Prove it works in my field!

Dan Frieberg
Premier Crop Systems
2017 InfoAg
Personal Background

• IA farm – ISU – wholesale fertilizer sales – 3 years, retail dealership – 8 years.

• CEO – IFCA – Agribusiness Association of Iowa. Lobbyist, lead in public policy debates.

• Business consulting – led to creation of Premier Crop – 19 crop years ago
Presentation outline

- Share who is Premier Crop and what we do
- Prove it works in my field
- Share some ideas on the future
Premier Crop’s mission - To assist growers and their trusted agronomic advisors in creating real value from their geo-referenced agronomic data by converting data to knowledge supporting improved production decisions in an economic and sustainable manner.
Premier Crop background

• Started with the 1999 crop year (in our 19th crop year).
• Historically have marketed through select retailers and advisors. An agronomy company that looks like a software company.
• Own our software. Web-based. Unlimited geography but primarily focused on crops with yield files.
• Any layer – agronomic, economic, weather, etc.
Premier Crop Customers

• Our customers are some of the largest and most successful retailers and advisors in their market areas.

• Many are considered the industry leaders in precision ag and offering quality agronomic advice to growers.

• Premier Crop is their behind-the-scenes technology provider

• Our greatest success is leading our customers to launch successful for-charge sustainable programs.
GPS technology has allowed us to begin to measure spatial variability of many layers of agronomic data across our fields.

Many growers are accumulating reams of data with notebooks full of maps and hard drives full of computer files.
Beyond “pretty maps”
Real world agronomy is integrated and complex
In building “big data”, we treat each 60’ by 60’ area as an observation – a typical 100 acre field = 1,000 observations!
A typical grower with 3,000 acres = 30,000 observations
A Premier Crop customer with 100,000 acres in their program = 1 million local yield observations each year. 5 years of data = 5 million local agronomic observations
Grower, farm, and field hierarchy

Soil samples

Yield
Variable rate fertilizer
Variable rate fertilizer

Planting points

Geo-referenced field boundary

Soils

Weather

52 weeks of:
GDU’s
Weekly Rainfall

Field production information, costs, etc.

(12 total attributes)
Soil Type
Soil Great Group
Soil SubOrder
Soil Order
Soil Texture
Slope
CSR

(8 total attributes)
Moisture
Harvest date
Harvest speed
Dry yield
Elevation

(24 total attributes)
Phosphorus
Potassium
Magnesium
pH
pH Buffer
Zinc
OM
CEC
Calcium
NO3
Sulfur
Manganese
Boron
Base Saturations

Variable rate

(28 total attributes)
Applied K Rates/Timings
Applied P Rates/Timings
Applied N Rates/Timings
Sulfur Rates/Timings
Boron Rates/Timings
Zinc Rates/Timings
Manure
Starter
Additives
ETC...

(15 total attributes)
Hybrid/Variety
Plant speed
Plant date
Target population
Inforce
Population
Singulation
Spacing
Seed Treatment
Insecticide
Premier Crop

• Organizes data into a database structure that allows you to see the relationship between all the layers of data that you can collect.
• Provides tools that show previously hidden relationships.
• Provides analysis at the sub field, field and grower level and across thousands of confidentially pooled acres.
Premier Crop

• Grower owns the data – Premier Crop owns no data.

• Collectively participating growers own the aggregated data

• Most important question – who owns the knowledge created from the data
Correlation—not always cause and effect

Years of working with farmers

Hair Loss
Understanding data uses & limitations

• Examples of disciplines that rely on observational or evidence-based data

  – Economics, epidemiology, insect and human behavioral sciences

  – Human medicine (both)

  – Genomics (both) – SCA (single gene mutation) vs. aging
Since 2005 - our fastest growing trend – Variable Rate Planting

• Visual – growers love using their historic yield data
• Simple message – A, B, C’s
• Checking our work – Learning Blocks™
• Synergy – with nutrients
Final Management Zone Map

Corn Management Zone

Premier 1020
- 79.86 to 94.83 (43.7 acres)
- 81.28 to 87.44 (1.0 acres)
- 79.59 to 93.81 (66.6 acres)
- 92.99 to 97.22 (6.2 acres)
- 84.55 to 98.32 (120.3 acres)
- 93.01 to 96.32 (6.2 acres)
Learning Blocks vs. Replicated Strip Trials

• Learning Blocks
  – Match real world field conditions
  – Doing research where it needs to be done

• Replicated Strip Trials
  – Designed to generate “average” results
  – Strip treatments cross ABC zones
Don’t We Already Know Better?

<table>
<thead>
<tr>
<th>Premier 1020</th>
<th>Range</th>
<th>Acres</th>
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<tbody>
<tr>
<td>Red</td>
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“Prove it works in my fields”

- Show me state
- Lack of adoption – precision ag
- New products that look great in plots but never reach/gain critical market share
What growers want

• “Integrate with me”
• “Local is always best and you can’t get more local than my fields”
• “but does it work on my fields”
• “don’t ask me to slow down to put in a plot or a trial”
“Prove it works in my fields”

- LB’s = great experience – growers love it – and many times LB’s are enough to answer the Missouri challenge.
A progression to the perfect recommendation
What are Enhanced Learning Blocks?

