Incorporating New Technologies Into On-Farm Research: Is This a Game Changer?

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Cotton Agronomics Manager
Windstar, Inc.
Cotton Agronomics Manager Role
Windstar Inc.

- Variety and other on-farm trials
- Newsletter for subscribed Windstar Inc. clientele
- Grower educational meetings
- Resource person for questions pertaining to:
  - Fertility
  - PGRs
  - Defoliation
  - Harvesting
  - Lint contamination
  - Unrecognized anomalies observed in field
  - Etc.
Technology Is Changing the On-Farm Testing Environment

• Growers are being empowered more than ever with various technologies
• They need to recognize this and initiate trials on their farms to evaluate expensive inputs to determine return on investment
• It just takes patience, understanding of tools and how best to use them
• Methods may change over time as capabilities are evaluated
What’s Needed in Cotton?

- An overall game plan for evaluating input (think variety)
- Google Earth Pro – can find fields and perform measurements
- Spend time in office developing a good plot plan (e.g. Excel)
- Documentation of treatment application according to plan
- Record in field any deviations from planned application
- Weighing system
- Ginning and fiber quality determination
- Statistical analysis
Considerations

• Match planter and harvester widths, for example:
  • 16 row planter with 8 row harvester = 2 varieties planted at once
  Or
  • 24 row planter with 8 row harvester = 3 varieties planted at once

• My experience indicates that uniform water distribution is critical to a high quality outcome – control water application and you generally control most variation in trials
  • In pivots, watch tower track row passes – skip these to minimize any variation they may introduce
    • Pivot nozzle package should be scrutinized to make sure experimental units have proper nozzling, watch for plugged nozzles during the season
  • Need to know where subsurface drip zones change
    • Place a whole replicate inside one zone, with other whole reps in other zones, watch for plugged emitters during the season

• Watch N fertility gradients – (if recognized)
  • Deep soil sample if possible
“We’re only as good as our data”
On-Farm Cotton Variety Testing

- Best to conduct replicated trials
  - Replication – multiple independent observations for each entry
- Known within a scientifically valid statistical certainty what actually happened in the fields
- Difficult to conduct, but getting easier due to technology
- Time consuming for cooperator
  - Reduces planting speed due to seed changes, but this can be improved with additional help running vacuums on turnrow
  - Slows down harvesting, and will consume more module wrap as each plot must be moduleed and weighed separately
Replication

• Applying a treatment to at least 2 experimental units in a trial
• This provides multiple INDEPENDENT observations for the treatment comparisons in the statistical model
• Provides an estimate of variation in response which allows us to have confidence in our results
• Should have 3 or more replicates in trial
Experimental Design Types

• Two basic designs:
  • CRD (Completely randomized design)
    • Seldom used
  • RCB (Randomized complete block)
    • “workhorse” design
    • Many related but more complicated versions
      • Regression - when evaluating product rates
      • Factorial designs
        • e.g. 2 factors (water level and varieties)
      • Split plot
### Examples of Replicated Trials

#### Large Plot
**Replicated** 8 row x field length strips
- 3 replicates, 5 entries

<table>
<thead>
<tr>
<th>Rep I</th>
<th>Rep II</th>
<th>Rep III</th>
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<tbody>
<tr>
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<td>5</td>
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<tr>
<td>2</td>
<td>3</td>
<td>4</td>
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</table>

**Test size:** 50 Acres

#### Small Plot
**Replicated** 4 row x 40’ plots
- 4 replicates, 5 entries

<table>
<thead>
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<tr>
<td>5</td>
<td>3</td>
<td>1</td>
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</table>

**Test size:** 1.5 Acres
What About Field Variability?

• Yield zones defined by 3-year yield maps
Extension Trials

Large Plot Trials With Producer-Cooperators and Extension Educators
Replicated Agronomic Cotton Evaluation (R.A.C.E.)

• Easier to work directly with producers, their equipment, and row spacing
  • Planted and harvested with producer equipment
• Generally excellent data
  • Yield, fiber quality, plant size, storm resistance
• Can transition to commercial ginning where feasible
Replicated Agronomic Cotton Evaluation (R.A.C.E.)

