

Integrated Pest Management of Lygus in Alfalfa Seed Production

Ricardo Ramirez

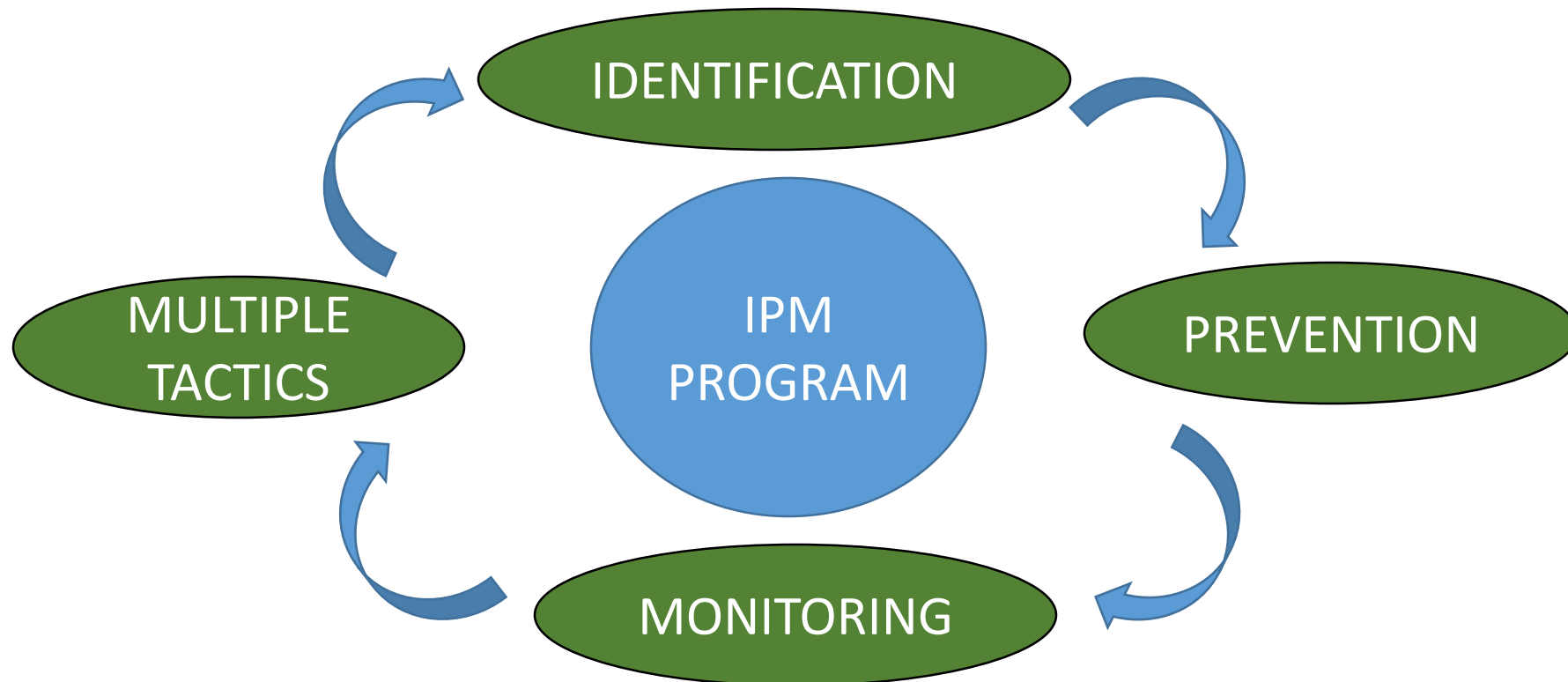
Utah State University

Department of Biology



Integrated Pest Management (IPM)

