

# **Picking Precision Tools That Meet Today's Needs**

**19<sup>th</sup> Annual National No-Tillage Conference**  
**January 12-15, 2011**  
**Cincinnati Hilton**

**S.A. Shearer and J.D. Luck**  
**Biosystems and Agricultural Engineering**

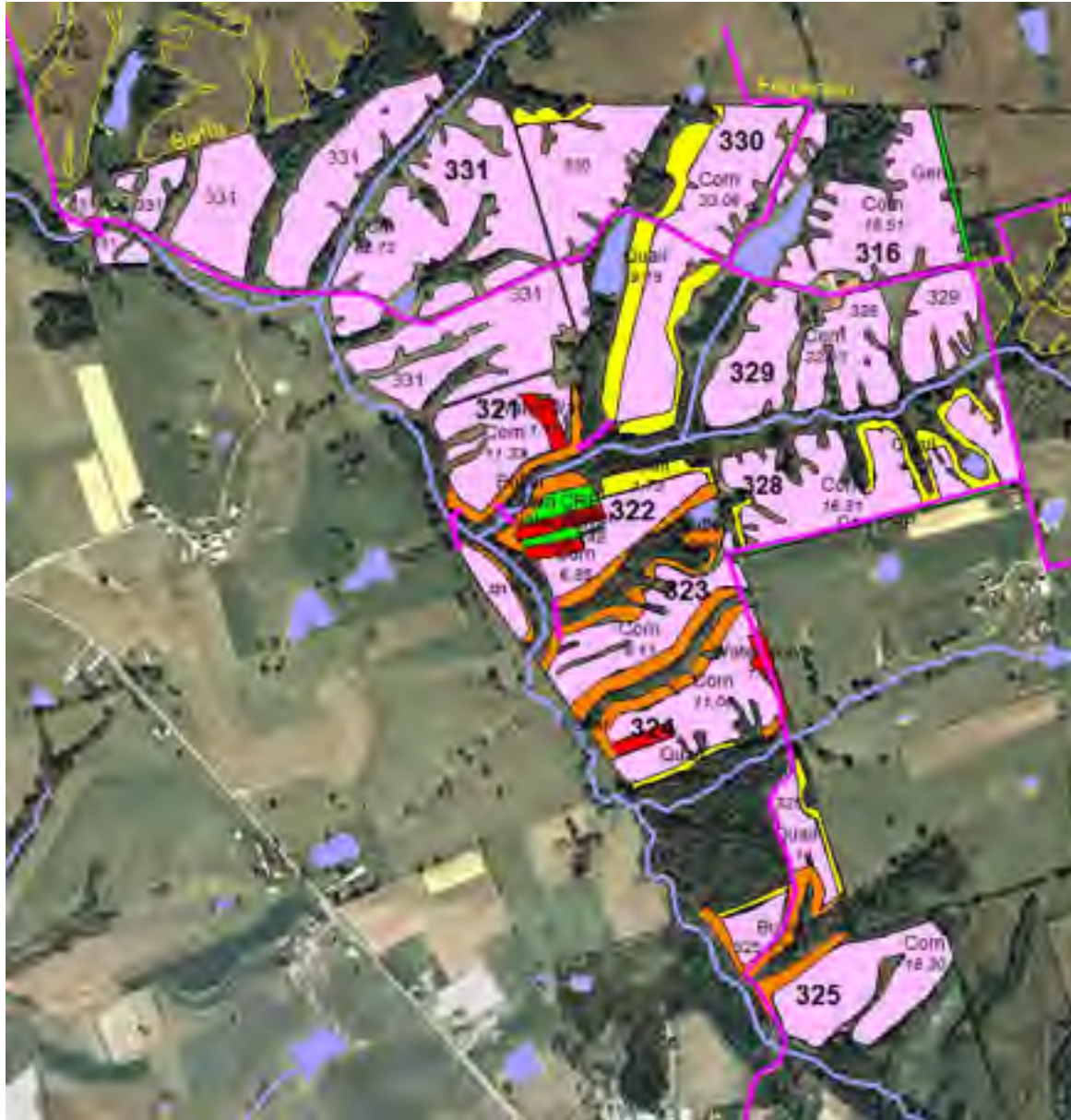


**How big is too big?**











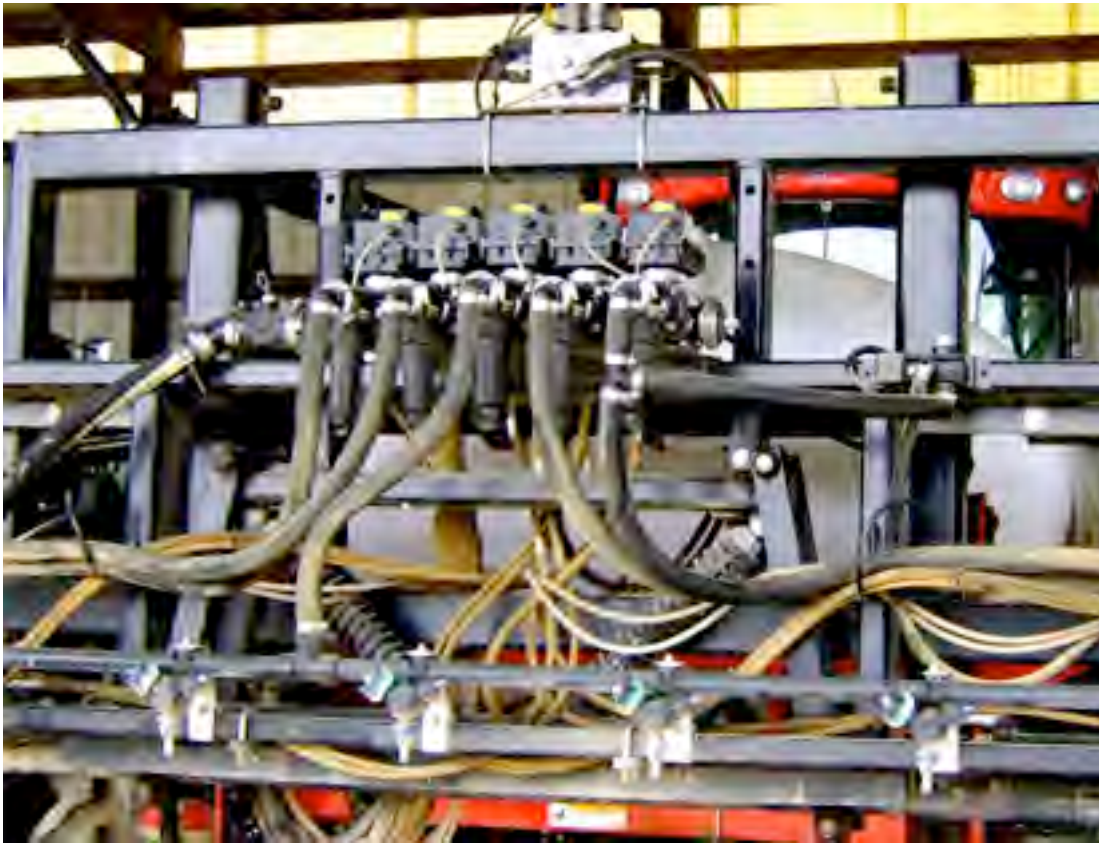
# Spraying







# Automatic Boom Section Control



**Manual vs. Automatic  
Boom Control Study**

**21 fields (578 ha)**

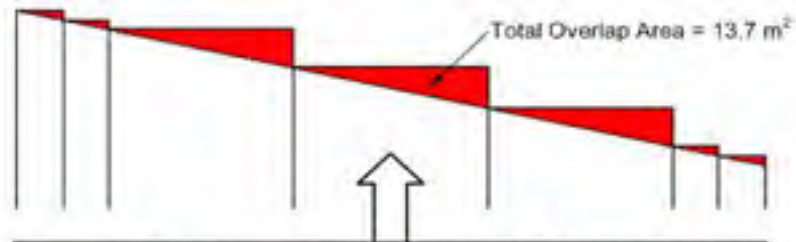
**Season 1: manual  
control of 5 sections**

**Season 2: automatic  
control of 7 sections**

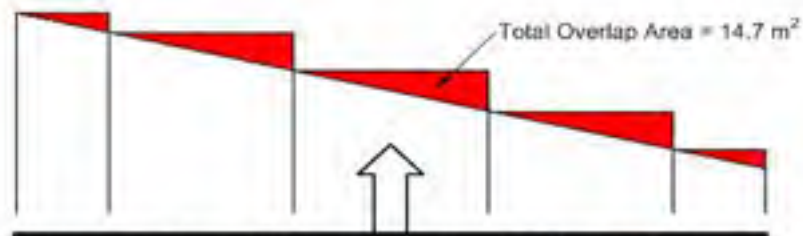




# Automatic Boom Section Control



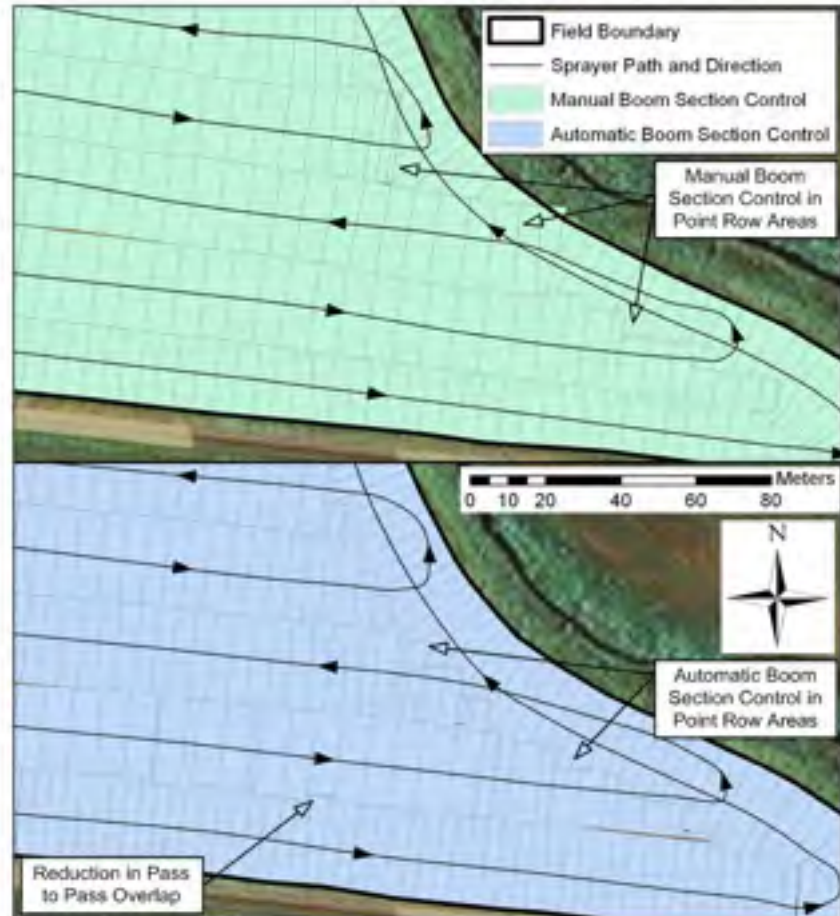
Scenario 3: Spray Boom (24.76 m) with 7 Control Sections



Scenario 2: Spray Boom (24.76 m) with 5 Control Sections

## Manual vs. Automatic Boom Control

- **Season 1: 12.4% over-application**
- **Season 2: 6.2% over-application**
- **6.2% reduction in coverage area**



# Summary of Coverage Error

<b>Field No.</b>	<b>Field Area (ha)</b>	<b>Manual Control 5 Sections Error (%)</b>	<b>Automatic Control 7 Sections Error (%)</b>	<b>Difference (%)</b>
1	101.0	6.0	4.4	1.6
2	10.5	14.2	7.7	6.4
3	28.8	8.8	2.5	6.3
4	21.0	21.4	6.4	15.0
5	4.1	13.8	4.9	8.9
6	13.4	15.0	6.0	9.0
7	6.8	10.4	7.3	3.1
8	3.1	12.2	7.9	4.2
9	65.0	7.4	6.1	1.3
10	18.8	12.1	8.1	4.0

# Map-Based Section Control



**CONTROL YOUR WORLD**



**X20 AUTOMATIC SECTION CONTROL AT A GLANCE**

- Decreases chemical inputs
- Eliminates overlap
- Controls up to 30 sections
- Works with spraying, seeding and spreading controllers

[topconna.com/sec](http://topconna.com/sec)

**X20 Auto Section Control**

*Once you've used Automatic Section Control you'll never spray without it again.*

With X20 Automatic Section Control you never have to worry about turning a sprayer section or the whole sprayer on or off again.

