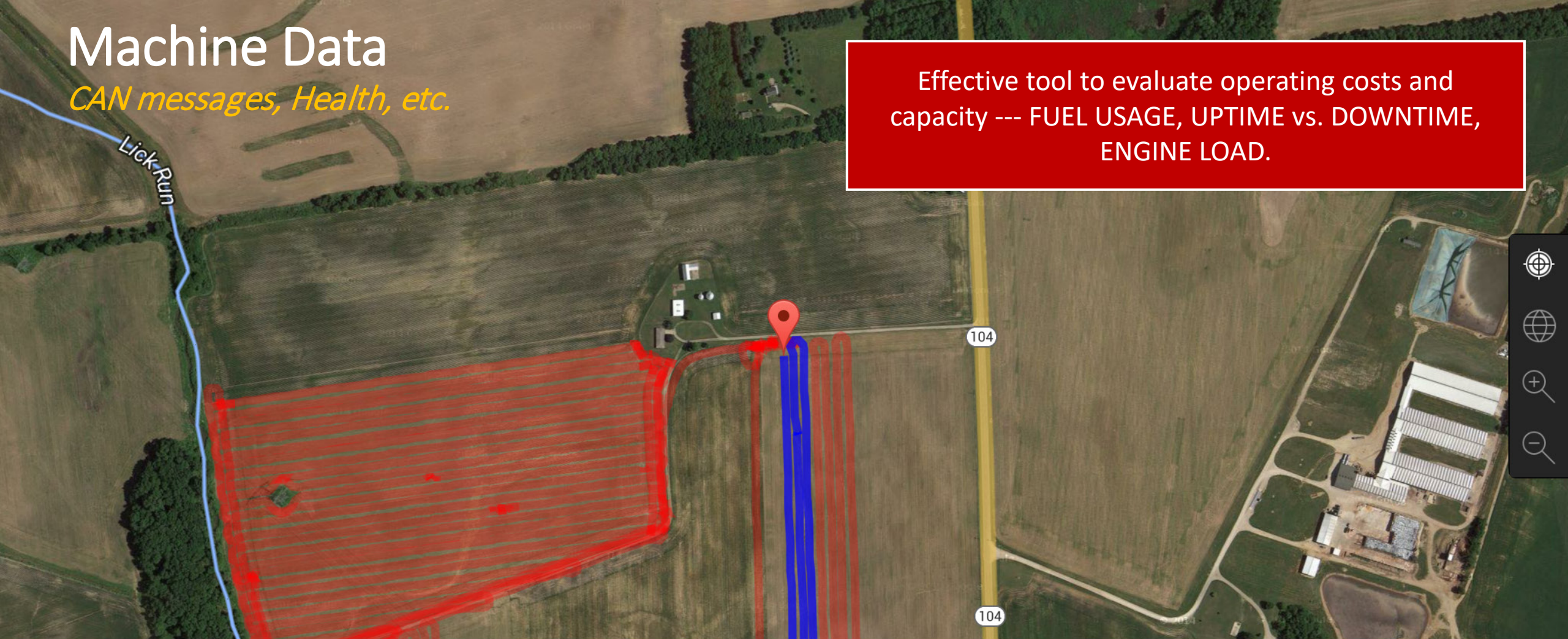




# Machine Data

*CAN messages, Health, etc.*

Effective tool to evaluate operating costs and capacity --- FUEL USAGE, UPTIME vs. DOWNTIME, ENGINE LOAD.