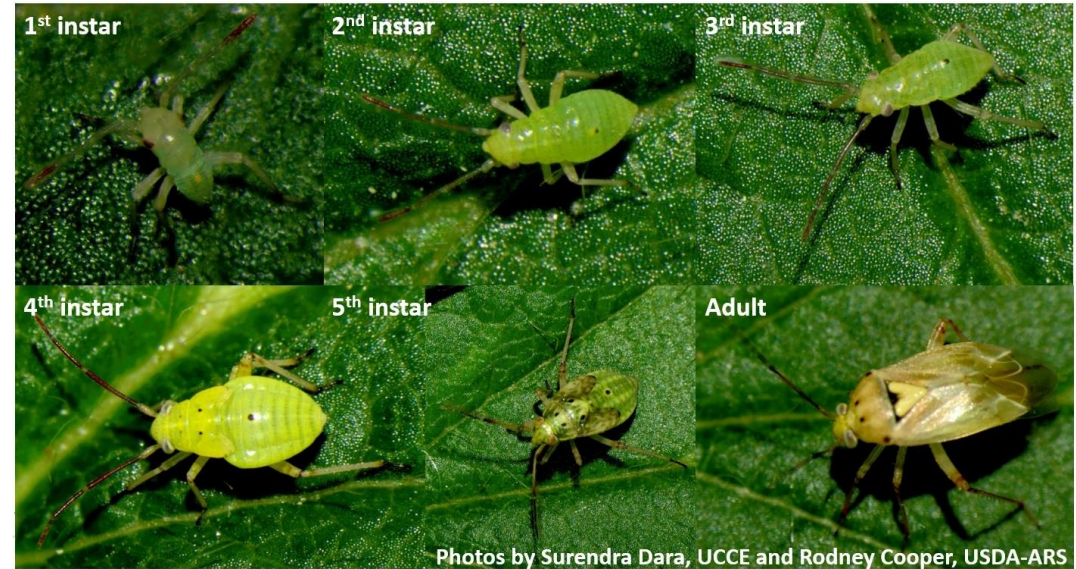
- **IPM** is the use of multiple pest management strategies and the judicious use of pesticides to prevent, reduce, or eliminate pests.



Lygus bug identification



Adult Lygus



- Belongs to the Mirid family of true bugs.
- **Lygus bugs** are small (5 mm; 0.18 inch) with piercing-sucking mouthparts. Variation of green to brown color.
- Wings folded over the abdomen with a distinct scutellum (triangle area) with heart shape behind the head.

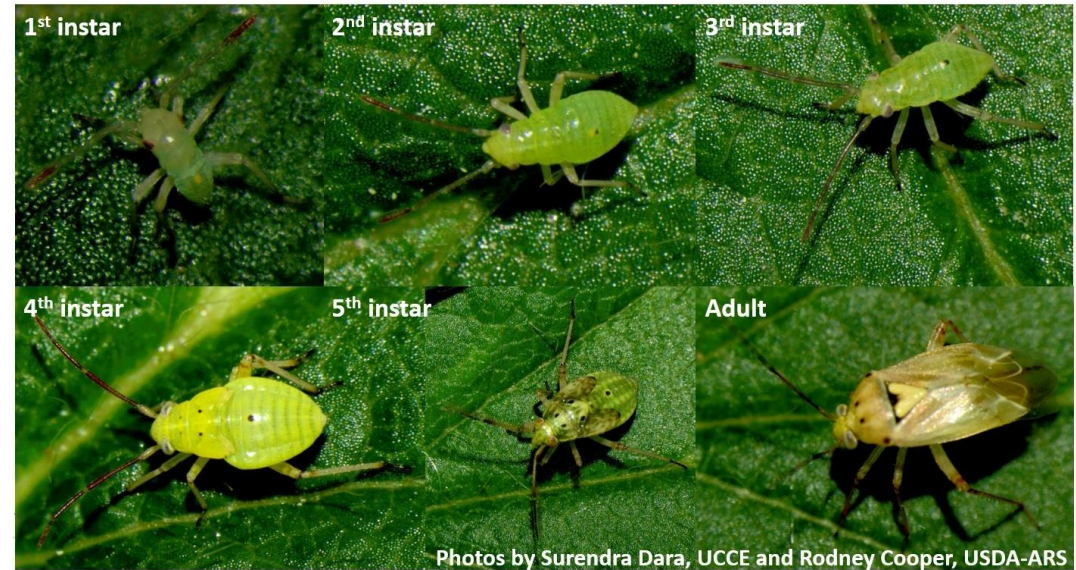
Lygus bug identification



Aphids



Alfalfa plant bug



- Be aware of look-alikes.
- **Aphids** are very small, soft bodied, with piercing-sucking mouthparts. Look similar to early stage Lygus. Lygus move quickly compared to aphids.
- **Alfalfa plant bugs** are also Mirids. Thinner and twice the size of Lygus (3/8 inch). Legs have speckled black spots.

