A HORROR HORDE OF CRAWL-AND-CRUSH GIANTS CLAWING OUT OF THE EARTH'S STEAMING DEPTHS!

"THEM!"

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PRESENTED BY WARNER BROS.
Official distribution of Japanese beetle in the United States

NAPIS Report, 2009

Original introduction
Japanese beetle life stages

EGGS
1-2 mm eggs laid in grassy areas
Eggs laid in batches of ~5
Require moisture to hatch

LARVAE
White and C-shaped
Develop in moist soil
Feed on roots, organic matter
Overwintering stage

PUPAE
Develop in soil in late spring

ADULTS
Adult beetles emerge in mid-summer
Highly mobile
Females lay ~50 eggs
Food sources

• Grubs:
  - feed on all cool-season turfgrasses, many weeds, and other plants.

• Adults:
  - feed on > 300 ornamental and woody landscape plants, and they love to eat GRAPE foliage!!!
Management Strategy 1
Make the farm landscape suppressive to Japanese beetle
Reduce feeding sites for adult Japanese beetle

Remove attractive non-crop host plants to reduce beetle attraction to farms/vineyards

• **Preferred plants**
  – Grape, linden, Japanese / Norway maple, birch, pin oak, horse chestnut, Rose-of-Sharon, ornament. apple, plum, cherry, rose, mountain ash, willow, elm, Virginia creeper

• **Rarely attacked plants**
  – Red / silver maple, tuliptree, magnolias, red mulberry, forsythia, ash, privet, lilac, spruce, hydrangea, taxus (yew)
Grow less attractive grape cultivars/species

Japanese beetles show strong preference for susceptible vines

Susceptibility: Juice grape < hybrids < *vinifera*
Enhance biological control agents

- Nematodes
- Ovavesicula
- Ground beetles
- Fungi
- Milky spore
- Ants

Photo credits - D. Cappaert
Other insect predators of JB

- Wasp parasite: *Tiphia vernalis*
- Fly parasite: *Istocheta aldrichi*

- In 2005, no wasp parasites recovered, but fly parasites at 4 of 10 sites.
Management Strategy 2
Scout vineyards regularly in late June, July, August
Scouting and monitoring beetles

- Look on vines for beetles or damage
- They are easy to see!!

**MONITORING TRAPS**
- Baited with floral lure (for female) and sex pheromone (for male)
- Highly efficient at attracting beetles
- Traps are NOT recommended, because they attract beetles to your farm and they do not trap all beetles.

  - Abundance is often higher at vineyard borders, so focused management is an option to minimize cost.

- Are beetles feeding only on “unimportant” leaves?
Management Strategy 3
Consider vine tolerance to leaf area removal
How much leaf injury can vines tolerate?

*Tolerance = Ability to withstand a certain level of injury without a reduction in vine productivity and fruit quality.*

Can vines tolerate Japanese beetle feeding?

In Seyval vines, natural levels of Japanese beetle feeding (6.5% leaf area loss) had no effect on vine growth or fruit quality.

Intensive feeding after veraison inside cages (11% leaf area loss) reduced fruit quality.

Boucher & Pfeiffer (1988) study in Virginia
Quantify the level of leaf feeding by Japanese beetle and rose chafer on young Niagara vines.

Determine the effect of different levels of leaf damage during bloom and veraison on young grapevines.
Young vines can withstand leaf area loss

Leaf Area Removed by Rose Chafer and Japanese Beetle (2 weeks exposure)

No effect of this leaf removal on...

- cane length
- cane diameter
- pruning weights
- next year’s growth
- Young fruitless vines
- Did not measure roots
30% leaf area loss
30% leaf area loss at bloom, not veraison, reduced vine growth
Non-bearing Niagara vines

<table>
<thead>
<tr>
<th>Timing of 30% area loss</th>
<th>Total shoot length (m)</th>
<th># Mature nodes</th>
<th>Pruning weight (g)</th>
<th>Next year Yield (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No damage</td>
<td>23.17 a</td>
<td>271.7 a</td>
<td>1035 a</td>
<td>3.6 a</td>
</tr>
<tr>
<td>Bloom</td>
<td>20.36 a</td>
<td>218.7 b</td>
<td>617 b</td>
<td>2.4 ab</td>
</tr>
<tr>
<td>Veraison</td>
<td>21.2 a</td>
<td>277.3 a</td>
<td>862 ab</td>
<td>3.6 a</td>
</tr>
<tr>
<td>Bloom and Veraison</td>
<td>19.2 a</td>
<td>201.9 b</td>
<td>559 b</td>
<td>1.3 b</td>
</tr>
</tbody>
</table>

Loss of 30% leaf area at bloom reduced growth (nodes and pruning wts)
Injury at veraison (30% leaf area loss) had little effect on growth

Evidence for a combined effect: damage at bloom made vines less tolerant of damage at veraison

Mercader & Isaacs (2003) AJEV
Effect of JB control on vine growth and fruit ripening

Hammons, Kurtural, and Potter (2009)

Compared untreated to Sevin weekly or biweekly in six different grape cultivars

Figure 1. *P. japonica* flight in 2006 and 2007, showing the dates of weekly (all arrows) and biweekly (open arrows) carbaryl sprays.

