Agronomics and Economics of Using GMO Corn

Joe Lauer

University of Wisconsin
Specialty Corns

Marketing Corns
- Amylomaize (high amylose)
- Waxy corn
- High-protein (lysine) corn
- High-oil corn
- White & Yellow Food corn
- HAP corn (high available P)
- Silage corn
- Sweet corn and Popcorn

Management Corns
- “IMI” - Imidazolinone resistant or tolerant
- “SR” - Sethoxydim resistant
- “Liberty Link” - Glufosinate resistant
- “Bt”
- “Round-up Ready” - Glyphosate resistant
- “Gene stacking”
  - Bt-LL, Bt-IMI, Bt-RR
Farmer Concerns About Specialty Corns

• Yield lag and drag
• Do the specialty traits work?
• Fair price for the technology fee
  ✓ Seed companies need to recoup research costs
  ✓ How well are companies able to incorporate trait into elite hybrids?
    ✓ In times of low prices, should the fees be adjusted?
• Where and when should specialty hybrids be used?
• Market and consumer acceptance
Yield of “IMI” Hybrids in Relation to the Trial Average in the WI Corn Trials

Frequency (%)

Above trial average
Below trial average

n= 213

Yield of “Bt” Hybrids in Relation to the Trial Average in the WI Corn Trials

![Graph showing the frequency of yield above and below the trial average from 1996 to 2000.]

- **Above trial average**
- **Below trial average**

- *n = 869*
Yield of “SR” Hybrids in Relation to the Trial Average in the WI Corn Trials

- Above trial average
- Below trial average

1996: 100%
1997: 100%
1998: 100%

n= 44
Yield of "Liberty Link" Hybrids in Relation to the Trial Average in the WI Corn Trials

- Above trial average
- Below trial average

n = 45

1997 1998 1999 2000
Yield of “Roundup Ready” Hybrids in Relation to the Trial Average in the WI Corn Trials

- Above trial average
- Below trial average

n= 132

Frequency (%)
Yield of “Gene Stack” Hybrids in Relation to the Trial Average in the WI Corn Trials

- Above trial average
- Below trial average

<table>
<thead>
<tr>
<th>Year</th>
<th>Bt,LL (n=96)</th>
<th>Bt,IMI (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Yield of Specialty Hybrids in Relation to the Trial Average in the 2000 WI Hybrid Trials

- Above trial average
- Below trial average

Frequency (%)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Bt</th>
<th>IMI</th>
<th>LL</th>
<th>RR</th>
<th>Bt-IMI</th>
<th>Bt-LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal dent</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Bt</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>IMI</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>LL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bt-IMI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bt-LL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Relative Performance of Specialty Hybrids in Relation to Dent Corn

<table>
<thead>
<tr>
<th>Specialty Trait</th>
<th>N</th>
<th>Grain yield</th>
<th>Grain moisture</th>
<th>Lodging</th>
<th>Grower return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bu/A</td>
<td>%</td>
<td>%</td>
<td>$/A</td>
</tr>
<tr>
<td>IMI</td>
<td>213</td>
<td>-3</td>
<td>0.1</td>
<td>0</td>
<td>-7.37</td>
</tr>
<tr>
<td>Bt</td>
<td>869</td>
<td>4</td>
<td>0.6</td>
<td>0</td>
<td>7.25</td>
</tr>
<tr>
<td>SR</td>
<td>44</td>
<td>-7</td>
<td>-1.7</td>
<td>0</td>
<td>-10.99</td>
</tr>
<tr>
<td>LL</td>
<td>45</td>
<td>2</td>
<td>1.1</td>
<td>-1</td>
<td>1.93</td>
</tr>
<tr>
<td>RR</td>
<td>132</td>
<td>0</td>
<td>-0.1</td>
<td>-1</td>
<td>1.08</td>
</tr>
<tr>
<td>Bt-LL</td>
<td>96</td>
<td>9</td>
<td>-0.1</td>
<td>0</td>
<td>22.13</td>
</tr>
<tr>
<td>Bt-IMI</td>
<td>29</td>
<td>-4</td>
<td>-0.5</td>
<td>0</td>
<td>-9.49</td>
</tr>
</tbody>
</table>

Grower return = (Yield x corn price) – (drying + handling + hauling)

Drying = $0.015 per point bu, Handling = $0.017 per bu; Hauling = $0.04 per bu

Lauer, © 1994-2001
University of Wisconsin – Agronomy
Breakeven Matrix for Corn Hybrid Seed Sold at Various Technology Fees

<table>
<thead>
<tr>
<th>Yield increase (Bu/A)</th>
<th>Technology fee= $10 / bag</th>
<th>Technology fee= $20 / bag</th>
<th>Technology fee= $30 / bag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn price ($/Bu)</td>
<td>Corn price ($/Bu)</td>
<td>Corn price ($/Bu)</td>
</tr>
<tr>
<td>0</td>
<td>2.00 2.50 3.00</td>
<td>2.00 2.50 3.00</td>
<td>2.00 2.50 3.00</td>
</tr>
<tr>
<td>4</td>
<td>0.13 0.87 1.87</td>
<td>4.25 3.25 2.25</td>
<td>8.38 7.38 6.38</td>
</tr>
<tr>
<td>6</td>
<td>3.87 5.87 7.87</td>
<td>0.25 1.75 3.75</td>
<td>4.38 2.38 0.38</td>
</tr>
<tr>
<td>8</td>
<td>7.87 10.87 13.87</td>
<td>3.75 6.75 9.75</td>
<td>0.38 2.63 5.62</td>
</tr>
<tr>
<td>10</td>
<td>11.87 15.87 19.87</td>
<td>7.75 11.75 15.75</td>
<td>3.62 7.62 11.62</td>
</tr>
<tr>
<td></td>
<td>15.87 20.87 25.87</td>
<td>11.75 16.75 21.75</td>
<td>7.62 12.62 17.62</td>
</tr>
</tbody>
</table>

Assume: 80,000 seeds/bag planted at 33,000 seeds/A for final population of 30,000 plants/A
Yield and Grower Return Advantage of “IMI” Hybrids in Relation to the Average Trial Yield (n=111 trials)

Yield advantage (bu/A) vs. Average Trial Yield (bu/A)

Grower return advantage (bu/A) vs. Average Trial Yield (bu/A)
Yield and Grower Return Advantage of “Bt” Hybrids in Relation to the Average Trial Yield (n=101 trials)

\[ R^2 = 0.09 \] **

\[ R^2 = 0.09 \] **

Yield advantage (bu/A)

Grower return advantage (bu/A)

Average Trial Yield (bu/A)
Yield and Grower Return Advantage of “Bt-LL” Stacked Hybrids in Relation to the Average Trial Yield (n= 59 trials)
Summary

• Bt and Bt-LL corn hybrids yield and return more than average dent corn.
  ✓ At this time IMI, SR, LL, RR, Bt-IMI traits do not add to yield or grower return.

• IMI, SR, LL, RR, and Bt-IMI corn hybrids should only be recommended for problem fields or difficult management situations.

• “Variation for grain yield exists among commercial GMO hybrids sold in Wisconsin.”
  ✓ Care must be taken in selecting individual hybrids.