• Building on our traditional Learning Blocks™

• Adding replication and randomization within each Learning Block
  – Fits traditional experimental design criteria
  – Proves cause and effect

• Area
  – 2.5-3 acres
    • 3 rates replicated a minimum of 5 times
Enhanced Learning Blocks℠

• 2016 crop year = over 500 trials – from concept to results

• Want to share some of the 2016 stories
Enhanced Learning Blocks℠

• Understanding real-world agronomy – likelihood that you could place a formal experiment in a field and have what you are testing be the yield limiting factor
**Enhanced Learning Blocks℠**

**Experiment Details**

- **Experiment Type:** Nitrogen
- **Nutrient Product:** 32-0-0
- **Number of Rates:** 3
- **Replicates per Rate:** 5
- **Total Replicates:** 15
- **ELB Area:** 5 acres

**Treatments**

<table>
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<tr>
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<th>Intended Rate</th>
<th>Avg. Applied Rate</th>
<th>Avg. Yield</th>
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<tr>
<td>A</td>
<td>24.96</td>
<td>36</td>
<td>270 bu/ac</td>
</tr>
<tr>
<td>B</td>
<td>62.4</td>
<td>61</td>
<td>271 bu/ac</td>
</tr>
<tr>
<td>C</td>
<td>99.84</td>
<td>93</td>
<td>272 bu/ac</td>
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$23/acre savings
Enhanced Learning Blocks℠

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$13/acre net gain for higher rate
Enhanced Learning Blocks℠

**Experiment Details**

- **Experiment Type:** Plant Population
- **Number of Rates:** 3
- **Replicates per Rate:** 5
- **Total Replicates:** 15
- **ELB Area:** 3.3 acres

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<td>17113</td>
<td>129 bu/ac</td>
</tr>
<tr>
<td>B 21000</td>
<td>21090</td>
<td>141 bu/ac</td>
</tr>
<tr>
<td>C 24000</td>
<td>24247</td>
<td>150 bu/ac</td>
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Enhanced Learning Blocks℠

• Knowledge being created has two distinct values
  • Increased product knowledge
  • Increased sub-field knowledge
we have over 1,500 N-rate yield response trials from seven states. 90% of these have come in the last 15 years.
Why current knowledge isn’t enough

- Foundations of current knowledge are from very few trials.
- Leap from results from limited trials fitting other spatial diverse landscapes.
- One variable at a time design with other like YLV elevated.
- Missing possible synergies because of experimental design and inability to scale.

This is likely the largest N rate response dataset... In the World

1500 N rate trials over 15 years over 7 states
- 90% in last 15 years
= 1350 trials/15/7
= 12.85 trials per state per year
What’s possible with Enhanced Learning Blocks

• One grower – 30 corn fields – 3 ELB’s per field = 90 replicated trials per year
• 10 similar growers in your market area = 900 replicated trials per year
• 25 market area per state = 22,500 trials per state per year
• 3 years = 67,500 trials per state
• Predictive models are response-trial-hungry
• Every new product has a “perfect fit”
• Every new product needs validation in grower’s fields.
The future

• Science Friday – Ira Flatow

• Fruit Flies Aid Efforts to Develop Personalized Cancer Treatments
  By Christine Gorman | August 15, 2013
Can “precision ag” become agriculture’s fruit fly?

• The genes that are important for such developments in fruit flies are close enough on the molecular level to those found in people that studying the pathways in the insect will give you a lot of insight about what’s going in people.

• Indeed, biologists have gotten so good at producing fruit flies with specific genetic mutations that they can now order their own custom-designed insects from various supply houses via computer and have them delivered straight to the laboratory door.
Can “precision ag” become agriculture’s fruit fly?

• In other words, some of the mutated genes found in a tumor are acting as “drivers” of cancer growth and spread while others are “passengers” that pop up as the cells becomes more and more disorganized and mutations start to accumulate. The trouble comes when clinicians find that an individual patient’s tumor has 200 or more mutated genes—which ones should they be focusing their attention on and which can they safely ignore?
Can “precision ag” become agriculture’s fruit fly?

• On average, they find 180 matching genes in the flies. Then they go to a computer and order up 180 fruit fly lines—each one of which is specifically bred to have the same Ras and Src mutations plus one rare variant, based on the genetic profile of the human patient’s tumor.

• Eventually they whittle the number of genes down to about ten that seem to matter. Those ten genes (including the Ras and Src genes) produce a cancerous growth in the fly that most closely resembles the one in the human being. In other words, as Cagan says, “We’re building personalized flies.”
Can “precision ag” become agriculture’s fruit fly?

• The beauty of these highly detailed fruit fly experiments is that they allow researchers to start tackle the real-world complexity of malignant tumors rather than having to simplify everything, treating all breast cancers or all colon cancers alike and being disappointed when the results aren’t more predictable.”
Can “precision ag” become agriculture’s fruit fly?

• The answer is “yes” – that’s the promise of precision ag!

• Most fundamental change – precision ag’s history is applying existing knowledge spatially vs. using spatial data to create new complex agronomic knowledge that can be used in the most site specific applications possible.
New Opportunities

• To help us grow and further develop, Syngenta Ventures has become a minority partner in Premier Crop.
New Opportunities

• We believe we can combine the best of big data analytics and traditional experimental design to create new local complex agronomic knowledge.

• Enhanced Learning Blocks = Knowledge Creation at the Speed of Farming