Using Precision Ag on Small and Medium Crop Farms Without Breaking the Bank

John Fulton

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Technology has become more readily available plus economical in recent years providing small to medium farms access to adopt and provide value.

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"Getting It Right"

Better Machine Performance | Improved Job Completion | Better Agronomic Decisions

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Execution Matters

SOURCE: Best Management Practices for Nitrogen Fertilizer in Missouri; Peter C. Scharf, Plant Sciences Extension

Air Conditioning in the Cab

Smart phones / iPads / Tablets

Guidance technology

Rate controller (VRT)

Yield monitors

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Planter Performance

Ability of the planter to:

- Reach target **seeding rate**.
- Obtain **uniform seed spacing**.
- **Achieve adequate and uniform planting depth without compaction** - supports immediate germination and uniform emergence.

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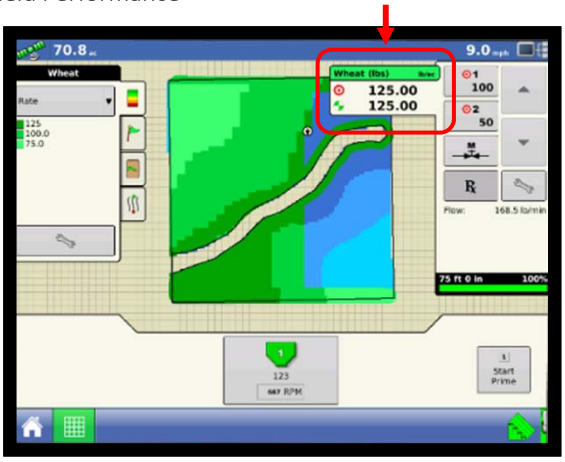
In-cab Displays

Monitor In-field Performance



Improves field execution & on-farm research

In-cab Display

Producer Value

1. Identify and correct equipment issues immediately
2. Execute prescriptions;
3. Verification of seed placement
4. Identify soil characteristics (e.g. clods, trafficked areas)

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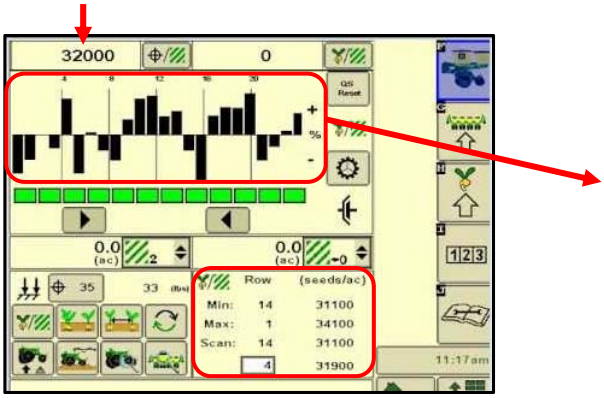
In-cab Displays

