The Digital Transformation of Row Crop Agriculture

AgState Electronic Survey Findings

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Mapping Success in the Food System
Discover, Analyze, Strategize, Implement, Execute.
Topics

- Farmer Survey Findings
- Agronomist Survey Findings
- Comparisons and Contrasts of Both Surveys
Farmer Survey Findings
A web-based survey was conducted among row crop farmers in Iowa. Participants were recruited by three organizations through emails inviting them to complete an online survey:

A total of 384 people answered most of the questions in the survey; 101 of them provided write-in comments – a hefty 26%.
**Definitions Provided**

**Precision Agriculture**: The use of relatively new tools that the farmer has available to exercise greater control and management over his / her farming operation. This would include, but not be limited to, such things as:

1. auto-steer guidance on tractors, sprayers or combines;
2. variable rate planting;
3. variable rate fertilizer application;
4. multiple seed planting;
5. use of drones for scouting;
6. yield monitors on combines;
7. weather data by field for precipitation, temperature, etc.;
8. or other technical tools that have not been generally available until the last 10-15 years.
**Definitions Provided**

**Prescription Agriculture**: Crop production practices in which a service provider designs a "prescription" of best production practices for each small grid within each field that includes:

1. what hybrids/varieties to plant, at what planting population, at what row spacing;
2. type of fertilizer and crop protection chemicals (CPCs) used;
3. fertilizer and CPC application rates;
4. timing of fertilizer and CPC application; and
5. timing of harvest.

- The prescription is based heavily on a computer algorithm that processes aggregated data on all of these factors from your farm and other farmers.

- The "prescription" might be provided directly to the farmer or it might be provided to his / her trusted advisor, like his / her preferred ag retailer or local crop consultant.
Demographic Profile

Acres Farmed

- Up to 500: 19%
- 501 - 1,000: 31%
- 1,001 - 2,000: 13%
- 2,001 - 5,000: 1%
- 5,001 - 10,000: 36%
- 10,001 and above: 1%

Farm Operations*

- Corn: 97%
- Soybeans: 94%
- Hay: 36%
- Beef cattle: 30%
- Swine: 23%

Age

- 16 - 25: 1%
- 26 - 35: 7%
- 36 - 45: 14%
- 46 - 55: 24%
- 56 - 65: 37%
- 66 - 75: 14%
- 76 and above: 3%

Education

- Some H.S.: 3%
- H.S. Grad: 26%
- 2 years tech school: 27%
- B.A. or B.S.: 38%
- Grad degree: 8%

*Sheep, 4%; Layers, 2%; Wheat, 2%; Dairy Cattle, 2%; Broilers, 1%; Turkeys, 0%.

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About a third of those who responded “No” cited the cost, and about a quarter said, “I like the way I do things now.”

Use of precision ag tools are roughly evenly utilized across education levels and age groups.
Those with a high school degree as their highest level of education are much less likely to use satellite or aerial imaging technology or weather data.
There are variations in adoption of precision ag tools across demographic cohorts: education and age.

While 34% overall have used weather data by field for precipitation, temperature, etc., those with a BA / BS degree are about twice as likely as those with a high school diploma to use this data.

Similarly, those with a BA / BS are more than 60% more likely than those with a high school degree to use satellite or aerial imaging.

The age cohort 56 – 65 is less likely than the overall sample to adopt both these technologies.
Overall Satisfaction with Precision Ag Tools

Satisfaction with Precision Ag Tools

- Very Satisfied: 58%
- Somewhat Satisfied: 38%
- Somewhat Dissatisfied: 1%
- Very Dissatisfied: 2%

N = 378

96%
Those in the 36-45 age group were much less likely than those in the 46-55 age group to be frustrated with manufacturers directions.
Some additional frustrations were written in:

- Several noted satellite interruptions
- Issues with equipment calibration
- Expense … “crop value is not higher when tech is used”
- Accuracy with yield monitors
- Down time
- Tracking things that do not matter
Have you or your trusted advisor analyzed your farm-specific data coming from precision ag tools and tried to improve yields or profitability?

