Bloom Period Management of Lygus Bug in Alfalfa Seed

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Lygus is effectively managed only with insecticides

- Insecticides labeled for lygus control include:
  - Broad spectrum OP’s, carbamates, pyrethroids
    - Useful for pre-bloom and post-bloom clean-up
  - Several lower-risk insecticides available
    - Useful especially during bloom
      - Efficacy and resistance management issues
      - Toxicity to pollinators: ID-alfalfa leafcutting bee (ALCB)
  - Need for effective, bee-safe insecticides during bloom
# Treatment list for 2017 Lygus efficacy trial

<table>
<thead>
<tr>
<th>No.</th>
<th>Trade Name</th>
<th>Common name</th>
<th>Rate (oz./ acre)</th>
<th>IRAC resistance group</th>
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<td>-</td>
<td>-</td>
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<td>4C</td>
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<td></td>
<td>(GF-2372)</td>
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<td>Transform</td>
<td>sulfoxaflor</td>
<td>2.25</td>
<td>4C</td>
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<td>BeLeaf 50 SG</td>
<td>flonicamid</td>
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<td>Burkholderia A396</td>
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<td>NK</td>
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<td>6</td>
<td>Azera</td>
<td>Azadirachtin/ pyrethrins</td>
<td>48.0</td>
<td>NK/ 3A</td>
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</tbody>
</table>
Pesticide trial methods

- 0.01 acre plots (22 ft x 22 ft) on-station trial
- Completely Random Design: 4 replicates
- 30 gpa: tractor-drawn boom sprayer
- 3 sweeps/plot pre-trt and 1 week intervals after trt
  - Lygus bug nymphs: early (1-3) and late (4,5) instars
  - Aphids (pea aphid, blue and spotted alfalfa aphids)
  - Hemipteran lygus predators: bigeyed bugs, pirate bugs, damsel bugs
2017 Lygus efficacy trial

Mean number of Adult Lygus on each sample day and over all sample days on treated and untreated plots

Number per Sweep

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0.0</th>
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<th>4.0</th>
<th>6.0</th>
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<tr>
<td>Azra_48</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Blf_2.8</td>
<td>AB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tnfm_1.5</td>
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<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tnfm_2.25</td>
<td></td>
<td>AB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vnte_32</td>
<td></td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTC</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Days after Treatment

3 July

A
AB
B
2017 Lygus efficacy trial

Mean number of **small Lygus nymphs** on each sample day and over all sample days on treated and untreated plots

![Bar chart showing mean number of small Lygus nymphs per sweep for different treatments.](image)

- **Azra_48**
- **Blf_2.8**
- **Tnfm_1.5**
- **Tnfm_2.25**
- **Vnte_32**
- **UTC**

**Treatment**

![Image of Lygus bug](image)

**Days after Treatment**

- **3 July**

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**Notes:**

- The bar chart represents the mean number of small Lygus nymphs per sweep on each sample day for different treatments.
- The chart includes treatments such as Azra_48, Blf_2.8, Tnfm_1.5, Tnfm_2.25, Vnte_32, and UTC.
- The graph shows the trend of nymph numbers over time for each treatment starting from the day of treatment (0 days) up to 21 days after treatment.
2017 Lygus efficacy trial

Mean number of large Lygus nymphs on each sample day and over all sample days on treated and untreated plots

![Graph showing mean number of large Lygus nymphs over days after treatment for different treatments.](image)
2017 Lygus efficacy trial

Mean number of pea and blue alfalfa aphids on each day and over all sample days on treated and untreated plots

Number per Sweep

Days after Treatment

Treatment

Days after Treatment
2017 Lygus efficacy trial
Mean number of damsel bugs on each day and over all sample days on treated and untreated plots

![Graph showing mean number of damsel bugs per sweep over days after treatment for different treatments: Azra_48, Tnfm_2.25, Blf_2.8, Vnte_32, Tnfm_1.5, UTC. The graph includes error bars and indicates a peak on 3 July.]

Days after Treatment

Days: 0, 3, 7, 14, 21
Conclusions

For lygus adults

• No strong effects of pesticides on lygus adults

For lygus small and large nymphs

• Generally lower lygus numbers on Transform and Beleaf-treated plots, but low nos. on UTC plots complicates the picture.

