Today’s Discussion

- Motivation
  - Field variability
  - Control technology
- Methodology
  - Static tests
  - Field tests
- Results
- Final thoughts

Trend Towards Larger Equipment

Field Variability

Management Resolution

- Minimize off-rate application
- Need quality data
  - Accurate as-applied maps
  - Make good informed management decisions.
- Environmental stewardship / public education

Objective

- To evaluate application rate stability when utilizing automatic section control on agricultural sprayers.
Rate Stability when Using ASC

Methodology

- Data acquisition system
  - National Instruments boards
  - Labview
- Measure
  - System flow rate
  - System pressure
  - Nozzle pressure then convert to tip flow
  - 5-Hz for field data
  - 50-Hz for static data
- GPS – location and speed

Field Testing

- 100-ft swath
- 30 channel control
- Capstan nozzle solenoids
- Wet-boom setup
- Post-herbicide application

Static Testing

- 120-ft swath
- 7 boom-sections (auto-boom)
- Wet-boom setup
- Post herbicide application

RESULTS

Nozzle Off-Rate Maps

System vs. Nozzle Flow Response

Auto-boom and auto-nozzle illustrate similar response.
Rate Stability when Using ASC

Nozzle Response under Various Conditions

Valve Calibration Number: 2123 versus 2213

Ground Speed: Accelerating from 6 mph to 10 mph

System flow ≠ nozzle response during changes

Nozzle Response during Acceleration

Speed change from 25.7 to 29.0 kph (16 to 18 mph)

“Re-entry speed”

Nozzle Response during Acceleration

Speed change from 9.7 to 12.9 kph (6 to 8 mph)

“Re-entry speed”

Auto-Nozzle under Point Row Operation

Moving Out

Re-Entry

Nozzles turned OFF

Nozzles turned back ON

% Difference between Target and Actual Nozzle Flow

Nozzle Off-Rate

Results

• Off-rate can occur more frequently than expected
• Extended nozzle, flow stabilization times
  – Several seconds in some operating conditions (2 to 30 sec.)
  – System flow does not necessarily represent nozzle response
• System response impacted by:
  ✓ Acceleration
  ✓ Auto-swath technology engagement (resolution)
  ✓ Valve control number (VCN) / Setup

Final Thoughts...

• As control resolution decreases (section vs nozzle):
  – More demand and response on control system
  – Move feedback closer to point of application
• Nozzle pressure variation (drift?)

• Further advance control algorithms/hardware to reduce errors (application efficacy)
Rate Stability when Using ASC

Thank-You

Ajay Sharda
shardaj@auburn.edu

Joe D. Luck
luck.joe@uae.uky.edu

John Fulton
fultojp@auburn.edu

Dr. Scott Shearer
Scott.A.Shearer@uky.edu

Twitter: AL_Prec_Ag
Facebook: Alabama Precision Ag Online

Improving producer profitability and environmental stewardship.

www.alabamaprecisionagonline.com