

# Impact of Automatic Section Control for the Southern US

13<sup>th</sup> Annual Kansas Precision Agriculture Technologies Conference

## IMPACT OF AUTOMATIC SECTION CONTROL ON AG SPRAYER PERFORMANCE



**John Fulton**  
Associate Professor and Extension Specialist  
Biosystems Engineering Department  
[www.AlabamaPrecisionAgOnline.com](http://www.AlabamaPrecisionAgOnline.com)

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## Alabama Case Study for Automatic Section Control

- 1 to 12% input savings per pass across field
  - AVG: 4.4% (7% for some operations)
- Savings:
  - AVG: **\$4.83/ac/yr** (5 boom-section sprayer & 12-row planter)
  - AVG: **\$8.36/ac/yr** if Nitrogen included
  - Highest savings in *irrigated corn*: **\$11-13/ac/yr**
- Payback period: **< 2 yrs**

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## Equipment Size



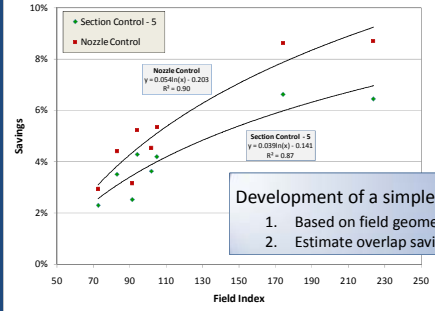
Overlap Reduction

Planter Size [No. of Rows]

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## Model to Estimate Savings



Savings

Field Index


Development of a simple index:

1. Based on field geometry
2. Estimate overlap savings

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## Pressure Variability???




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## Today's Discussion

- Automatic Section Control
  - Rationale
  - Testing Methods
  - Lab and field testing
  - What we have learned
  - Future efforts
- Final thoughts



Trend Towards Larger Equipment



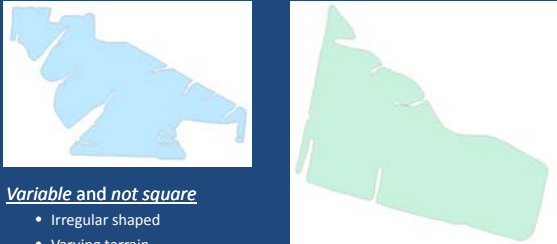
Field Variability

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# Impact of Automatic Section Control for the Southern US

## Field Boundaries in the South




Variable and not square

- Irregular shaped
- Varying terrain
- Environmental structures (waterways, terraces, buffer strips, etc.)

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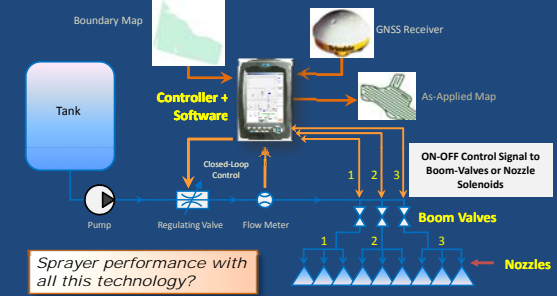
## Automatic Section Control

- Automatic ON / OFF of sections or individual nozzles
- Reduces 1) overlap and 2) application in unwanted areas (waterways, buffer strips, etc.).
- Environmental stewardship – Alabama NRCS EQIP



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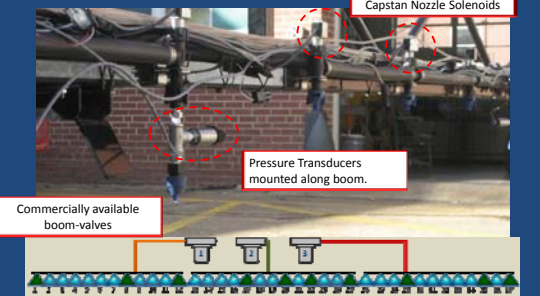
## Spray Control System with Automatic Section Control



*Sprayer performance with all this technology?*

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## Test Setup



Capstan Nozzle Solenoids

Pressure Transducers mounted along boom.

Commercially available boom-valves

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## Data Collection - Lab



Our Controller

- Minimize the influence of field, operator, and other variables.
- Focus on impact of auto-swath and plumbing.
- Can prescribe field maneuvers and common situations