Fuel Rate



6.88

gal/hr

Speed



4.1

mph

Engine Torque



55

%

Engine Speed



1762

rpm

Engine Temp



180

°F

PTO Speed



0

rpm

Battery



13.4

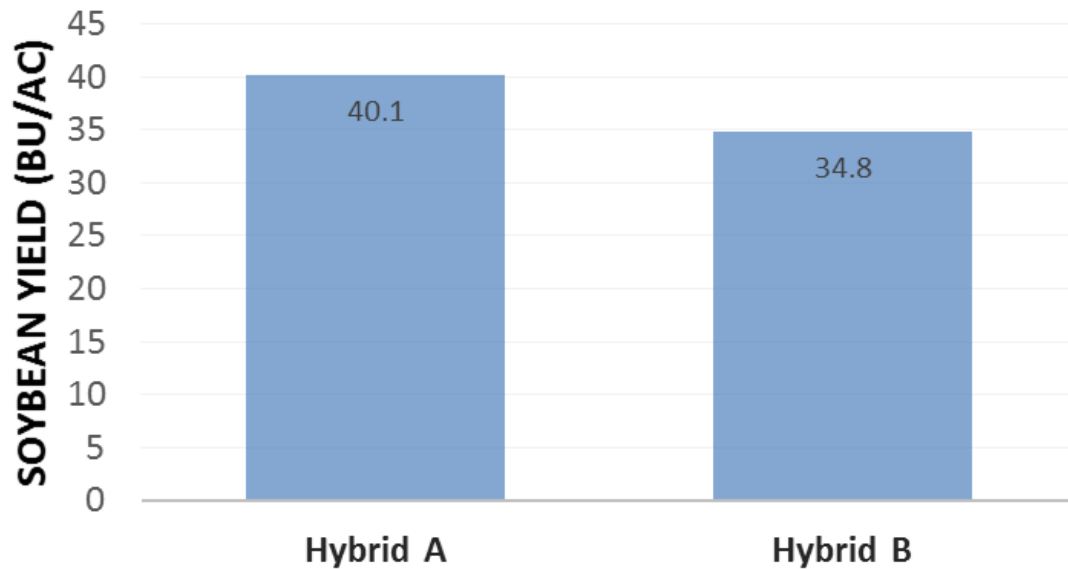
volts



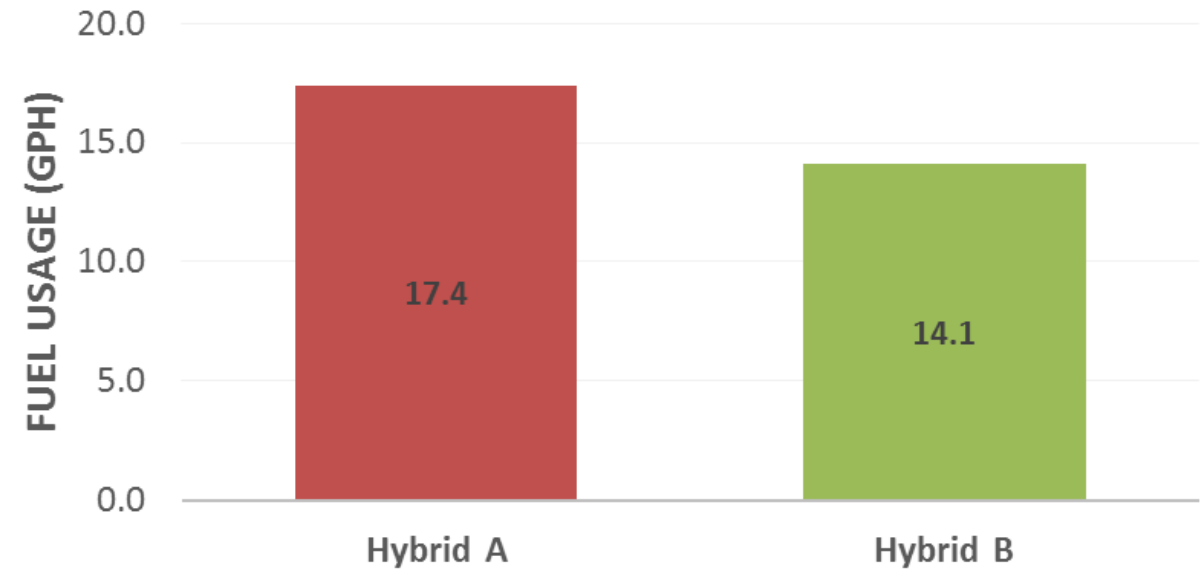


# Bridging Agronomic and Machine Data

Split Planter Comparison for 2 Hybrids



Fuel Usage by Hybrid



**Big Data** - Accelerate learning and thereby earlier selection of a favorable economic response.

	Moisture Content (%)	Ground Speed (mph)	Fuel Usage (gallons per acre)	Mean % Engine Load	Mean Field Capacity (ac/hr)
Hybrid A	14.8	2.8	1.71	86	10.2
Hybrid B	14.3	5.2	0.86	44	18.9