Lygus bug biology

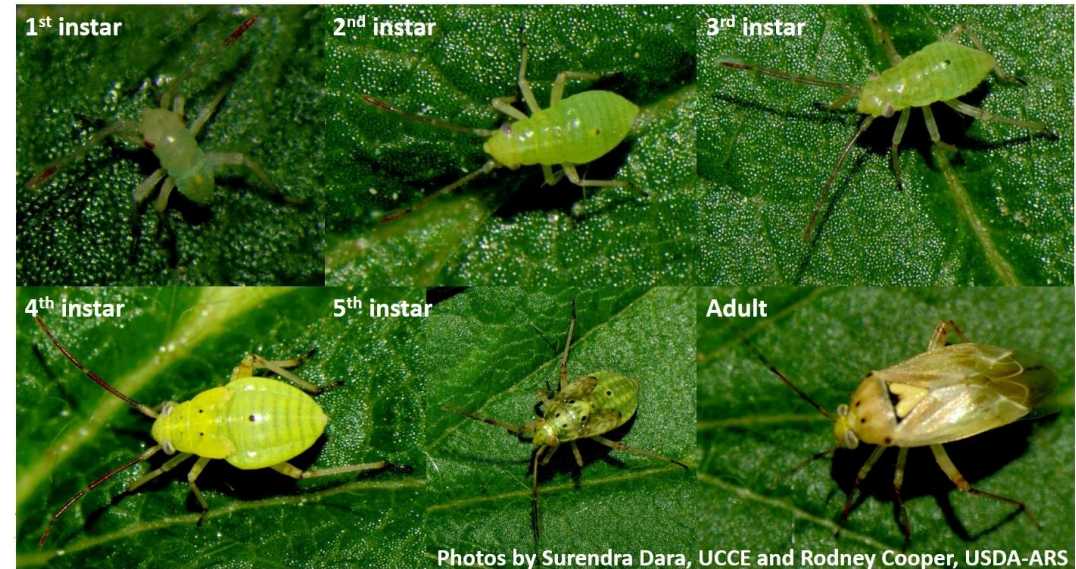


Adult Lygus



- Overwinter as adults. Movement to overwintering sites in the fall.
- Sites include plants crowns, litter, debris, field margins, natural areas.
- Become active and mate in spring.

Lygus bug biology



- **Eggs** deposited in plant tissue. Hatch within 1-4 wks
- **Nymphs** have 5 instars (immature stages) developing in 1-2 months.
- Have 3-4 overlapping generations per year (SW Idaho).

Lygus bug feeding



- Piercing-sucking mouthparts
- Prefer reproductive plant parts (buds, flowers, seeds)
- Reproductive stage alfalfa vs nearly any other plant

ALFALFA WINS

Lygus bug feeding



- Very broad host range
- Ornamental perennials (penstemon and lupine)
- Weeds (Russian thistle, kochia, mustards)

Lygus bug damage



- Results in **Physical Damage** from probing.
- Inject salivary enzymes into plant tissue.
- Results in **Chemical Damage**.
 - Deformed growth
 - Death of plant tissue

Lygus bug damage



- Cause blasting (drying) of flower buds.
- Leads to flower, seed pod shedding.
- A component of reduced seed numbers.

