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

John Fulton

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

Better Machine Performance | Improved Job Completion | Better Agronomic Decisions

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

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.
In-cab Displays
Monitor In-field Performance

Improves field execution & on-farm research

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)
In-cab Displays
Monitor In-field Performance

Improves field execution & on-farm research

As-Planted Data
Downforce Map

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%20Technology%20for%20Spinners.pdf

**Section / Row Control for Planters**

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

Section / Row Control for 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
  o Compaction
  o Seed placed too deep
- NOT Enough DF
  o Too shallow
  o Risk of seed depth variation

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

Planter Row-Unit

Down Force Options
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.

<table>
<thead>
<tr>
<th>Target Depth (in.)</th>
<th>Downforce TRTS</th>
<th>AVG Depth (in.)</th>
<th>CV Depth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>none</td>
<td>0 lbs.</td>
<td>1.84</td>
</tr>
<tr>
<td>2</td>
<td>optimal</td>
<td>100 lbs.</td>
<td>2.20</td>
</tr>
<tr>
<td>2</td>
<td>heavy</td>
<td>195 lbs.</td>
<td>2.28</td>
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</tbody>
</table>

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%

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

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

192 bu/ac

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

Agronomic Data
Yield Maps

Requires cleaning before creating Rx's.
4 to 8 years of good yield data for prescriptive services.

Producer Value
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

Sensor

Impact plate

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.

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.

Machine Data

CAN messages, Health, etc.

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

<table>
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<tr>
<th>Fuel Rate</th>
<th>Speed</th>
<th>Engine Torque</th>
<th>Engine Speed</th>
<th>Engine Temp</th>
<th>PTO Speed</th>
<th>Battery</th>
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</thead>
<tbody>
<tr>
<td>6.88</td>
<td>4.1</td>
<td>55</td>
<td>1762</td>
<td>180</td>
<td>0</td>
<td>13.4</td>
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Agronomic Data

Yield Maps, As-applied...

Bridging Agronomic and Machine Data

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>Moisture Content (%)</th>
<th>Ground Speed (mph)</th>
<th>Fuel Usage (gallons per acre)</th>
<th>Mean % Engine Load</th>
<th>Mean Field Capacity (ac/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid A</td>
<td>14.8</td>
<td>2.8</td>
<td>1.71</td>
<td>86</td>
<td>10.2</td>
</tr>
<tr>
<td>Hybrid B</td>
<td>14.3</td>
<td>5.2</td>
<td>0.86</td>
<td>44</td>
<td>18.9</td>
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Evaluate variability of fields (field-by-field basis)

Identifying Man- / Machine-made Vs. Natural variability
Identifying Man-/Machine-made Vs. Natural variability

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

Click on the eFields tab
Digital Agriculture
Providing solutions to meet world demand

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