Alfalfa Insect Management in the Southwest US

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Insect Pests of Alfalfa Hay Production

- **Worms**
  - beet armyworm
  - western yellowstriped armyworm
  - alfalfa caterpillar
  - alfalfa webworm
  - alfalfa looper
  - cutworms

- **Aphids**
  - Spotted alfalfa aphid
  - Blue alfalfa aphid
  - Pea aphid
  - Cowpea aphid

- **Alfalfa weevils**

- **Leafhoppers**
Beneficial Arthropods in alfalfa

PREDATORS:
- Spiders
- Predacious bugs
- Lacewings
- Lady beetles
- Entomophagous parasitoids

POLLINATORS:
- Leaf cutter bees
- Honey bees
Biological Control for Worms

- Beet armyworm & Western yellowstriped armyworm
  - Predators (bigeyed bugs, spiders, minute pirate bugs, damsel bugs, and lacewings)
  - Spiders
  - Parasites, e.g. *Hyposoter exiguae*

- Alfalfa caterpillar
  - Predators (bigeyed bugs, spiders, minute pirate bugs, damsel bugs, and lacewings)
  - Spiders (several species)
  - Parasites, e.g. *Cotesia medicaginis*

- Cutworms
  - Birds (gulls, ibis, egret, black birds)
  - Parasites (several Ichneumonidae wasp species and several Tachinidae fly species)
Biological Control for Aphids

- Blue alfalfa aphid & Pea aphid
  - Predators: lady beetles, syrphid fly, minute pirate bugs, bigeyed bug, damsel bugs, & lacewings
  - Entomopathogenic Fungi
  - Parasites, e.g. *Aphidius smithi* & *A. ervi*

- Cowpea aphid
  - Predators: lady beetles, syrphid fly, minute pirate bugs, bigeyed bug, damsel bugs, & lacewings
  - Parasites, e.g. *Lysiphlebus sp.* and *Diaraeiella sp.*

- Spotted alfalfa aphid
  - Predators: lady beetles, syrphid fly, minute pirate bugs, bigeyed bug, damsel bugs, & lacewings
  - Entomopathogenic Fungi
  - Parasites, e.g. *Trioxys complanatus*
Biological Control for Weevils

- Alfalfa weevil & Egyptian alfalfa weevil
  - Predators (bigeyed bugs, spiders, minute pirate bugs, damsel bugs, and lacewings)
  - Soil dwelling fungi, e.g. *Zoophthora phytonomi*
  - Larva parasites, e.g. *Bathyplectes curculionis* & *Bathyplectes anurus*
  - Adult parasites
CULTURAL PRACTICES

- Border-strip harvesting is a useful method for preserving natural enemies because it helps retain parasites in the field.

- Weed control – weeds in and around the field harbor insect pests such as cutworms.

- Early cutting will give satisfactory control if the pest infestation appears late in the cutting cycle.
Several “Reduced Risk” insecticides are under development or were recently registered for alfalfa insect pest control. But, do they work?

Are “Older Insecticides” still efficacious?

Are new insecticides better?

Are mixtures better?
“Newer” Worm Control Chemistries

- **Anthranilic Diamide Insecticide:** (MoA 28)
  - Belt® (a.i. flubendiamide) Bayer CropScience (no label)
  - Coragen® SC (Rynaxypyr™ a.i. chlorantraniliprole) DuPont (no label)

- **IGR’s:**
  - Intrepid® (a.i. methoxfenozoide) (Dow AgroSciences) (MoA 18)

- **Mixtures:**
  - Voliam Xpress (a.i. chlorantraniliprole + lambda-cyhalothrin) Syngenta (MoA 28 & MoA 3)
  - Cobalt (a.i. gama-cyhalothrin + chlorpyriphos) (MoA 3 & MoA 1B)
  - Cobalt Advanced (a.i. lambda-cyhalothrin + chlorpyriphos) (MoA 3 & MoA 1B)
  - Stallion (a.i. zeta-cypermethrin + chlorpyriphos) (MoA 3 & MoA 1B)
“Older” Worm Control Chemistries

- **Avermectins & Bt Products:**
  - *Bacillus thuringiensis ssp. Aizawai* (various products) (MoA 11B1)
  - *Bt ssp. Kurstaki* (various products) (MoA 11B2)

- **Pyrethroids:** (MoA 3) (many others not listed)
  - (a.i. permethrin) Ambush® or Pounce® (Amvac & FMC)
  - Warrior II® (a.i. lambda-cyhalothrin) Syngenta
  - Mustang® (a.i. zeta-cypermethrin) FMC

- **Organophosphates:** (MoA 1B)
  - Lorsban® (a.i. chlorpyrifos) Dow AgriSciences

- **Carbamates:** (MoA A1)
  - Lannate® (a.i. methomyl) DuPont

- **Others**
  - Steward® (a.i. indoxacard) DuPont (MoA 22)
Beet Armyworm Post Treatment Means for 2010