Those with a BA degree are more likely to respond “Yes;” those in the 36 – 45 age group were also more likely to respond “Yes.”

Have you tried "prescription agriculture" where a service provider designs a "prescription?"

Of these, 78% were Satisfied or Very Satisfied with the Results

Yes 22%
No 78%

N = 370
Respondents were asked what might have eased the transition to use of prescription tools, and compatibility among equipment / computers is clearly the most important factor.

**Aids to Ease Transition to Prescription Ag**

- Easy compatibility among all pieces of equipment and computers: 83%
- "Hands on" assistance when first using it: 55%
- A clear explanation of how to use it ahead of time: 37%

N = 76
Reasons for using prescription ag in order of importance:

N = 357

Maximum score = 10
The following information sources are ranked in order of trustworthiness.

\[ N = 374 \]

**Maximum score = 10**
Farmers were asked who has access to their farm data.

- **No one but you**: 49%
- Your agronomist/crop consultant: 45%
- Your seed company: 28%
- Your local retailer: 16%
- Your land owner or farm manager (for rental property): 14%
- Your equipment company: 7%

The youngest farmers were **less** likely to restrict data access to “only you” and **more likely** to give access to their seed company.

N = 380

- Protection of data security is a clear priority.
Concern about unauthorized access to farm data.

Average concern: 80%

- Unauthorized individuals: 34% Concerned, 40% Not Concerned
- Activist groups: 54% Concerned, 28% Not Concerned
- State or Federal governmental agencies: 52% Concerned, 31% Not Concerned

N = 378
Survey respondents were asked to rank several options for the most desirable way to store farm-specific data. The following represents the rank order of preference.

1. The farmer’s own computer
2. A local crop consultant
3. The farmer’s local ag retailer
4. An independent data warehouse firm
5. A major seed, chemical or equipment company
6. Doesn’t care

N = 369
Skeptical and/or Fearful of the New Technology – 65%

- The biggest concern is misuse of farm data by:
  - The ATPs
  - Activist groups
  - Grain traders
  - The government
  - Computer hackers
- Fear that it favors the large farmers.
- Prescriptions will recommend only some products, i.e., are biased.
- It doesn’t work. Agriculture is a complex biological system.

Neutral or Nuanced in Attitudes – 19%

- It has potential, but must be implemented carefully.

Embracing the New Technology – 16%

- The technology is here to stay. Let’s embrace it and make it work for us.
- No one that is highly profitable today is doing it with only their own ideas and crop data.
There is broad concern that vested interests are protected and promoted, e.g., the relationship an advisor has with seed / ag input / equipment vendors trumps the true best solution for the farmer.

The lack of clarity in data / information interpretation is problematic.

Profit-generation *versus* cost-saving perspectives are two schools of thought in the farmer community.

The rapid change in technology results in high-cost, yet obsolete systems in place.

Cost-benefit equation does not work for many.

A concern: “Retail suppliers and manufactures (chemical, seed, fertilizer) knowing the yield potential of the acres I control and then generating a "value" price for their product.”

Data is a valuable commodity … and the value should accrue to the farmer.

Diametrically opposed views exist in the farmer community: “I don’t care who has access to my data as long as it benefits me” *versus* “No one will have access to my data, and certainly not the government!”
Traders may use data / information to negatively impact market for farmers.

“The Big will get Bigger”

“Seed companies want to CHARGE me for the technology, then make money off MY data.”

“Some technology pays back fast, i.e. row shut-offs; while others will never pay off, i.e., auto-steer.”

Satellite dependency makes agriculture more vulnerable to terrorism.

Hacking is a huge issue.

“The data does not support sustained, increased yields due to new technology.”

Data will be used by activists against farmers.

In-field support is critical for the successful adoption and utilization of prescription ag tools.