# RGB Image

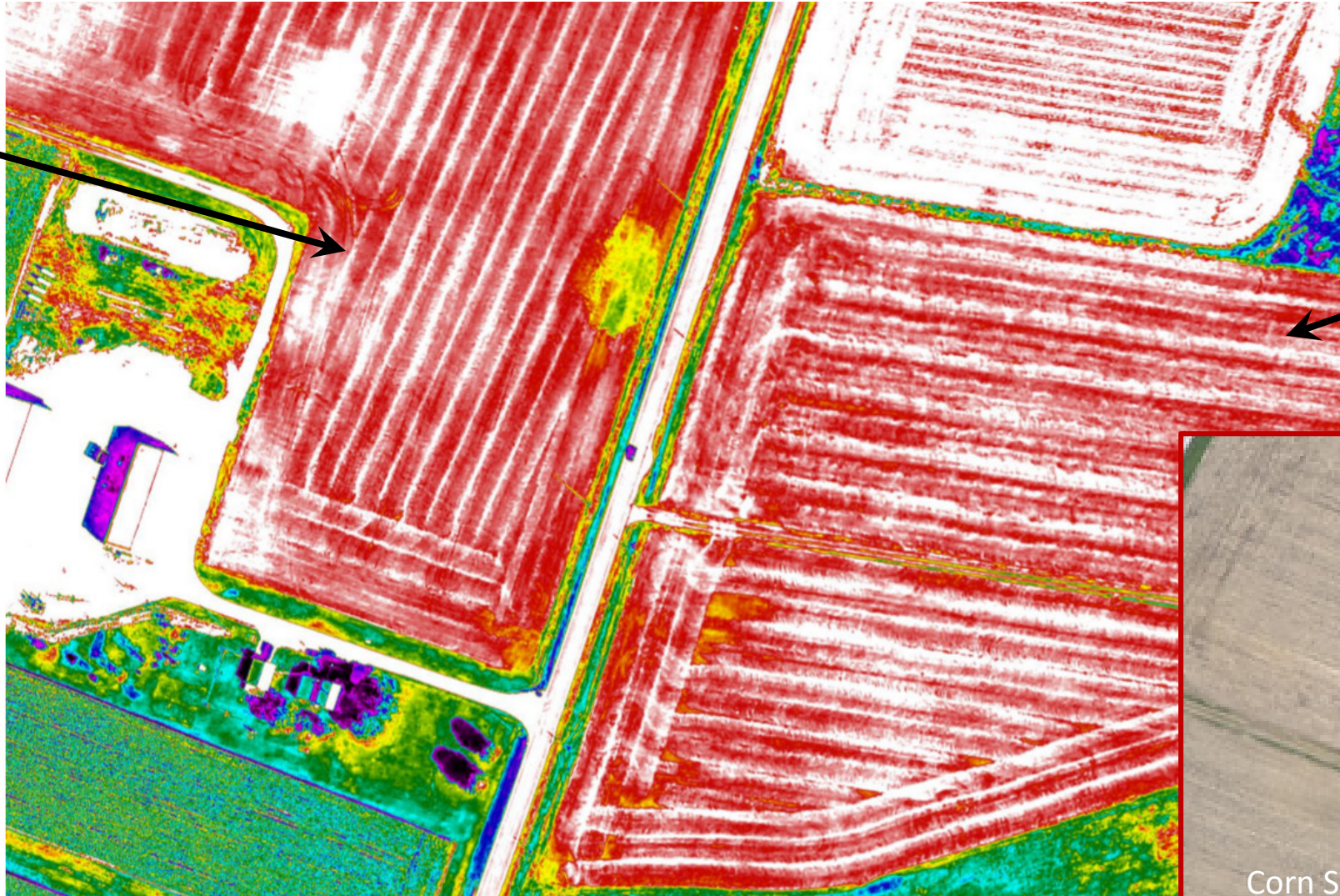
- Machine paths still present
- Corn biomass variability