LSD, $P < 0.05$

- Untreated Control
- Voliam Xpress @ 7 oz
- Warrior II @ 1.92 oz
- Intrepid @ 8 oz
- Belt 480 SC @ 3 oz

Belt is not labeled for use on alfalfa Dec 2011
Alfalfa Caterpillar Post Treatment Means for 2010

LSD, $P \leq 0.05$

Beet armyworm larvae 10 per sweeps

**Untreated Control**

**Voliam Xpress @ 7 oz**

**Warrior II @ 1.92 oz**

**Intrepid @ 8 oz**

**Belt 480 SC @ 2 oz**

Belt is not labeled for use on alfalfa Dec 2011
Beet Armyworm Post Treatment Averages for 2008

- Untreated Control
- Steward @ 6.7 oz
- Lorsban Advanced @ 32 oz
- Intrepid @ 6 oz
- Intrepid @ 7 oz
- Baythroid XL @ 2.8 oz
- Belt 480 SC @ 1 oz
- Belt 480 SC @ 2 oz
- Belt 480 SC @ 3 oz

LSD, \( P \leq 0.05 \)

Belt is not labeled for use on alfalfa Dec 2011
Alfalfa Caterpillar Post Treatment Averages for 2008

LSD, \( P \leq 0.05 \)

Untreated Control
- Steward @ 6.7 oz
- Lorsban Advanced @ 32 oz
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- Baythroid XL @ 2.8 oz
- Belt 480 SC @ 1 oz
- Belt 480 SC @ 2 oz
- Belt 480 SC @ 3 oz

Belt is not labeled for use on alfalfa Dec 2011
“Newer” Aphid Control Chemistries

- **Beleaf®** (flonicomide) FMC Corp.
  - (MoA 9C)
  - 24c special local needs label in several states

- **Transform** (a.i. sulfoxaflor under development Dow AgriSciences)
  - (MoA unknown)
  - No US EPA nor CDPR label at this time.
“Older” Aphid Control Chemistries

Organophosphates (MoA 1B)
- Lorsban® (a.i. chlorpyrifos) Dow AgriSciences
- a.i. Dimethoate (Gowan & other sources)
- a.i. Malathion (Gowan & other sources)

Pyrethroids: (MoA 3) (many others not listed)
- (a.i. permethrin) Ambush® or Pounce® (Amvac & FMC)
- Baythroid (a.i. cyfluthrin) Bayer CropScience
- Warrior II® (a.i. lambda-cyhalothrin) Syngenta
- Mustang® (a.i. zeta-cypermethrin) FM
Pea Aphid Post Treatment Means for 2009

LSD, $P \leq 0.05$

Pea aphids per sweep

4DAT 7DAT 14DAT 21DAT

Untreated Control
Cobalt @ 19 oz
Cobalt @ 26 oz
Lorsban Advanced @ 16 oz + Steward @ 9 oz
Furadan 4F

Furadan is not labeled for use in USA
Blue Alfalfa Aphid Post Treatment Means for 2009

- LSD, $P \leq 0.05$

**Factors:***
- Untreated Control
- Cobalt @ 19 oz
- Cobalt @ 26 oz
- Lorsban Advanced @ 16 oz + Steward @ 9 oz
- Furadan 4F

**Notes:**
- Furadan is not labeled for use in USA.
Cowpea Aphid Post Treatment Means for 2009

LSD, $P \leq 0.05$

- Untreated Control
- Cobalt @ 19 oz
- Cobalt @ 26 oz
- Lorsban Advanced @ 16 oz + Steward @ 9 oz
- Furadan 4F

Furadan is not labeled for use in USA
Pea Aphid Post Treatment Means for 2011

LSD, $P \leq 0.05$

- **Untreated Control**
- **Mustang EW @ 4.3 oz**
- **Stallion @ 9.25**
- **Voliam Xpress @ 9 oz**
- **Cobalt Advanced @ 24 oz**

Stallion is zeta-cypermethrin + chlorpyrifos

Voliam Xpress is chlorantraniliprole + lambda-cyhalothrin

Cobalt is gama-cyhalothrin + chlorpyrifos

Pea aphids per sweep vs. time:
- **3DAT**
- **7DAT**
- **14DAT**
- **21DAT**
Blue Alfalfa Aphid Post Treatment Means for 2011

LSD, $P \leq 0.05$

- **Untreated Control**
- **Mustang EW @ 4.3 oz**
- **Stallion @ 9.25 oz**
- **Voliam Xpress @ 9 oz**
- **Cobalt Advanced @ 24 oz**

**Stallion** is zeta-cypermethrin + chlorpyrifos

**Voliam Xpress** is chlorantraniliprole + lambda-cyhalothrin

**Cobalt** is gama-cyhalothrin + chlorpyrifos
Cowpea Aphid Post Treatment Means for 2011

LSD, \( P \leq 0.05 \)