“Information sharing is healthy and necessary for farmers to succeed at becoming as efficient as possible.”
Agronomist Survey Findings
A web-based survey was conducted among agronomists and managers of ag retailers in Iowa. Participants were recruited by two organizations through emails inviting them to complete an online survey:

A total of 215 people answered most of the questions in the survey; 65 of them provided write-in comments – a hefty 30%.
Demographic Profile

**Occupation**
- Employed by an ag retailer: 71%
- Provide other products or services to row crop producers: 18%
- Independent crop consultant: 8%
- Employed by an ag wholesaler: 3%

**Time in Role**
- N = 201
- < 3 years: 3%
- 3 to < 5 years: 4%
- 5 to < 10 years: 5%
- 10 to nearly 15 years: 8%
- > 15 years: 79%

**Primary Role**
- A management role: 49%
- An agronomist: 41%
- An ownership role: 10%

**Education**
- N = 201
- H.S. Grad: 18%
- 2 Yrs Tech: 26%
- B.A. / B.S.: 46%
- Master's: 6%
- Other: 3%
Agronomists were asked to estimate the percentage of acres they serve that are using eight different precision ag tools.

They were given the option of checking the relevant quintile – that is:

- 0 – 19%
- 20 – 39%
- 40 – 59%
- 60 – 79%
- 80 – 100%

The percentage of agronomists who answered in each of the five categories is presented in the following slides.

We present the eight tools in order from most common to least common.

In the successive slides, note the decline of agronomists who selected the high percentage usage and the rise of the low percentage usage.
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.

![Bar chart showing the percentage of acres served using auto steer guidance. The chart has a horizontal axis labeled 'Percentage of Acres Served' with categories 'Up to 20%', '20% to 40%', '40% to 60%', '60% to 80%', and '80% or More'. The vertical axis is labeled 'Percentage of Agronomists' and ranges from 0% to 100%. The chart indicates that the majority of agronomists estimate that 60% to 80% of acres are served using auto steer guidance. N = 220. Copyright © 2014 by The Hale Group, Ltd.]
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.

Percentage of Acres Served

N = 218
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.

![Bar graph showing the percentage of acres served ranging from 0% to 100%. The graph indicates that most agronomists estimate serving up to 20% of their acres.]
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.

Percentage of Acres Served

- Up to 20%
- 20% to 40%
- 40% to 60%
- 60% to 80%
- 80% or More

N = 219
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.
Agronomists were asked to estimate the percentage of acres served using particular precision ag tools.
Farmer-Customer Satisfaction with Precision Ag Tools

Satisfaction with Precision Ag Tools

N = 220

- Very dissatisfied: 1%
- Somewhat dissatisfied: 3%
- Rather neutral: 12%
- Somewhat satisfied: 66%
- Very satisfied: 19%

85%
Agronomists were asked if they …

…analyze farm-specific data from precision ag and help farmers improve yields or profitability using farm-specific data?

N = 215
Agronomy Services Provided (continued)

Agronomists were asked if they …

…provide *Prescription Ag* services that recommend hybrids/varieties to plant, population, row spacing, etc., based on aggregated farmer data?

N = 211

![Diagram showing the percentage of acreage for which prescription ag services are provided. 68% is the highest, followed by 17%, 8%, and 8%.]
Satisfaction with Prescription Ag

N = 209

71%
Motivators to Try Prescription Ag

N = 200

Maximum score = 10

- Improve yields
- Reduce costs
- Increase profitability
- Reduce risk
- Simplify operations
- Expand operation
- Use latest technology
- Improve environment
Unauthorized Access to Farm-Specific Data

Concern about access by unauthorized third parties.

Average concern: 73%

- Unauthorized individuals: 64%
- Activist groups: 74%
- State or Federal governmental agencies: 81%

N = 184
Impacts of Widespread Adoption of Prescription Ag

- Present new opportunities for data management as a service to farmers. (86%)
- Increase competition among providers of agronomic advice to farmers. (72%)
- Present new opportunities for providing field monitoring with drones as a service to farmers. (72%)
- Increase consolidation of farm size over time. (58%)
- Increase consolidation of ag input retailers over time. (53%)
- Reduce the sale of some input supplies, like nitrogen fertilizer. (35%)
- Lead to the integration of row crop farming similar to that of the swine industry. (32%)
- Reduce the need for local agronomists over time due to computerization. (26%)

Agronomists were asked the impacts – good and bad – of widespread adoption of Prescription Ag

N = 198
The last question of the survey asked,

What other ways might prescription agriculture change row crop farming or businesses closely related to farming over the long-term?

