Utilizing the Precision Ag Tools you Already Have

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Using Precision Ag Technologies

• Technology allows for variable rate control of crop inputs
• It also provides georeferenced data records when implemented properly
• This gives us the opportunity to compare field productivity with several other data layers
• Technology must be setup and maintained properly to ensure best-possible data
• Some data layers are questionable for analysis
Why do your own field tests?

- You may have practices unique to your operation that make a study particularly informative
- You can see how a new product or practice would directly affect your operation
- Some costs may be associated with On-Farm Research (OFR):
  - Time to collect and analyze data
  - Wasted products or inputs
- It’s a great way to partner with researchers to supplement University studies
Site Selection

• The site is where you conduct the study, by testing different treatments (products or practices)
• Choose a uniform area of the field to test differences (unless you’re using soil type or slope for a treatment, for instance)
• You want to limit the effects of external factors on your treatments, if possible
• Try to focus on simpler studies with two or three treatments to minimize unknown interactions
Site Selection

• Use historical yield data to help identify field locations where studies would be best conducted
• You can use other data layers as well (aerial, soil maps, etc.)
Layout of In-Field Experiments

- Try to always leave a check strip (no treatment) if possible
- Plan to have replications (>> 3) of each treatment (multiple strips of each treatment, for instance)
- Randomize the treatments across the field (not treatment A on the east half and B on the west half)
- Equipment widths become very important!
Data Collection

• Some field studies may not lend themselves to using precision ag technology, notes become even more important!

• Examples of data:
  • Dates of planting, harvest, treatments, rainfall
  • Plant populations during the season
  • Any in-field applications
  • GPS points of in-plot issues
  • Photographs of test area
Ensuring Quality Data Collection

- This can be a considerable time investment, but is an important part of the management process.
- The basis of these systems rely on sensors which all have error associated with them.
- We need to be consistent!
Precision Ag Tools for Data Collection

• Precision Ag equipment can automate much of this data collection for us
• As-applied planting, chemical application, fertilizers, harvest data are some examples
• GPS gives us the ability to record location and time
• GIS systems (ArcMap, SMS, SST, Apex, etc.) give us the ability to analyze the data
• We will look at some examples of pros and cons with these systems
Precision Ag Tools for Data Collection

• Some tips can help with using yield monitor data:
  • Calibration is critical for each crop
  • Plot strips need to be greater than 200 feet in length to ensure data smoothing is minimized
  • Separating data into Loads may help (for instance in headlands)
  • Data should be “cleaned” using post-processing tools like Yield Editor (USDA)
Precision Ag Tools for Data Collection

- Other data sets (planters, applicators) also need to be scrutinized to ensure good info is collected:
  - Treatment application locations (hybrids on a planter, paths made by sprayers, etc.) are generally okay, depending on GPS
  - Using a seeding rate or application rate with these implements should be verified somehow (calibration or field verification)
  - Many of these systems are not changing rates instantly, this can affect our results
Analyzing Results

- We’ve focused on collecting good data, remember, bad data in = bad information out
- Data should be analyzed using statistical methods to determine if differences among treatments does exist and how confident we can be in those results
- Work with someone with experience to do this analysis, which often requires special software
- In the end, tying an economic analysis is really worth the time, the change must make sense in dollars, not necessarily bushels!
Drawing Conclusions

- The goal of OFR is to help you decide what products or practices have been beneficial to your operation.
- This could be economic or environmental change!
- Hopefully, the information you gain can be used in the next year to improve your operation.
Examples

- Opportunities include using yield monitor data to conduct our OFRN trials
- Data attributes including yield and crop moisture content may be interesting
Examples

- GIS analysis of as-applied split-planter data versus yield monitor data across a field
- Analysis can be automated to generate results within minutes
Examples

- GIS can be used to analyze multiple field data layers to separate out unknowns within field
- Did soil type, texture, or slope affect our production
Examples

- Tracking as-applied data can be used to help evaluate field research and record keeping.
- GIS analysis can help to separate out unintended “treatments” in the data.
- Were natural factors involved?
- Did we unintentionally affect the plots in any other ways?
Examples

• Precision Ag technologies to help with study setup and to ensure that our data provides useful and correct information
• Study design is critical in every case
Examples

• We can now track our prescriptions for different products (seed, fertilizer, pesticides)
• Comparisons with as-applied data will allow us to determine where improvements can be made in our operations
• Operator training/technology development will benefit from this information
Furthering GIS Analysis

- GIS analysis provides the opportunity to get more from the data
- In this example, we have as-applied split-planter hybrid, NRCS soil grades, and yield monitor data
Furthering GIS Analysis

- A preliminary analysis would tell us that yield versus hybrid was:
  - Hybrid A = 137 bu/ac
  - Hybrid B = 135 bu/ac
- Is there more information we can get from these data?
Furthering GIS Analysis

• Overall yield versus NRCS soil grade estimates would lead us to conclude that:
  • 0 to 2% Grade = 188 bu/ac
  • 2 to 6% Grade = 89 bu/ac
  • 6 to 11% Grade = 58 bu/ac
• Surely there’s more we can find???
Furthering GIS Analysis

- Furthering the analysis, we can separate Hybrid versus NRCS soil grade to look at yield, which would show:
- Separating these variables with GIS provide more information…what other layers could we use?

Hybrid A planted within NRCS Soil Grade 2 to 6%
Data Quality

- Poor data into any analysis leads to poor information gained
- This can include future evaluations or prescription development
- Example of yield data errors on N rate predictions:
Future Data Analytics:
Dataset Overlay for Spatial Analysis
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Precision Technology: Coming up

• Harnessing all of these data sources will be difficult for individuals
  • Weather forecasting
  • Remote sensing data (satellite, UAVs)
  • Crop growth modeling
  • In-season sensing from field equipment
• Enrolling in cloud-based data management programs may be necessary for sufficient data analytics tools
• This has been a one reason for the recent discussions on data ownership and usage
Precision Technology: Coming Up

• This may or may not provide good information…depends on what you’re looking to change in certain operations and what your management capabilities are.
• Decision support tools are lacking, but decisions will likely be increasingly based on ag data analyses.

[Graph showing the increase of Experience Based Decisions and Analytics Based Decisions over time.]
Summary

• Using Precision Ag technologies and GIS software, we can perform analyses based on our own operations.
• Equipment setup, calibration, and monitoring is critical for good data.
• Proper analysis methods and research trial setup is important: [http://cropwatch.unl.edu/farmresearch](http://cropwatch.unl.edu/farmresearch)
• Learning how to conduct proper analyses is also important: [http://cropwatch.unl.edu/ssm](http://cropwatch.unl.edu/ssm)
Thank you very much!

Please let us know if you have questions!

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