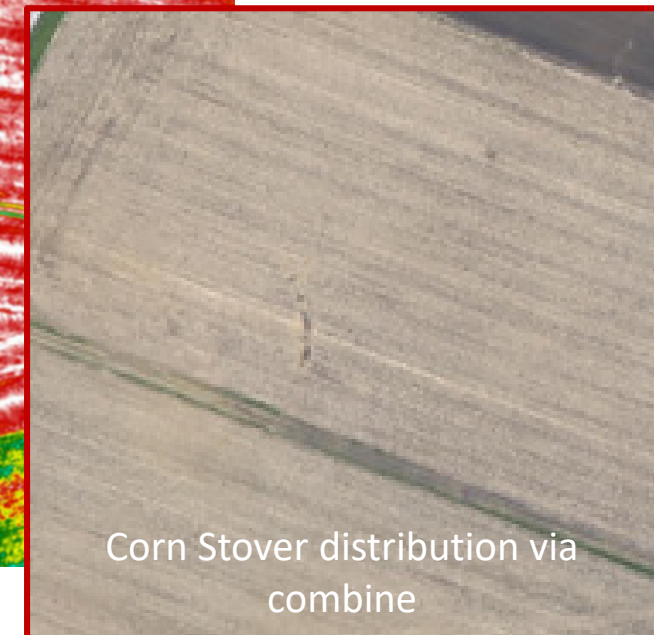


# Post-harvest crop residue

Soybean



Corn Stover



Corn Stover distribution via  
combine



# Digital Agriculture

## Adoption

**Precision Ag: +70% US acres**

**Prescriptive Ag: +15% of farms**

**+95% of farmers will outsource data management.**

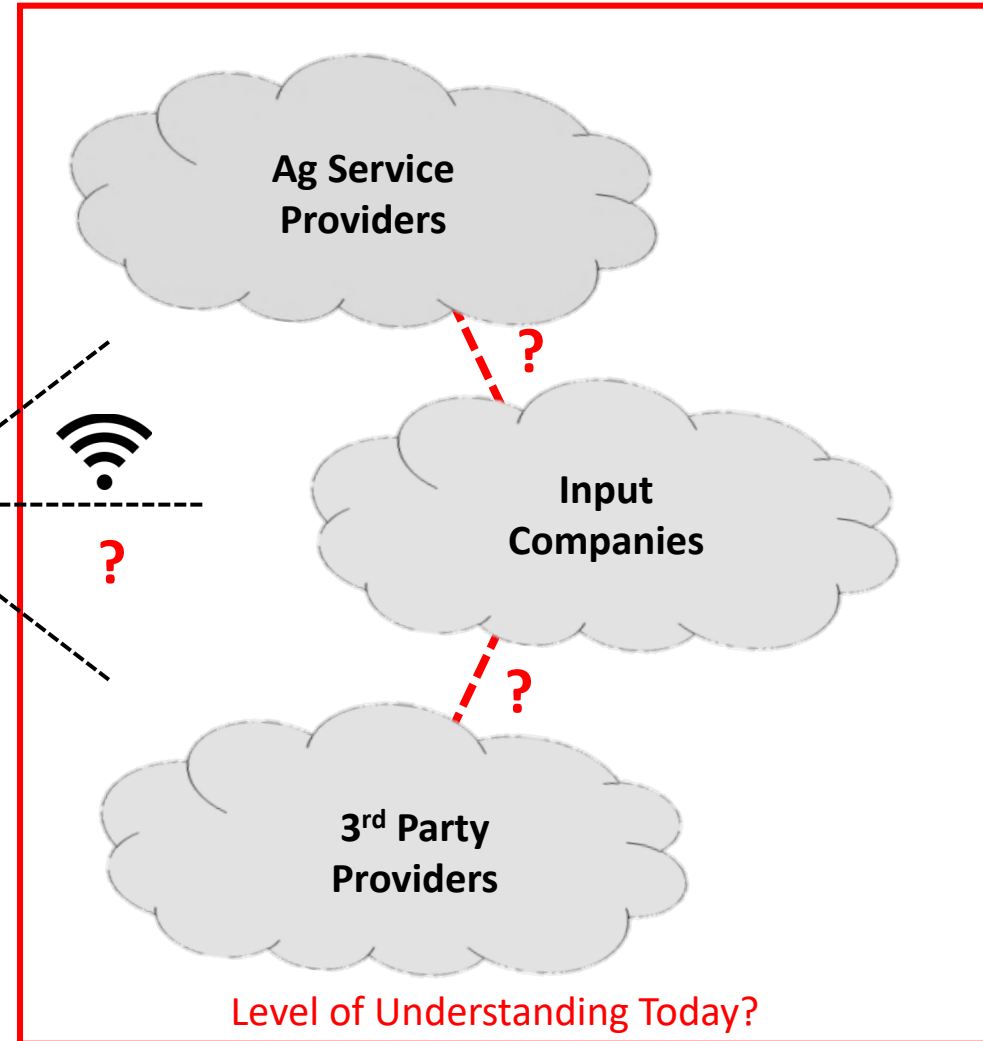


Based on information from an Iowa AgState / Hale Group report.



# Precision Agriculture

# Prescriptive Ag – Big Data







1. Ability to move data between data warehouses?
2. Total access of data by owner or trusted advisers?





# Future Data Exchange for Growers



Producer



Recommendations

- **Preseason Fertility Management**
  - Prescription P and K application (Precision Crop Services)
- **Tillage Management**
  - Prescription tillage maps (AGCO; CNH)
- **Multi-Hybrids**
  - Prescription seeding of multi-hybrids (Beck's; Pioneer)
- **SCN Management**
  - Prescription application/use of nematicides (FMC)
- **In-Season Fertility Management**
  - Prescription N application (DuPont Pioneer; Climate Corp)
- **Irrigation Management**
  - Prescription Irrigation (AgSmart)
- **Disease Management**
  - Prescription fungicide application (BASF)

Data will need to move through multiple organizations and each organization will need different data sources.



