Understanding Insect Thresholds In Agronomic Crops

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### Green and Southern Green Stink Bugs

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Amount of Formulation per Acre</th>
<th>Pounds Active Ingredient per Acre</th>
<th>Acres 1 Gallon or 1 Pound Dry Will Treat</th>
<th>PHI (days)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>imidacloprid (CN), β-cyfluthrin (P) Leverage 369</td>
<td>2.85 oz</td>
<td>–</td>
<td>45</td>
<td>21</td>
<td>Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Maximum AI per acre per season: 0.06 lb.</td>
</tr>
<tr>
<td>λ-cyhalothrin (P) Karate Z 2.48CS</td>
<td>1.6–1.92 oz</td>
<td>0.025–0.03</td>
<td>83–69</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>thiamethoxam (CN), λ-cyhalothrin (P) Endigo ZC</td>
<td>3.5–4.5 oz</td>
<td>–</td>
<td>37–28</td>
<td>30</td>
<td>Toxic to aquatic invertebrates. Maximum AI per acre per season: 0.125 lb.</td>
</tr>
<tr>
<td>Z-cyprinethrin (P) Mustang Mtx 0.8EC</td>
<td>3.2–4 oz</td>
<td>0.02–0.025</td>
<td>40–32</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

**THRESHOLD:** If you use a drop cloth, the threshold is one bug per foot of row. If you are using a sweep net, the threshold is nine bugs per 25 sweeps. Count only stink bug nymphs larger than ¼ inch. When soybeans reach the R6 growth stage, treat only populations of 20 stink bugs per 25 sweeps or higher, and terminate stink bug applications at R6+7 days (R6.5). Read label to determine the preharvest interval.
How do we come up with recommendations?
Economic Injury Level (EIL) = “The lowest population density of a pest that will cause economic damage; or the amount of pest injury which will justify the cost of control.”

\[ P = \frac{C}{(V \times I \times D)} \]
### Economic Injury Level (EIL)

**Corn Earworm in Soybeans, Sweep Net Sampling**

\[
P = C \div (V \times I \times D)
\]

\[13.1 = \frac{\$20}{\text{acre}} \div (\$9\text{/bu} \times 1\text{ larva per 25 sweeps} \times 0.17\text{ bu lost})
\]

#### No. Larvae / 25 Sweeps

<table>
<thead>
<tr>
<th>Control Costs ($/acre)</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crop Value ($/bu)</strong></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>9.8</td>
<td>14.7</td>
<td>19.6</td>
<td>24.5</td>
<td>29.4</td>
</tr>
<tr>
<td>7</td>
<td>8.4</td>
<td>12.6</td>
<td>16.8</td>
<td>21.0</td>
<td>25.2</td>
</tr>
<tr>
<td>8</td>
<td>7.4</td>
<td>11.0</td>
<td>14.7</td>
<td>18.4</td>
<td>22.1</td>
</tr>
<tr>
<td>9</td>
<td>6.5</td>
<td>9.8</td>
<td><strong>13.1</strong></td>
<td>16.3</td>
<td>19.6</td>
</tr>
<tr>
<td>10</td>
<td>5.9</td>
<td>8.8</td>
<td>11.8</td>
<td>14.7</td>
<td>17.6</td>
</tr>
<tr>
<td>12</td>
<td>4.9</td>
<td>7.4</td>
<td>9.8</td>
<td>12.3</td>
<td>14.7</td>
</tr>
</tbody>
</table>

- **P** = Density or intensity of pest population (for example insects/acre)
- **C** = Pest Management Costs ($/acre)
- **V** = Market Value of per unit of produce (for example, $/acre)
- **D** = Damage per unit injury (for example, bushels lost/acre/percent defoliation)
- **I** = Injury units per production unit (for example, % defoliation/insect/acre, expressed as a proportion)
Economic Threshold

• The level of pest infestation at which management action is justified
EIL And ET In Relation To Pest Density

above EIL, benefit > cost

control

below EIL, cost > benefit

pest population without control

Figure credit: Ed Zaborski, University of Illinois.
Examples Of Thresholds And Threshold Modifications In Recent Years
Relationship Between Fruit Injury And Yield

- Y = 39.36 - 0.3085x
  P < 0.0001, R² = 0.203

- Y = 39.77 - 0.3387x
  P < 0.0001, R² = 0.174

- Y = 41.69 - 0.3551x
  P < 0.0001, R² = 0.223

- Y = -2.15 + 0.9690x
  P < 0.0001, R² = 0.88
Data Indicated We Were Spraying Too Late
Threshold Adjustments For Quality Problems With Stink Bugs

Base Assumptions:
- 40 bu/acre yield potential
- 2.0% and 0.3% total and heat damage, respectively, without stink bugs
- $9 / bu value before discounts
Sometimes Circumstances Dictate Changes to Thresholds

**Pre-bloom**

- Foliage feeding- 35% prior to bloom

**Post-bloom**

- Foliage feeding- 20% when plants are blooming through filling pods
- Two beetles per sweep after pod set
Sometimes the Data Supports NO THRESHOLD
No Matter How Accurate Your Threshold is, If Folks Don’t Adopt it....It’s Worthless

### Pearson Correlation Coefficients (r) to Percent Stalks Tunnled at Harvest

<table>
<thead>
<tr>
<th></th>
<th>Vegetative</th>
<th>Early Reproductive</th>
<th>Late Reproductive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs Sampled</td>
<td>0.10</td>
<td>0.36</td>
<td>0.65</td>
<td>0.48</td>
</tr>
<tr>
<td>Pheromone Trap</td>
<td>0.30</td>
<td>0.31</td>
<td>0.64</td>
<td>0.38</td>
</tr>
</tbody>
</table>

### Relationships to Tunneling

<table>
<thead>
<tr>
<th></th>
<th>Needed for 25% Tunneling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Egg Infestation</td>
</tr>
<tr>
<td>Vegetative</td>
<td>33</td>
</tr>
<tr>
<td>Early Reproductive</td>
<td>19</td>
</tr>
<tr>
<td>Late Reproductive</td>
<td>8</td>
</tr>
</tbody>
</table>

### Former MS Recommendation

Treat when larvae or egg masses are present on 25% of more of the plants.

### New MS Recommendation

<table>
<thead>
<tr>
<th>V1</th>
<th>V2</th>
<th>Vnth</th>
<th>VT</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>R4</th>
<th>R5</th>
<th>R6</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Leaf</td>
<td>2 Leaf</td>
<td>Nth Leaf</td>
<td>Tassel</td>
<td>Silk</td>
<td>Blister</td>
<td>Milk</td>
<td>Dough</td>
<td>Dent</td>
<td>Black Layer</td>
</tr>
<tr>
<td>Treat 7-10 days after moth traps average 50 per trap on a 7 day catch from V1-Vnth or when plants average 5% corn borer egg masses or larval infestations per plant.</td>
<td>Treat 7-10 days after moth traps average 100 per trap on a 7 day catch from R1-R3 or when plants average 10% corn borer egg masses or larval infestations per plant.</td>
<td>Do Not Treat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Food For Thought
Cannot Manage for The Exceptions

Probability of Economic Damage to BG3, WS3, or TL+
It’s Not Always As It Seems
It’s Not Always As It Seems
You Absolutely Have To Take Counts....
Cannot Have Zero Tolerance
There Are Limitations To Thresholds, But We Can Do Much Better With Zero Yield Penalties

Our End Goal Is For Our Producers to Remain Profitable
Thank You