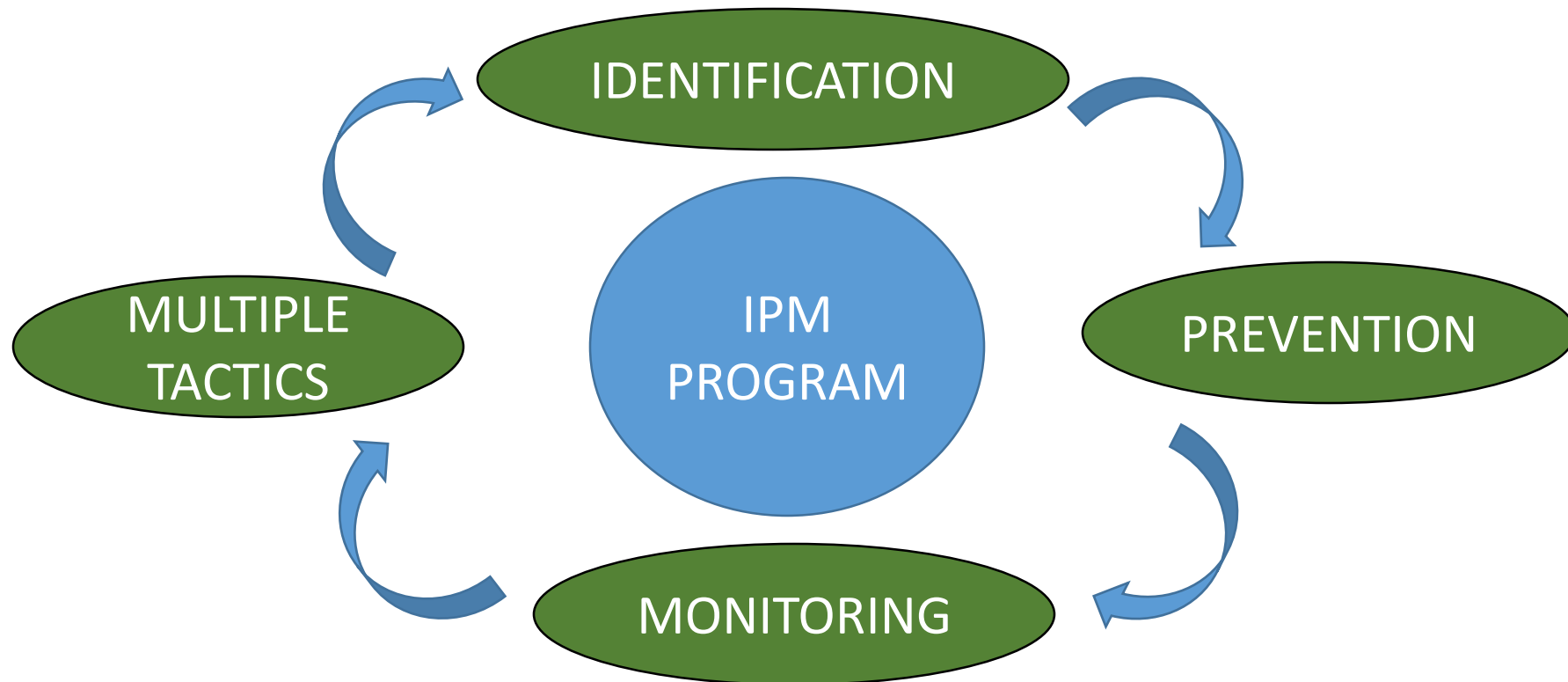
Lygus bug damage



- Most damage results from feeding on immature seeds in developing pods.
- Upwards of 70% of damage caused by late instars (4-5) and adults.
- Damage occurs with the green seed since they can't penetrate hard seed.
- Left unmanaged, losses can reach 50% to nearly 100%.

Integrated Pest Management (IPM)

- **IPM** is the use of multiple pest management strategies and the judicious use of pesticides to prevent, reduce, or eliminate pests.