# Data Access --- APPs

- **Collect, store and view** field map data in a single mobile tool
- **Share** field map data with your trusted advisors
- **Compare** your maps to other data layers
- Simply understand input response by field, soil zone, rate, etc...





# Precision / Prescriptive Agriculture Status

*(2015 Survey)*

- **3 out of 4 growers** surveyed using precision technologies
  - Financial benefits outweigh the costs
  - Overlap reduction within fields #1 benefit (#2 seed savings)
- Value Proposition
  - **AVG cost savings of 6.8%**
  - **AVG yield increases of 7.6%**
- **+15% using prescriptive ag services**
- *Optimization through data analytics / information*



# MISSION:

---

To organize agriculture's information and make it universally accessible and useful.







- Internet-related services and products
- **Founded:** September 4, 1998, Menlo Park, CA
- **Mission:** to organize the world's information and make it universally accessible and useful.
- Revenue: \$66 billion (2014)
- Net Revenue: \$14.4 billion (2014)
- 2 High-use Data Services
  - **Gmail**
  - **Google Search**





- Internet-mobile app allowing consumers to submit and secure trip requests.
- Contracts with individual car owners to provide cab services
- **Founded:** March 2009, San Francisco, CA
- **Goal:** connecting riders to drivers
- Privately Held: Estimated 2015 worth \$62.5B



# How many agriculture companies look or want to look like an Internet-related services and products company?

1. Grow market share, OR
2. Look for other revenue streams



Keeping an eye on “Big Data”...



# AFBF Privacy and Security Principles for Farm Data

[www.fb.org/tmp/uploads/PrivacyAndSecurityPrinciplesForFarmData.pdf](http://www.fb.org/tmp/uploads/PrivacyAndSecurityPrinciplesForFarmData.pdf)

- 13 Principles with descriptions
- Led by AFBF
- 35 signers --- Ag Technology Providers, Commodity Groups & AFBF

## INTRODUCTION

**“As technology continues to evolve, the undersigned organizations and companies believe the following data principles should be adopted by each Agriculture Technology Provider (ATP).”**

# 13 Privacy and Security Principles (Signed by 35 Companies)

- 1) **Education**
- 2) **Ownership**
- 3) **Collection, Access and Control:** An ATP's collection, access and use of farm data should be granted only with the affirmative and explicit consent of the farmer....
- 4) **Notice:** Farmers must be notified that their data is being collected and about how the farm data will be disclosed and used....
- 5) **Transparency and Consistency:** ATPs shall notify farmers about the purposes for which they collect and use farm data.
- 6) **Choice:** ATPs should explain the effects and abilities of a farmer's decision to opt in, opt out or disable the availability of services offered...
- 7) **Portability:** ...farmers should be able to retrieve their data for storage or use in other systems...
- 8) **Terms and Definitions:** Farmers should know with whom they are contracting with if the ATP contract involves sharing with third parties, partners, business partners, ATP partners, or affiliates.
- 9) **Disclosure, Use and Sale Limitation:** An ATP will not sell and/or disclose non-aggregated farm data to a third party without first securing a legally binding commitment .....with the farmer. Farmers must be notified....
- 10) **Data Retention and Availability:** Each ATP should provide for the removal, secure destruction and return of original farm data from the farmer's account upon request...
- 11) **Contract Termination:** Farmers should be allowed to discontinue a service...
- 12) **Unlawful or Anti-Competitive Activities:** ATPs should not use the data for unlawful or anti-competitive activities...
- 13) **Liability & Security Safeguards**



# Transparency Evaluator

## TERMS AND CONDITIONS

Unless this Purchase Order expressly provides otherwise, it is limited to the terms and conditions set forth herein. Buyer hereby objects to any additional or different terms and conditions proposed by Seller in any proposal, quotation, acknowledgment or other document. Any such proposed terms and conditions shall be void and the terms and conditions herein shall constitute the complete and exclusive statement of the terms and conditions of the contract between the parties. When used in this Purchase Order, the term "Goods" means the items, materials, equipment, tooling, parts and/or work or services supplied pursuant to this Purchase Order.

**1. ACCEPTANCE AND MODIFICATIONS.** This Purchase Order ("Order"), whether or not issued with reference to a quotation or proposal of Seller, shall constitute an offer. Acceptance by Seller is expressly limited to the terms and conditions hereof and is evidenced by commencement of performance. No changes or modifications in this Order shall be valid unless confirmed in writing by Buyer.

**2. PACKING AND TRANSPORTATION.** No charge for packing or transportation will be allowed except as provided for in this Order.