Monitor In-field Performance



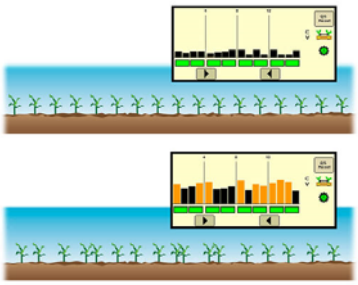


Image courtesy of John Deere

Improves field execution & on-farm research

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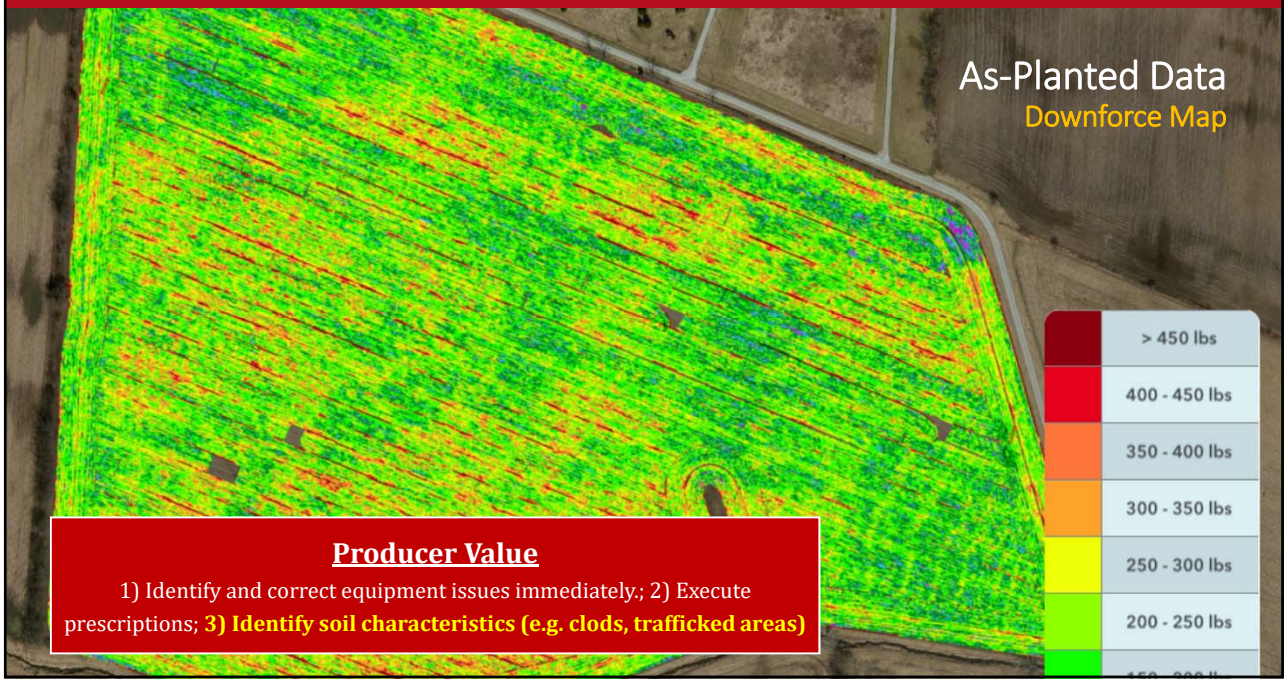
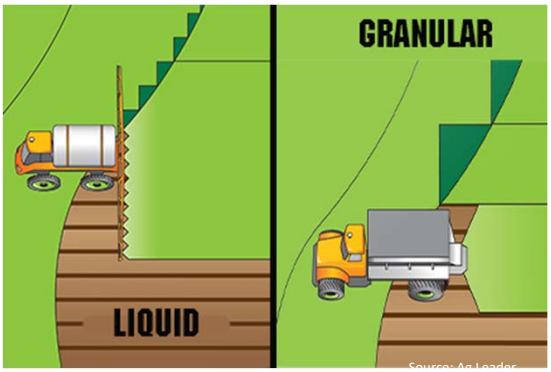


Producer Value

1) Identify and correct equipment issues immediately.; 2) Execute prescriptions; **3) Identify soil characteristics (e.g. clods, trafficked areas)**

Automatic Section Control



- **Automatic ON / OFF** of sections on equipment
- **Reduces:**
  - **Overlap**
  - **Application in unwanted areas** (waterways, buffer strips, etc.).

Automatic Section Control (ASC) for Spinner Disc Spreaders (Auburn Extension Publication)
https://sites.aces.edu/group/crops/precisionag/Publications/Timely%20Information/Automatic%20Section%20Control%20(ASC)%20Technology%20for%20Spreaders.pdf

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Section / Row Control for Planters

Corn
- SAVINGS: **4.4%**
- YIELD: **17% less**
- HARVET LOSS: **>6 times higher**

Automatic Section Control Technology for Row Crop Planters (Auburn Extension Publication)
www.aces.edu/pubs/docs/A/ANR-2217/ANR-2217.pdf