Automatic Section Control does even more. It also handles point rows and irregularly-shaped fields and can turn off spray sections that are outside field boundaries.



*• Reduce operator fatigue*

**X20 BOOM LEVELER AT A GLANCE**

- Guides user screen sensor at optimum boom height
- Combination of GPS and ultrasonic sensor technologies give industry leading performance
- Increased operating speeds with reduced risk of boom damage

[topconna.com/boom](http://topconna.com/boom)

**X20 Boom Leveler**

*Automatically controls boom height*

The X20 Boom Leveler uses a combination of ultrasonic sensors and GPS to maintain control of the boom in the most demanding spraying situations.

The Boom Leveler controls the boom to stay at a user-prescribed distance above the ground, so that it remains unimpeded by environmental obstacles. This allows you to increase the speed and quality of application, and extend your operating hours into darkness.

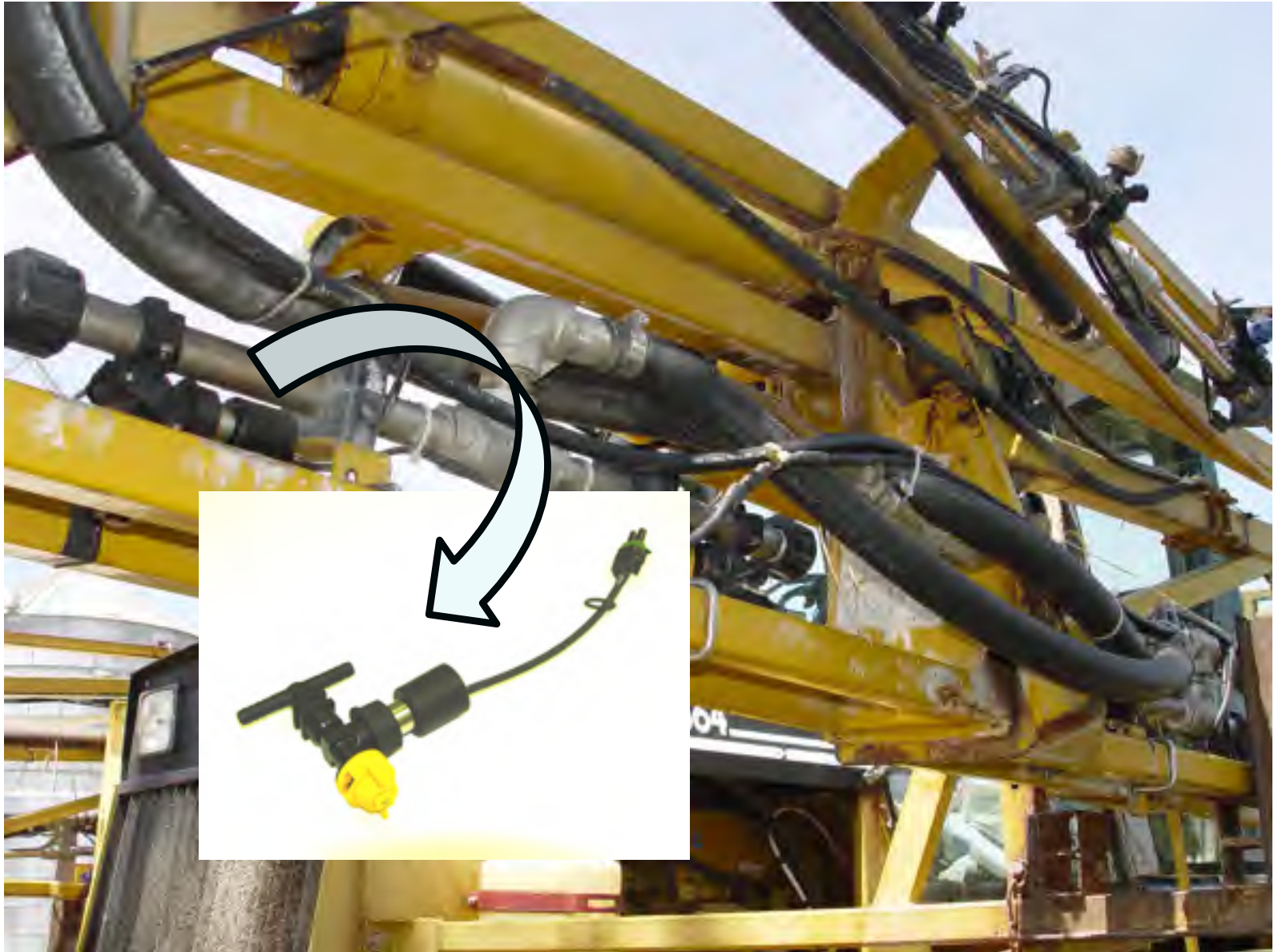
- 1 PC-RT Antenna**  
Location - In tractor cabin  
Function - Tells the X20 where you've been and where you are.
- 2 X20 Console**  
Location - In tractor cabin  
Function - Mapping, guidance, and setting the controller when to turn sections on or off.
- 3 Electronic Control Unit**  
Location - In tractor cabin  
Function - Turns specific boom sections on or off as instructed by the X20 console.
- 4 Boom Leveler ultrasonic sensor**  
Location - Boom mounted  
Function - Calculates boom height above ground.
- 5 Boom Leveler Hydraulic Valve**  
Location - Near the center of the spray boom  
Function - Controls hydraulic operation of boom.
- 6 Boom Leveler Electronic Control Unit**  
Location - Mounted on the sprayer  
Function - Communicates with the ultrasonic sensor and manual gate to control boom height.

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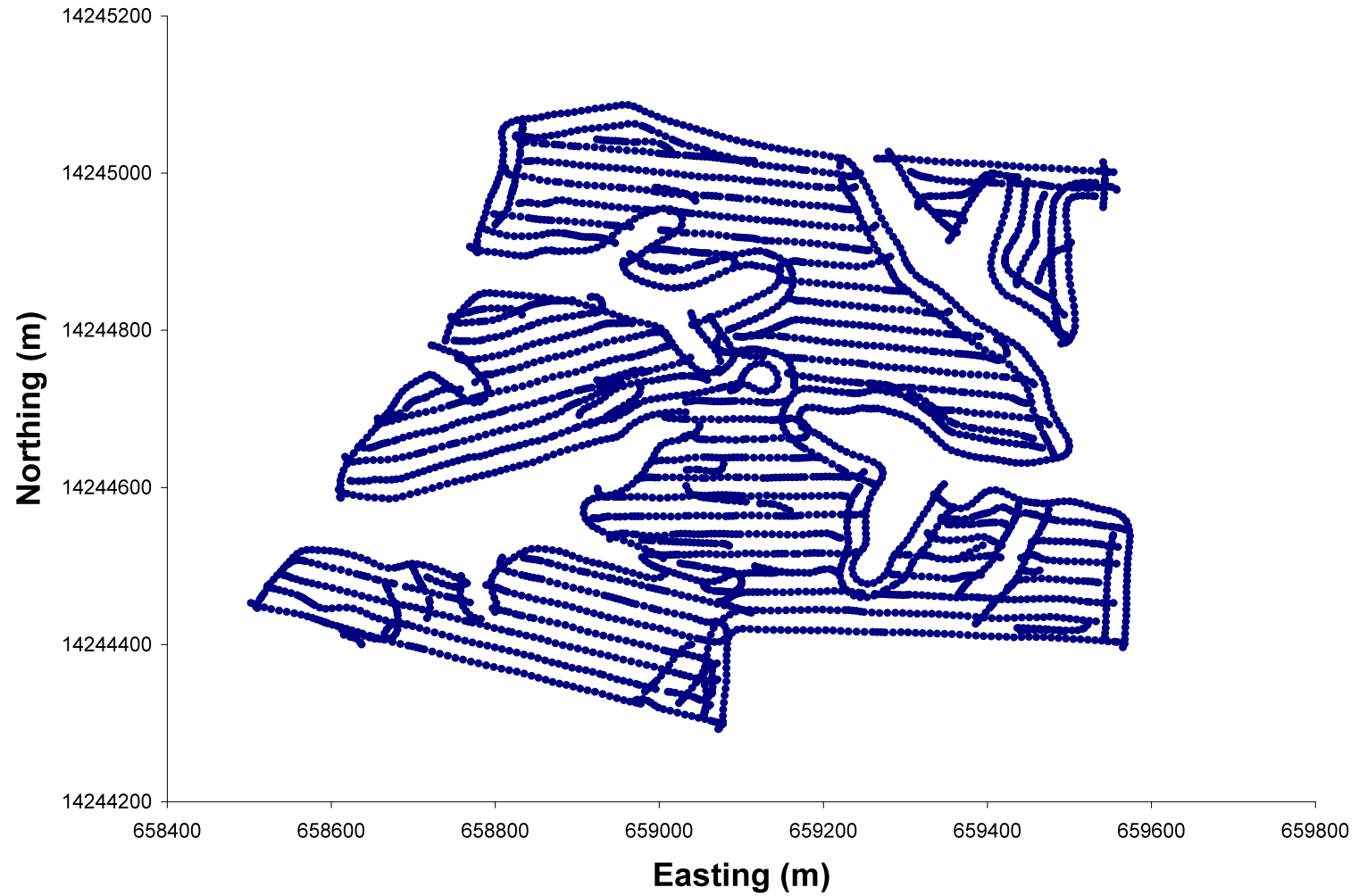