- There were 65 responses to this question.

- The following slides summarize the write-in comments into four categories:
  - Potential opportunities for farmers
  - Potential threats to farmers
  - Potential opportunities for ag retailers
  - Potential threats to ag retailers
Potential Opportunities for Farmers

- Increase profitability
- Produce more food for a growing population – especially abroad
- Enhance global competitiveness
- Greater cost efficiency
- Will enable farmers to make better environmental decisions
  - No excessive use of fertilizer and CPC
- Decisions will be based more on data and less on personal relationships and emotion
The most common concerns were:

- The potential for more government regulation or mandates using the data
- Accelerated consolidation of farms
  - *Farmers less tech savvy will likely exit*
  - *Large progressive farmers will get bigger*
- Could lead to integration of row crop farming

Concerns cited less frequently:

- Will be difficult to change ATPs after they have massive amounts of data on the farm
- Farmers will have fewer choices
- Farmer will become more of a manager and less of an operator
Potential Opportunities for Ag Retailers

- Will enable retailers to build stronger relationships with farmers
- Creates new business opportunities
  - UAVs
  - Software / data management
- Will increase the demand for agronomists who understand all of the interactions in growing a crop
- The “trusted advisor” will be the most important person for each farmer
- Will create stronger bonds between farmer and ag retailer
- Will enable better inventory management
Potential Threats to Ag Retailers

- Creates the potential for more government regulation
- Will accelerate consolidation of ag retailers
- Will shift some of the services farmers receive from local ag retailers to distant ATPs
- Will require more investment to provide needed services and some retailers may provide these services for no fees to gain market share
Comparison of the Two Surveys
The ranking of the prevalence of use of the eight Precision Agriculture tools was virtually identical in both surveys.

The satisfaction of farmers with Precision Agriculture tools differed slightly in the two surveys:

- 96% of farmers themselves said they were “somewhat satisfied” or “very satisfied.”
- 85% of the agronomists believed their farmer-customers were “somewhat satisfied” or “very satisfied.”

For the use of Prescription Agriculture, the responses were:

- 22% of the farmers said they tried Prescription Ag
- 50% of the agronomists said they tried Prescription Ag
- The above is not contradictory, but should be expected
In general, both farmers and agronomists agreed on the major motivations for adopting Precision Agriculture.

However, there was a slight nuance of difference:

- *Farmers ranked “Improving Profitability” as the highest reason.*
- *Agronomists ranked “Increasing Yields” as the highest reason.*

The difference was not highly significant.
Both farmers and agronomists were concerned about unauthorized access to data.

However, farmers were somewhat more concerned, as shown below.

**Percentage of those “Extremely Concerned”**

<table>
<thead>
<tr>
<th></th>
<th>Individuals</th>
<th>Activists</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>34%</td>
<td>54%</td>
<td>52%</td>
</tr>
<tr>
<td>Agronomists</td>
<td>19%</td>
<td>33%</td>
<td>34%</td>
</tr>
</tbody>
</table>

**Percentage of those “Extremely Concerned” and “Concerned”**

<table>
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<tr>
<td>Farmers</td>
<td>74%</td>
<td>82%</td>
<td>83%</td>
</tr>
<tr>
<td>Agronomists</td>
<td>64%</td>
<td>74%</td>
<td>81%</td>
</tr>
</tbody>
</table>
Both groups expressed concerns – especially about:

- Increased regulation
- Accelerated consolidation

The farmers were clearly more strongly negative than the agronomists in both:

- The percentage of negative comments, compared to neutral or positive comments
- The tone of the negative comments
Thank you