4-8 row plots, 3 replicates

Minimum 500 ft length plots

Planted, managed, and harvested by cooperator
Cotton Incorporated
Enhanced Variety Trials

- 4-8 row plots, 3 replicates
- Minimum 500’ in length
- Planted, managed, and harvested by cooperator
- ~10 entries, some based on market share
Planting
A Few Hours in the Office Reduces Confusion in the Field!
Google Earth Pro

Useful for planning and calculating plot sizes plus start/stop locations in the field.

Can number plot locations sitting on turnrow once AB line is known.
Once AB Line is Established All Passes Are Numbered

Courtesy Brennen George
# 2019 Windstar Gins Variety Trial - Jeff George - Tule Creek - 16 Row Planter 8 Row Plots

<table>
<thead>
<tr>
<th>Field/GPS</th>
<th>Plot Plan</th>
<th>Jeff George</th>
<th>Plot Plan</th>
<th>Pass Length</th>
<th>Field or GPS Pass Number by Hop</th>
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<tr>
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<td>Planting</td>
<td>Planting</td>
<td>Sequence</td>
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### Hop I
- **Pass Length**: Long ~3800 ft, Short ~1800 ft.
- **Elevation**: 3449 ft.
- **Row Spacing**: 58 inch.
- **Temp @ Planting**: 90 degrees.
- **Moisture @ Planting**: Moderately dry.

### Hop II
- **Pass Length**: Long ~3800 ft, Short ~1800 ft.
- **Elevation**: 3449 ft.
- **Row Spacing**: 58 inch.
- **Temp @ Planting**: 90 degrees.
- **Moisture @ Planting**: Moderately dry.

### Hop III
- **Pass Length**: Long ~3800 ft, Short ~1800 ft.
- **Elevation**: 3449 ft.
- **Row Spacing**: 58 inch.
- **Temp @ Planting**: 90 degrees.
- **Moisture @ Planting**: Moderately dry.

### Notes:
- **Seed Swap**

*Started planting from southeast corner and ran east and west past north of barn area.*

*Pass 16 (west end), planter was not planting seed for 156 ft.*

*That area was filled with EW 1078 SBDF to western plot boundary.*
Climate FieldView Web Output

Courtesy Brennen George
<table>
<thead>
<tr>
<th>HYBRID</th>
<th>ACRES</th>
<th>POPULATION</th>
<th>LAST PLANTED</th>
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<td>FM 2398 GLTP</td>
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<td>NG 3930 B3XF</td>
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<td>Phy 250 W3FE</td>
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<td>Phy 350 W3FE</td>
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<td>Totals/Avg</td>
<td>141.3</td>
<td>55338</td>
<td>--</td>
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</table>

Climate FieldView Web Output

Courtesy Brennen George
Climate FieldView Monitor Screen Photo

Courtesy Tommy Cartrite
“Old School” Whips and Stakes
Harvesting
John Deere CP690 with On-the-Go Moduling

Photo courtesy of John Deere
John Deere CS690 Stripper with On-the-Go Moduling

Photo courtesy of John Deere
John Deere CS690 Stripper with On-the-Go Moduling and Scale System on Handler

Photo courtesy of John Deere
Western Forage Systems
Platform Scale

Hydraulic Portable Truck Scales
Sets Up In Less Than 5 Minutes, On Any Hard Level Surface.
No Jacks or tools required for setup
Pulls Behind Vehicle at Highway Speeds

Standard Scale
Size 7' 1/2 ft. x 10 ft.
7' high deck
Features include
Hydraulic Lift Kit
12 Volt Power Pack

NEW! Wide Model Scale
Size 7' 1/2 ft. x 15 ft.
Designed for Cotton Gin and other "Wide" Vehicles
Includes all the features of the standard scale Plus

Watch our Video On YouTube. Click Here
Plot Weight (Dryland Only) Western Forage Scale vs. JD CP690

\[ y = 1.0067x + 78.388 \]

\[ R^2 = 0.9886 \]
Plot Weight (Irrigated Only) Western Forage Scale vs. JD CP690

\[ y = 0.9311x + 389.6 \]

\[ R^2 = 0.9632 \]
Plot Weight (All)
Western Forage Scale vs. JD CP690

\[ y = 0.9903x + 124.24 \]

\[ R^2 = 0.997 \]
Considerations

• Plot size – needs some thought
• Harvester must be stopped for best weight capture
• Must make sure accumulator is purged of cotton before initiating wrap sequence
• How many “wraps for a plot” and how do we do this?
• How much plastic wrap will it take?
• What is the wrap cost?
Ginning
Grab Sampling