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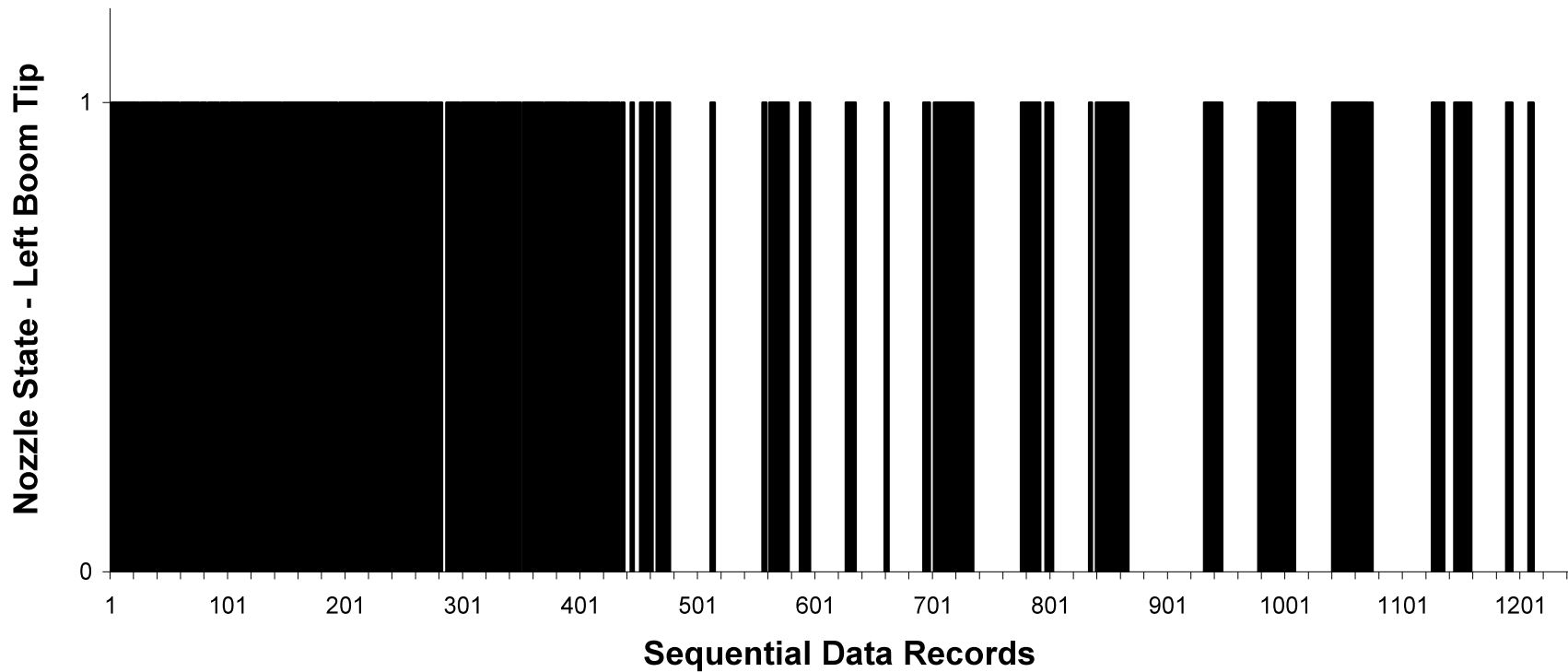




# Sprayer Trek

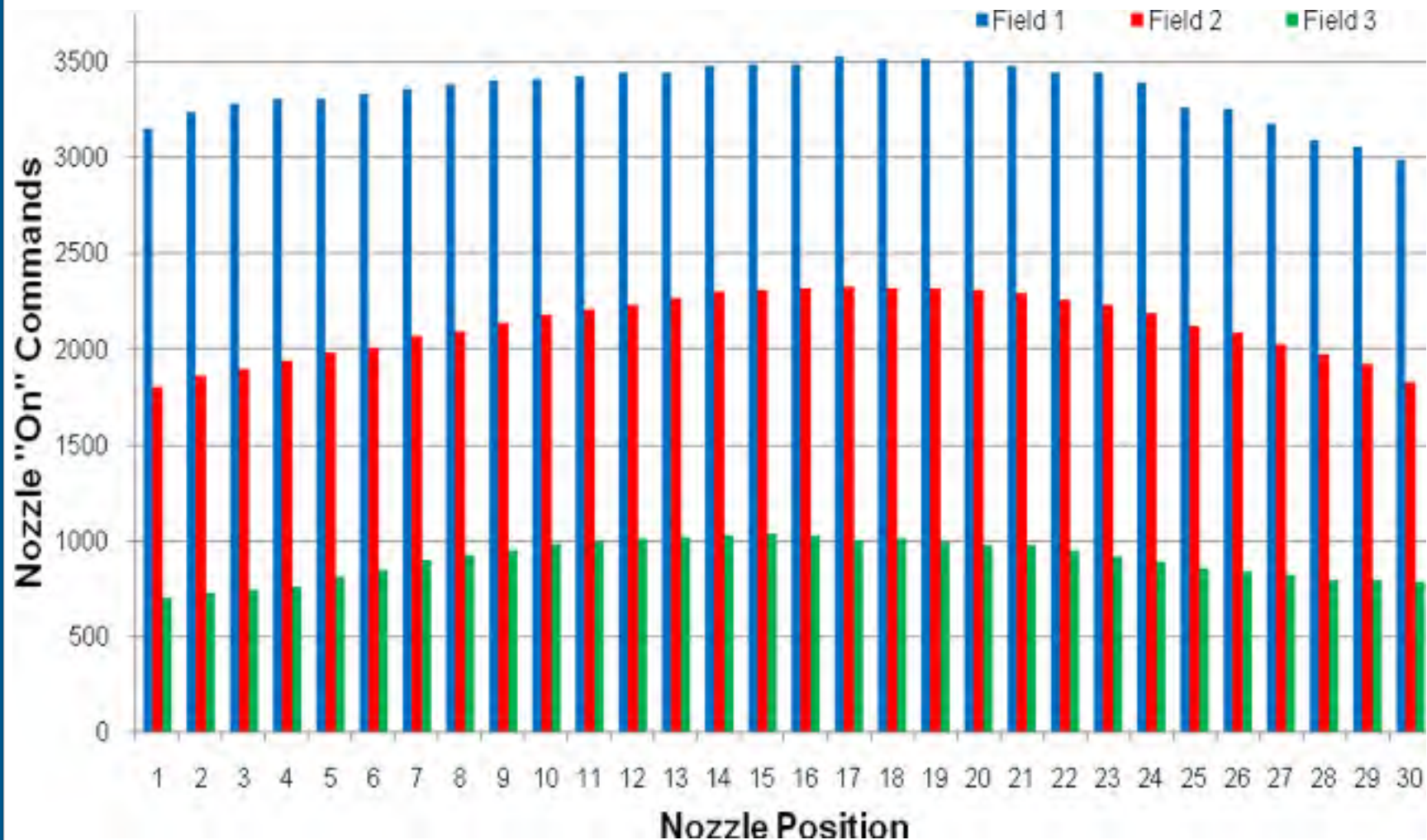


# Left Boom Tip State





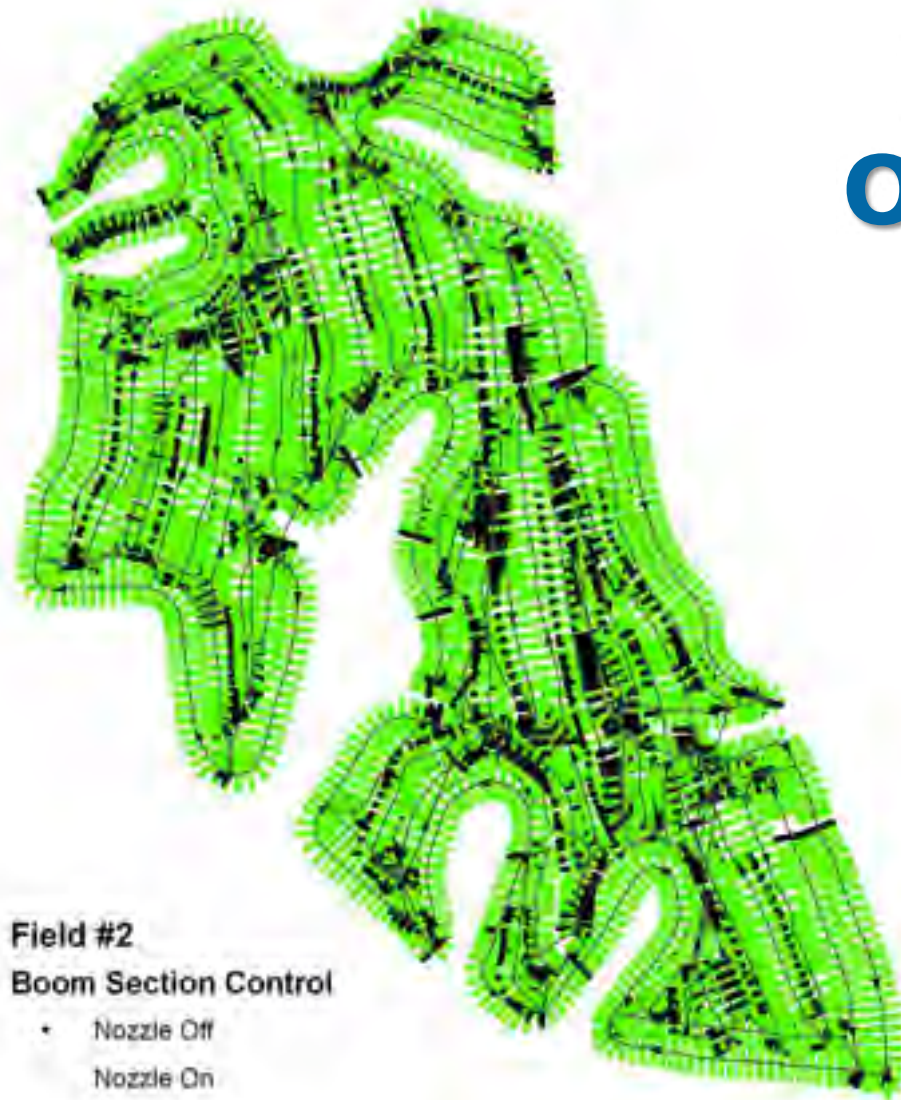
# Map-Based Nozzle Control



**Table 1. Projected product savings utilizing map-based single nozzle control.**

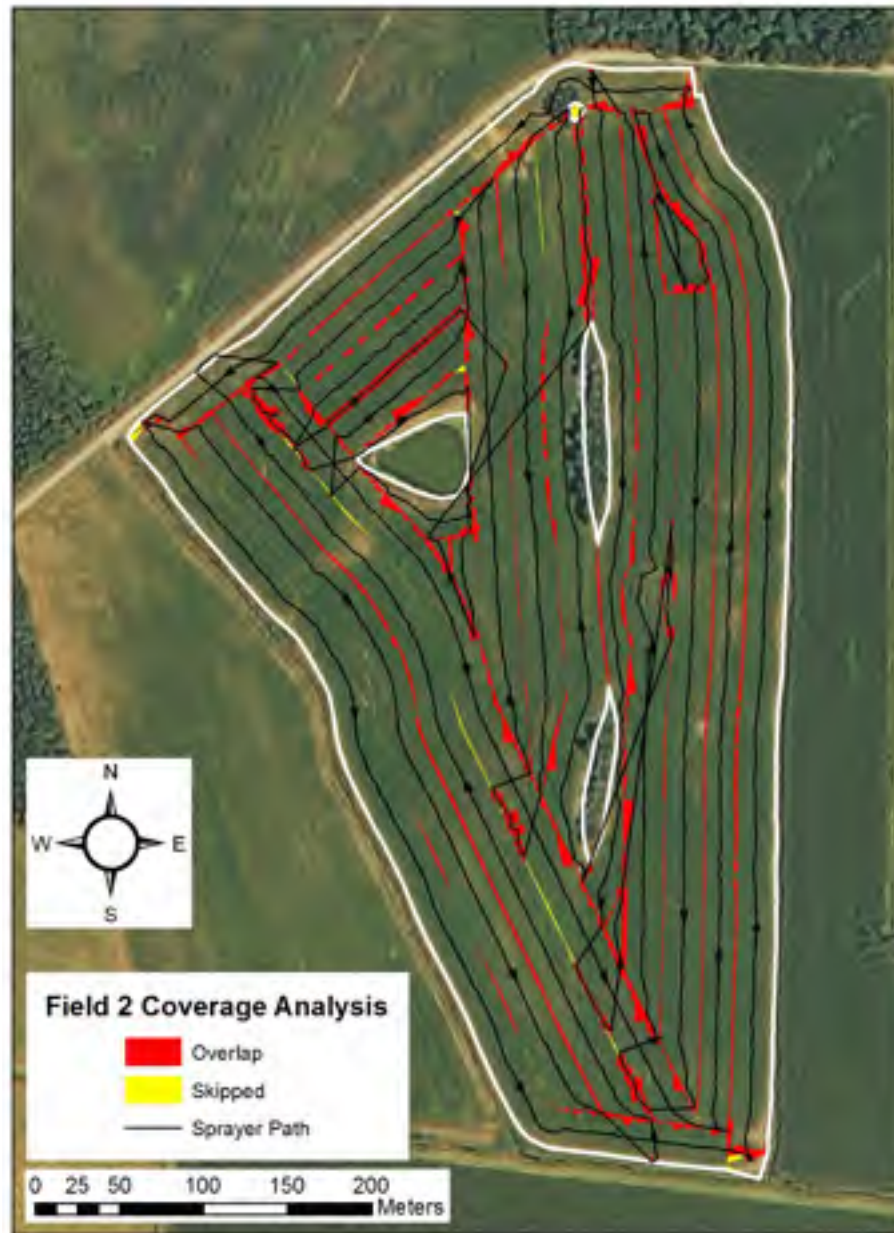
<b>Field</b>	<b>Applied Area w/o Map-Based Control</b>	<b>Applied Area w/ Map-Based Control</b>	<b>Applied Area Reduction</b>
<b>1</b>	68.8 ha	58.4 ha	15.2%
<b>2</b>	41.8 ha	34.9 ha	16.4%
<b>3</b>	18.9 ha	16.0 ha	17.6%

