BENEFITS AND COSTS OF ENTRY LEVEL PRECISION AGRICULTURE TECHNOLOGIES

2017 OPERATION MANAGERS CONFERENCE

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TODAY'S AGENDA

• Benefits of Precision Agriculture for your Operation
• Features of Auto Steer & Section Control
• Financial Impacts
• Questions/Discussion
GOALS OF TECHNOLOGY

- Technology allows a new level of efficiency, without which would be unachievable
- Minimizing our inputs, wastes
- Maximizing our yields, information
- Precision Ag is Decision Ag
WIRELESS TELEMATICS

AUTO STEER
YEAR ROUND APPLICATIONS

INITIAL BENEFITS

- Overlap control
  - Immediate cost savings
- Yield accuracy
  - Accurate vs inaccurate data
- Machine wear
- Labor saver
  - Less qualified operators
  - Let the machine do the thinking
- Transferable
REQUIRED HARDWARE

- Display Interface
  - Add-On
  - Integrated

- GPS Receiver
  - Location, direction, height, heading
  - Activations/subscriptions

- Mechanical steering
  - Add-On
  - Integrated

- Activation(s)
  - Auto-Steer Activation

TILLAGE

- Overlap reduction
  - Time
  - Fuel
  - Wear

- Consistency across field
- Operator fatigue
PLANTING/SEEDING

• Eliminate your guess rows
• Operator fatigue*
• Focus on planter functions
• Ease at harvest

CROP CARE

• Protect emerged crops
• Ease operator strain
• Reducing overlap
METHODS

- Guidance Lines
  - Match up with planting lines
  - Level of guidance key
- Sensors
  - Mechanical sensors
  - Optical sensors

MOWING

- Overlap control
- Operator fatigue
- Focus on your task
- Efficiency
HARVEST: COMBINES & SPFH

- Manual Row Guidance
- Automatic Row Guidance
- Integrated Technology
- Add-on
- Yield monitor accuracy

<table>
<thead>
<tr>
<th>Application</th>
<th>&lt;1&quot;</th>
<th>&lt;1.5</th>
<th>~2&quot;</th>
<th>6&quot;-9&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spraying/Spreading</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Tillage</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Mapping</td>
<td></td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Mowing</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Harvest</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Seeding</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Strip Tilling</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Section Control</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>In-Row Guidance</td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>
WHAT IS ‘PASS TO PASS’

POTENTIAL DRIFT AFTER 15 MIN.
COMPATIBILITY/INTEGRATION

GUIDANCE LINE OPTIONS

Straight Tracking

Adaptive Tracking

Curve Tracking
IMPLEMENT GUIDANCE

Passive

Active

IMPLEMENT GUIDANCE COMPANIES

- SUNCO
- John Deere
- Orthman
- ProTRAKker
- Trimble
### WHO OFFERS WHAT?

**CASE IH/AFS**
- EGNOS
  - 8" (SAT)
- RTX Range Point*
  - 6" (SAT)
- RTX Center Point*
  - 1.5 (SAT)
- RTK
  - 1"

**JOHN DEERE**
- SF1
  - 9" (SAT)
- SF2*
  - 2" (SAT)
- SF3*
  - 1.2" (SAT)
- RTK/Mobile RTK*
  - <1"

### WHO OFFERS WHAT?

**TRIMBLE/NEW HOLLAND**
- OmniSTAR VBS
  - <39"
- RangePoint RTX*
  - <6"
- OmNiSTAR G2/XP*
  - 3"-4"
- CenterPoint RTX*
  - <1.5"
SECTION CONTROL

- Seeders
  - Corn Planters
  - Drills
- Sprayers
  - Dry & Liquid
AVAILABLE ON VARIETY MODELS

- You don’t need a 2017 planter with all the bells & whistles to take advantage of section control
- Many planters have retrofit kits allowing you to upgrade your current planter w/o having to purchase an entirely new machine.

HARDWARE/SOFTWARE REQUIREMENTS

- Display interface
- GPS Receiver
- Section Control Activation (software)
- Machine Hardware
  - Clutches
  - Harnesses
  - Controller
IS THIS FOR ME?

Start measuring & do some simple math!

- Overlap for each practice
  - Tillage
  - Application
  - Seeding
  - Harvest
- Time spent
- Operator Fatigue
- Contact your dealer to demo this technology!

THINK DOWN THE ROAD
COMPATIBILITY!

SUPPORT IS KEY!
ECONOMIC ANALYSIS OF AUTO STEER AND AUTO SECTION CONTROL

• What changes in profit can be expected?
• What net present values and rates of return can be expected?
• How sensitive are results to changes in key variables?
  • expected acres affected
  • before and after overlap
  • percent double planted acres
• What factors, considerations omitted from the analysis need mention?

