Impacts of Changing Seeding Rates in Soybean

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Purdue University
What is Driving Reduced Soybean Seeding Rates?

• Growing cost concerns:
  • Seed cost RR - 2007
    • List price – $30.99 to 33.99
    • Farm gate – $23.50 to 26.50
  • Non GMO
    • List price – ~$21.00
    • Farm gate – ~$15.00

• Seed treatment cost - 2007
  • Fungicide ~ $2.50 to $3.00
  • Insecticide + fungicide ~ $9.50

• What is it cheaper to do?
  • Plant more seeds or treat seed
Good Thing All Universities Agree!!

<table>
<thead>
<tr>
<th>State</th>
<th>Germination</th>
<th>30”</th>
<th>15”</th>
<th>7.5”</th>
<th>Seeds or plants acre⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iowa-seeds</td>
<td>90%</td>
<td>125 to 140</td>
<td>125 to 140</td>
<td>200*</td>
<td></td>
</tr>
<tr>
<td>Kentucky-plants</td>
<td>80%</td>
<td>111 to 139</td>
<td>139 to 167</td>
<td>119 to 179</td>
<td></td>
</tr>
<tr>
<td>Michigan-seeds</td>
<td>90%</td>
<td>122 to 157</td>
<td>139 to 174</td>
<td>175 to 280</td>
<td></td>
</tr>
<tr>
<td>Missouri-seeds</td>
<td>90%</td>
<td>140,000</td>
<td>175,000</td>
<td>200,000</td>
<td></td>
</tr>
<tr>
<td>Ohio-seeds</td>
<td>90*90%</td>
<td>129,000</td>
<td>160,000</td>
<td>196,000</td>
<td></td>
</tr>
<tr>
<td>Indiana-seeds</td>
<td>90*90%</td>
<td>129,000</td>
<td>160,000</td>
<td>196,000</td>
<td></td>
</tr>
<tr>
<td>Wisconsin</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

*Old versus new
What Else is Driving Reduced Soybean Seeding Rates?

- Farm equipment changes (farm size and technology)
  - Growers giving up the drill
    - Uniformity in seed placement and emergence

- What is your average seeding rate by row spacing?

<table>
<thead>
<tr>
<th>Row spacing</th>
<th>Seeding rate</th>
<th>Purdue rec’s (90*90)</th>
<th>% respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 21 in.</td>
<td>155,000</td>
<td>129,000</td>
<td>12%</td>
</tr>
<tr>
<td>11 ≥ x ≤ 20</td>
<td>180,000</td>
<td>160,000</td>
<td>31%</td>
</tr>
<tr>
<td>≤ 10 in.</td>
<td>198,000</td>
<td>196,000</td>
<td>57%</td>
</tr>
</tbody>
</table>

Conley and Santini, 2007
Common Questions Related to Variety Selection in Reduced Soybean Seeding Rate Systems

• Variety selection – Is it important?

• Erect vs. bushy response to reduced plant populations or row spacing
  • Real or marketing/grower perception?

• What about maturity group response?
  • Should I tweak my population based on maturity group adaptiveness?
**Soybean Variety Selection**

- Independent of farm size 28, 25, 29, and 18% of growers planted 1, 2, 3-4, or ≥ 5 varieties of soybean in 2005.

- 55% of growers with 1000+ acres planted 4 or less varieties

<table>
<thead>
<tr>
<th>Grain Yield</th>
<th>0 - 99</th>
<th>100 - 249</th>
<th>250 - 499</th>
<th>500 - 999</th>
<th>1000+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield Potential</td>
<td>1.5</td>
<td>1.4</td>
<td>1.4</td>
<td>1.4</td>
<td>1.2</td>
</tr>
<tr>
<td>RR ® Ready Trait</td>
<td>1.5</td>
<td>1.6</td>
<td>1.5</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Disease Resistance</td>
<td>1.6</td>
<td>1.7</td>
<td>1.7</td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Seed Dealer</td>
<td>2.3</td>
<td>2.1</td>
<td>2.2</td>
<td>2.2</td>
<td>2.3</td>
</tr>
<tr>
<td>Seed Price</td>
<td>2.3</td>
<td>2.5</td>
<td>2.4</td>
<td>2.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Seed Company</td>
<td>2.7</td>
<td>2.8</td>
<td>2.6</td>
<td>2.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Grain Quality Traits</td>
<td>2.9</td>
<td>3.1</td>
<td>3.0</td>
<td>3.1</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Conley and Santini, 2007
Maturity Group and Stem Phenotype Response to Decreased Soybean Populations

- **Northern:**
  - 2.8 and 3.6 M.G

- **Southern:**
  - 3.6 and 4.2

- **Plant populations**
  - 50,000 to 250,000

- **Erect vs. bushy beans**

- **10 site years; 4 varieties**

- **Drilled soybean (7.5”)**
Impact of plant population on soybean yield

![Graph showing the impact of plant population on soybean yield](image-url)
Does Planting Date Impact My Decision to Reduce My Soybean Seeding Rate
Defining Planting Date Responses in Illinois*
2001-2003 University of Illinois CMRA Project

<table>
<thead>
<tr>
<th>Seed rate†</th>
<th>Planting date</th>
</tr>
</thead>
<tbody>
<tr>
<td>000/acre</td>
<td>Early April</td>
</tr>
<tr>
<td>75</td>
<td>38.7</td>
</tr>
<tr>
<td>125</td>
<td>41.9</td>
</tr>
<tr>
<td>175</td>
<td>43.8</td>
</tr>
<tr>
<td>225</td>
<td>45.3</td>
</tr>
</tbody>
</table>