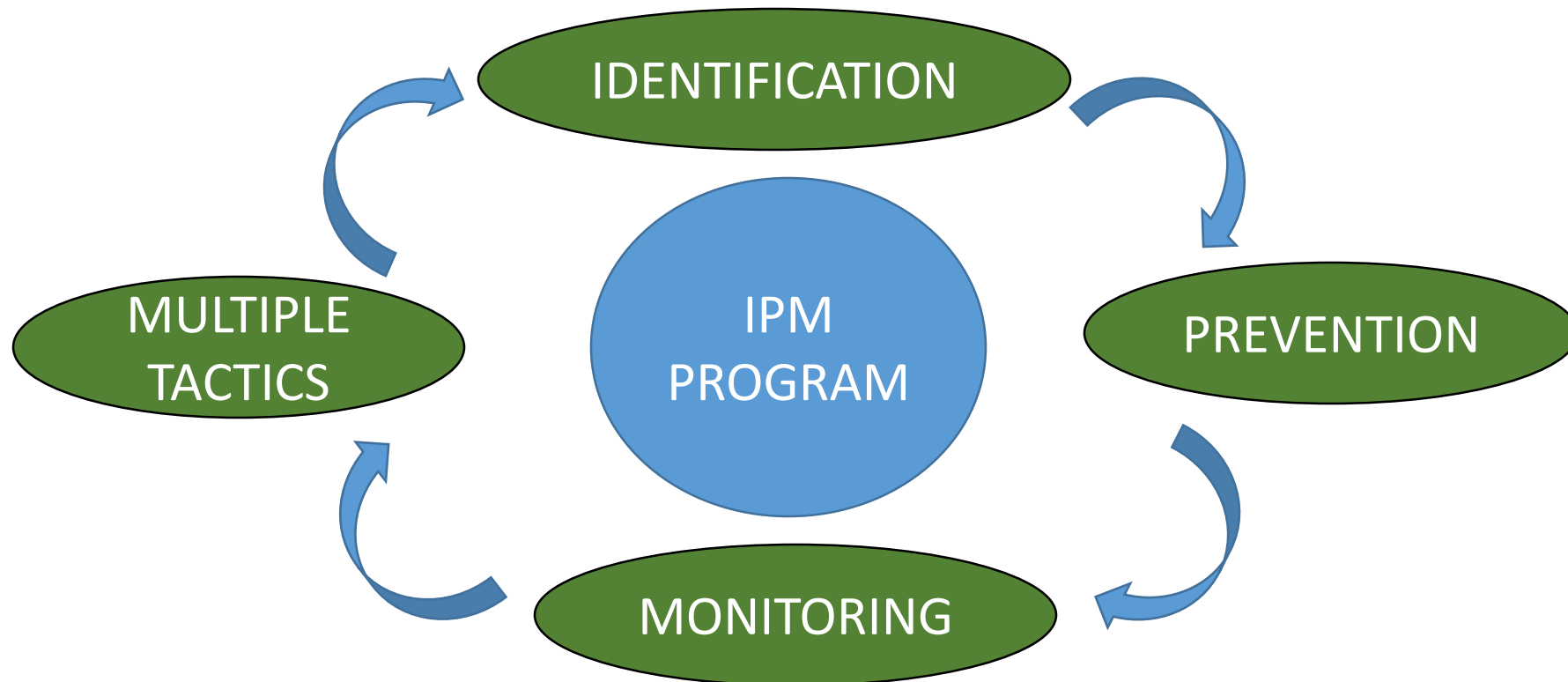
Lygus prevention

- Management of weeds
- Management of overwintering sites



Integrated Pest Management (IPM)

- **IPM** is the use of multiple pest management strategies and the judicious use of pesticides to prevent, reduce, or eliminate pests.

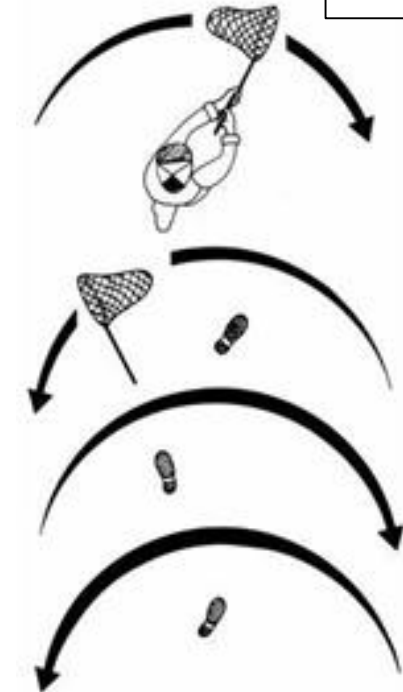


Lygus bug management

- Monitoring
 - Sweep sampling



Plant stage	# Lygus/Sweep	Strategy
Prior to bloom and pollinator release	>4 Lygus	Active management
During bloom to seed set	8-10 Lygus	Active management
Alfalfa seed set and maturing	10-15 Lygus	Active management



