On-Farm Research
A Grassroots Approach
The story of the Kansas Ag Research & Technology Association

Presented by Lucas Haag, Associate Professor and KARTA Faculty Advisor
Kansas State University Northwest Research-Extension Center, Colby, Kansas
Disclaimers

- This is a story of many people, over many years, who have worked in a voluntary capacity. Any success that we may have had is due to the contributions of countless producers, industry, and K-State Research & Extension faculty.

- We do not necessarily have this figured out. I’ll do my best to not overstate our accomplishments and will freely share our challenges with you. I might be hard on ourselves also.

- This presentation is largely the view through my eyes, and thus includes my biases.

- The research examples I give aren’t intended to discuss the topic per se, but to give examples of what our members have done.
What is KARTA?

A brief history...
The same group of people keep showing up to this precision ag conference....

- Beginning in 1998, K-State Extension faculty working in precision ag, led by Randy Taylor, had organized several annual precision ag conferences.

- An astute observation: There was a core group of people that came to and actively engaged in every precision ag event of the time.

- How can we in Extension leverage the excitement and knowledge of these tech-savvy producers to move precision ag forward in Kansas?

- This needed to be bigger than an Extension effort, we needed producers with skin in the game to also provide leadership.
Next steps...

- In 1999, Scott Staggenborg, KSU Extension Agronomist, visits the Montana Precision Ag Research Association, an organization of early adopters of precision ag tech, who had begun to conduct on-farm research.

- The idea of forming a similar organization in Kansas is pitched to the attendees of the next Kansas Ag Technologies Conference. Initially the response from attendees is quite subdued, but momentum builds.

- May 17th, 2000 - Articles of Incorporation are filed, 4 producers and 1 agribusiness representative are the first board members.
On-Farm Research Becomes a Key Mission

- At the 2002 Annual Meeting the first presentations from producers conducting on-farm research are part of the agenda and the membership votes to allocate $6,000 towards producer research grants

- Research funding is subsequently increased to $8,000 in 2006 and $11,000 in 2013

- Funding and support continues to evolve as a key mission of the organization
Why On-Farm Research?
Producer Implementation of Precision Ag

- Better whole-farm management
  - On-Farm Research

- Better whole-field management
  - Making changes from field to field

- Site Specific Management
  - Same process, different scale
A key thought motivating on-farm research

“Precision ag will allow us to make better uniform (whole-field or whole-farm) management decisions.”

- Randy Taylor

- What we learn from PA will lead to better large scale decisions
- Farmers will at least “turn the dial” at the field scale
Technology Changes the Game

- Yield monitors and other precision ag technologies are making it easier for producers to conduct meaningful research.
  - It also makes it easier to conduct junk “research”, just because your software lets you slice yield by some factor doesn’t make it a useful number you should trust. Research should be purposeful.
Why On-Farm Research

- Resources at land-grants are declining and the answers are not going to be as site and situation specific as you would like
- Barrage of specialty products in the market
- \( G \times E \times M \) Interaction
- A way to generate another economic return on your technology investment
Why On-Farm Research

- Producers were looking for an ROI on their technology investments
  - Think back to the early 2000’s, PA hardware was not standard equipment, significant investments has been made
  - The “duh” technologies of autosteer, autoswath, etc. had not yet emerged, people were looking for a payback
KARTA’s Role in On-Farm Research
The role of KARTA - Philosophical

- On-farm research results are considered a byproduct to our mission
  - We are more interested in teaching, sharing, and improving the process of on-farm research than we are any of the results.

- We want to empower you with the skillset needed to use the technology to answer your own questions

- Grassroots vs. Top-Down: While organized projects have a role, the producer will have more buy in if they are researching a topic of their choosing
The role of KARTA

- Networking
- Grant Support, aka “Guilt money”
- Learning Opportunities to Support On-Farm Research
- Outreach to the broader Ag industry
- Annual Ag Technology Conference
The role of KARTA - Networking

- A unique blend of producers, industry, and land-grant personnel
- The source of many ideas, both in terms of research ideas and more importantly, ideas of how to best implement a research project
- Our long-time farmer researchers are a critical piece of this, practical experience
- Land-grant members bring perspective on field and analysis methods
The role of KARTA - Grant Support