*Soybean yield averaged over nine environments in Northern Illinois.
†Seeding rates are expressed as **viable** seeds per acre.
<table>
<thead>
<tr>
<th>Seed rate(^\d)</th>
<th>Mid-April</th>
<th>Early May</th>
<th>Late May</th>
<th>Early June</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>30.4</td>
<td>33.7</td>
<td>35.9</td>
<td>30.6</td>
</tr>
<tr>
<td>125</td>
<td>29.3</td>
<td>33.7</td>
<td>35.3</td>
<td>32.8</td>
</tr>
<tr>
<td>175</td>
<td>32.3</td>
<td>34.6</td>
<td>36.3</td>
<td>32.4</td>
</tr>
<tr>
<td>225</td>
<td>32.9</td>
<td>35.4</td>
<td>34.6</td>
<td>33.7</td>
</tr>
</tbody>
</table>

*Soybean yield averaged over four environments in Southern Illinois.
\(^\d\)Seeding rates are expressed as **viable** seeds per acre.
Defining Planting Date Responses in Illinois
2001-2003 University of Illinois CMRA Project

• “In Northern Illinois….Planting in early April reduced yield by about 10 percent, and planting in late May reduced yield by about 5 percent; these results suggest that planting “too early” tends to reduce yield more than planting late.”

• “It pays to wait to plant, but if planting is earlier than ideal, it pays to add extra seed.”

Emerson D. Nafziger
University of Illinois
Defining Planting Date Responses in Illinois 2001-2003 University of Illinois CMRA Project

• “In Northern Illinois….Optimum planting rates for planting in the optimum window were about 150,000 to 160,000 viable seeds per acre, but this rose to above 200,000 per acre if planting was earlier than the optimum time.”

• “Still it appears that planting rate should be between 150,000 to 175,000 viable seeds per acre in Southern Illinois.”

Emerson D. Nafziger
University of Illinois
Does Row Spacing Impact My Decision to Reduce My Soybean Seeding Rate
Should Yield Environment Affect Seeding Rate

Seeding Rate (1000’s)

Yield

Harvest Pop

Bu/Ac

High Yield Environment

250 220 190 160 130 100

0 10 20 30 40 50 60 70

167 159 138 116 106 70
Economic Analysis for a High Yield Field

$\text{Seed Cost ($)}$

$\text{Profit}$

$\text{Max}$

$\text{$ of Yield}$

$\text{Seeding Rate (1000’s)}$

$\text{250, 220, 190, 160, 130, 100}$

$\text{250, 220, 190, 160, 130, 100}$

$\text{0, 50, 100, 150, 200, 250, 300, 350}$

$\text{$\text{Seeding Rate (1000’s)}$}$

$\text{$ of Yield$}$

$\text{Prof}$
Should Yield Environment Affect Seeding Rate

Seeding Rate (1000’s)

Yield

Harvest Pop

Bu/Ac

250  220  190  160  130  100

225  204  175  150  108  78

Moderate Yield Environment
Economic Analysis for a Medium Yield Field

- **Seed Cost ($)**
- **Profit**
- **Max**
- **$ of Yield**

- **Seed Cost ($)**
  - 0
  - 50
  - 100
  - 150
  - 200
  - 250
  - 300

- **Seeding Rate (1000’s)**
  - 100
  - 130
  - 160
  - 190
  - 220
  - 250
Should Yield Environment Affect Seeding Rate

Yield vs. Harvest Pop

Bu/Ac

250 220 190 160 130 100

Seeding Rate (1000’s)

Low Yield Environment

Yield

197 177 154

Harvest Pop

131 92 65
Economic Analysis for a Low Yield Field

Seed Cost ($)

$ of Yield

Profit

Max

245

Seed Cost ($)

Seeding Rate (1000’s)
Weed control implications

- Weeds are the #1 IN soybean pest
- Glyphosate resistance is a reality
- Delayed canopy closure as row spacing increases

<table>
<thead>
<tr>
<th>Row Spacing</th>
<th>May planting date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 5/5</td>
</tr>
<tr>
<td>7.5</td>
<td>35</td>
</tr>
<tr>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>75</td>
</tr>
</tbody>
</table>
Soybean Yield Loss Influenced by the Timing of Weed Removal and Row Spacing

Weed Management in GR Soybean

- 26% of respondents indicated that they applied a preemergence herbicide to their soybean crop.

- 23% of growers indicated that they utilized a one pass weed control program.

- The percentage of growers utilizing a one trip weed control programs was 40% (99 or less), 34% (100 to 249), 20% (250 to 499), 13% (500 to 999), and 11% (1000+).

- One pass program produced a 5.8% yield loss compared to those growers with 2+ passes.

Johnson et al. 2007
What is the Take Home Message

- Growers are slowly backing off seeding rates
  - Driven by seed cost and equipment changes

- Variety selection based on yield potential and defensive traits is important; canopy architecture is not important

- Planting date will affect seeding rate
  - Critical factor is getting a base population $\geq 100,000$

- Row spacing and environment factors are related to maximizing leaf area

- Don’t forget about weed competition and glyphosate resistance
  - (Weed Scientists aren’t that bad after all)
Acknowledgements

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Friends Don’t Let Friends Plant Corn!