**3. SHIPMENT/DELIVERY.** Seller shall ship/deliver Goods in accordance with instructions and specifications set forth in this Order. If Goods are not shipped/delivered in accordance with Buyer's instructions and specifications, Seller shall be responsible for any additional costs incurred by Buyer as a result of Seller's failure to comply with such instructions and/or specifications.

**4. DUTY DRAWBACK RIGHTS.** This Order includes all related customs duty and import drawback rights (including rights developed by substitution and rights which may be acquired from Seller's suppliers) if any, which Seller can transfer to Buyer. Seller shall inform Buyer of the existence of any such rights and upon request, supply such documents as may be required to obtain such drawback.

**5. PAYMENT.** Unless otherwise stated in this Order, invoices for Goods shall be paid net 30 days from the date of receipt of the invoice or receipt of the Goods, whichever is later ("Payment Due Date"). Discounts offered by Seller to Buyer shall be allowed if payment is made on or before the Payment Due Date. Buyer reserves the right to require Sellers to U.S. Buyer units, to submit invoices electronically as set forth in this Order.

**6. EXCESS GOODS.** Except for customary quantity variations recognized by trade practice, Goods in excess of those specified in the Order will not be accepted, and such Goods will be held at Seller's risk. Buyer shall have no obligation to keep or preserve any excess Goods delivered by Seller. Buyer may, and at Seller's request shall, return the excess Goods at Seller's risk, and all transportation charges, both to and from the original destination, shall be paid by Seller.

**7. FABRICATION AND MATERIAL COMMITMENTS.** Unless otherwise authorized in writing by Buyer, Seller shall not make commitments for materials or fabricate or assemble in advance of time reasonably necessary to comply with the terms of this Order.

**8. TERMINATION.** Buyer may terminate this Order for its convenience, in whole or in part, by written or electronic notice at any time. If this Order is terminated for convenience, any claim of Seller shall be settled on the basis of reasonable costs incurred by Seller in the performance of this Order for labor and materials which are not usable by Seller for other

quality and reliability procedures and review the data supporting same. Acceptance of the Goods by Buyer shall not relieve Seller from any of its obligations and warranties hereunder. In no event shall payment or transfer of title constitute acceptance of the Goods.

**11. QUALITY AND WARRANTY.** Seller expressly warrants that all Goods covered by this Order will conform to the standards, specifications, drawings, samples, models, 3-D geometry or other description furnished or expressly adopted by Buyer, and will be of good material and workmanship, and free from defects, including defect in design (if Seller's design) and, if custom-designed by Seller for the application specified by Buyer, be comparable in quality to similar custom-designed goods sold for similar applications, and if the Goods are not ordered to Buyer's specifications, Seller further warrants that they will be of merchantable quality and fit and sufficient for the purpose intended. Seller further warrants that all Goods covered by this Order, including but not limited to components and material furnished for or incorporated into the Goods, including Goods intended for distribution as service parts, will comply with all applicable Federal, State, Provincial and local statutes, laws, regulations, orders, and ordinances, including, without limitation, all environmental and occupational health and safety laws and industry standards and Buyer's specifications that restrict or prohibit certain chemical compounds as constituents of Goods as specified in the John Deere Banned Chemical List. The John Deere Banned Chemical List is found at:

<http://dsupply.deere.com/bannedchemicals/>

Seller also warrants that its processes shall comply with the John Deere Quality Manual and that the Goods will comply with all current industry safety standards, including labeling requirements and adequate warnings as required. The John Deere Quality Manual is found at:

<http://dsupply.deere.com/qualitymanual/>

**12. DEFECTIVE GOODS.** If any of the Goods fail to meet the warranties contained in Section 11 (a "Nonconformity"), Seller shall, upon notice from Buyer, promptly correct or replace those Goods at Seller's expense. If Seller shall fail to adequately address the Nonconformity, then Seller shall reimburse Buyer for all costs to correct or replace the Nonconformity in the Goods. If Seller fails to do so, Buyer may cancel this Order as to all such Goods, and in addition, may cancel the then remaining balance of this Order. After notice to Seller, all such Goods will be held at Seller's risk. Buyer may, and at Seller's direction shall, return such Goods to Seller at Seller's risk, and all transportation charges, both to and from the original destination, shall be paid by Seller. Any payment for such Goods shall be refunded by Seller unless Seller promptly corrects or replaces the

## End User License Agreement

This End User License Agreement (this "Agreement") is a legal agreement between (i) you (either an individual or a single legal entity), and (ii) The Climate Corporation and its Affiliates (such as Precision Planting LLC and Solum, Inc.) ("Climate"). By downloading, installing, activating or otherwise using the Climate Products, you represent and warrant that you have the power and authority to enter into this Agreement, and you agree to be bound by these terms and conditions.