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## Lab Results

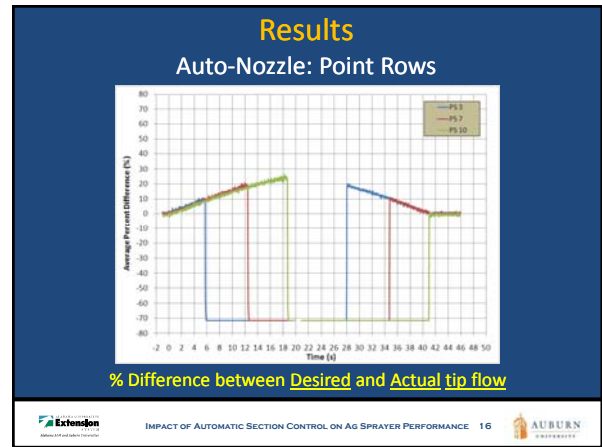
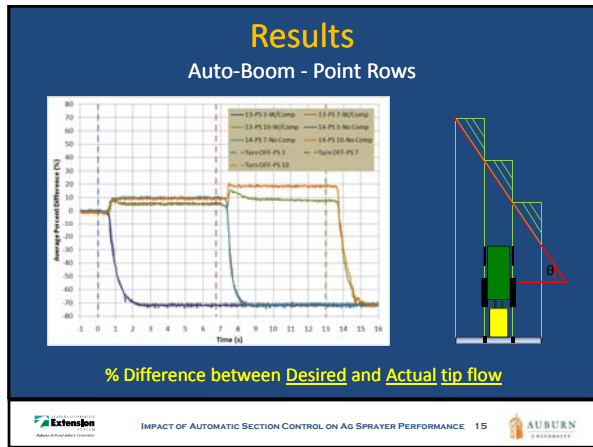
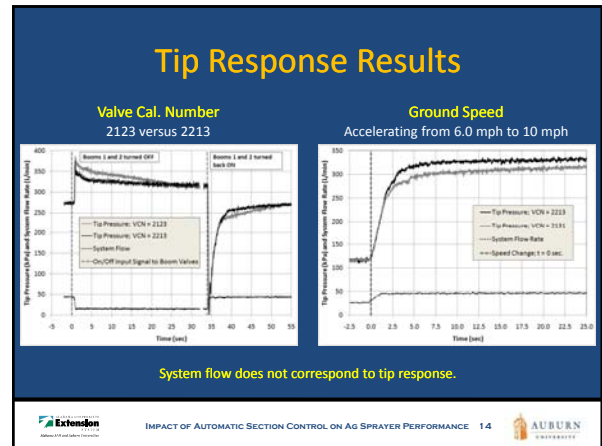
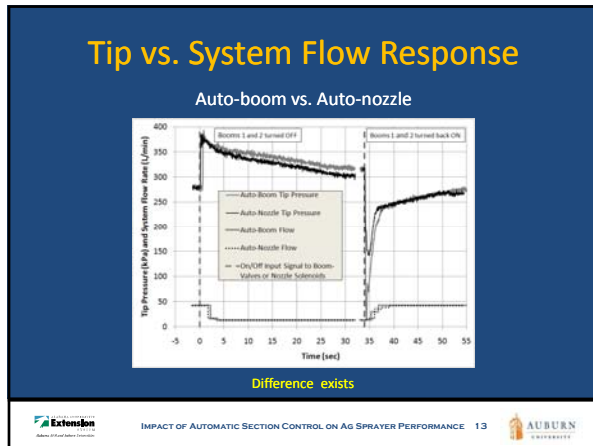
- Auto-nozzle response different from Auto-Boom
- Response different for turning ON versus OFF
- Valve Control Number (VCN) impacts system response
- Controller unable to respond in certain conditions
- Tip flow stabilization
  - Range: 2 to 30 seconds
  - Majority between 19 and 30 seconds
- System flow stabilization - Range: 1 to 4 seconds

