Bean leaf beetle and bean pod mottle virus – double trouble in soybean

Marlin E. Rice
Department of Entomology
Iowa State University
A Fork in the Road
Which path do you take?

- bean leaf beetles (late season)
  - manage beetles to prevent physical injury and economic damage

or

- bean pod mottle virus (early season)
  - manage bean leaf beetles to prevent transmission of virus and subsequent economic damage
bean leaf beetle
red phase
Bean leaf beetle – the first half of the problem

• adults feed on above ground plant parts
  – stems, leaves, especially pods
• larvae feed on soybean nodules
  – impact on yield unknown
• adults transmit bean pod mottle virus
  – confirmed in Iowa in 1999
Symptoms of bean pod mottle virus
Vegetative stages

Beetle density

Overwintered beetles

1st generation beetles

2nd generation beetles

Seedlings

Vegetative stages

Reproductive stages

Time
Second generation bean leaf beetle abundance

*Why has the population skyrocketed?*
1. Mild winters
   2000-2001, 99 continuous days of snow cover
   2001-2002, second mildest winter in Iowa
2. Earlier planting of soybeans
economic thresholds – they can be used to make management decisions, however, they do not take into account any possible disease transmission by beetles
Economic thresholds overwintered beetles

<table>
<thead>
<tr>
<th>crop value ($/bushel)</th>
<th>treatment cost per acre (insecticide + application)</th>
<th>beetles per plant</th>
<th>beetles per foot of row</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5.00</td>
<td>$8.00 $10.00 $12.00</td>
<td>5.0 6.2 7.4</td>
<td>38.0 47.1 56.2</td>
</tr>
</tbody>
</table>
Economic thresholds for first generation beetles

- Soybean plants can tolerate 30-40% defoliation during vegetative growth stages.
- Adult densities must be extremely large to justify insecticide application.
- Fields in Iowa are rarely sprayed for first generation beetles.
Second generation economic thresholds

- pod feeding reduces seed quality and quantity
- beetles feed on pods for several weeks before reaching economic threshold
- some yield loss occurs before insecticide normally can be justified
- challenge is to prevent economic damage before it occurs
Predict first generation peak beetle emergence using degree days

<table>
<thead>
<tr>
<th>Date</th>
<th>northeast Iowa</th>
<th>southwest Iowa</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1-7</td>
<td>July 7</td>
<td>June 24</td>
</tr>
<tr>
<td>May 8-14</td>
<td>July 15</td>
<td>July 1</td>
</tr>
<tr>
<td>May 15-21</td>
<td>July 20</td>
<td>July 6</td>
</tr>
<tr>
<td>May 22-28</td>
<td>July 24</td>
<td>July 11</td>
</tr>
</tbody>
</table>
Scouting procedures

1. determine week soybeans emerged
2. consult table and match dates
3. sample fields 1 week after peak beetle emergence
4. if below threshold, scout next week
5. if below threshold, scout 1 more wk
6. if 1\textsuperscript{st} generation below threshold then field unlikely to develop economic 2\textsuperscript{nd} generation
using a drop cloth to count first generation bean leaf beetles
sweep down the row for bean leaf beetles
1st generation economic thresholds necessary to spray 2nd generation beetles

<table>
<thead>
<tr>
<th>Crop value ($/bushel)</th>
<th>Treatment cost per acre (insecticide + application)</th>
<th>Beetles per 3 row feet</th>
<th>Beetles per 20 sweeps</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5.00</td>
<td>$10.00 $12.00 $14.00</td>
<td>7.9 9.5 11.0</td>
<td>32.6 39.0 45.4</td>
</tr>
</tbody>
</table>
Based upon a low density of first generation beetles, it is expected that the second generation will not exceed the economic threshold.

This new management concept predicts the damage potential of the second generation prior to the susceptible crop stage.
Beetle density overwintered beetles

1st generation beetles

2nd generation beetles

seedlings vegetative stages reproductive stages

Time

old threshold

new threshold

sample here
Bean pod mottle virus – the second half of the problem

• 1999 many reports of soybean green stem and discolored seed
• bean pod mottle virus was suspected
• confirmed in western Iowa near Sioux City in 1999
Bean pod mottle virus symptoms
Northwest Iowa Field
Unsprayed Control
9/05/00
Bean pod mottle virus

- infects soybeans and other legumes
- reduces yield quality & quantity (50%)
- symptoms resemble herbicide drift or soybean mosaic virus
- symptoms: crinkled leaves, plants may be stunted, mottled seed
- can occur in combination with soybean mosaic virus, causing greater losses
Infected Soybean

Infected Seed?

Overwintered BLBs?

Alternate host plant?

Other vectors?
Seed Transmission?

0.037% = 66 of 180,000
Virus & beetle management

• manage virus by controlling beetles
• planting date is first tactic
  – later planting
    • reduces beetle populations
    • reduces disease incidence in crop
• insecticides are second tactic
  – spray at plant emergence (OW popl.)
  – spray early July (1st gen. popl.)
Management options based on damage potential

<table>
<thead>
<tr>
<th>Population</th>
<th>Beetle injury</th>
<th>Virus infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overwintered beetles</td>
<td>Rarely sprayed</td>
<td>Spray</td>
</tr>
<tr>
<td>First generation</td>
<td>Never sprayed</td>
<td>Spray</td>
</tr>
<tr>
<td>Second generation</td>
<td>More commonly sprayed</td>
<td>No spray</td>
</tr>
</tbody>
</table>
How do you decide?

Ask yourself.

1. Yield reductions (10-20 bu.)
2. Green stem at harvest
3. Bleeding hilum soybeans
4. High beetle popl. September

plant later

1. Insecticide at soybean emergence
2. Insecticide early July

plant later

1. Yields okay
2. No green stem
3. No bleeding hilum

1. Scout 1st gen. July