- One-page grant application
- Research Coordinator is a position on the board of directors
- Applications are reviewed, external input is sought when needed
- Awards are generally small ($1,000 or less)
- The idea isn’t to fully fund a project but help
- Guilt Money
The role of KARTA - Learning Opportunities

- Workshops are organized through the year
- Serve a dual purpose
  - General audience
  - Support our members who are conducting on-farm research
- Examples
  - Creating VRT scripts from on-farm response data
  - Data analysis and presentation (prior to annual meeting)
  - Using Yield Editor to clean yield monitor data
  - sUAVs and their role in supporting on-farm research
The role of KARTA – Outreach to the broader Ag industry

- These efforts have been opportunistic in nature
- Kansas Applicator Institute (2012-2014)
  - Partnered with Kansas Ag Retailers in providing content for a program geared towards retailers and custom applicators
- Ag Tech Expo in partnership with KS Dept. of Ag
  - Facilitated producer/industry panel on ag tech adoption
  - Presentation on implementing on-farm research for tech ROI
The role of KARTA - Annual Conference

- A project isn’t considered complete until a presentation is made at the Annual Kansas Ag Technologies Conference (*Jan. 16-17, Junction City*)
- Forces synthesis and analysis of the data
- At times, a December workshop has been conducted for participants
- Provides an open venue for feedback on both the findings and more importantly the research process
Lessons Learned
Keep it Simple

- Defining a clear research question is often the hardest part of the process.
- With first time participants, having a success in year one is key to keeping them hungry for more.
- Simpler projects have a much higher probability of success (especially as skills are being built in the early years).
- As the skillset grows so can the complexity of the project.
Keep it Simple to Start Success

- Teach the basics
  - Considering planting width and pattern vs. harvesting width and pattern
  - With and without make for easy T-Test analysis
- Build success, build skills, and work from there
The Power in Numbers

*Multiple Producers, Multiple Site-Years*

- While we are a grass-roots group with a huge range of independent research interest, there is tremendous power in getting a handful of folks on the same page.

- Growers with the same question who are in similar production systems can amass a site-years quickly with a well planed project.
Effect of Oat Cover Crop and N Fertilization on Subsequent Soybean Grain Yield

Year 2 – 2013 Crop Year
Doug Palen, Glen Elder, Kansas
Chad Simmelink, Esbon, Kansas
Justin Knopf, Gypsum, Kansas
Kevin Wiltse, Rush Center, Kansas
Lucas Haag, K-State NWREC, Colby, Kansas
### Materials and Methods – Mitchell 2012 Plot Plan

- Strip plot design
- 6 replications of 3 treatments
- 90ft wide strips
- Ensures 1 clean yield monitor pass

<table>
<thead>
<tr>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Seed</td>
</tr>
<tr>
<td>Oats Only</td>
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<tr>
<td>Oats and Fertilizer</td>
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<tr>
<td>No Seed</td>
</tr>
<tr>
<td>Oats Only</td>
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<tr>
<td>Oats and Fertilizer</td>
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<tr>
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</tbody>
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Plan 2012 FS2.21

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24 January, 2014
## Soybean Yield Results

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dickinson</th>
<th>Jewell</th>
<th>Mitchell</th>
<th>Across Locations</th>
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</thead>
<tbody>
<tr>
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<td>bu ac⁻¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NT Fallow</td>
<td>45.7 a</td>
<td>38.3 a</td>
<td>42.6 a</td>
<td>42.3 a</td>
</tr>
<tr>
<td>Oat Cover</td>
<td>42.6 b</td>
<td>24.7 b</td>
<td>36.3 b</td>
<td>34.5 b</td>
</tr>
<tr>
<td>Oat Cover w/Nitrogen</td>
<td>42.5 b</td>
<td>20.2 b</td>
<td>31.2 c</td>
<td>30.8 c</td>
</tr>
</tbody>
</table>