The Climate Products provide information, estimates or recommendations based on models and third party sources, as well as Data provided by you or your equipment. Our services, models, data and recommendations may change over time. Individual results may vary, as weather, growing conditions and farming practices differ across growers, locations and years. We do not guarantee any results, and none of the Climate Products should be used as a substitute for sound farming practices, including diligent field monitoring, or as a sole means for making farming, risk management or financial decisions. We recommend that you consult your agronomist, commodities broker and other service professionals before making financial, risk management and farming decisions.

### Scope of this Agreement

This Agreement sets out how you can and cannot use the Climate Products provided or licensed to you by us, and what we will and will not do in connection with your use, as well as other important legal restrictions and obligations. While some Climate Products may be provided or licensed to you for free, you or your Sales Representative will need to submit an order for certain fee-based Climate Products. Your order will become effective only if we accept the order.

### Your Use of the Climate Products

#### What you can do:

- As long as you comply with the terms of this Agreement, you and the individuals who work for you can use the Climate Products for your internal use only in connection with your farming operations.
  - The Climate Products are licensed, not sold, to you.
- If you have placed an order for a fee-based Climate Product, you can use that Climate Product only for the time set out in your order.
- We encourage you to let us know how we are doing or how you feel about the Climate Products.

#### What you agree to do:

- provide accurate, reliable and appropriate Data
- pay all amounts set forth in the applicable order when due for any fee-based Climate Product
  - amounts listed in an order are exclusive of taxes and expenses, and you will be responsible for all applicable taxes, except for taxes based on Product pricing.

- 9 to 11 questions
- % of specific questions answered in accordance to the Principles receives a "logo".
- Public record for how questions answered
- *Coming in 2016*





[www.OhioStatePrecisionAg.com](http://www.OhioStatePrecisionAg.com)

Precision Agriculture at The Ohio State University

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*"Precision agriculture is much more than adopting technology, it's about whole farm management with the goal of optimizing returns to inputs and preserving resources."*



### CONTACT

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### EVENT CALENDAR

5/17

2016 NCERA 180 Annual Meeting

[More Events](#)

### IN THE PRESS

9/30

It's cool, yes, but drone's true value is in the data

9/30

Yield Monitor Tips for Harvest



## Extension/Outreach: Big Data

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**Big Data is data whose scale, diversity, and complexity require new architecture, techniques, algorithms, and analytics to manage it and extract value and hidden knowledge from it.**

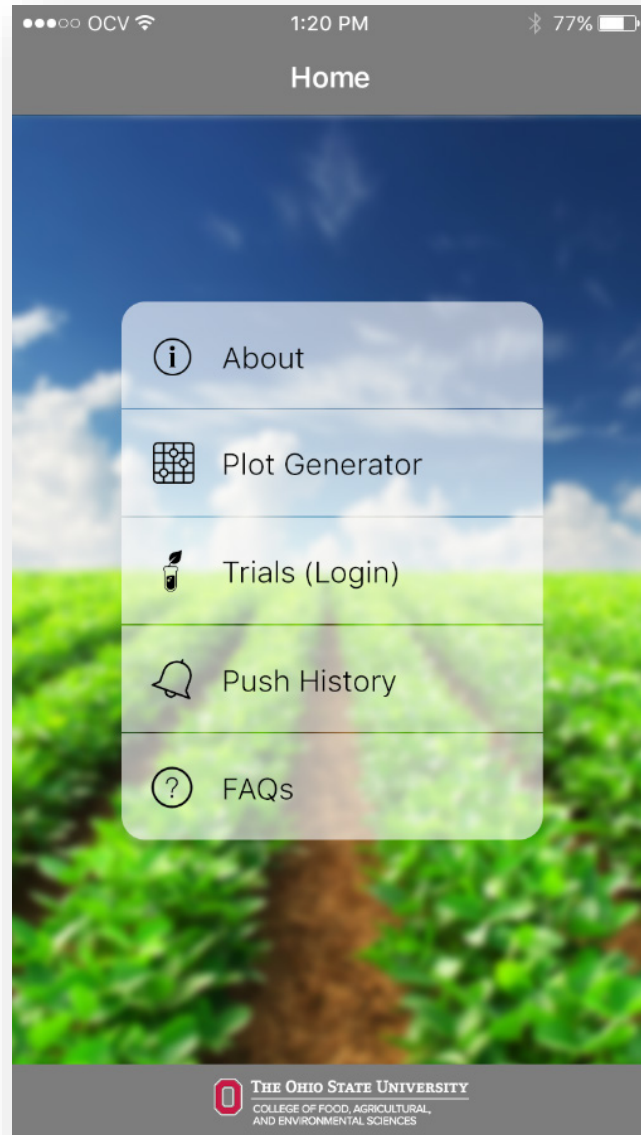
So what exactly does that mean? This data includes large collections of farm data that is being used by farmers, companies, and government agencies to aid in decision making related to crop production and management practices as well as better predictions around nutrient and water availability. It is important to understand what value all of this farm data provides to the producer. By using farm data to drive input management and other farm decisions, producers can identify and quantify limiting productivity variables.