❖ Large difference between tip and system response

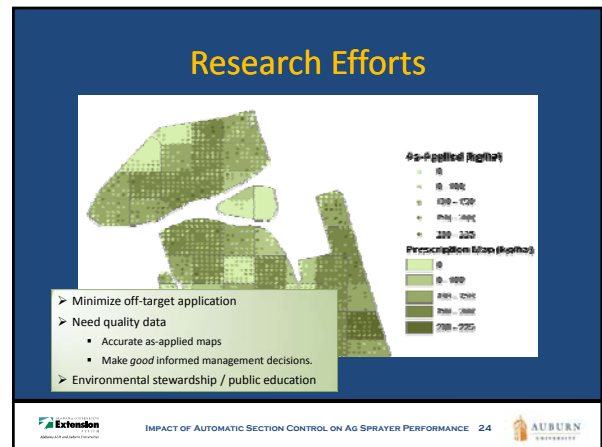
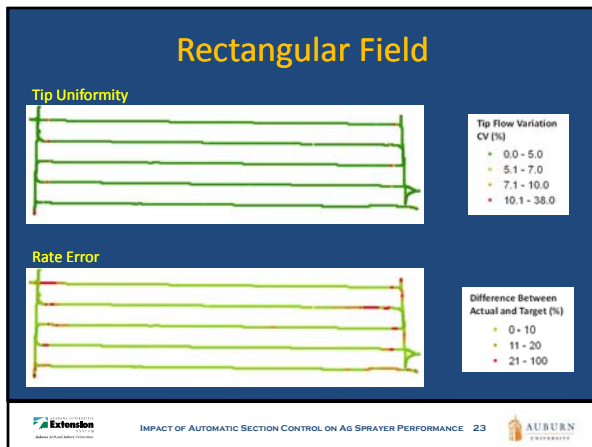
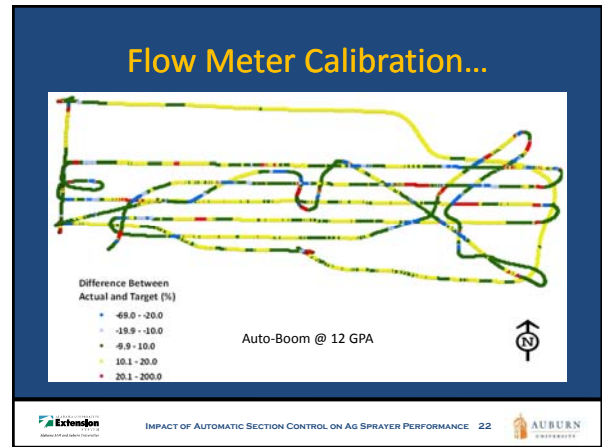
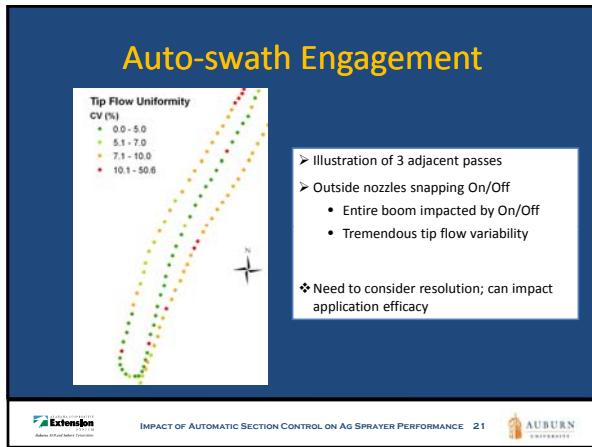
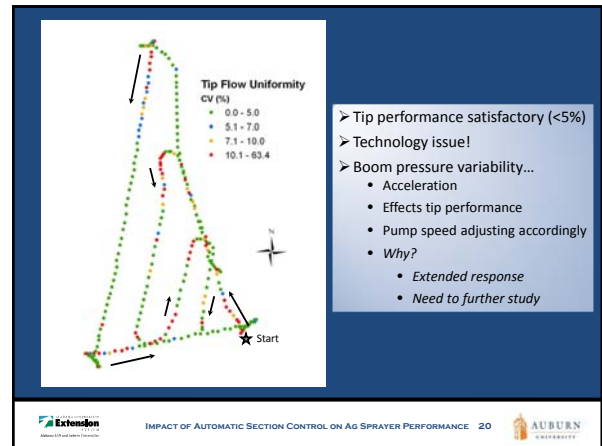
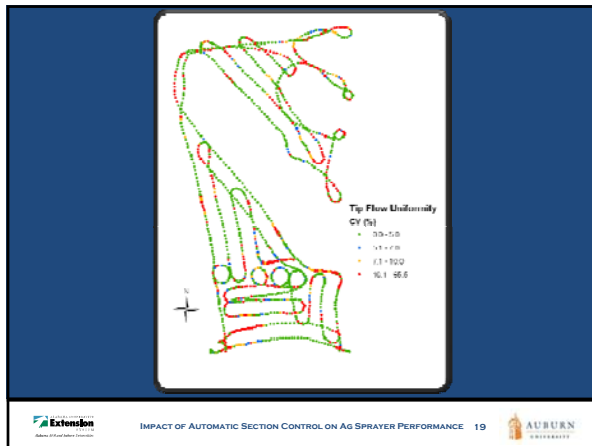
- Suggests regulating valve responds quickly but tip flow stabilization occurs well after valve has adjusted to desired rate.

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# Impact of Automatic Section Control for the Southern US



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## Field Results

- Tip flow uniformity (CV) varies across a boom
  - Ground speed variations
  - Auto-swath engagement
- Flow meter calibration is critical!
- Rate error occurs more frequently than expected (*as-applied data?*)
- Further advance control algorithms



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## What have we learned?

- Differences between auto-nozzle and auto-boom
- System flow does not represent tip response
- Purchase a controller with flow compensation
- System response impacted by:
  - ✓ Valve control number (VCN)
  - ✓ Acceleration
  - ✓ Auto-swath technology engagement (resolution?)



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## Future Work

- Additional field testing
  - Hose / tube compliance testing
  - “Smart” control algorithms
  - Auto-calibration (automatic and dynamic)?
- ❖ Provide software / hardware solutions to improve sprayer application accuracy.



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## Final Thoughts...

- Realistic expectations – misperceptions can lead to incorrect decisions
- TLC for technology
  - Requires proper setup and implementation
  - Periodic system checks
- Additional R&D needed to fully capture perceived benefits of technology
- **GOAL: Use PA Technologies to improve production and not profitability - this approach will lead to profitability**



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## Thank-You

John Fulton  
fultojp@auburn.edu  
334-844-3541

Twitter: AL\_Prec\_Ag  
Facebook: Alabama Precision Ag Online

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