ANOVA P>F

<table>
<thead>
<tr>
<th>Source</th>
<th>Dickinson</th>
<th>Jewell</th>
<th>Mitchell</th>
<th>Across Locations</th>
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</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>0.0112</td>
<td>0.0013</td>
<td>0.0001</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>LSD = 0.05</td>
<td>1.8</td>
<td>6.6</td>
<td>3.6</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Discussion

- Spread of yield differences among sites
- Difference in residual N across sites
- Delayed emergence at Jewell site
- Why an 18 bu. ac$^{-1}$ reduction at JW, 11 at MC, and 3 at DK? What made the difference?
Conclusions

- On-farm research methods can produce “clean” data
  - Plots of equal size
  - Treatment strips of 3x header width will help in getting one good pass of yield data

- Coordinated multi-site studies allows collection of multiple “site-years” in less time

- Nitrogen effected biomass growth of oats
The Power in Numbers

One Producer, Large Number of Site-Years

Another benefit to maintaining simplicity in projects, it’s easier to handle large numbers of replications and thus increase the confidence in what you observe.

Example: Do row-cleaners pay in Northwest Kansas No-Till Limited Irrigation Corn?

This question flies in the face of common perception, “Of course they do!”
Row Cleaner Evaluation in limited irrigation no-till corn -in Northwest Kansas

22nd Annual Kansas Ag. Research & Technology Association (KARTA) Conference
January 17 and 18, 2019
Junction City, Kansas

www.kartaonline.org
Standard Strip Trial
## Results 2016

Table shows reps, averaged by Field. Total observations = 58

<table>
<thead>
<tr>
<th>Field</th>
<th>Reps</th>
<th>Row Cleaner</th>
<th>No Row Cleaner</th>
<th>Yield Diff</th>
<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>197.54</td>
<td>193.42</td>
<td>4.12</td>
<td>Grazed</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>120.80</td>
<td>122.53</td>
<td>-1.73</td>
<td>Cover</td>
</tr>
<tr>
<td>C</td>
<td>14</td>
<td>238.20</td>
<td>237.72</td>
<td>0.48</td>
<td>Cover</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>207.26</td>
<td>207.35</td>
<td>-0.09</td>
<td>Grazed</td>
</tr>
<tr>
<td>E</td>
<td>8</td>
<td>213.27</td>
<td>215.10</td>
<td>-1.83</td>
<td>Grazed</td>
</tr>
<tr>
<td>F</td>
<td>10</td>
<td>209.20</td>
<td>211.35</td>
<td>-2.14</td>
<td>Grazed</td>
</tr>
</tbody>
</table>

No Difference!
Table shows reps, averaged by Field. Total observations = 67

<table>
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<tr>
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<th>Reps</th>
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<th>Yield Diff</th>
<th>Treatment</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>16</td>
<td>166.56</td>
<td>171.74</td>
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<td>Grazed</td>
</tr>
<tr>
<td>C</td>
<td>13</td>
<td>154.19</td>
<td>152.18</td>
<td>2.01</td>
<td>Grazed</td>
</tr>
<tr>
<td>E</td>
<td>16</td>
<td>190.41</td>
<td>184.10</td>
<td>6.32</td>
<td>Grazed</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>253.03</td>
<td>252.75</td>
<td>0.28</td>
<td>None</td>
</tr>
<tr>
<td>G</td>
<td>4</td>
<td>209.30</td>
<td>205.60</td>
<td>3.71</td>
<td>Rye Cover</td>
</tr>
</tbody>
</table>

Maybe a little Difference?
## Results 2017 –Same Combine

<table>
<thead>
<tr>
<th>Field</th>
<th>Reps</th>
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<th>No Row Cleaner</th>
<th>Yield Diff</th>
<th>Treatment</th>
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<tr>
<td>A</td>
<td>3</td>
<td>178.80</td>
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<tr>
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<tr>
<td>G</td>
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<td>194.93</td>
<td>194.91</td>
<td>0.02</td>
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</tr>
</tbody>
</table>

To check for data collection problems associated with running 4 machines across plots, this table shows only observation pairs that resulted from the same machine cutting both the plot and the control for any specific observation. Again, little Difference!
## Results 2018

The table below shows the yield differences across different treatments, averaged by field. A total of 85 observations were recorded.