Lygus bug management

- Monitoring
 - Sweep sampling

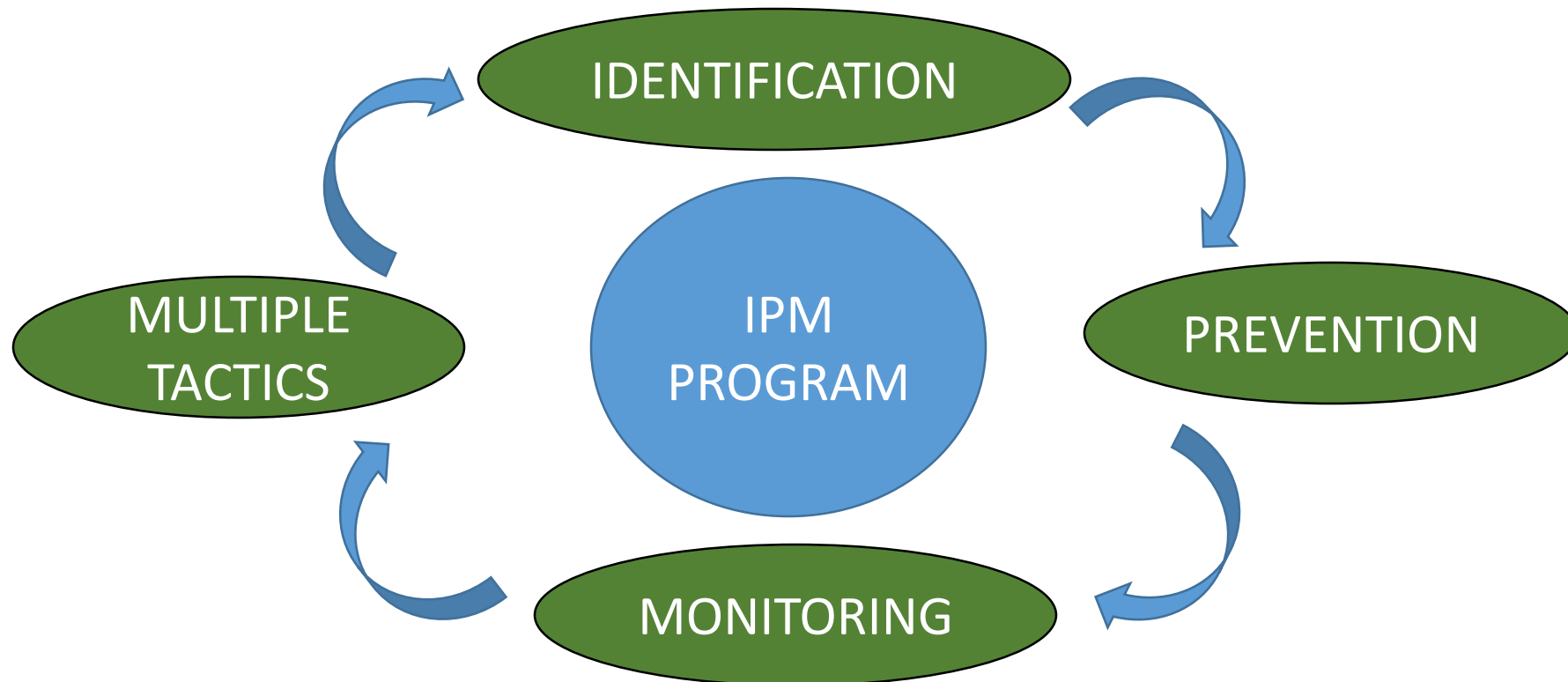


Plant stage	# Lygus/Sweep	Strategy
Prior to bloom and pollinator release	>4 Lygus	Active management
During bloom to seed set	8-10 Lygus	Active management
Alfalfa seed set and maturing	10-15 Lygus	Active management



Integrated Pest Management (IPM)

- **IPM** is the use of multiple pest management strategies and the judicious use of pesticides to prevent, reduce, or eliminate pests.