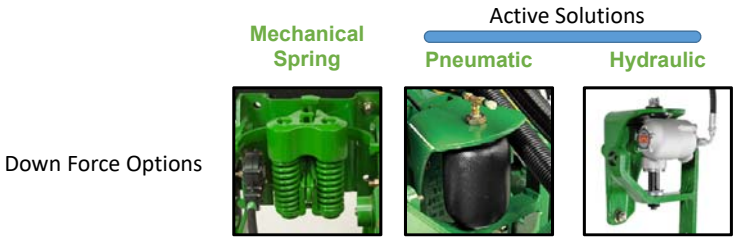
Seed Depth = Downforce (DF)

Downforce is what helps us to maintain a uniform seeding depth

- TOO Much DF
  - Compaction
  - Seed placed too deep
- NOT Enough DF
  - Too shallow
  - Risk of seed depth variation

Considering texture and moisture variations, how do you maintain target depth?

Planter Row-Unit



Active DownForce Technologies

- Soil physical properties vary spatially indicating planter performance could be improved by adjusting planter settings to field spatial variability.
- Seeding depth and downforce management are critical for optimization of planter performance (Hanna et al., 2010).
- Hydraulics provide quicker response and stability.

Target Depth (in.)	Downforce TRTS		AVG Depth (in.)	CV Depth (%)
2	none	0 lbs.	1.84	14.5
2	optimal	100 lbs.	2.20	**5.1**
2	heavy	195 lbs.	2.28	7.8

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Shallow Placement

Non-active Downforce

- 2” target depth
- 1.3” placement depth
- Increased depth CV by 13 points

Non-uniform Depth

Seeding Depth CV = 33.5%

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2" Target with Active DF
(100 lbs with active downforce)
Uniform Spacing and Emergence

192 bu/ac

2" Target with Mechanical Springs
(nominal 125 lbs)
Non-Uniform Spacing and Emergence

178 bu/ac

Uniform Depth Placement @ Target Depth

- Seed Depth CV = 4% to 8% with active downforce
- 8% increase in Seed Depth CV without active downforce
- 10 bu/ac gain for good seed-to-soil contact
  - Need additional DF margin in dry years
  - Less DF margin in wet years

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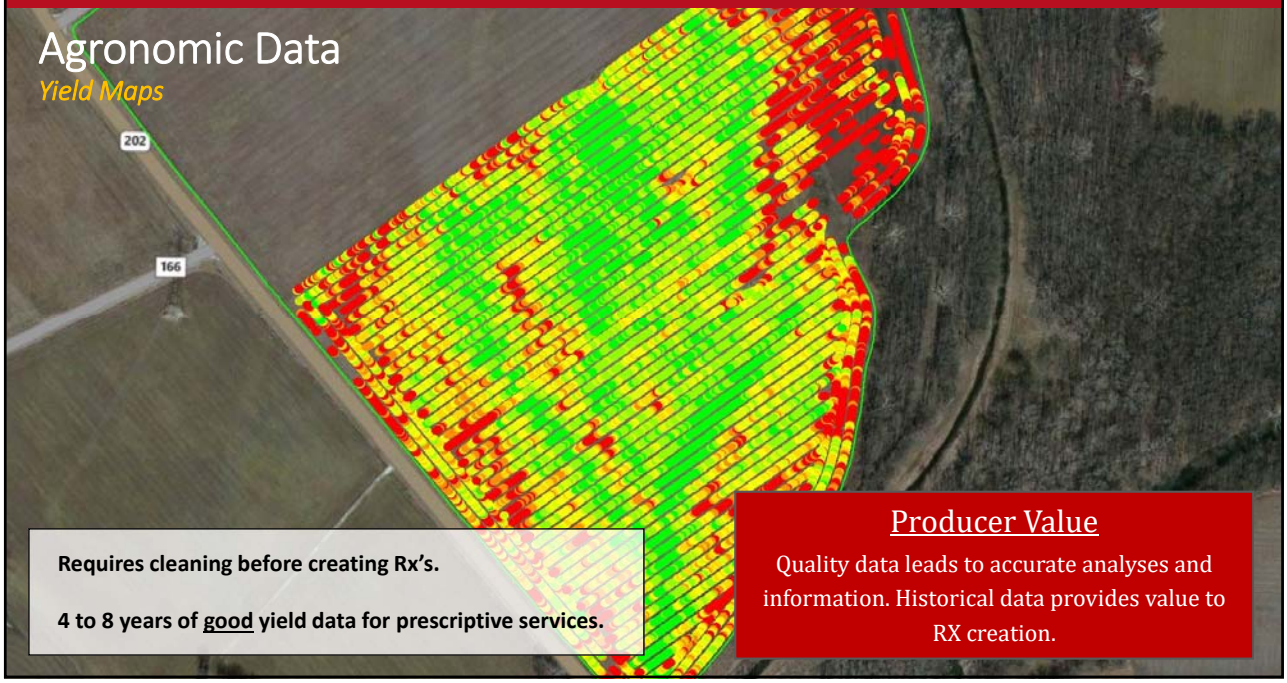
Agronomic Data

