Section Control Technology for Sprayers

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US Trends for Ag Equipment

• Time conducting field operations is critical to farmers

• Equipment increasing in size
  – SPRAYERS: 90 or 120 foot wide
  – Planters: 60 to 80 foot wide
  – Harvesters: 35 to 45 foot wide

• Field speeds: 3 to 20 mph (12-18 mph)

• Machine automation
  – Autoguidance
  – Accurate input management (maximize return)
  – GPS/GNSS provides the essential sensor for today’s equipment automation
Field Conditions

- Shape: not square
- Size: 20 to 200 acres
- Terrain: 0% to 12%

Precision Ag Adoption in Alabama
AVG Savings for PA Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Percent Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS-based Guidance</td>
<td>10%</td>
</tr>
<tr>
<td>Variable-Rate Application</td>
<td>7%</td>
</tr>
<tr>
<td>Automatic Section Control (ASC)</td>
<td>5%</td>
</tr>
</tbody>
</table>

1. Quality of life (happier as day’s end)
2. Will not go back to traditional mgnt

Precision Technology and Management

• Cost Management Tools
• Best Management Technologies
  – On-farm efficiency
  – Fertilizer use-efficiency
  – Environmental stewardship
• Risk Management
  – Production decisions, loans, insurance, etc.
  – Field documentation (legal)
BASICS OF AUTOMATIC SECTION CONTROL FOR SPRAYERS

Manual Control – Switch Box

• Located in cab
  – Dash mounted
  – Joystick
  – Control box
• Switch On/Off
  – Individual sections
  – Whole boom
**Automatic Section Control**

- **Automatic ON / OFF** of sections or individual nozzles
  - Controller generates field coverage files
  - Sections turn off as they pass over previously treated areas
- **Reduces** 1) overlap and 2) application in unwanted areas (waterways, buffer strips, etc.).

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**Manual versus Automatic Section Control**

- **Manual Shut-Off**
- **3-Section Control**

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- Operator Response
- Needed Overlap

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**Headland Pass**

Boom sections are automatically actuated off as the sprayer enters the headlands.
BENEFITS OF ASC TECHNOLOGY

Overlap Reduction Technologies

- Adjacent Passes
  - Overlap occurs at boom ends
  - Reduced with automated guidance

- Headland or Point Rows (turnaround)
  - Overlap occurs across the boom
  - Reduced with automatic section control
Benefits of Automatic Section Control

- Overlap errors reduced during application
- Input cost reduction for producers
- Less fill-ups
- Improved environmental stewardship
- Preservation of conservation structures

Field shape and size impact savings (overlap)

Reduction in Overlap
Manual versus Automatic Section Control

[Graph showing reduction in overlap compared to manual section control]

Courtesy of Luck and Shearer, University of Kentucky
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)
  - Savings nearly doubled if ASC used on N
  - $11 to $13/ac/yr for irrigated corn
- Payback period: < 2 yrs
Preservation of Conservation Structures
Automatic Section Control Benefits

– Grassed waterway conservation
– Establish “no-spray” zones

ASC shines:
• Irregular shaped fields
• Self-propelled sprayers (12-18 mph)
Additional Benefits

• Application Errors
  – Overlaps in blue
  – Skips in red

• Paint a picture!
  – Overlaps in blue
  – Eliminate skips

Images courtesy of Luck

Improved Field Capacity and Management
As-applied data
- As-applied maps
- Time, area applied and amount (verification)
- Future management decisions (analysis)

ASC COMPONENTS AND SELECTION CONSIDERATIONS
Spray Control System with Automatic Section Control

ASC Components

- Technology
  - GPS receiver
  - Display/Controller - proper software
  - Control valves
  - Cabling, electronic control units (ECUs), and other components

- Consult dealer about your sprayer
Selection of GPS Accuracy
Pass-to-Pass vs. Long-Term

<table>
<thead>
<tr>
<th>Correction Service</th>
<th>Pass-to-Pass Accuracy*</th>
<th>Potential Range of Drift†</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAAS</td>
<td>± 6 to 13 inches</td>
<td>± 4.7 ft</td>
</tr>
<tr>
<td>Sub-meter</td>
<td>± 6 to 13 inches</td>
<td>± 2.3 ft</td>
</tr>
<tr>
<td>Decimeter</td>
<td>± 2 to 4 inches</td>
<td>± 1.7 ft</td>
</tr>
<tr>
<td>RTK</td>
<td>± 1 inch</td>
<td>± 1 inch</td>
</tr>
</tbody>
</table>

* Based on manufacturer literature.
† Based on research conducted at Auburn University.

Displays / Control Systems

- AgLeader
- John Deere
- Raven
- TeeJet
- Topcon
- Trimble

1. Select what works best for your operation (cost).
2. Purchase a display which allows for technology upgrades.
Control Valves for ASC

Two Types of Valve Solutions

– Boom Shut-Off Valves (2 or 3-way)
– Individual nozzle solenoid valves (2-way)

SPRAYER SETUP CONSIDERATIONS
Sprayer Off-Rate Errors

Auto-Section Control on Sprayers

Extended time for nozzle flow to stabilize
1. Calibrate
2. Select correct nozzle for application

Considerations for Sprayer Setup when using ASC

- Distribute boom sections evenly
  - Minimize overlap
  - Consistent response for rate controller

- Place boom shut-off valves as close to boom section as possible.
Rate Controller Response

Look-ahead feature

Controller Setup
(valve control number)

Setup impacts performance

Sprayer Operator

Operator vs. Driver

– Understands the controller and sprayer functions
– Properly setup controller
– Potential pressure variations (gauge in cab)
– Consistent acceleration and deceleration
– Don’t rush
CASE EXAMPLES: COSTS OF AUTOMATIC SECTION CONTROL

- Guidance and rate control
- Adding ASC

AgChem / AGCO RoGator
TeeJet Spray Control

Teejet Martix Pro
- $1,758: 5.7” display
- $2,500: 8.4” display
  - Display
  - External GPS antenna
  - WAAS correction
  - Cables
- $1500: application control

Comments:
- $225 for camera kit
- $860 for Tilt Module

Adding ASC to Matrix Pro

- $1100 Boom Pilot Kit
- Specify for your sprayer (valves)
Trimble – ASC technology

- CFX 750 Display: $3000
- FMX Display: $6000 ($20k for RTK AutoPilot)
- Field IQ: $2500 to $3000
  - Application rate control
  - Automatic section control

John Deere Sprayers

- 20, 30 and 40 series sprayers
- Already using rate control: 1800, 2600 or 2630 display
John Deere Sprayers

John Deere Swath Control Pro
– $5200
  • $2700: SF 3000 receiver (SF1 correction)
  • $2500: Auto-swath activation unlock

Purchase Considerations
• Select the **right** company / technology for your operation
  – Current or new equipment
  – Evaluate your current technology
    • GPS/GNSS receiver
    • Level of GPS correction (WAAS, StarFire, OmniStar, RTK, etc.)
    • Rate controller plus software
• No. of control channels (>5)
• **Capabilities beyond guidance** (application control)
• **System easily upgradeable** with new firmware
• **Documentation data** (as-applied maps + reports)
• **System service** or support
Good benefits with happy results!

Precision Ag Technology has improved profitability and environmental stewardship.

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