- **Untreated Control**
- **Mustang EW @ 4.3 oz**
- **Stallion @ 9.25 oz**
- **Voliam Xpress @ 9 oz**
- **Cobalt Advanced @ 24 oz**

**Stallion** is zeta-cypermethrin + chlorpyrifos

**Voliam Xpress** is chlorantraniliprole + lambda-cyhalothrin

**Cobalt** is gama-cyhalothrin + chlorpyrifos

Cowpea aphids per sweep

- 3DAT
- 7DAT
- 14DAT
- 21DAT
“Newer” Weevil Control Chemistries

- Voliam Xpress (a.i. chlorantraniliprole + lambda-cyhalothrin) Syngenta (MoA 28 & MoA3)
“Older” Weevil Control Chemistries

**Pyrethroids: (MoA 3) (many others not listed)**
- (a.i. permethrin) Amvac’s Ambush® or FMC’s Pounce®
- Warrior II® (a.i. lambda-cyhalothrin) Syngenta
- Mustang® (a.i. zeta-cypermethrin) FMC
- Baythroid (a.i. cyfluthrin) Bayer CropScience

**Organophosphates: (MoA 1B)**
- Lorsban® (a.i. chlorpyrifos) Dow AgriSciences
- Imidan (a.i. Phosmet) Gowan
- a.i. Malathion (Gowan & other sources)

**Carbamates: (MoA A1)**
- Lannate® (a.i. methomyl) DuPont

**Others**
- Steward® (a.i. indoxacarid) DuPont (MoA 22)
Alfalfa Weevil Larvae Post Treatment Means for 2009

Alfalfa weevil larvae per sweepsweep

LSD, $P \leq 0.05$

Untreated Control

Cobalt @ 19 oz

Cobalt @ 26 oz

Lorsban Advanced @ 16 oz + Steward @ 9 oz

Furadan 4F

Furadan is not labeled for use in USA
Alfalfa Weevil Larvae Post Treatment Means for 2011

LSD, $P \leq 0.05$

- **Untreated Control**
- **Mustang EW @ 4.3 oz**
- **Stallion @ 9.25 oz**
- **Voliam Xpress @ 9 oz**
- **Cobalt Advanced @ 24 oz**

**Stallion** is zeta-cypermethrin + chlorpyrifos

**Voliam Xpress** is chlorantraniliprole + lambda-cyhalothrin

**Cobalt** is gama-cyhalothrin + chlorpyrifos
“Newer” Leafhopper Control Chemistries

- **Beleaf®** (flonicomid) FMC Corp.
  - (MoA 9C)
  - 24c special local needs label in several states

- **Transform** (a.i. sulfoxaflor under development Dow AgriSciences)
  - (MoA unknown)
  - No US EPA nor CDPR label at this time.
“Older” Leafhopper Control Chemistries

- **Pyrethroids:** (MoA 3) (many others not listed)
  - (a.i. permethrin) Amvac’s Ambush® or FMC’s Pounce®
  - Warrior II® (a.i. lambda-cyhalothrin) Syngenta
  - Mustang® (a.i. zeta-cypermethrin) FMC
  - Baythroid (a.i. cyfluthrin) Bayer CropScience

- **Organophosphates:** (MoA 1B)
  - Lorsban® (a.i. chlorpyrifos) Dow AgriSciences

- **Carbamates:** (MoA A1)
  - Lannate® (a.i. methomyl) DuPont
Empoasca spp. Leafhopper Post Treatment Means for 2011

LSD, $P \leq 0.05$

Leafhoppers per sweepsweep

<table>
<thead>
<tr>
<th>Treatment</th>
<th>2DAT</th>
<th>7DAT</th>
<th>14DAT</th>
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<tbody>
<tr>
<td>Untreated Control</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lorsban Advanced @ 10 oz</td>
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<td>10</td>
<td></td>
</tr>
<tr>
<td>Dimethoate E267 @ 10 oz</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Warrior II @ 1.6 oz</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mustang Max @ 4 oz</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Lannate LV @ 32 oz</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Baythroid XL @ 1.6 oz</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ambush Insecticide @ 6.4 oz</td>
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<td>1</td>
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</tr>
</tbody>
</table>

LSD, $P \leq 0.05$
Study Conclusions

- All insecticides tested had some efficacy against insect pests in alfalfa.

- Treatments containing a pyrethroid insecticide have consistently shown resurgence of beet armyworm over the past several years in Imperial Valley efficacy trials.

- All insecticides tested had some harmful affect on beneficial insect worm predators, but the least harmful insecticides to most predators were Beleaf, Transform, Intrepid and Belt (no label for alfalfa hay at this time).
Acknowledgments

We wish to express our sincere thanks to the following Agricultural Chemical Companies for supporting this research:

- Amvac
- Bayer CropScience
- Dow AgroSciences
- DuPont
- FMC
- Gowan
- Syngenta