Using On-Farm Research:

Detecting Real Differences

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Purpose and outline...

The purpose of this presentation is to help growers and consultants better understand a few of the fundamental concepts of on-farm research.

Outline
- On-Farm research: Why do it?
- Is it real or is it "noise"?
- Sample protocols

Why Do On-farm Research?

- Come up with a fact-based answer to a question for which no sound answer previously exists.
- Use answer to predict FUTURE performance or response of the crop to some change in management practices.

Why Do On-Farm Research?

- Validate previously discovered answers for a question of interest.
- Site-specific
- Convince yourself that some alternative management practice is profitable for own conditions.

On-Farm Demonstrations

- Are not synonymous with research.
- Their purpose is not to identify or validate answers to research questions, but rather to simply...
  - Acquire experience with new technology
  - Expose others to new technology
  - Yield response or other data need not be measured or analyzed.

Research answers questions...

- “XXX hybrid beat YYY hybrid on my farm last year by 10 bu/ac.”
- “Therefore, I am not going to plant your hybrid on my farm next year!”
- Is this a mistake?
Similar or different colors?

Excessive background noise can mask differences.

What’s causing the difference?

A
B
C
D

Background noise can be...

- Human error in conducting the trial.
- Variable soil characteristics within a field.
  - Soil texture, drainage, compaction, elevation
- Within-field variability for insect & disease damage, herbicide injury, weather, etc.
- From year to year, weather variability creates a lot of "background noise", especially as it interacts with other factors.

Your challenge is...

- To sort out the true yield effects of the treatments from those effects caused by "background noise".
- You can never be 100% certain that yield differences in a trial are solely due to the treatments being evaluated.
- Fortunately, that’s why statistical analysis was invented!

Statistics: Who cares?

- "There are three kinds of lies: lies, damn lies, and statistics."
  -- Mark Twain
- "Figures don’t lie, but liars figure."
  -- Anonymus
- "In reality 50% of all statistics are worthless."

Plan the research project

- Understand and practice the three R’s of on-farm trials:
  - Request help
  - Replicate
  - Randomize
A poorly planned (statistically-speaking) on-farm trial has a high risk of failure.

Field selection, treatment replication, treatment randomization, plot layout & size, treatment choice

If research is not your vocation, then don’t be shy about requesting help from those who conduct research for a living.

University researchers & Extension specialists

Industry researchers & agronomists

Crop consultants

Replicating or repeating treatments in a trial enables the mathematical separation of the true treatment effects from those due to “background noise”.

For example, the background effects of soil variability and yearly weather patterns

Replicating wisely

If spatial variability can be consistently identified (e.g., soil types), then design replicates such that each “rep” of plots is reasonably uniform within itself.

Paired comparisons vs. randomized complete block

Randomizing the location of each treatment within a replicate decreases the odds that spatial variability (foreseeable or not) will influence treatment effects.

For example, areas of the field that are poorly drained.

During the season, take notes on any possible “noise” that may influence the outcome of the test, especially if not distributed equally over field.

Field operations, human error, crop stresses

Variable crop appearance is often your clue that background “noise” is developing.

Whether weigh wagon or yield monitor, minimize risk of harvest “noise” by faithfully calibrating scales or sensors.

This includes grain moisture sensors.

Triple-check yield monitor settings!

Logging of data to card

Swath width

Load identification
Interpret the Results

- Data analysis and interpretation can be challenging if the research project was not well designed and/or maintained.

Well-designed trials...

- Follow a systematic approach:
  - A meaningful question or hypothesis is developed.
  - The research project is planned to objectively (without bias) test the question.
  - Data are carefully measured & recorded.
  - Results are statistically interpreted to answer the research question.

When developing questions...

- Keep it simple, simple, simple!
  - Trials require time, energy & money.
  - Complex trials involve more of each.
  - Are you a researcher or do you work for a living?
  - Best questions involve a yes/no answer.
    - Herbicide 'A' versus herbicide 'B'
    - Inoculated soybean versus non-treated

When selecting treatments...

- Include a control or check treatment.
  - A logical choice for a control may be your standard practice.
  - Include a range of treatment levels if variable inputs such as seeding rates or fertilizer rates are being tested.
    - e.g., corn seeding rates of 20, 25, 30, and 35 thousand seeds per acre

Example – Strip-till Corn

- Objective: Determine if grain yield is increased with strip-till compared to CT.
  - Possible noise – things to consider
    - N management, planting time, growing conditions, weed and insect management
  - 4 reps, randomly placed throughout the field

Example – Strip-till Corn

- Experimental Design
  - Paired Comparison
    - 5-7 pairs
On Farm Research

Example – Seeding Rate

- Objective: Determine optimal seeding rate for irrigated corn in NE Oklahoma.
- Possible noise – things to consider
  - N management, planting time, growing conditions, weed management, pest pressure
- 4 reps, randomly placed throughout the field

Two Populations

Two lines on the graph:

- Red line: \( y = 0.0045x + 10 \), \( R^2 = 1 \)
- Blue line: \( y = -4E-07x^2 + 0.0299x - 322.29 \), \( R^2 = 0.9581 \)

Ideal Situation

Process

- Contact someone to assist
- Planting and Harvest
- Data Reporting
- Analysis
- Meeting and publish

Bottom line...

- On-farm research can help answer questions important to growers, but requires sound planning and attention to detail.
- Together we can accomplish a lot and provide better recommendations on a farm level!
Example of why replicated trials are important!

LSD’s allow us to account for variability

Usually 4-5 varieties have equal chance of topping a variety trial