Seed Dust and Honey Bees: Research, Mitigation and Stewardship

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Content of Presentation

- Why plant treated seeds?
- Potential side effects to bees
- Mitigation options
  how effective? how practical?
- Stewardship
Caveats

- Some of the research results presented are preliminary, have not undergone QA review and may change slightly when final reports are prepared.
Acres Planted with Neonicotinoid-treated Seeds

Figure 2: Proportion of Planted Acres Treated with Neonicotinoids by Crop

- Sorghum
- Cotton
- Winter Wheat
- Spring Wheat
- Soybean
- Corn

Source: AgInfomatics (2015). GrowingMatters.org
Why plant treated seeds?

Survey of

- 622 corn farmers from 12 U.S. states and three Canadian provinces
- 622 soybean farmers from 14 U.S. states and three Canadian provinces
- 500 canola farmers from three Canadian provinces

<table>
<thead>
<tr>
<th>Factor Groups</th>
<th>Examples</th>
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</thead>
<tbody>
<tr>
<td>Cost, Planting, Time &amp; Ease</td>
<td>Reducing equipment wear &amp; tear, Convenience, Saving time &amp; labor, Simplicity, Reducing Scouting, Flexibility, Cost, Planting early, Replant</td>
</tr>
<tr>
<td>Health, Environment &amp; Marketability</td>
<td>Public safety, Protecting water quality, Protecting beneficial insects, Protecting wildlife, Family &amp; worker health, Crop marketability</td>
</tr>
<tr>
<td>Plant Performance</td>
<td>Improving plant health, Improving crop stand, Protecting yield</td>
</tr>
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<td>Yield Risk</td>
<td>Consistent insect control, Long-lasting insect control</td>
</tr>
<tr>
<td>Marketability</td>
<td>Crop marketability, Simplicity and convenience</td>
</tr>
</tbody>
</table>

Source: AgInfomatics (2015).GrowingMatters.org
Figure 5. Average yield benefit by crop for neonicotinoid insecticide treatments relative to untreated control treatments

Source: AgInfomatics (2015). GrowingMatters.org
Potential side effects to honey bees

• Exposure to abraded seed dust released during planting with pneumatic systems
  Bee kill incidents confirm this can happen
• Exposure to soil dust
  Concentrations are not high enough to cause effects
• Exposure to residues taken up systemically by flowering crops and weeds
  Concentrations are not high enough to cause effects
Drop-zone Dead Bee Traps

Figure 2. Apiary setup of OSU sites. Each colony was equipped with a pollen trap fitted between the bottom board and the hive body, and a dead bee trap in front of the entrance. Photo was taken at CH on May 11, 2014.
Elevated counts of dead bees sometimes coincide with corn planting.

Figure 7. Summary of dead bee trap collection data. Dead bee counts were standardized between colonies by taking the proportion of dead bees caught from each hive each day relative to the total trap catch from a hive throughout the period of the study. Standardized counts for the four hives at each site were averaged together to generate a line for each site. The corn planting window is defined by the gray boxes.
Potential Key Factors

• Quality Seed Treatment
  – Clean seed
  – Proper application and coatings
  – Type of seed (corn vs. soybean vs canola, etc.)
• Planter type (pneumatic system design)
  – Airflow and pressure
  – Exhaust configuration
• Seed lubricants (Talc, Graphite, BFA)
• Pre-planting weed management
• Location of apiaries and bee forage plants
• Weather / Timing of planting activities
Potential Mitigation Options

• Monitoring of Seed Treatment Quality – reject batches that don’t pass QC criteria
• Improve Seed Coatings (BASF / Bayer / Syngenta)
• Redesign/modify planter pneumatic system
  – Airflow and pressure
  – Exhaust configuration
• Seed lubricants (Bayer Fluency Agent)
• Pre-planting weed management
• Location of apiaries and bee forage plants
Tunnel Study Results: Clothianidin Seed Dust Applied to Blooming *Phacelia*

No-effect Level for dead bee counts
= 0.1 g ai/ha
= 1 ng ai/cm²

No-effect Level for colony-level effects
= 2 g ai/ha
= 20 ng ai/cm²
New Results – Deposition of Neonicotinoid Load in Fugitive Dust

How effective is the Bayer Fluency Agent, or deflectors, in reducing the amount of neonicotinoid drifting off-site?