<table>
<thead>
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<th>Treatment</th>
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<tbody>
<tr>
<td>A</td>
<td>9</td>
<td>213.65</td>
<td>204.97</td>
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</tr>
<tr>
<td>C</td>
<td>16</td>
<td>220.48</td>
<td>224.38</td>
<td>-3.89</td>
<td>Grazed</td>
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<tr>
<td>E</td>
<td>16</td>
<td>263.84</td>
<td>263.05</td>
<td>0.80</td>
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</tr>
<tr>
<td>F</td>
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<td>288.56</td>
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<tr>
<td>G</td>
<td>12</td>
<td>226.42</td>
<td>224.66</td>
<td>1.76</td>
<td>Rye Cover</td>
</tr>
<tr>
<td>H</td>
<td>16</td>
<td>294.49</td>
<td>288.26</td>
<td>6.23</td>
<td>Soybeans</td>
</tr>
</tbody>
</table>

Again, maybe a little Difference?
## Results 2018 – Same Combine

To check for data collection problems associated with running 4 machines across plots, this table shows only observation pairs that resulted from the same machine cutting both the plot and the control for any specific observation.

<table>
<thead>
<tr>
<th>Field</th>
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<tbody>
<tr>
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<tr>
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<td>295.51</td>
<td>301.62</td>
<td>-6.11</td>
<td>Soybeans</td>
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</table>

| 18    | 253.26 | 253.42 | -0.16 |

Noppe, back to no difference!
## Results 2016, 2017, 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Field</th>
<th>Reps</th>
<th>Yield Cleaner</th>
<th>Yield No Cleaner</th>
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Prior Planning Prevents Poor Performance

- Our biggest disappointments have generally resulted when planning and design of the study was inadequate
  - Poor treatment selection
    - (e.g. wide enough ranges for response curve work)
  - Poor Experimental Design
    - No true replications, design doesn't match inference space
  - Failure to maintain data integrity
    - Can occur by accident or negligence
- Difficult to salvage something that starts off wrong
Future Challenges
Future Challenges - On Farm Research

- Ag software has made little, if any, progress in facilitating on-farm research. Often still a multi-application approach, FMS, GIS, Excel, R, etc.

- Balancing increasingly complex questions with the practical limitations of on-farm research

- Still a need for people with research experience as well as boots on the ground agronomy. People, and their time, is in short supply
Future Challenges - KARTA Organization

- Things have changed a lot since the late 1990’s, we’ve tried to keep up. How do we continue to evolve?

- Changing demographics, changing ways of learning, changing ways of ingesting information. How do we adapt?

- Changes in how people want to learn from and interact with their data. “I don’t have time for the process, just give me the answer”
Future Opportunities

- We have access to more data, at less cost, than ever before. This supplementary data will help us better understand the key yield response. (This is also a challenge)

- There is an opportunity here for CCA’s and consultants to drive the use of ag technology for \textit{quality} on-farm research, as a value-added service to their clients and to better inform their own recommendations.
A Wide Range of Interest - 2018 Projects

- Cover Crops in Continuous Irrigated Corn
- Soil-Specific Cover Crop Selection
- VariMax Testing
- Fungicide on Soybeans
- Evaluating Talc Seed Treatments for Corn
- Row Cleaner Evaluation in Irrigated Corn
- Zinc Soil Management for Corn
- Long-Term Effect of Canola in Crop Rotation
- Soybean Seed Rate x Plant Date x Maturity
- Low-Cost Thermal Camera Use in Ag
- Vegetable Production Tunnel Comparison
- Grain Sorghum Seeding Rates
- What Does a Yield Data Point Represent?
Reflections from 10 Days in Germany & Agritechnica, the World's Largest Farm Show

- Mark and Kim Viets
- Gary and Dianna Kastens
- Terry and Marilyn Kastens
- John Kreuger
- Denton Haag
- Lee Scheufler
- Dan Taylor
- Tony Steuve
- Ajay Sharda
- Randy Taylor

November 1 – 12, 2015
What really makes KARTA tick?

Our people, who thrive on technology but also enjoy a good story, sharing ideas, and calling BS on someone when needed.
Comments, Questions, Discussion

www.KARTAonline.org