For aphids

• Lower nos. of pea and blue alfalfa aphids on plots treated with Transform and Beleaf than on Venerate and Azera –treated plots. Nos. low on all plots by two weeks post-treatment.
• No. of spotted aphids very low. No measurable treatment effects.
Natural enemies of Lygus potentially important in alfalfa seed production
Biological control of lygus in alfalfa seed

- Generally by conservation of natural enemies
  - Using selective pesticides (less toxic to natural enemies than to lygus)
  - Using pesticides selectively (treat when natural enemies are not present, i.e. early season clean-up sprays)
  - Habitat management to increase natural enemy numbers is not practiced
  - Slower action and low pest thresholds (for lygus), makes timing difficult
Natural enemies of Lygus potentially important in alfalfa seed production

| Bigeyed bug  
| (Geocoris spp.) | Damsel bug   
| (Nabis spp)    | Minute pirate bug   
| (Orius spp.)   | Parasitic Wasps   
| (Peristenus ssp.) |
|---|---|---|---|
| [Image] | [Image] | [Image] | [Image] |

<table>
<thead>
<tr>
<th>Generalist predators (small caterpillars, caterpillar eggs, aphids, sider mites and lygus</th>
<th>Specialist on Lygus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer instars 1-3</td>
<td>Attacks instars 1-2?</td>
</tr>
<tr>
<td>Will switch to aphids and others when present in numbers</td>
<td>Prefers aphids, mites and thrips</td>
</tr>
<tr>
<td>A few to 10’s per predator per day</td>
<td>0% to 100% parasitism</td>
</tr>
<tr>
<td>Immediate mortality</td>
<td>Delayed mortality</td>
</tr>
</tbody>
</table>
Predators: Big-eyed bugs (Hemiptera, Geocoris spp)

Feed on

- *Lygus* bugs, chinch bugs
- Caterpillar eggs, small larvae
- Mites and mite eggs

- Small, gray and black to black
- < 1/16 to 3/16 inches
- Oval with bulging eyes
- Needle-like mouth parts
Predators: Pirate bugs (Hemiptera, Orius spp.)

Feed on

- Mites all stages
- Aphids
- Thrips
- Caterpillar eggs, small larvae

- Tiny, black and white adults
- Orange, pear-shaped nymphs
- < 1/16 to 1/8 inch
- Needle-like mouth parts
Predators: Damsel bugs (Hemiptera, Nabis spp.)

Feed on

- Lygus!
- Aphids, other bugs
- Small caterpillars
- Mites

- Slender, tan to brown
- < 1/3 to 1/2 inch
- Bulging eyes, long antennae
- Nymphs similar to adults
- Needle-like mouth parts
Predators: Lady beetles (Coleoptera)

Feed primarily on

- Aphids
  - Soft-bodied insects
  - Insect eggs
  - Spider mites & mite eggs

Predators: Lady beetles (Coleoptera)

Sevenspotted lady beetle

Convergent lady beetle

Multicolored Asian lady beetle

Coccinella septempunctata

Hippodamia convergens

Harmonia axyridis

Parasitic Wasps: Larval parasites

Braconids
Mostly internal parasites of beetle and moth larvae. May pupate externally.

Ichneumonids
External or internal parasites of many insects including beetles and caterpillars.

e.g. *Bathyplectes* parasites of alfalfa weevils
Parasitic Wasps: Egg parasites

**Trichogrammatid**

*Trichogramma* spp.
- Moth eggs

**Mymarid**

*Anagrus* & *Anaphes* spp.
- Beetle & fly eggs

**Scelionid**

*Telonomus* & *Trissolcus* spp.
- Bug eggs
Parasitic Wasps: Aphid parasites

**Aphelinids**

*Aphytis & Aphelinus spp.*

Black mummies typical

**Aphidiids**

*Aphidius, Diaeretiella Praon, & Trioxys spp.*

Gold-tan mummies typical
Parasitism of lygus nymphs in the Pacific Northwest

*Peristenus howardi*, braconid wasp that parasitizes lygus bug nymphs in the Pacific Northwest

- Native to the Pacific Northwest
- Parasitizes early (2\textsuperscript{nd} & 3\textsuperscript{rd}) instar lygus nymphs
- Larvae emerges from 5\textsuperscript{th} instar lygus nymphs
- Potentially high parasitism rates
2002-2003 survey: sampling area

- 4 to 5 sites for each lygus host in each year
- Sites sampled every two weeks using a sweep net

- Cultivated lygus hosts
  - Alfalfa seed
  - Alfalfa hay
  - Clover
- Weed lygus hosts
  - Kochia
  - Hoary cress
  - Annual pepperweed
- Unsprayed alfalfa at UI Parma
Parasitism of lygus nymphs collected in 2003 from crop and non-crop lygus hosts in the Treasure Valley of SW Idaho and E Oregon