# Nozzle Overlap



- Field #2**  
**Boom Section Control**
- Nozzle Off
  - Nozzle On





# Glyphosate Savings

- **Assumptions:**

- 3000 ac of Round-Up Ready corn and soybeans
- 1.5 qt/ac treatments
- Three treatments per season
- Herbicide cost of \$15/gal
- 15% reduction using single nozzle control

- **Projected annual savings:**

- \$7,600



**Automatic Section Control (ASC) Technology for Agricultural Sprayers**

Automatic section control (ASC) or subrow technology has been readily adopted on agricultural sprayers over the past few years. Farmers are always implementing this technology because of the numerous benefits it offers. Sprayers that have been previously equipped with GPS and/or GPS/GNSS-based guidance technology and other areas wanted for application of pesticides or nutrients. ASC technology utilizes a GPS/GNSS-based guidance system for location of the pre-defined no-application areas as well as keeping the implement from overlapping adjacent nozzles. Currently, equipment manufacturers and third-party companies are offering systems that control boom-sections (Fig. 1a) or even individual nozzles (Fig. 1b) on agricultural sprayers with the number of sensor channels allowing the control resolution. However, the performance of this technology is partially associated with the GPS correction service used. Today, most sprayer manufacturers provide this technology as an option on new sprayers. Meanwhile, some older sprayers can be retrofitted with ASC. You should consult the manufacturer concerning compatibility with your equipment.

**INSIDE THIS PUBLICATION**

- What is ASC and its benefits for your operation
- Required components
- Calibration and operating tips
- List of companies providing ASC technology

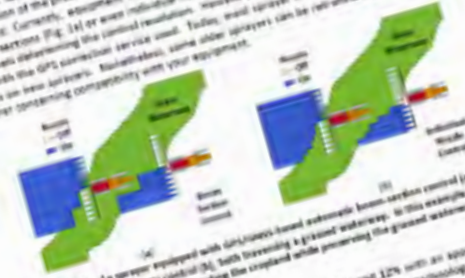


Figure 1. Example of a sprayer equipped with GPS/GNSS-based automatic boom-section control (a) and a sprayer with individual nozzle control (b). Both bypassing a ground waterway. In this example, this provides the benefits of avoiding the cropstand while protecting the ground waterway.

**Benefits**  
A recent study at Auburn University indicated input savings between 2% and 12% with an application of ASC technology. The study also showed that the technology can save 6.3% on seed cost within a field using ASC technology. These savings are shown for more Alabama farm operations. However, savings are dependent upon field shape and size with higher benefits occurring in small, irregularly-shaped fields or fields containing conservation management structures such as grass waterways containing conservation management structures such as grass waterways.

[www.alabamaprecisionag.com](http://www.alabamaprecisionag.com)

**Automatic Section Control (ASC) Technology for Planters**

Automatic section control (ASC) is a precision agriculture technology that has been readily adopted by producers. Currently, equipment manufacturers and third-party companies are offering systems that control sections and/or rows on planters. The technology allows planter sections to skip areas that have been previously planted or skip rows, terraces, and/or waterways. Today, most manufacturers provide this technology as an option on new planters. However, some older planters can be retrofitted with this technology. You should consult the manufacturer or third party vendor to determine if ASC is compatible with your equipment.

**INSIDE THIS PUBLICATION**

- Benefits of ASC for your farm
- Required components, installation points, and pre-season checks
- List of companies providing ASC components or complete systems

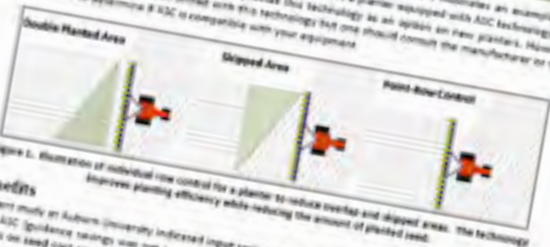


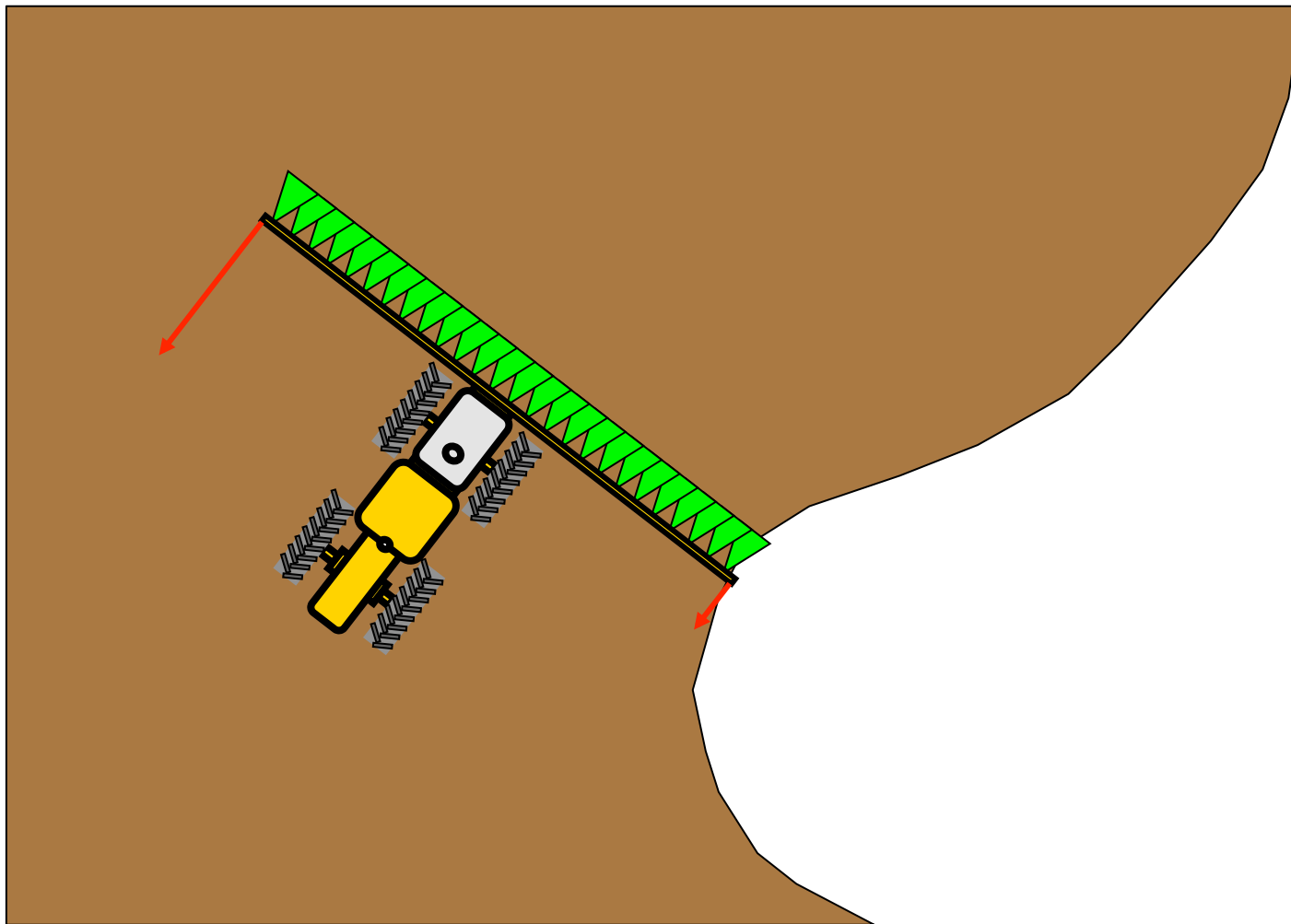
Figure 2. Illustration of individual row control for a planter to reduce overlap and skipped areas. The technology improves planting efficiency while reducing the amount of planted seed.

**Benefits**  
A recent study at Auburn University indicated input savings from 1% to 12% for each pass across a field when using ASC guidance savings were not considered in this study. This study indicated that an average 4.3% savings on seed cost could be observed for a farm while some operations could see as high as a 7% savings. Savings are dependent upon field shape and size with the highest benefits occurring in small, irregularly-shaped fields or fields containing conservation management structures such as grass waterways and terraces. Generally, ASC technology can pay for itself within 2 years.

[www.alabamaprecisionag.com](http://www.alabamaprecisionag.com)