• Sample obtained at weigh wagon before dumping into module

• If round module, grab sample must be removed from the end of the bale
Grab Sample Ginning/Data

- Total, lint, and seed weights obtained
- 3-replication mean of turnout used to convert plot weights to lint, seed/acre
- Lint sample carefully handled
  - Center portion of lint sample submitted for HVI analysis
Costs of Grab Sampling and Ginning

• Texas Tech University Fiber and Biopolymer Research Institute

• Requires a minimum 8 pound sample for micro-ginning on the new gin there.
  • Ginning charges are $25/grab sample, so for a 3-rep, 10 entry trial, this would be $750
  • HVI analysis would be about $3/sample, this would be an additional $90
  • Each site could cost up to $1000 just for ginning and HVI
Texas Tech University
Fiber and Biopolymer Research Institute
HVI Analysis/Data

- HVI analysis performed
- CCC Loan Value calculated by plot
  - Color grade not necessarily accurate
  - Leaf questionable
  - No classer’s bark call
- Correlation studies comparing 3-rep mean from grab sampling and plot ginning to mean of all bales in module-level commercial data has been performed
- Results indicate that the 3-rep mean of fiber properties and Loan value from grab sample offer reasonable accuracy
Commercial Classing Is Real World! But MUST Coordinate and Work with Ginner!
Stage Modules by Variety and Track Through Gin
Commercial Ginning

- Module feeders cleaned out
- Gin stream cleared
- Seed rolls dumped
- Remnant bales ejected from press and weighed
- Critical for turnout precision
- Commercial USDA-AMS classing
Commercial Ginning

- After ginning module, process restarted for each variety module
Statistical Analysis
Statistical Analysis Software

• Complicated
• It is a good idea to work with university or other personnel who are familiar with data analysis
• Gylling Data Management – Agricultural Research Manager (ARM)
  • A lot of basic industry companies have historically used this
  • Good value for $, user should have some experience in statistical analysis
• SAS – best to work through university personnel since site license is pricey
• Others such as JMP, etc
Nichols Irrigated RACE - 2017
# 2017 Tillman County DT Trial
## Pivot Irrigated
## Mark Nichols Farm Near Tipton

<table>
<thead>
<tr>
<th>Entry</th>
<th>Lint turnout %</th>
<th>Seed turnout</th>
<th>Bur cotton yield</th>
<th>Lint yield</th>
<th>Seed yield</th>
<th>Lint loan value</th>
<th>Lint value</th>
<th>Seed value</th>
<th>Total cost value</th>
<th>Ginning cost</th>
<th>Seed/tech cost</th>
<th>Net value</th>
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<tbody>
<tr>
<td>Croplan CL 9598 B3XF</td>
<td>41.8</td>
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<td>126</td>
<td>978</td>
<td>124</td>
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<td><strong>Test average</strong></td>
<td><strong>39.3</strong></td>
<td><strong>51.9</strong></td>
<td><strong>4710</strong></td>
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<td><strong>141</strong></td>
<td><strong>67</strong></td>
<td><strong>956</strong></td>
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</table>

| CV, %                  | 2.1    | 1.3    | 2.6    | 2.5    | 2.6    | 0.4    | 2.5    | 2.6    | 2.6    | 2.5    | --   | 2.7 |
| OSL                    | <0.0001| <0.0001| <0.0001| <0.0001| 0.3410 | <0.0001| 0.0002 | <0.0001| <0.0001| <0.0001| --   | <0.0001|
| LSD                    | 1.5    | 1.2    | 215    | 83     | 113    | NS     | 42     | 7      | 53     | 6      | --   | 46   |
In Summary…

• Many topics are “researchable”
• Tools exist today which can be extremely valuable to growers at the farm level
• Commitment to success is important
• How these technologies can be utilized for on-farm research has to be thoughtfully considered and implemented
• These tools can be used to evaluate numerous crop inputs but interpretation of results is critical
• Must strive to understand and identify factors involved in “context”
• Multi-site and multi-year comparisons are best as each year is different
Be wise with input $ !
Spend $ where they count!
Randy’s Contact Info

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