Insecticide reduced defoliation in susceptible c.v.’s

Insecticide biweekly improved sugar accumulation in Cabernet vines
Management Strategy 4
If needed, apply effective insecticides to protect vines
# Insecticides for JB control

## Broad-spectrum
- Organophosphate
  - Imidan 70W*
- Carbamate
  - Sevin XLR
- Pyrethroid
  - Capture 2EC*
  - Danitol 2.4EC*
  - Baythroid XL*
  - [Mustang Max 0.8 EC*]

## Reduced-risk
- Oxadiazine
  - [Avaunt 30WG]
- Neonicotinoids
  - Provado*, Assail 30SG, [Venom*], [Actara], [Clutch 50 WDG]
- Botanicals (neem)
  - Neemix*, AzaDirect*, etc.
- Botanicals (pyrethrums)
  - Pyganic EC1.4*, Evergreen EC60-6, etc.

## Pre-mixes
- [Voliam Flexi 40WDG], Brigadier, [Tourismo], Leverage 2.7 SE

*With pre-mixes, consider the two chemical classes you are using when planning for resistance management*

* Restricted use pesticide  [ ] Not registered in NY  *Organic
Comparison of insecticides for Japanese beetle control

Five foliar insecticides – Danitol, Imidan, Clutch, Actara, Warrior

Applications: 
July 5 for all treatments

Assessments: 
1, 7, 14 days after treatment

![Graph showing beetle population per 7 vine plot over time after applying different insecticides. The x-axis represents time points (Precount, 1 DAT, 7 DAT, 14 DAT), and the y-axis represents beetles per 7 vine plot. Different treatments are indicated by distinct lines and colors.}
Comparison of insecticide rain-fastness

Project led by John Wise

Grape leaves treated with field rates of insecticides
The day after treatment, leaves exposed to simulated rainfall
Amount of insecticide residue measured on the leaves
JB survival assessed on leaves after 48 hours

Percent of ‘no rain’ residue

Grape leaves treated with field rates of insecticides
The day after treatment, leaves exposed to simulated rainfall
Amount of insecticide residue measured on the leaves
JB survival assessed on leaves after 48 hours

Proportion of JB alive, 48h exposure

Grape leaves treated with field rates of insecticides
The day after treatment, leaves exposed to simulated rainfall
Amount of insecticide residue measured on the leaves
JB survival assessed on leaves after 48 hours
## Rain-fastness decision chart for Japanese beetle control

Based on bioassays and residue measurements. Green areas indicate sufficient residue to retain control. X = insufficient control, so reapplication may be needed.

| Insecticide | Half inch | | One inch | | Two inches |
|-------------|-----------|-----------|-----------|-----------|
|             | 1 day     | 7 days    | 1 day     | 7 days    | 1 day     | 7 days    |
| Imidan      | X         | X         | X         | X         | X         | X         |
| Sevin       | X         | X         | X         | X         | X         | X         |
| Capture     | X         | X         | X         | X         | X         | X         |
| Actara      | X         | X         | X         | X         | X         | X         |
| Avaunt      | X         | X         | X         | X         | X         | X         |
**Systemic insecticides**

- Applied as soil or foliar sprays, then absorbed
  - Foliar examples: Provado, Assail, Venom, Clutch
  - Soil examples: Venom, Admire, Platinum

- Move inside the vine
  - Within treated foliage: locally systemic movement
  - From the roots to the foliage: systemic movement

- Can move to new foliage (soil application)

- Lower potential for breakdown and wash-off
- Long residual activity
- Low risk to workers, natural enemies

- Good options for control of beetles, leafhoppers, phylloxera, etc.

- Soil application most effective on drip-irrigated vines
Japanese beetle IPM

Maintain foliage injury below levels that affect the crop or vine development

Create suppressive vineyard landscape
- Remove attractive non-crop plants, mow cover crops to remove flowers when adult beetles are active
- Support biocontrol agents
- Bare ground or non-grass cover crops can reduce egglaying

Monitor regularly
- Sample border and interior locations (combine with berry moth sampling)
- Use visual observation, not traps
- Learn how to estimate leaf area removed

Consider factors influencing vine tolerance
- Crop load, water status, season
- Where beetles are feeding (terminals/main leaves)

Spray only when and where needed
- Combine with sprays for other pests
- Border treatments to reduce cost