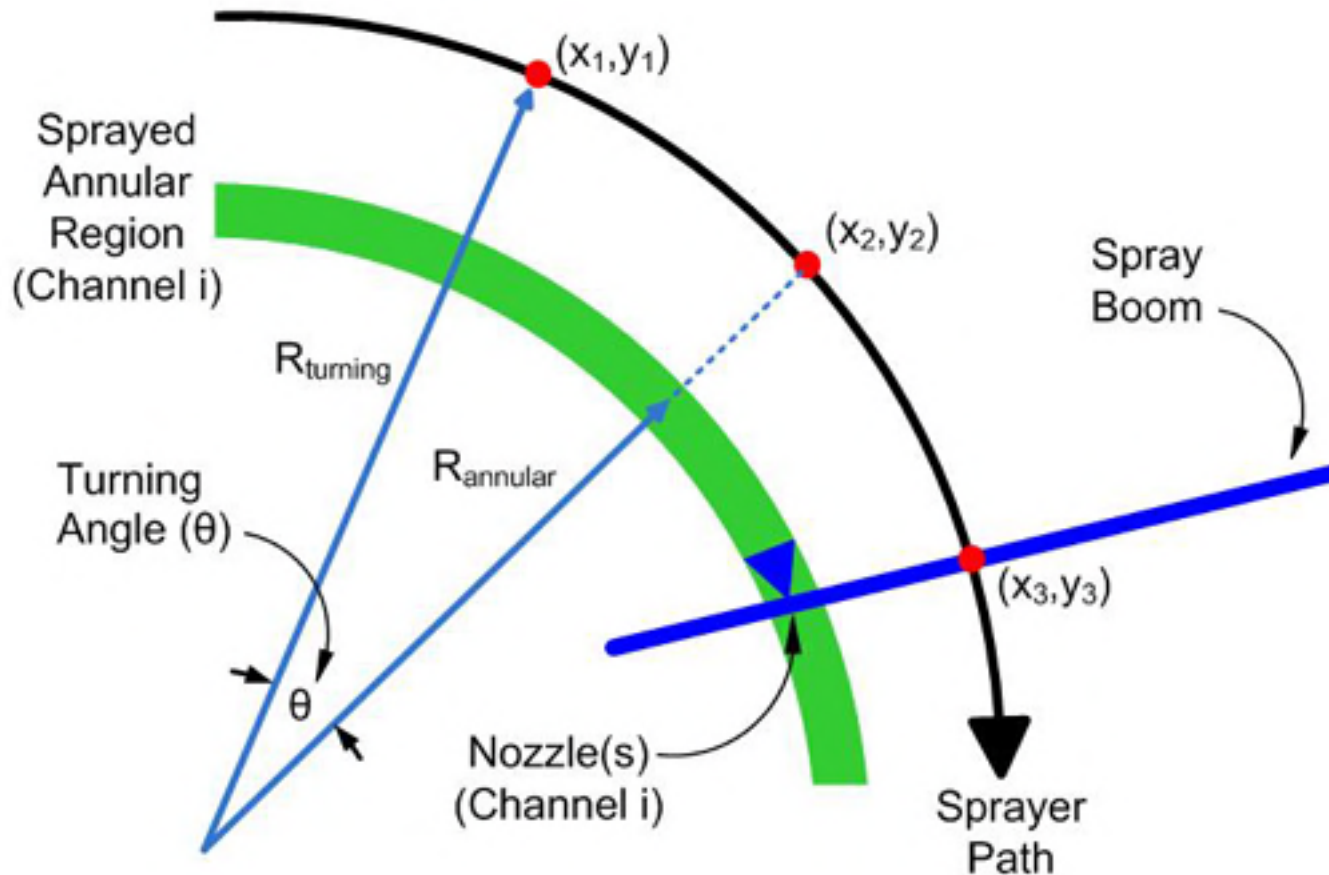
**Auburn University – John Fulton**

# Spraying Challenges - Turning



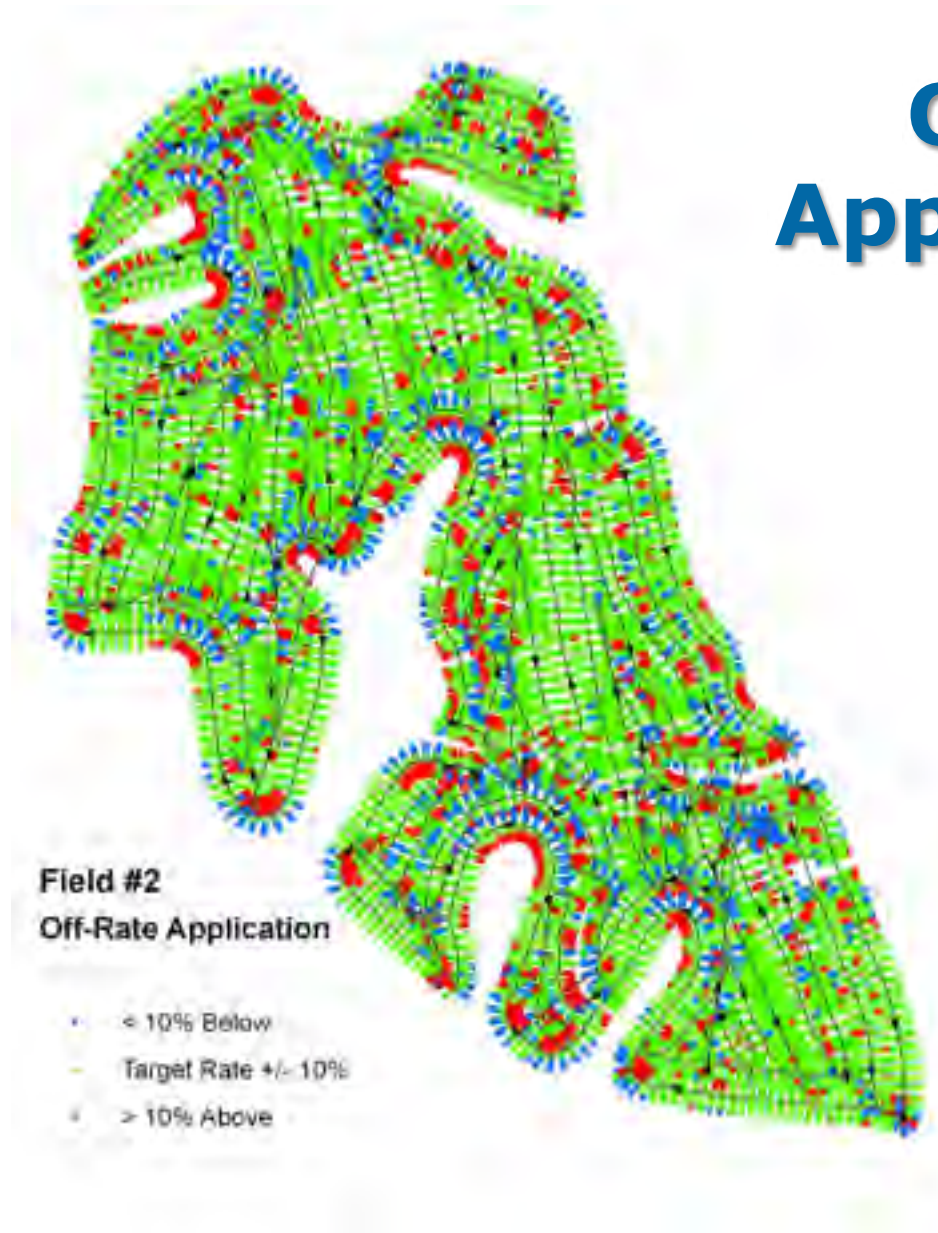


# Off-Rate Application Errors

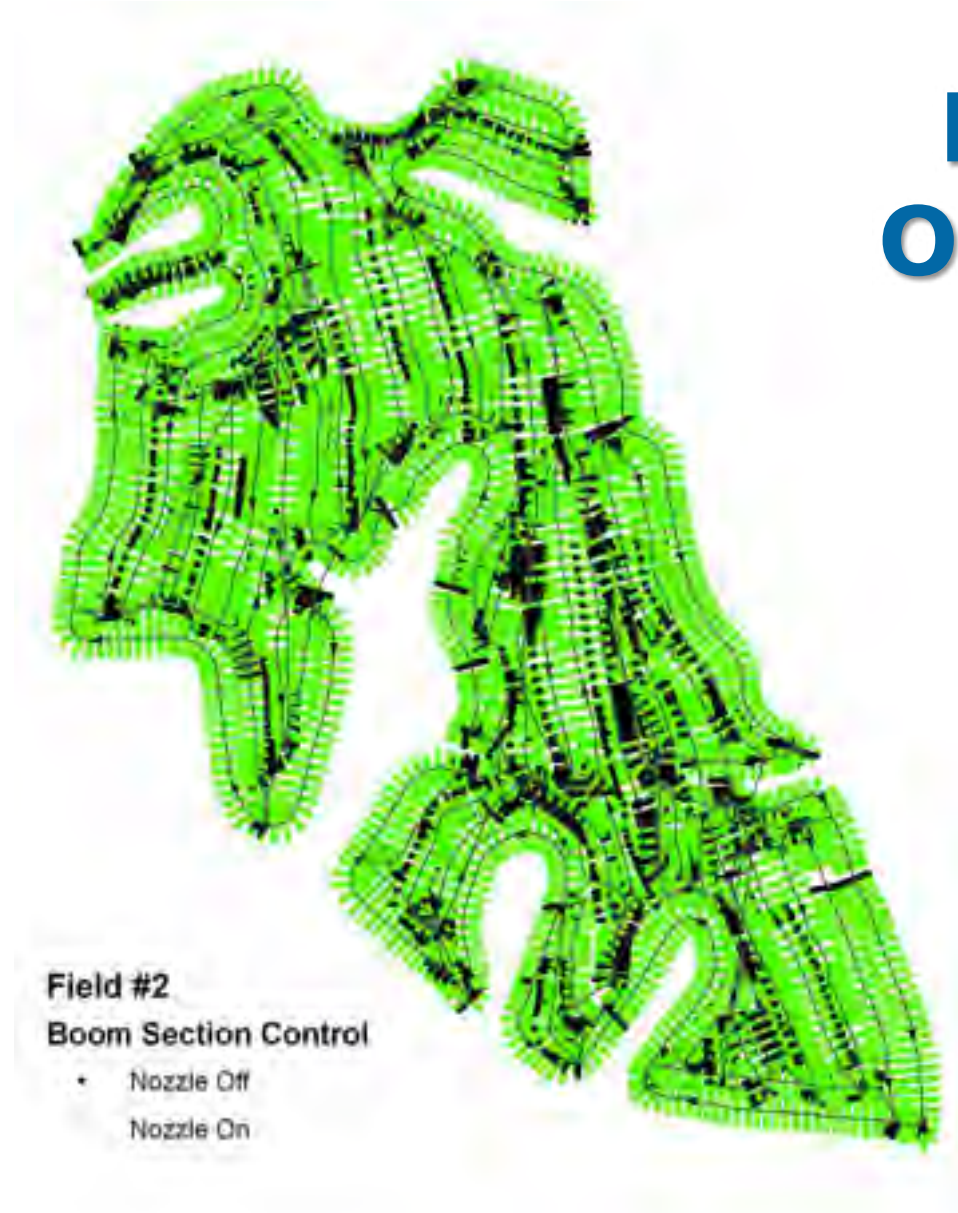


Geometry-Based Method for Determining Treated Area for Control Sections

# Off-Rate Application

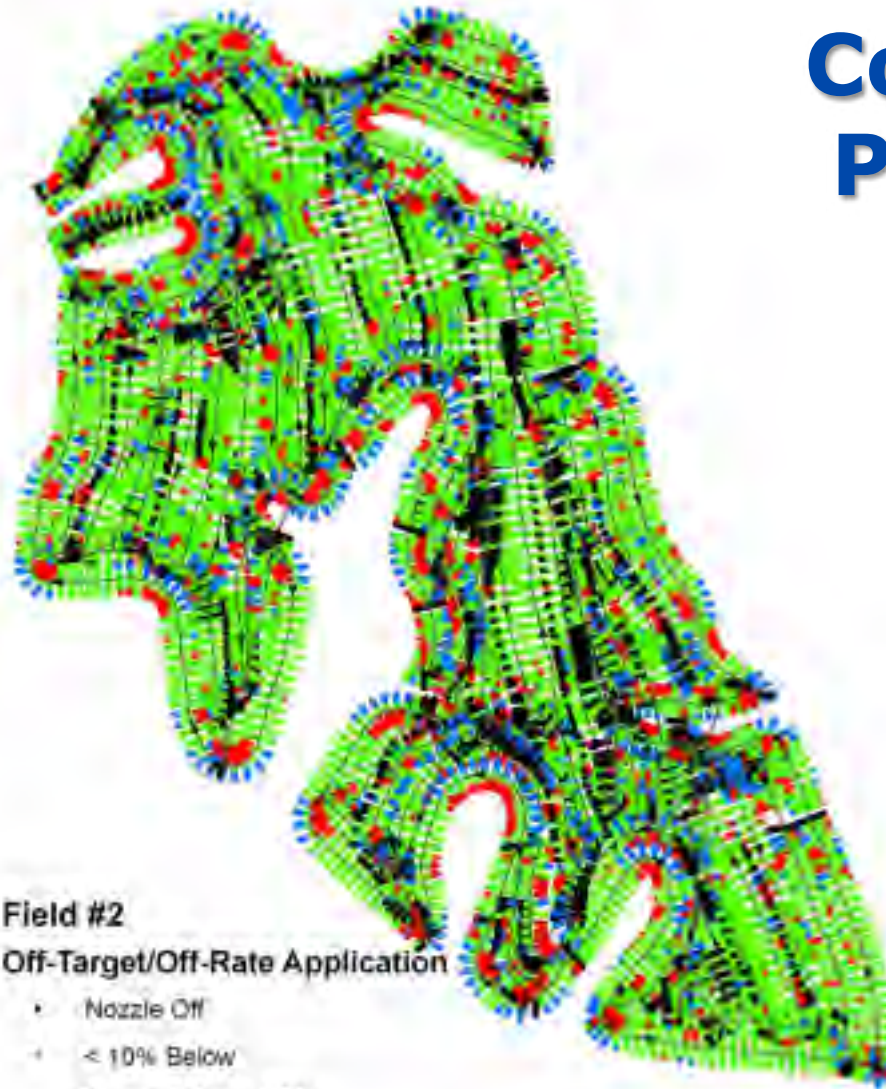


# Nozzle Overlap





# Combined Problems



## Field #2

### Off-Target/Off-Rate Application

- Nozzle Off