![Graph showing parasitism percentage over weeks in 2003 for different plant species.]
Thank you for your time and support

Idaho Alfalfa and Clover Seed Commission
Dow Agrosciences

Noemi Fernandez
Brenda Nelson, Katie Walker

Questions?
<table>
<thead>
<tr>
<th>Pesticide</th>
<th>ALCB</th>
<th>Bigeyed bug</th>
<th>Damsel bug</th>
<th>Minute pirate bug</th>
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<tbody>
<tr>
<td>Assail</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>~96</td>
</tr>
<tr>
<td>Beleaf</td>
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<td>Capture</td>
<td>&gt;96</td>
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<tr>
<td>Carzol</td>
<td>4</td>
<td>96</td>
<td>48</td>
<td>&gt;96</td>
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<td>Grandevo*</td>
<td>?</td>
<td>?</td>
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<tr>
<td>Rimon</td>
<td>4</td>
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<tr>
<td>Transform</td>
<td>2</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

**RT\textsubscript{25} ≤ 2:** apply when bees are not foraging  
**RT\textsubscript{25} ≤ 8:** apply during late evening or night  
*Grandevo causes little or no bee mortality but may repel bees for several days*
Toxicity of potential lygus bug compounds to beneficial insects

- $RT_{25}$ to alfalfa leafcutting bees and lygus predators
  - Treat foliage in the field
  - Determine toxicity of field-weathered foliage to insects at determined intervals after application
    - 2h, 8h, 24h, 48h, 96h
Residual toxicity of Transform to adult alfalfa leafcutting bees (2012)

Control adjusted percentage mortality of adult bees exposed to alfalfa foliage treated with Transform and Capture and field-weathered for 2 to 96 hours
Insecticide Resistance Action Committee (IRAC) Classification of Sulfoxaflor

**Group 4**
Nicotinic acetylcholine receptor (nAChR) competitive modulators

**Sub-group 4A**
Neonicotinoids
- Acetamiprid
- Clothianidin
- Dinotefuran
- Imidacloprid
- Nitenpyram
- Thiacloprid
- Thiamethoxam

**Sub-group 4B**
Nicotine
- Nicotine

**Sub-group 4C**
Sulfoximines
- Sulfoxaflor*
- Transform

**Sub-group 4D**
Butenolides
- Sivanto
- Flupyradifurone

**Sub-group 4E**
Mesoionics
- Triflumezopyrim

- **Sulfoxaflor:**
  - Complex, unique target site interactions.
  - Lack of cross resistance.
  - Metabolism differs from neonicotinoids.

Effective against lygus nymphs in previous trials

**Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow**
2017 Beleaf rate by MSO grower trial

Mean number of spotted alfalfa aphids on each day and over all sample days on treated and untreated plots

Number per Sweep

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Days after Treatment</th>
</tr>
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<tbody>
<tr>
<td>Azra_48</td>
<td>3 July</td>
</tr>
<tr>
<td>Blf_2.8</td>
<td>3 July</td>
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<td>Tnfm_1.5</td>
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<td>Vnte_32</td>
<td>3 July</td>
</tr>
<tr>
<td>UTC</td>
<td>3 July</td>
</tr>
</tbody>
</table>

3 July

Days after Treatment
Predators: Lacewings (Neuroptera).

Feed on

- Aphids
- Small caterpillars
- Mites & mite eggs
Predators: Lacewings (Neuroptera).

Green Lacewings

Feed on

- Aphids
- Small caterpillars
- Mites & mite eggs
Predators: Syrphids (hover flies)

Feed on

✓ Nectar (adults)
✓ Aphids (Larvae)
Other Natural Enemies

Predators

Beetles

Spiders

Flies
Other Natural Enemies

Parasitoids

Pathogenic nematodes
Objective 1: Estimate overall percentage parasitism of lygus nymphs from selected crop and non-crop hosts

- Lygus nymphs separated from other insects and debris
- Dissected to determine parasitism
- Parasitoid larvae were preserved for identification
Other Natural Enemies

Pathogens

Bacteria

Viruses

Fungi
Parasitism of lygus nymphs collected in 2002 from crop and non-crop lygus hosts in the Treasure Valley of SW Idaho and E Oregon.
Number and percentage parasitism of lygus nymphs on unsprayed alfalfa seed at the Parma R & E Center, Canyon Co., Idaho in 2001
Peak annual parasitism rate of lygus nymphs collected in 2002 and 2003 from crop and non-crop lygus hosts in the Treasure Valley of SW Idaho and E Oregon.
2017 Lygus efficacy trial