Lygus bug management

- Chemical control
 - PRE-Bloom: Organophosphates and Pyrethroids

POISON
KEEP OUT OF REACH OF CHILDREN
READ SAFETY DIRECTIONS BEFORE OPENING OR USING

Dow AgroSciences

Lorsban* 750 WG

Insecticide

ACTIVE CONSTITUENT: 750 g/kg CHLORPYRIFOS (an anticholinesterase compound)

GROUP 1B INSECTICIDE

For control of certain insect pests in FRUIT and OTHER SITUATIONS as specified in the Directions For Use Table.

WATER SOLUBLE PACKAGING. KEEP DRY.

Dow AgroSciences Australia Limited A.B.N. 24 003 771 659
20 Rodborough Road FRENCHS FOREST NSW 2086
www.dowagrosciences.com.au
CUSTOMER SERVICE TOLL FREE 1-800 700 006
* Trademark of Dow AgroSciences

RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS
FOR RETAIL SALE TO AND USE ONLY BY CERTIFIED APPLICATORS,
OR PERSONS UNDER THEIR DIRECT SUPERVISION, AND ONLY FOR
THOSE USES COVERED BY THE CERTIFIED APPLICATOR'S CERTIFICATION.

GROUP 2 INSECTICIDE

Warrior
with Zeon Technology®

Insecticide

Active Ingredient:
Lambda-cyhalothrin¹
[1a(S*),3a(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl-
3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-
dimethylcyclopropanecarboxylate 11.4%
Other Ingredients: 88.6%
Total: 100.0%

Warrior Insecticide with Zeon Technology contains 1 lb. of active ingredient per gal. and is a capsule suspension.

¹Synthetic pyrethroid

KEEP OUT OF REACH OF CHILDREN.
WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See additional precautionary statements and directions for use in booklet.

EPA Reg. No. 100-1112
Product of the United Kingdom
Formulated in USA
SCP 1112A-L3J 1109
310383

syngenta®

Specimen Label

RESTRICTED USE PESTICIDE
For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

Dow AgroSciences

Cobalt®

Advanced

Insecticide

®Trademark of Dow AgroSciences

For control of listed insects infesting listed field, fruit, nut, and vegetable crops.

Active Ingredients:

chlorpyrifos: O,O-diethyl-O-(3,5,6-trichloro-2-pyridinyl)phosphorothioate	28.12%
Lambda-cyhalothrin: [1a(S*),3a(Z)]-(±)-cyano-(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate	1.44%
2-dimethylcyclopropanecarboxylate	70.44%
Total	100.00%

Other Ingredients

EPA Reg. No. 62719-615

Contains 2.503 lb chlorpyrifos and 0.129 lb lambda-cyhalothrin per gallon
Contains petroleum distillate.

PEEL HERE TO OPEN

Dimethoate 4E
SYSTEMIC INSECTICIDE ORGANOPHOSPHATE

ACTIVE INGREDIENT:
Dimethoate (0,0-dimethyl S-(N-methyl-carbamoylmethyl) phosphorodithioate) 43.5%
INERT INGREDIENTS: 56.5%
TOTAL 100.0%
1 gallon contains 4 pounds of dimethoate

KEEP OUT OF REACH OF CHILDREN
WARNING/AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

See inside of booklet for complete Precautionary Statements and Directions For Use.

EPA Reg. No. 66330-223 EPA Est. No. 51036-GA-001
AD 090105-A
101749

Product of Denmark;
Formulated in the United States with U.S. and imported ingredients.