- < 10% Below  
Target Rate +/- 10%
- > 10% Above



# Off-Rate Application Errors

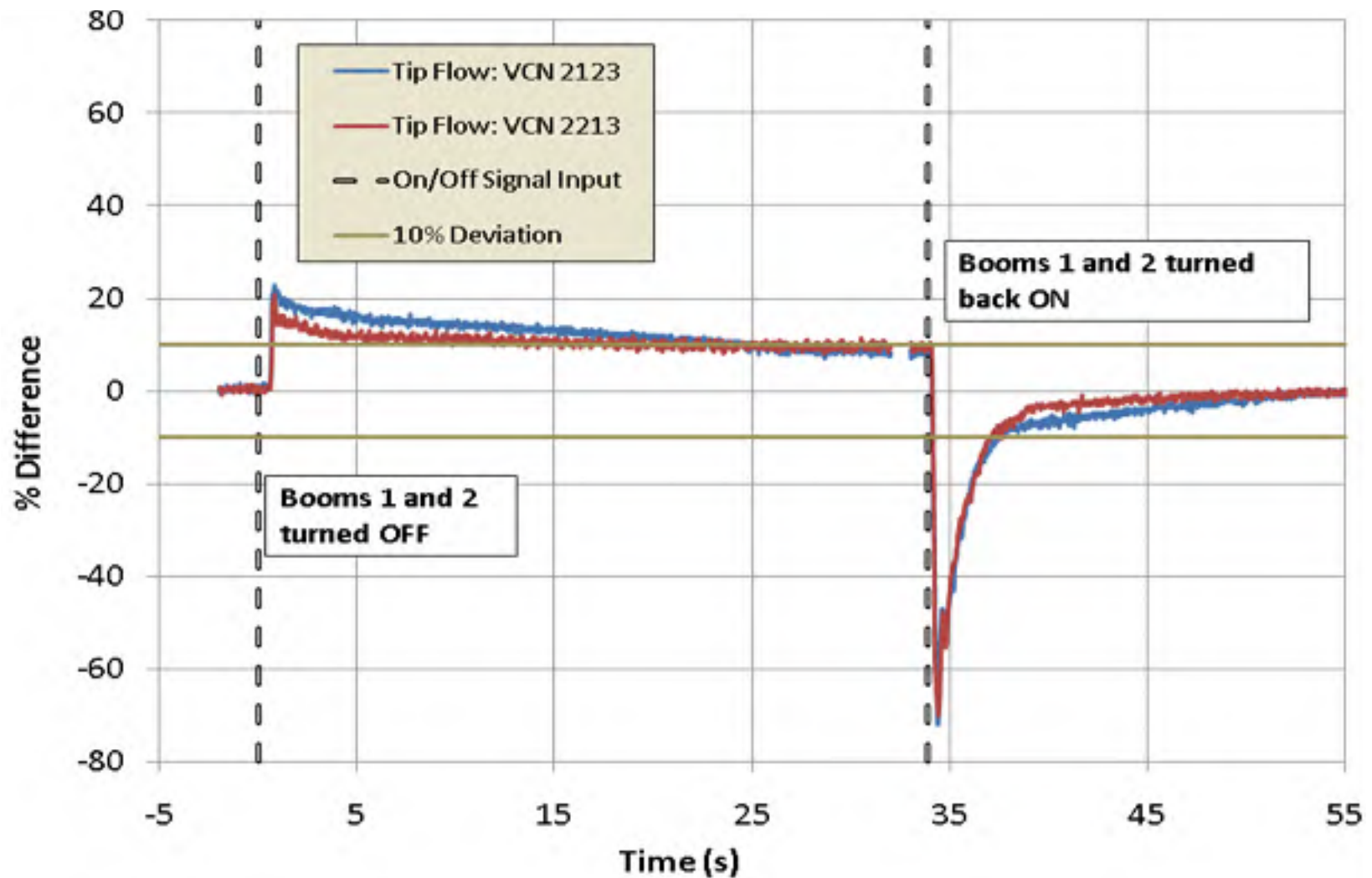


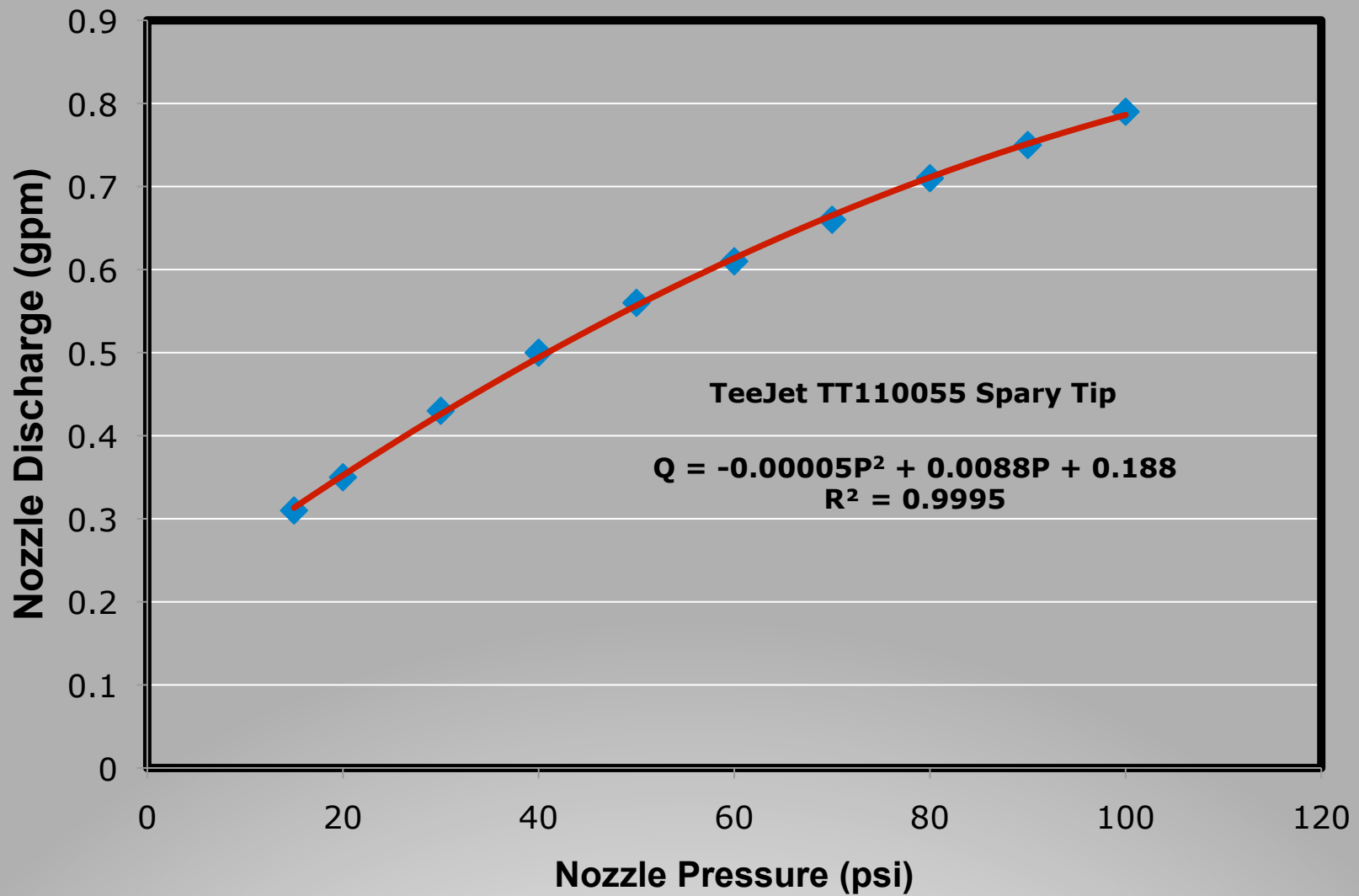
# Off-Rate Application Errors



Dr. John Fulton - Auburn University

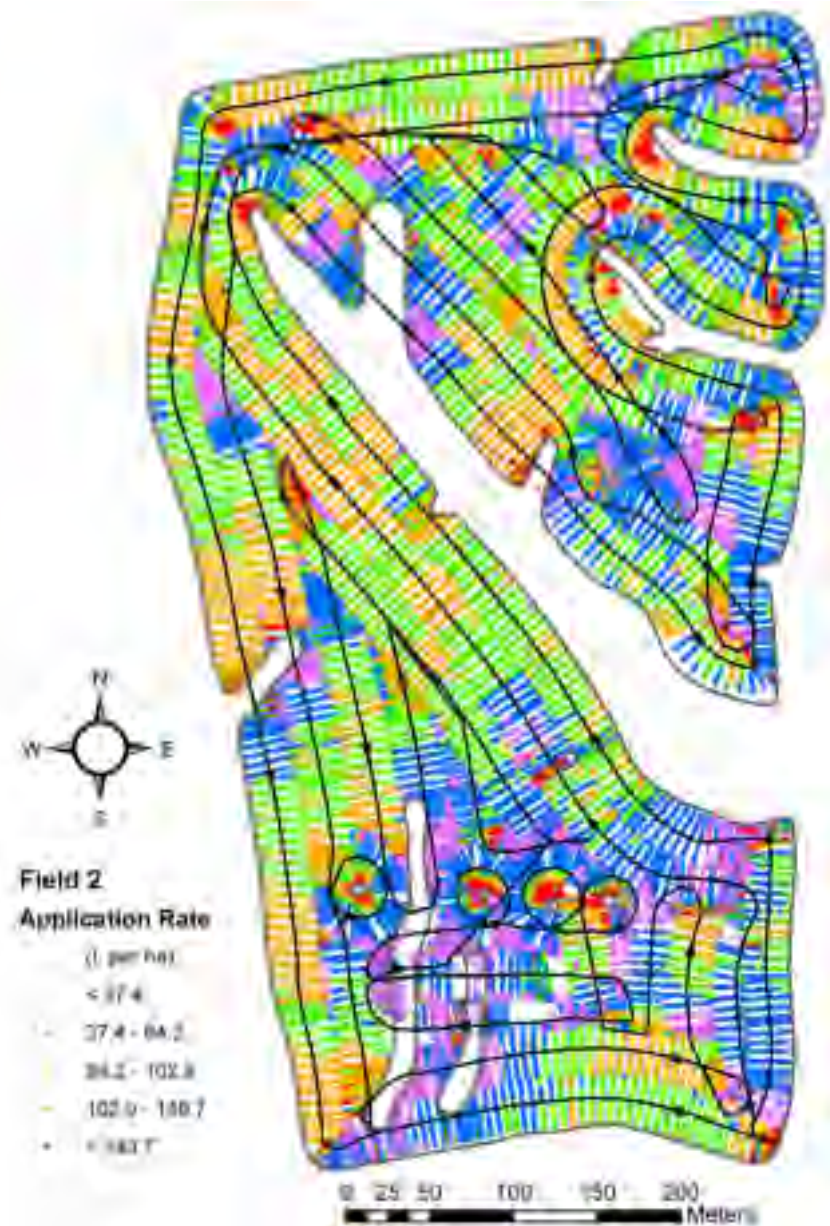
# Boom Section Response







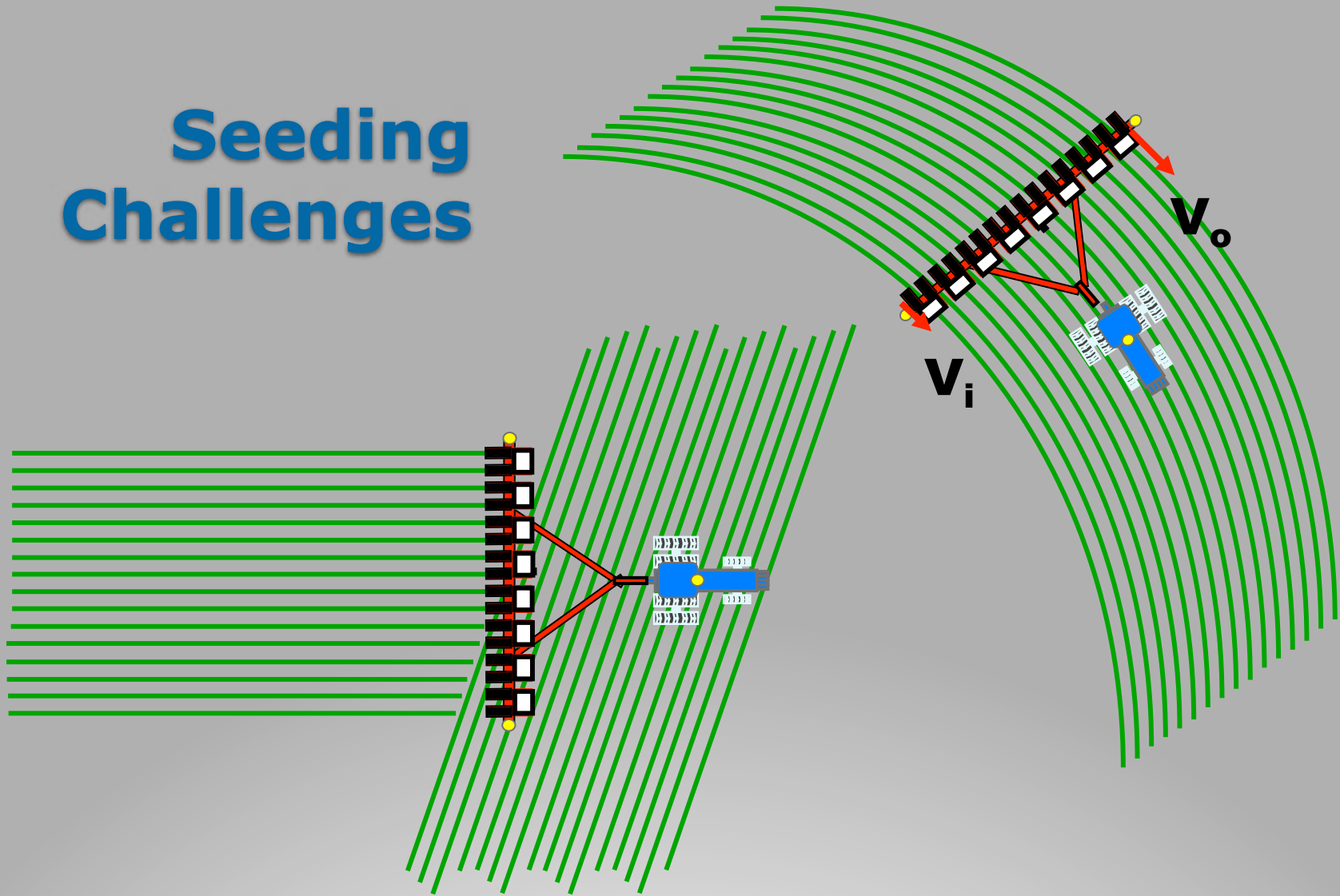
# Rate Variation



# Seeding



# Seeding Challenges



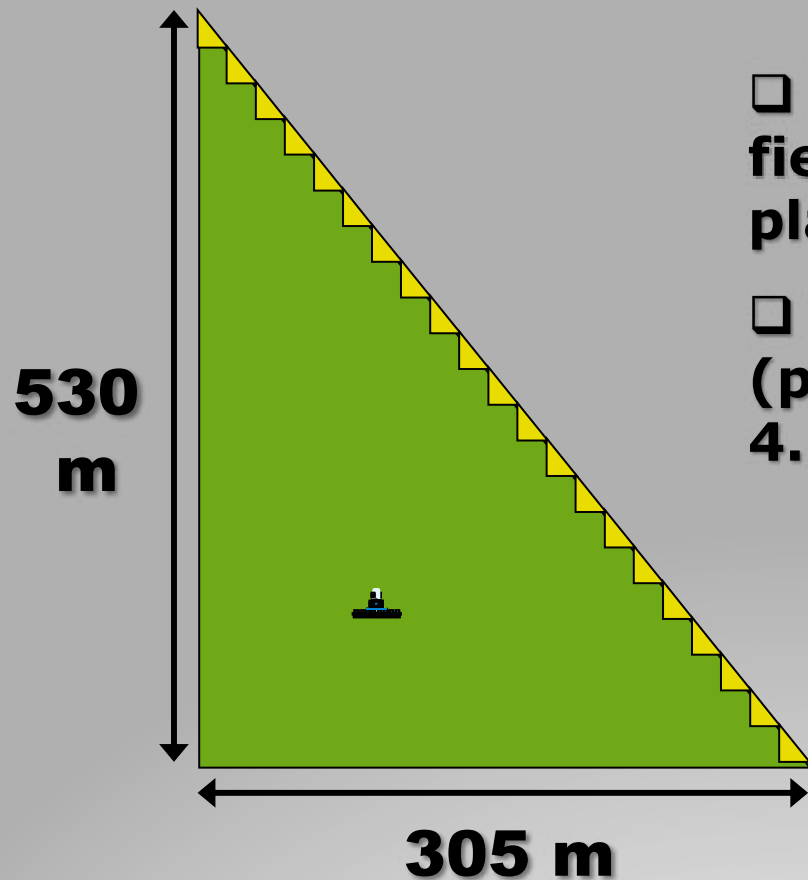








# Triangular Borders



- ❑ This 16.2 ha triangular field requires 70, 8-row planter passes.
- ❑ Total unplanted area (point rows) is 0.7 ac or 4.2%.

# Seed Savings

- **Assumptions:**

- 3000 ac of Round-Up Ready Corn and Soybeans
- Corn seeded at 30K seeds/ac
- Corn \$250/bag (80,000 seeds/bag)
- Beans seeded at 120,000 seeds/ac
- Beans \$50/bag (50 lb w/3000 seeds/lb)
- 10% seed savings with planter section control

