ECONOMIC BENEFITS OF NEONICOTINOID INSECTICIDES IN THE U.S. AND CANADA

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University of Wisconsin
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Neonicotinoid Benefits Study Reports
GrowingMatters.org
The most popular insecticide class for these crops (Mitchell) (GfK Kynetec 2010-2012 avg)

98% of NNi applied as seed treatments

- Corn accounts for 61% of acres treated with NNi in these crops
- Soybean accounts for 22%

% Acres Treated

- Corn: 89%
- Soybeans: 40%
- Cotton: 65%
- Winter Wheat: 20%
- Spring Wheat: 43%
- Sorghum: 20%
Neonicotinoid Target Pests

- Reported targets by farmers/consultants/retailers (% acres targeted) (2010-2012 GfK Kynetec average)
  - Wireworm (29%)
  - Seed Maggot (16%)
  - Corn Rootworm (15%)
  - White Grub (10%)
- 70% of neonicotinoid acres targeted at soil-dwelling pests
Non-Neonicotinoid Counterfactual

- Reallocated neonicotinoid treated acres to non-neonicotinoid alternatives
  - based on market shares for other insecticides
  - by management system and target pest
  - GfK Kynetec data for 2010-2012

- Issue: essentially no practical non-neonicotinoid alternatives to manage soil-dwelling pests in soybean & wheat
  - Soil-dwelling pests are the reported targets for 31% & 73% of neonicotinoid acres respectively
Reallocation Impact on Insecticide Use

- Pyrethroids: 200% increase
- OPs: 190% increase
- Soybean & Wheat soil-dwelling pests

IPM: Untreated

Product Acres (1,000,000)

2010-2012 Average
Non-Neonicotinoid Scenario
Cost Impacts

Projected net cost increase of $848M per year

Increased spending on **insecticides**: $157M
Increased spending on **applications**: $383M
Increased spending on **field scouting**: $210M
Increased spending on **seeds/replant**: $97M

![Bar chart showing cost impact per acre by crop type]

- Average Cost per Neonicotinoid Base Acre
Would You Have Used a Seed Treatment If You Could Get the Same Varieties Without It?

Hurley & Mitchell: Telephone survey: US: 500 corn, 500 coy, Canada: 500 canola, 120 corn, 120 soy

Corn

- Yes: 75%
- No: 16%
- Some: 5%
- Don't Know: 4%

Soybean

- Yes: 80%
- No: 12%
- Some: 3%
- Don't Know: 5%
<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corn</td>
<td>Soybean</td>
</tr>
<tr>
<td>Bt Corn</td>
<td>$19.78</td>
<td></td>
</tr>
<tr>
<td>Seed Treatment</td>
<td>$13.38</td>
<td>$11.93</td>
</tr>
<tr>
<td>Soil Insecticide</td>
<td>$12.92</td>
<td></td>
</tr>
<tr>
<td>Foliar Insecticide</td>
<td>$14.17</td>
<td>$13.48</td>
</tr>
</tbody>
</table>

Seed treatments worth about $12-$14.50/A to US and Canadian corn, soybean and canola farmers

Neonicotinoid seed treatments the most valued insect control method in North America:
$1.4 B for seed treatments, $1.3 B for Bt corn
### Total Value (US$ Million)

<table>
<thead>
<tr>
<th>Control Method</th>
<th>U.S.</th>
<th>Canada</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed Treatment</td>
<td>$1,130</td>
<td>$301</td>
<td>$1,431</td>
</tr>
<tr>
<td>Bt Corn</td>
<td>$1,248</td>
<td>$56</td>
<td>$1,304</td>
</tr>
<tr>
<td>Foliar Insecticide</td>
<td>$249</td>
<td>$57</td>
<td>$306</td>
</tr>
<tr>
<td>Soil Insecticide</td>
<td>$175</td>
<td>---</td>
<td>$175</td>
</tr>
</tbody>
</table>

Neonicotinoid seed treatments are the most valued insect control method in North America.
Yield Meta-Analysis (Mitchell)

- Data from replicated small plot field experiments
- 1,500+ site-years generating 3,300+ observations of yield with and without neonicotinoid
- ~1,000 site-years generating 1,600+ observations of yield with neonicotinoid versus an insecticide alternative
- An observation is a paired comparison of average yield by treatment: NNi vs UTC or NNi vs non-NNi
- Corn, soybean, wheat, cotton, sorghum, potato, tomato
- Source: Journals, AMT, online extension/research reports, registrant studies by universities & outside researchers
Yield Impacts for NNI