EXPECTED CHANGE IN PROFIT, AUTO STEER, AN EXAMPLE OF PARTIAL BUDGETING

• Screen shots of MS Office Excel Workbook, partial budget analysis follow
Partial Budget, Expected Change in Profit Attributed to the Proposed Change in the Farm Business

### Proposed Assumptions

1. Average future year, before tax, marginal analysis measuring the expected change in profit
2. 2015 price levels
3. acres affected: **500 corn**
4. herbicide application by custom operator
5. no effects on harvest operations
6. overlap current, 5 to 13 pct.: **10**
7. overlap proposed, %: **0**
8. tasks, operations affected: a) spring chisel plow; b) spring field cultivator; c) corn planting; d) fall residue management, chisel plow
9. initially no cover crop planted
10. Machinery complement size, performance, costs per Lazarus, 2015
11. expected change in total value of production: **0**
12. initial, additional capital investment required for auto steer equipment: **$12,000 dollars**

### Partial Budget

<table>
<thead>
<tr>
<th>Items that Increase Profit (A)</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increased Value of Production</strong></td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Decreased Costs</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labor</strong></td>
<td></td>
</tr>
<tr>
<td>spring chisel plow pass</td>
<td>77</td>
</tr>
<tr>
<td>spring field cultivator pass</td>
<td>77</td>
</tr>
<tr>
<td>corn planting</td>
<td>143</td>
</tr>
<tr>
<td>fall residue management pass</td>
<td>77</td>
</tr>
<tr>
<td><strong>Machinery repairs &amp; maintenance</strong></td>
<td></td>
</tr>
<tr>
<td>spring chisel plow pass</td>
<td>69</td>
</tr>
<tr>
<td>spring field cultivator pass</td>
<td>49</td>
</tr>
<tr>
<td>corn planting</td>
<td>73</td>
</tr>
<tr>
<td>fall residue management pass</td>
<td>69</td>
</tr>
<tr>
<td><strong>Fuel &amp; lube</strong></td>
<td></td>
</tr>
<tr>
<td>spring chisel plow pass</td>
<td>93</td>
</tr>
<tr>
<td>spring field cultivator pass</td>
<td>49</td>
</tr>
<tr>
<td>corn planting</td>
<td>52</td>
</tr>
<tr>
<td>fall residue management pass</td>
<td>93</td>
</tr>
<tr>
<td><strong>Fertilizer &amp; lime</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Seeds &amp; plants</strong></td>
<td></td>
</tr>
<tr>
<td>corn seed</td>
<td>5500</td>
</tr>
<tr>
<td><strong>Sprays &amp; other crop expenses</strong></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6,414</td>
</tr>
<tr>
<td>Total (A)</td>
<td><strong>$6,414</strong></td>
</tr>
</tbody>
</table>
Items that Decrease Profit (B)  

<table>
<thead>
<tr>
<th>Decreased Value of Production</th>
<th>Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0</td>
</tr>
</tbody>
</table>

| Increased Costs               |         |
| Fixed, ownership costs        |         |
| Auto steer equipment, DIRT1:  | 1748    |
| depreciation, interest, repairs, taxes, insurance | 1748 |

Total (B) $1,748

Expected Change in Profit (A minus B) $4,666

EXPECTED CHANGE IN PROFIT ATTRIBUTED TO AUTO STEER BY ACRES OF CORN BY OVERLAP WITHOUT AUTO STEER

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>Overlap Without Auto Steer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>13</td>
</tr>
</tbody>
</table>

--- Annual change in profit (dollars) ---

| 250 | -145 | 1,459 | 2,421 |
| 500 | 1,459 | 4,666 | 6,590 |

Notes: 1) Expected change in value of production = $0; 2) initial capital cost = $12,000, expected useful life = 10 years; 3) expected overlap with auto steer = 0%
### NET PRESENT VALUE (NPV), AUTO STEER, BY ACRES OF CORN BY OVERLAP WITHOUT AUTO STEER

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>Overlap Without Auto Steer (%)</th>
<th>Net Present Value (today’s dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>-1,496</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>11,513</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>19,316</td>
</tr>
</tbody>
</table>

**Notes:** 1) Expected change in value of production = $0; 2) initial capital cost = $12,000; 3) expected overlap with auto steer = 0%; 4) 10 year planning horizon; 5) discount rate in real terms = 4%; 6) if NPV > or = 0, then investment is attractive, appealing.