- **Projected annual savings:**

- \$14,050 Corn Seed
- \$6,000 Soybean Seed
- \$20,050 Total





# Other Inputs

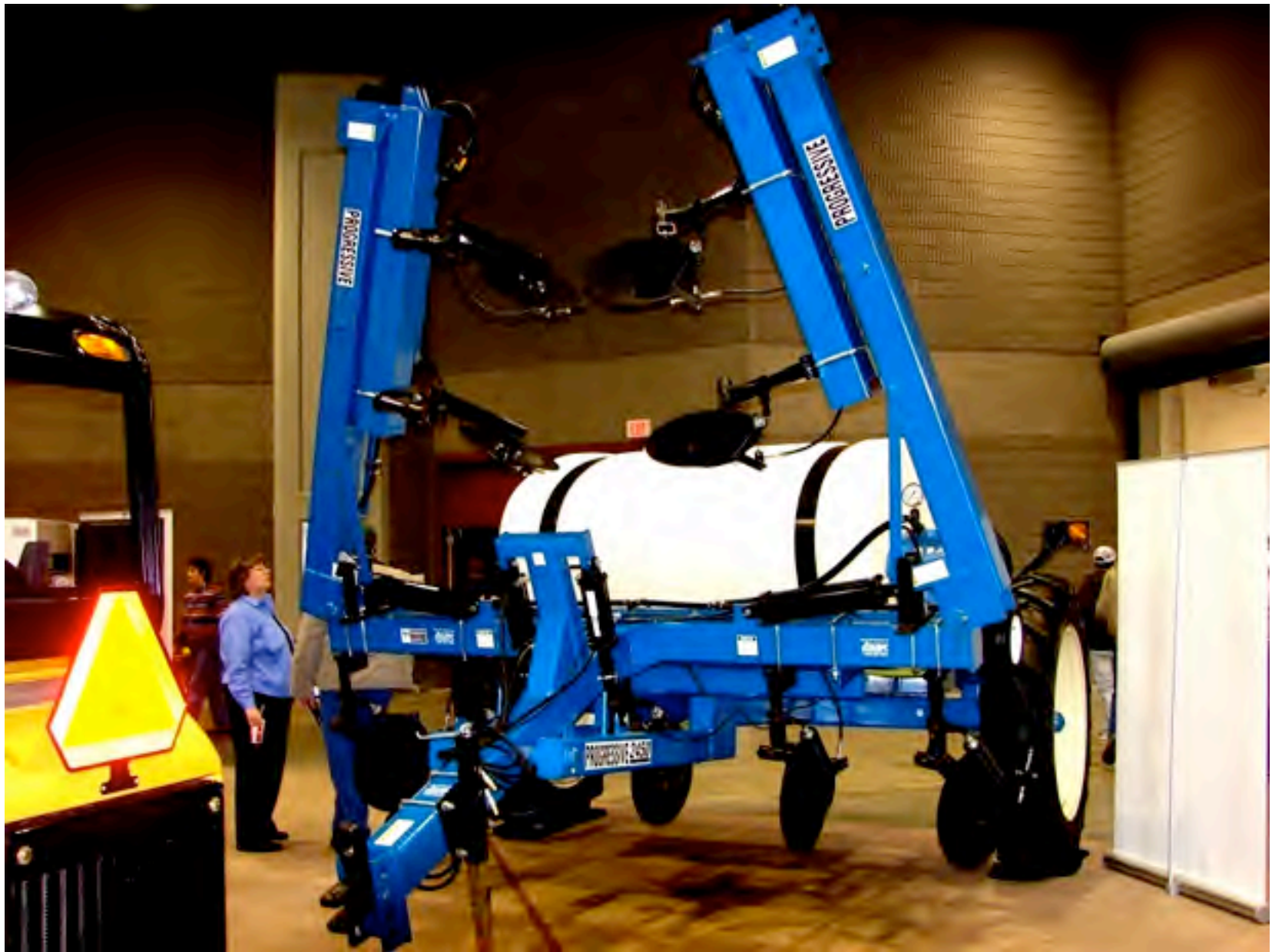


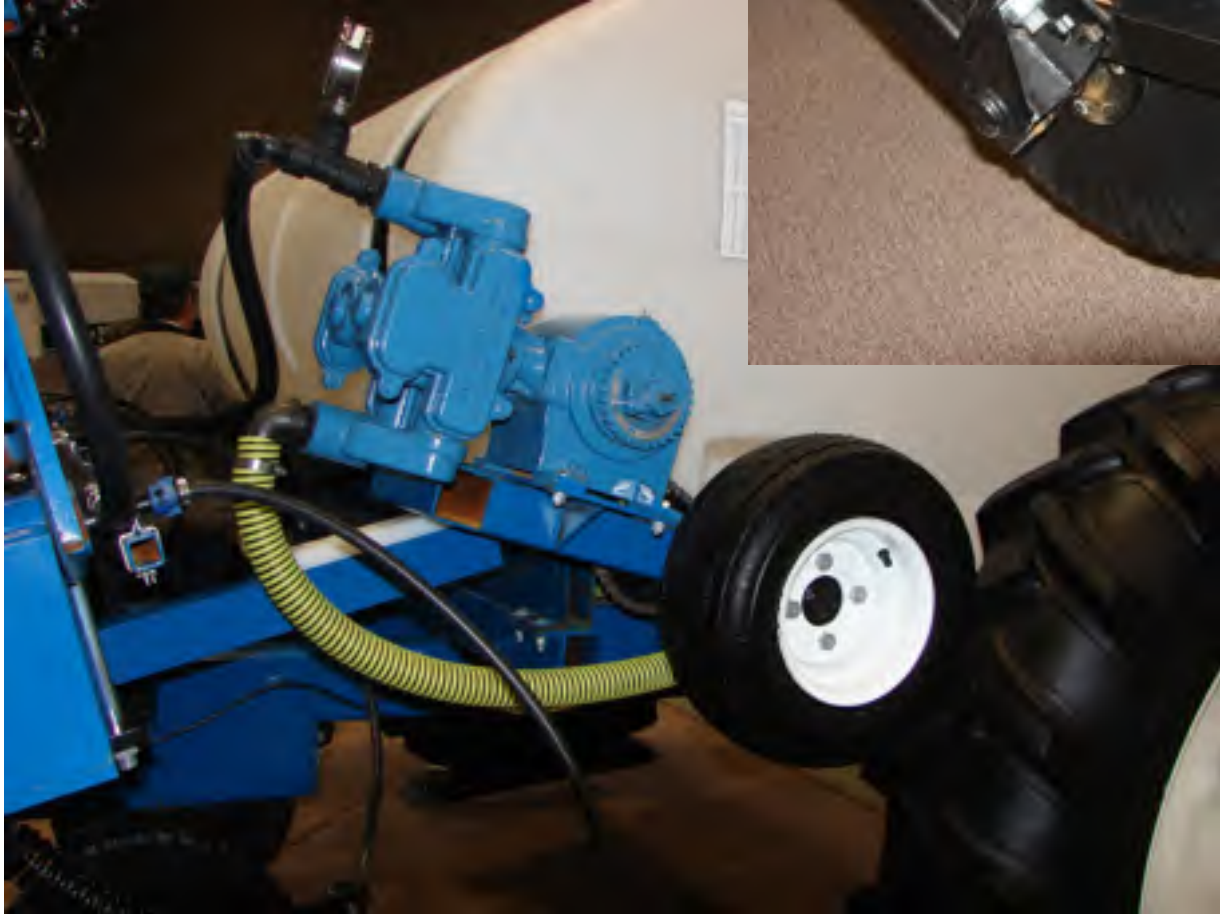


**TeeJet Part  
No. 56720**



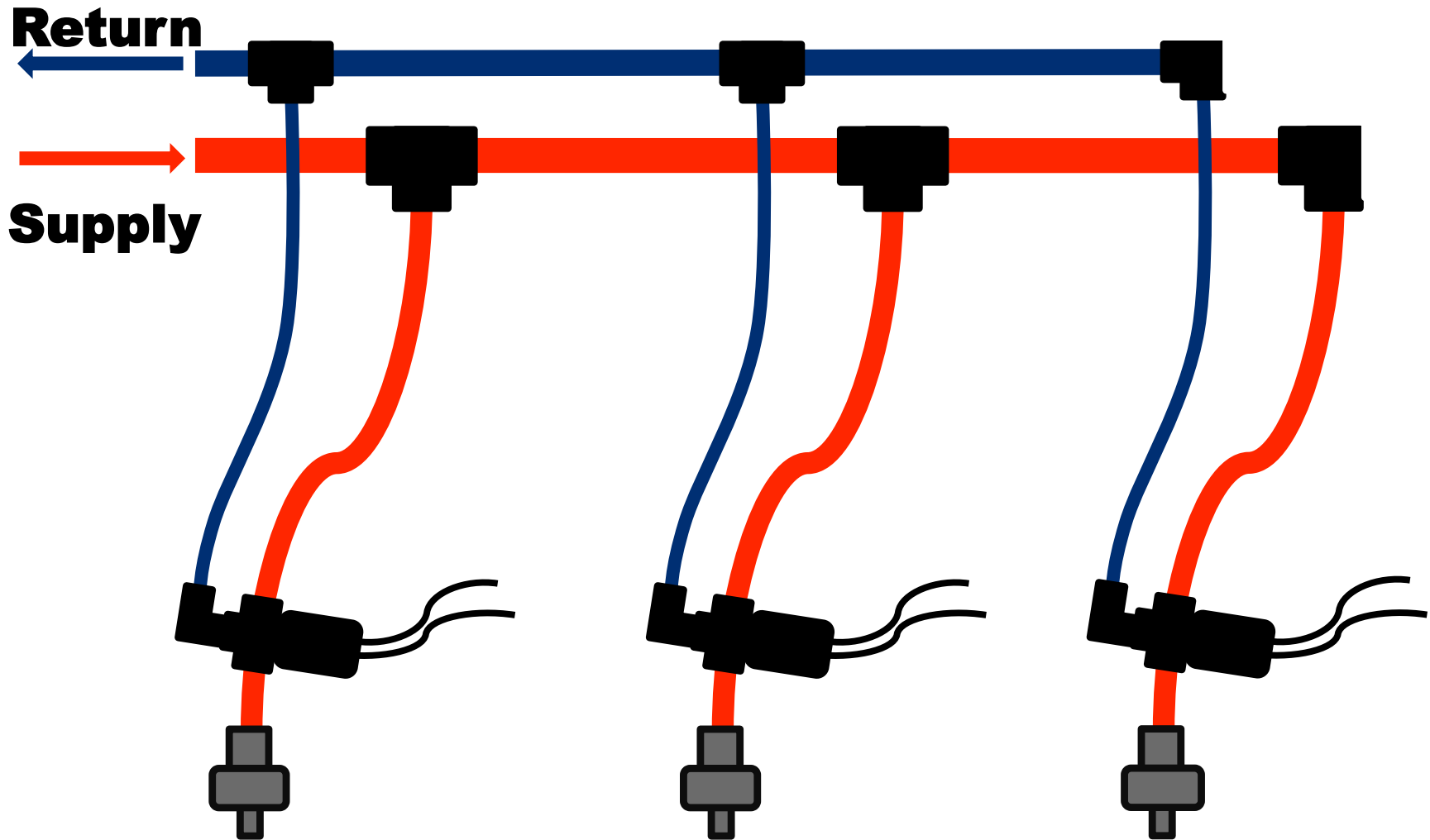
**CapStan Valve**







# Positive Displacement Systems







# N Savings

- **Assumptions:**
  - 1500 ac of Corn
  - Application rates of 175 lb N/ac
  - N priced at \$0.35/lb
  - 10% N savings with section control
- **Projected annual savings:**
  - \$9,190





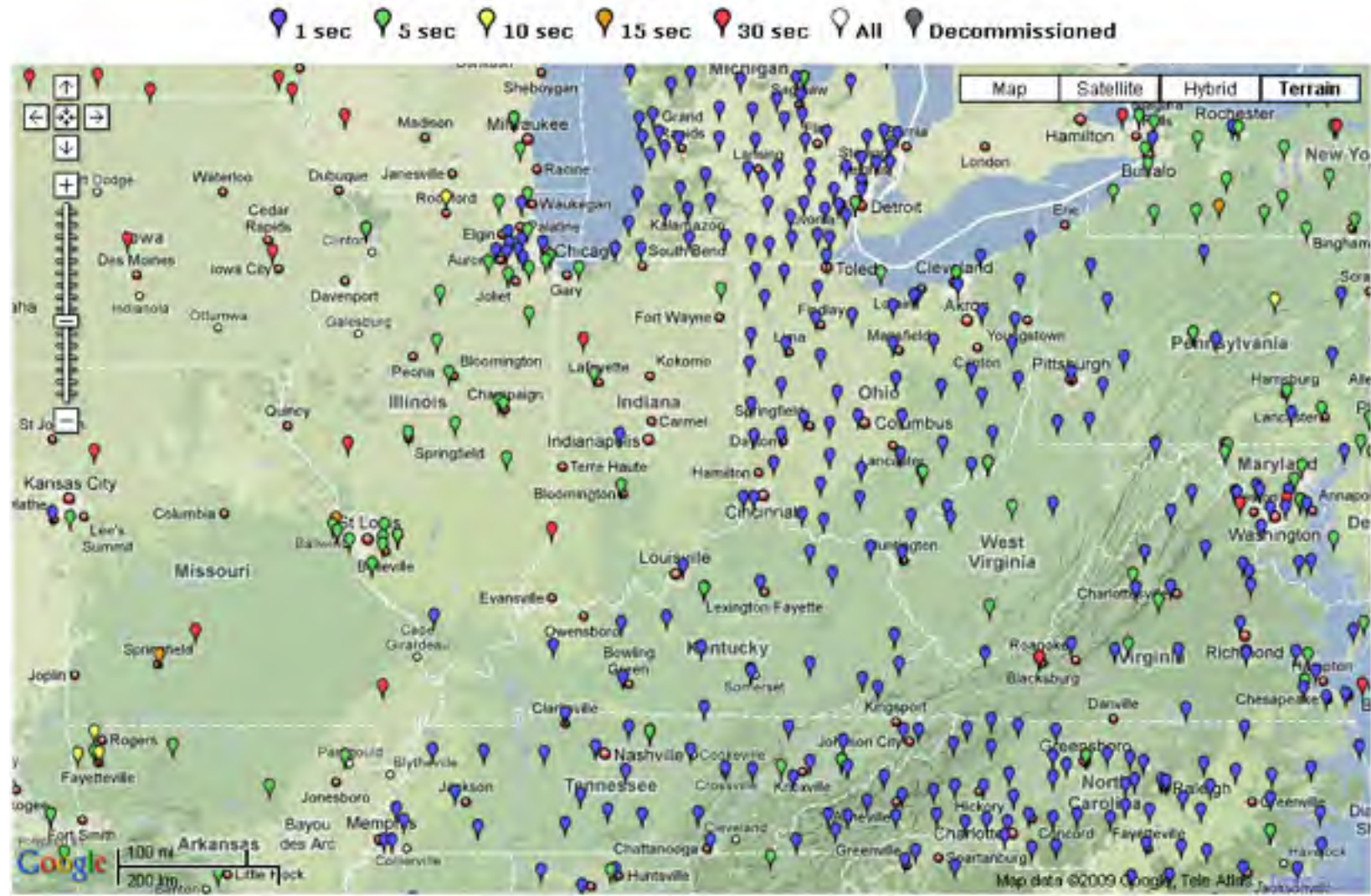
# Questions to ask ...

- **How many channels of control are available?**
- **Can the unit be expanded in the future (CAN)?**
- **Is map-based control available?**
- **How do they handle map files?**
- **Are “as-applied” files produced for verification?**

# What is the cost of RTK GPS?



# Continuously Operating Reference Stations (CORS)





## **CORS Access**

**Bridges  
Smartphones  
Integrated**







**Questions?**