**Corn: NNI vs UTC**

Count

Yield Benefit

N=774

**Corn: NNI vs non-NNI**

Count

Yield Benefit

N=429

**Soybean: NNI vs UTC**

Count

Yield Benefit

N=718

**Soybean: NNI vs non-NNI**

Count

Yield Benefit

N=216

Corn: NNI vs UTC

Soybean: NNI vs UTC

N=774

N=718

Corn: NNI vs non-NNI

Soybean: NNI vs non-NNI

N=429

N=216

Yield Impacts for NNI
### Average Yield Benefit by Crop

<table>
<thead>
<tr>
<th>Crop</th>
<th>NNI vs UTC</th>
<th>NNI vs non-NNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>17.4%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Soybean</td>
<td>3.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Wheat</td>
<td>16.8%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Cotton</td>
<td>16.9%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Sorghum</td>
<td>20.1%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Canola</td>
<td>34.8%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Potato</td>
<td>71.3%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Tomato</td>
<td>23.2%</td>
<td>---</td>
</tr>
</tbody>
</table>
Example of Geographic Yield Variation - Soybeans

Average soybean yield benefit for neonicotinoid treatments relative to untreated control treatments by state/province

Average soybean yield benefit for neonicotinoid treatments relative to non-neonicotinoid insecticide treatments by state
Significance of a 2.8% Yield Benefit in Soybeans

• The Context
  ✓ 2013 U.S. average soybean yield = 44bu/A
  ✓ 2013 U.S. average marketing price = $13 bu

• Quick Calculation
  ✓ 2.8% X 44 bu X $13 = $16.02/A
  ✓ Minus average seed treatment cost = $7.67

• Based on soybean yield histogram and these yield and price assumptions
  • on average a farmer would earn $16.02 – $7.76 = $8.26/A
  • a farmer would earn back at least the $7.67/A cost of the seed treatment 59% of the time
Market Level Analysis (Mitchell and Dong)

- Aggregate these yield & cost impacts to market level
- Allow crop prices & acreage to equilibrate to the new supply & profitability conditions & estimate “surplus”
- Value of neonicotinoids in U.S. ranges $4.0 to $4.3 Billion per year, mostly for corn
- Value of neonicotinoids in Canada ranges US$150-$275 Million per year, mostly for canola
- Without neonicotinoids:
  - Corn price increase $0.25/bu, wheat $0.22/bu
  - 350,000-400,000 acres move into crop production from non-crop uses, 225,000-250,000 from CRP
<table>
<thead>
<tr>
<th>Market</th>
<th>Surplus</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Grains</td>
<td>Consumer Surplus</td>
<td>-$4,245</td>
<td>-$4,596</td>
</tr>
<tr>
<td></td>
<td>Farm Income</td>
<td>$351</td>
<td>$426</td>
</tr>
<tr>
<td></td>
<td>Net Surplus</td>
<td>-$3,894</td>
<td>-$4,170</td>
</tr>
<tr>
<td>US Specialty</td>
<td>Consumer Surplus</td>
<td>-$102</td>
<td>-$116</td>
</tr>
<tr>
<td></td>
<td>Farm Income</td>
<td>-$33</td>
<td>-$45</td>
</tr>
<tr>
<td></td>
<td>Net Surplus</td>
<td>-$135</td>
<td>-$161</td>
</tr>
<tr>
<td><strong>US Total</strong></td>
<td><strong>Consumer Surplus</strong></td>
<td><strong>-$4,347</strong></td>
<td><strong>-$4,712</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Farm Income</strong></td>
<td><strong>$318</strong></td>
<td><strong>$381</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Net Surplus</strong></td>
<td><strong>-$4,029</strong></td>
<td><strong>-$4,331</strong></td>
</tr>
<tr>
<td>Canada Grains</td>
<td>Consumer Surplus</td>
<td>-$284</td>
<td>-$568</td>
</tr>
<tr>
<td></td>
<td>Farm Income</td>
<td>$135</td>
<td>$291</td>
</tr>
<tr>
<td></td>
<td>Net Surplus</td>
<td>-$149</td>
<td>-$276</td>
</tr>
</tbody>
</table>
Quick Summary: Neonicotinoid seed treatments

- Most popular class of insecticides – effective, reduced-risk, safe, convenient
- Farmers target 70% of neonicotinoids at soil-dwelling pests: wireworm, seed maggots, rootworm and white grubs
- Soybean and wheat farmers do not have non-neonicotinoid alternatives for soil-dwelling pests
- Without neonicotinoids, acres treated with pyrethroids and organophosphates would roughly triple
  - Resistance concerns, non-target effects, spray drift
Quick Summary

• Highly valued by corn, soy, canola farmers, with stated values of $12-$14.50/ac
• Most valued insecticide treatment by North American farmers, with a stated value of $1.4 Billion per year
• 75%-80% of farmers who use neonicotinoid seed treatments say they would continue to do so even if untreated seeds were available
• Meta-analysis finds substantial yield benefits for neonicotinoids, even relative to alternatives
• Market-level analysis finds that the value of neonicotinoids ranges $4.0 to $4.3 Billion in the U.S. and $150-$275 Million in Canada
Thanks for Your Attention!

Neonicotinoid Benefits Reports
GrowingMatters.org

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