### The Big Data Flow

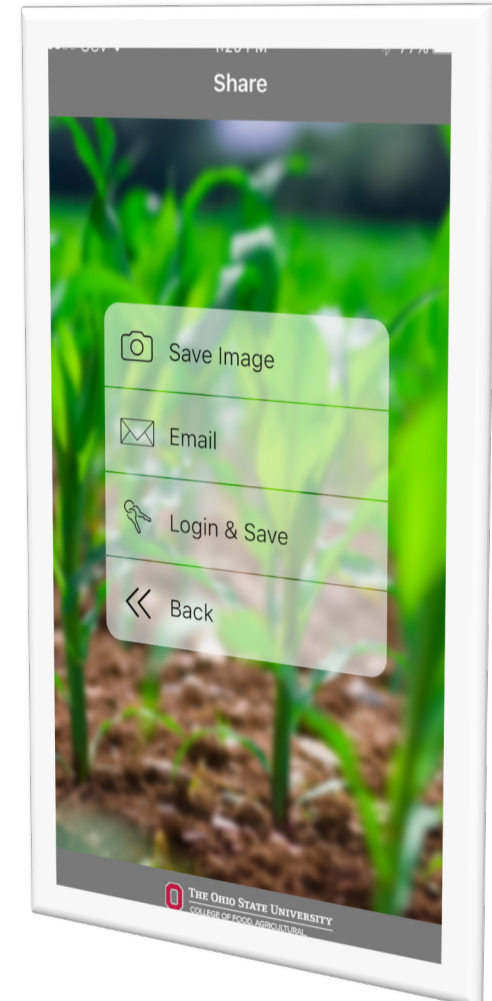
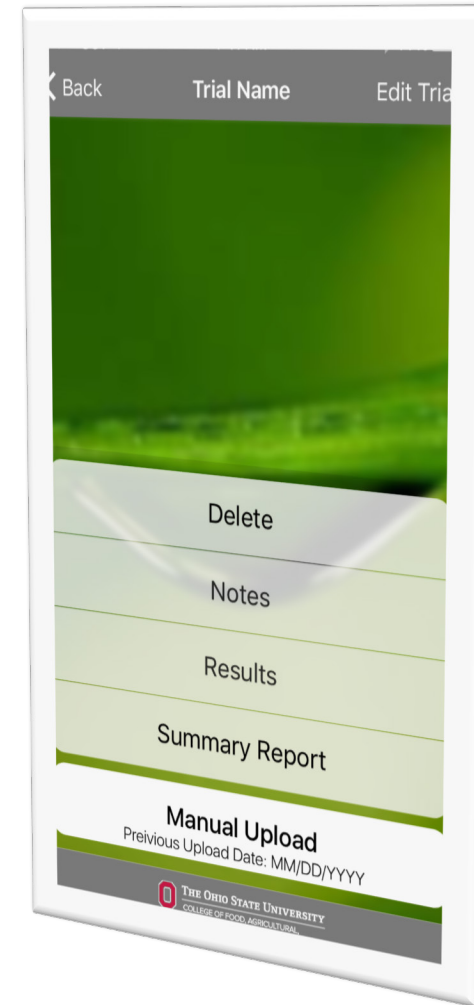
- A farmer will **upload farm and personal data** from ground and equipment sensors, drones, etc.
- Agricultural Technology Provider (ATP) will **aggregate farmer's data**, combines other relevant data set, and applies algorithms to analyze

# OSU Crop / Nutrient Trial APP *(coming early 2016)*



## On-farm Research

- Setup
- Notes
- Results





# FINAL COMMENTS...

- **Prescriptive Services & Connectivity** evolving rapidly within agriculture.
- **Clearly understand what you will receive from data services**
  - Define your need for the service
  - Collect e-copies of Rx and As-Applied data
- **Understand terms and conditions, and how data is moved and accessed.**
- **You are responsible for original data; make a copy.**



# Ag Data Services and Products NOT going away.







## Digital Agriculture

Providing solutions to meet world demand

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#### Ohio State Precision Ag Program

[www.OhioStatePrecisionAg.com](http://www.OhioStatePrecisionAg.com)

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