### INTERNAL RATE OF RETURN (IRR), AUTO STEER, BY ACRES OF CORN BY OVERLAP WITHOUT AUTO STEER

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>Overlap Without Auto Steer (%)</th>
<th>Internal Rate of Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20.4</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>29.8</td>
</tr>
</tbody>
</table>

**Notes:** 1) Expected change in value of production = $0; 2) initial capital cost = $12,000; 3) expected overlap with auto steer = 0%; 4) 10 year planning horizon; 5) IRR is the discount rate (%) that generates a NPV = 0 ; 6) if IRR for the investment is > or = the discount rate in real terms used by the business for capital investment decisions, then investment is attractive, appealing.
### Expected Change in Profit Attributed to Auto Section Control (ASC) by Acres of Corn by Double Planted Acres Distribution Without ASC

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>% of Fields, Low, Moderate, High: 15, 50, 35</th>
<th>% of Fields, Low, Moderate, High: 20, 50, 30</th>
<th>% of Fields, Low, Moderate, High: 25, 50, 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>-871</td>
<td>-946</td>
<td>-1,021</td>
</tr>
<tr>
<td>500</td>
<td>855</td>
<td>677</td>
<td>499</td>
</tr>
<tr>
<td>1,000</td>
<td>3,845</td>
<td>3,489</td>
<td>3,133</td>
</tr>
</tbody>
</table>

--- Annual change in profit (dollars) ---

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>Net Present Value (today’s dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>-7,465</td>
</tr>
<tr>
<td>500</td>
<td>6,534</td>
</tr>
<tr>
<td>1,000</td>
<td>30,786</td>
</tr>
</tbody>
</table>

Notes: 1) Expected change in value of production = $0; 2) initial capital cost = $15,000, expected useful life = 10 years; 3) expected double planted acres with ASC = 0; 4) A field is classified as Low when less than 2 percent of the field is double planted, Moderate when the double planted area is at least 2 percent but not more than 5 percent, High when more than 5 percent of a field is double planted.

### Net Present Value (NPV), Auto Section Control (ASC), by Acres of Corn by Double Planted Acres Distribution Without ASC

<table>
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<th>Acres of Corn Affected</th>
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<th>% of Fields, Low, Moderate, High: 25, 50, 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>-7,465</td>
<td>-8,073</td>
<td>-8,682</td>
</tr>
<tr>
<td>500</td>
<td>6,534</td>
<td>5,091</td>
<td>3,647</td>
</tr>
<tr>
<td>1,000</td>
<td>30,786</td>
<td>27,899</td>
<td>25,011</td>
</tr>
</tbody>
</table>

--- Net Present Value (today’s dollars) ---

Notes: 1) Expected change in value of production = $0; 2) initial capital cost = $15,000; 3) expected double planted area with ASC = 0; 4) 10 year planning horizon; 5) A field is classified as Low when less than 2 percent of the field is double planted, Moderate when the double planted area is at least 2 percent but not more than 5 percent, High when more than 5 percent of a field is double planted; 6) discount rate in real terms = 4%; 7) if NPV > or = 0, then investment is attractive, appealing.
INTERNAL RATE OF RETURN (IRR), AUTO SECTION CONTROL (ASC) BY ACRES OF CORN BY DOUBLE PLANTED ACRES DISTRIBUTION WITHOUT ASC

<table>
<thead>
<tr>
<th>Acres of Corn Affected</th>
<th>Double Planted Acres Distribution without ASC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of Fields, Low, Med, High: 15, 50, 35</td>
</tr>
<tr>
<td>250</td>
<td>-7.9</td>
</tr>
<tr>
<td>500</td>
<td>12.0</td>
</tr>
<tr>
<td>1,000</td>
<td>35.9</td>
</tr>
</tbody>
</table>

--- Internal Rate of Return (%) ---

Notes: 1) Expected change in value of production = $0; 2) initial capital cost = $15,000; 3) expected double planted area with ASC = 0; 4) 10 year planning horizon; 5) A field is classified as Low when less than 2 percent of the field is double planted, Moderate when the double planted area is at least 2 percent but not more than 5 percent, High when more than 5 percent of a field is double planted; 6) IRR is the discount rate (%) that generates a NPV = 0; 7) if IRR for the investment is > or = the discount rate in real terms used by the business for capital investment decisions, then investment is attractive, appealing.

SUMMARY

- Expected changes in profit attributed to entry level precision agriculture technologies exceed 0 over a range of expected values for key factors
  - overlap without and with auto steer
  - acres affected
  - percent double planted without auto section control
- Net present value analysis yields similar favorable results
- Some benefits to the operator difficult to quantify, but valuable -- reduced stress, reduced fatigue
- Producers encouraged to take advantage of analysis provided by equipment professionals, advisors etc. when making decisions
QUESTIONS

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