Yield Maps



Requires cleaning before creating Rx's.

4 to 8 years of <u>good</u> yield data for prescriptive services.

<u>Producer Value</u>

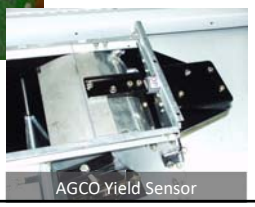
Quality data leads to accurate analyses and information. Historical data provides value to RX creation.

Example Impact-Style Mass Flow Sensors

Precision Planting Impact Plate

Agleader's Impact Plate

New Holland's Impact Style



AGCO Yield Sensor

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Precision Planting Yield Monitoring System (YieldSense)

Grain property kit; adjustment for yield estimates.

Images courtesy of Precision Planting

John Deere Active Yield

Improved yield sensor estimates for those not conducting routine calibrations.

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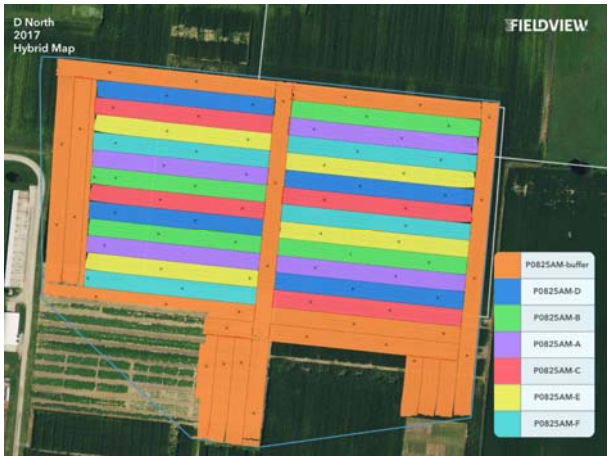
Thoughts on Yield Monitors…

- Yield monitors good for field scale studies that are replicated.
- Follow calibration procedures
  - Consider the **lb/sec** during calibration
  - Keep in mind the expected flow range (high yield variation versus low)
  - Calibrate by **crop conditions annually**



General Use of Yield Maps for Nutrient Prescriptions

Published Research

- **Quantify crop performance (report card)**
- **Good for identifying management zones by production levels (*placement*).**
- **Good for using within P and K management (*removal map for helping establish rate*)**
- **Cautiously use yield maps to drive N decisions.**

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Machine Data

CAN messages, Health, etc.