- U of Guelph (CDRC) 2013 field trial
- Eurofins (Syngenta-Bayer) 2013 field trial
- Lange Research (Syngenta-Bayer) 2014 field trial
Fluency wax lubricant dosing
JD pneumatic fan outlet & JD deflector kit terminus
Kinze 16 row planter pneumatic fan / prototype deflector
Trial placement
Dust Deposition – 2D Petri Dish layout

Drilling whilst 1-5 m/s wind velocity and wind direction within ±45 degree to perpendicular
CDRC Studies (U of Guelph/ Ohio State Univ)
“Krupke” sampling stations
Neonicotinoid Load in Fugitive Dust

[Data from CDRC / U of Guelph (2013)]

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Horizontal sampler</th>
<th>Vertical sampler</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>55.2%</td>
<td>35.3%</td>
</tr>
<tr>
<td>10</td>
<td>35.4%</td>
<td>25.1%</td>
</tr>
<tr>
<td>50</td>
<td>34.4%</td>
<td>10.3%</td>
</tr>
<tr>
<td>100</td>
<td>28.3%</td>
<td>12.6%</td>
</tr>
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</table>

Combining High and Medium wind speeds (>5 km/h), BFA reduced deposition at edge of field by 35-55%

Off-site drift is low when wind velocity is <5 km/h
Neonicotinoid Load in Fugitive Dust Deposited at Sampling Stations (High and Medium Wind Velocity (>5 km/h))

**Horizontal Samplers**

- **Conventional**
- **BFA**

**Tunnel study NOEL**

**U of Guelph 2013 Results**
Neonicotinoid Load in Fugitive Dust Deposited at Sampling Stations (High and Medium Wind Velocity (>5 km/h))

Vertical Samplers

Total Neonicotinoid (ng/cm²)

Distance downwind (m)

Conventional
BFA

Tunnel study NOEL

U of Guelph 2013 Results
**John Deere Planter**

**Neonicotinoid Load in Fugitive Dust**

**Syngenta/Bayer Field Trials 2013**

- **Talc, No Deflector**

  - **Tunnel Study - No effect Rate**

  - **Talc, Deflector**

  - **BFA, No Deflector**

  - **Tunnel Study No effect Rate**

- **BFA reduced neonic deposition by 41%**
- **Deflector reduced neonic deposition by 13%, but by 69% if you ignore anomalous trial**
- **No effect level of Bee Tunnel test not exceeded except in one anomalous trial**

NAICC Meeting - January 23, 2015
Kinze Planter
Neonicotinoid Load in Fugitive Dust
Syngenta/Bayer Field Trials 2013

BFA reduced neonic deposition by 37%
Deflector reduced neonic deposition by 48%,
No effect level of Bee Tunnel test sometimes exceeded, but just barely when either BFA or Deflectors were used.

NAICC Meeting - January 23, 2015
John Deere Planter
Neonicotinoid Load in Fugitive Dust
Syngenta/Bayer Field Trials 2014

Low wind speed (2-11 mph)

Median deposition (ng ai/cm²)

Source: Bayer-Syngenta 2014 Trials (Lange Research)
John Deere Planter
Neonicotinoid Load in Fugitive Dust
Syngenta/Bayer Field Trials 2014

High wind speed (15-25 mph)

Distance downwind from planted area

Source: Bayer-Syngenta 2014 Trials (Lange Research)
Conclusions

1. Use of Bayer Fluency Agent reduces potential bee exposure by 35 – 80%

2. Use of air exhaust deflectors reduces potential bee exposure by 20 – 70%

3. When you combine BFA with deflectors, potential bee exposure is reduced by 80-90% (JD planter)

Key question: How much exposure reduction is needed to achieve minimal risk?

BFA alone appears adequate to get below tunnel study NOEL with JD Planters
Thank you for your attention!