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

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Agronomic Data

Yield Maps, As-applied…

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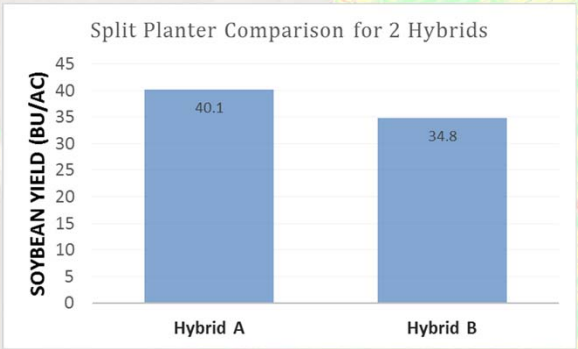
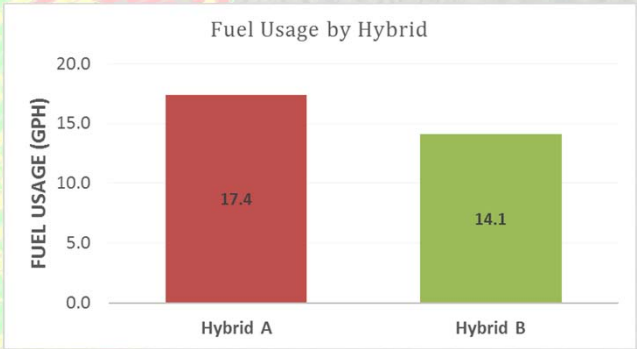
Bridging Agronomic and Machine Data





	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**

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Evaluate variability of fields (field-by-field basis)

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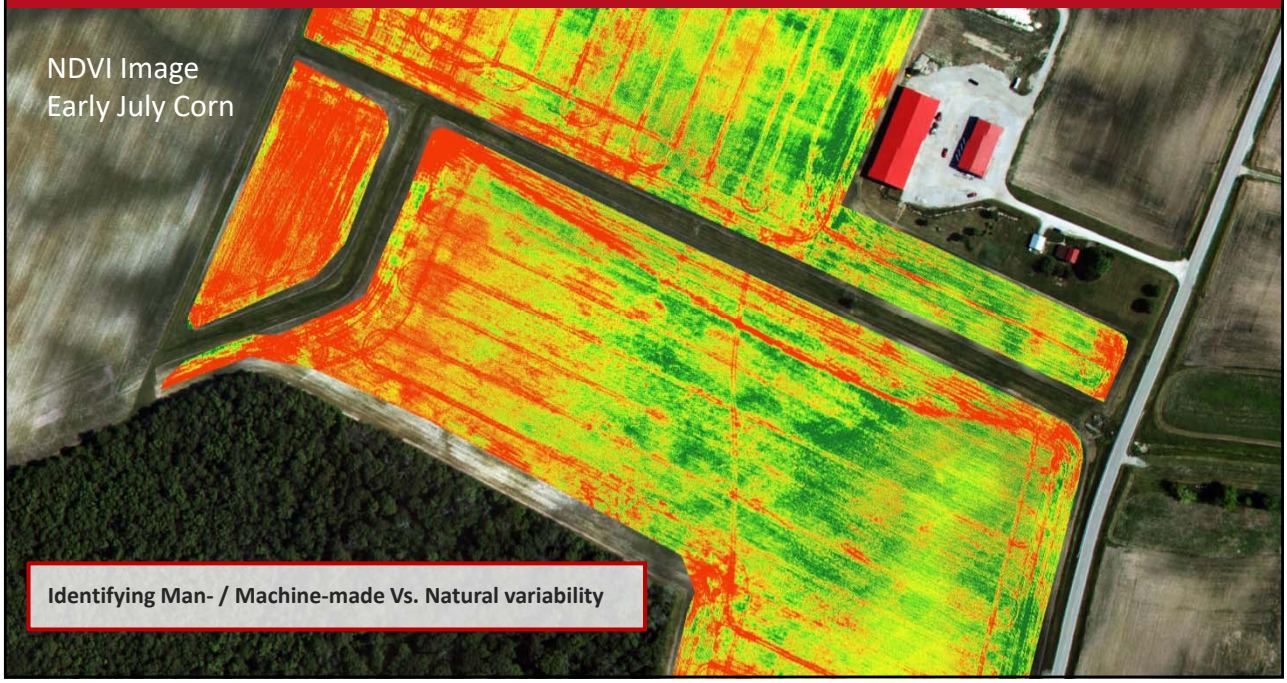
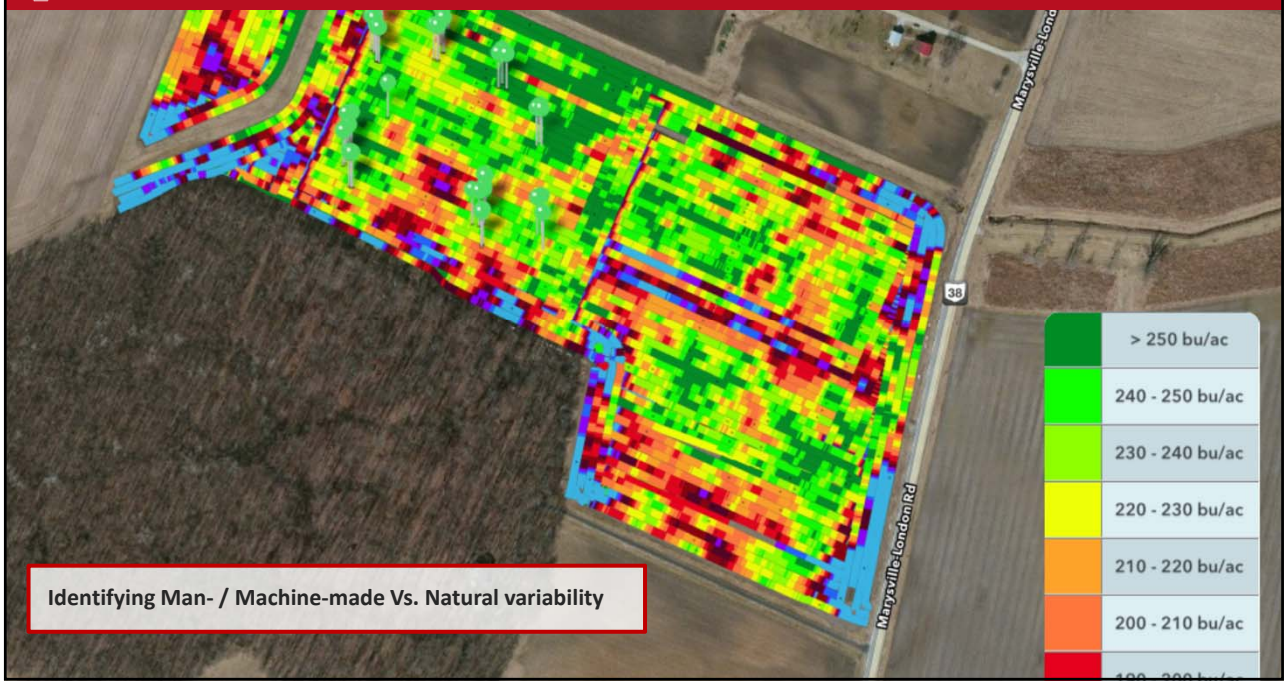


Identifying Man- / Machine-made Vs. Natural variability



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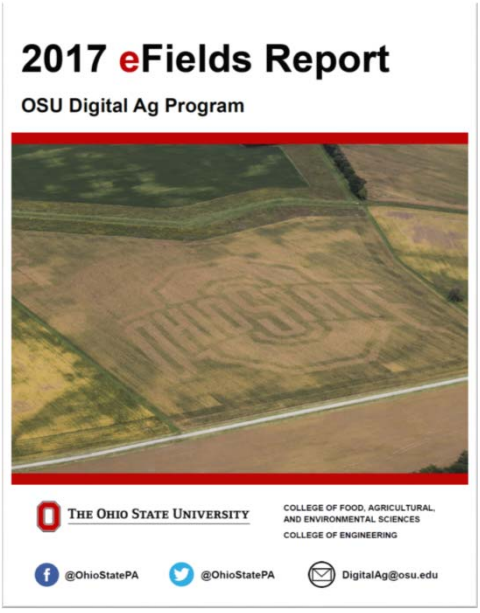

eFields
connecting science to fields

eFields represents an Ohio State University program dedicated to advancing production agriculture through the use of field-scale research.

www.OhioStatePrecisionAg.com

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