Net Contents: 2.5 Gallons

Manufactured For:
Arysta LifeScience North America Corporation
15421 Weston Parkway, Suite 150
Cary, NC 27513

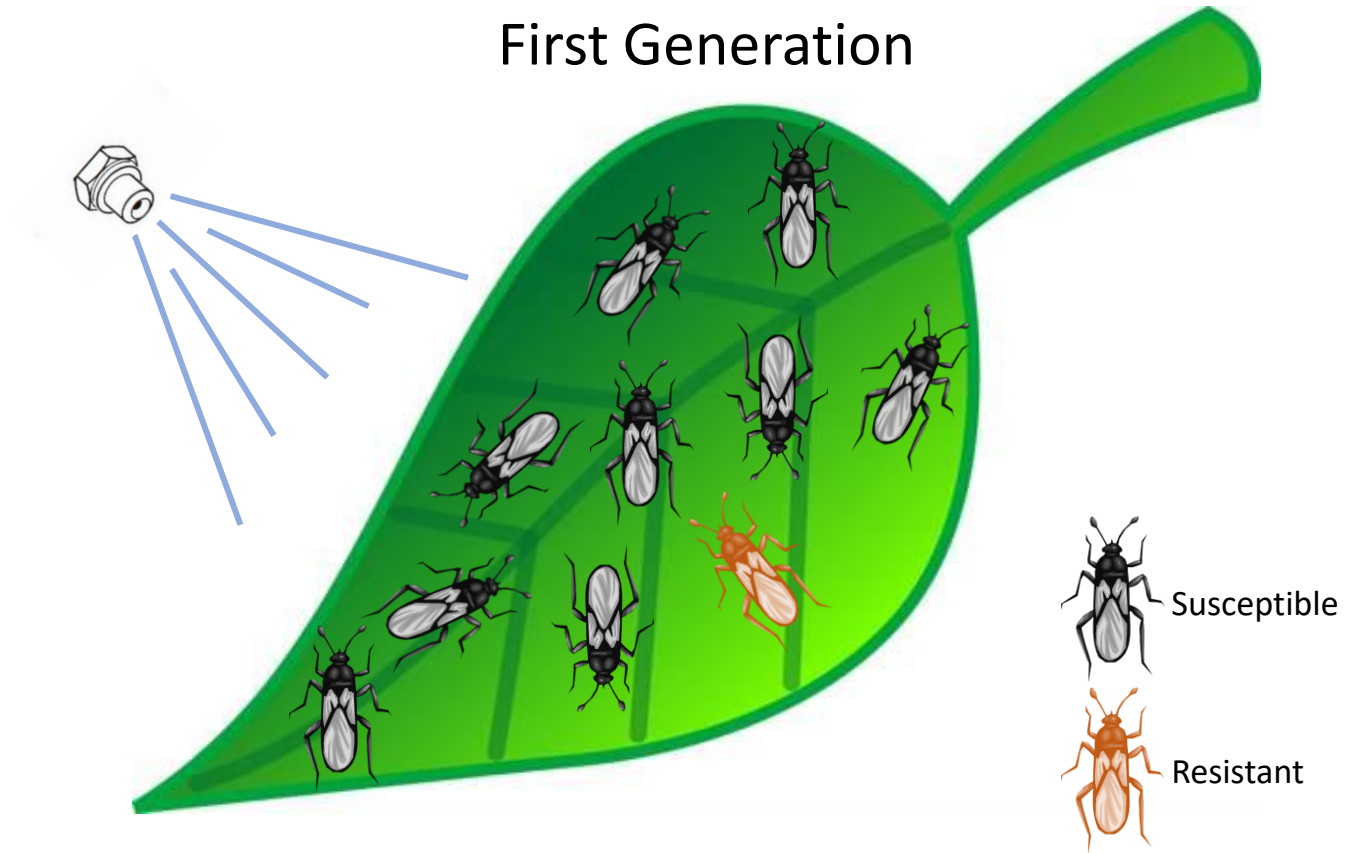
Lygus bug management

- Chemical control
 - Reduced efficacy because of Lygus resistance issues

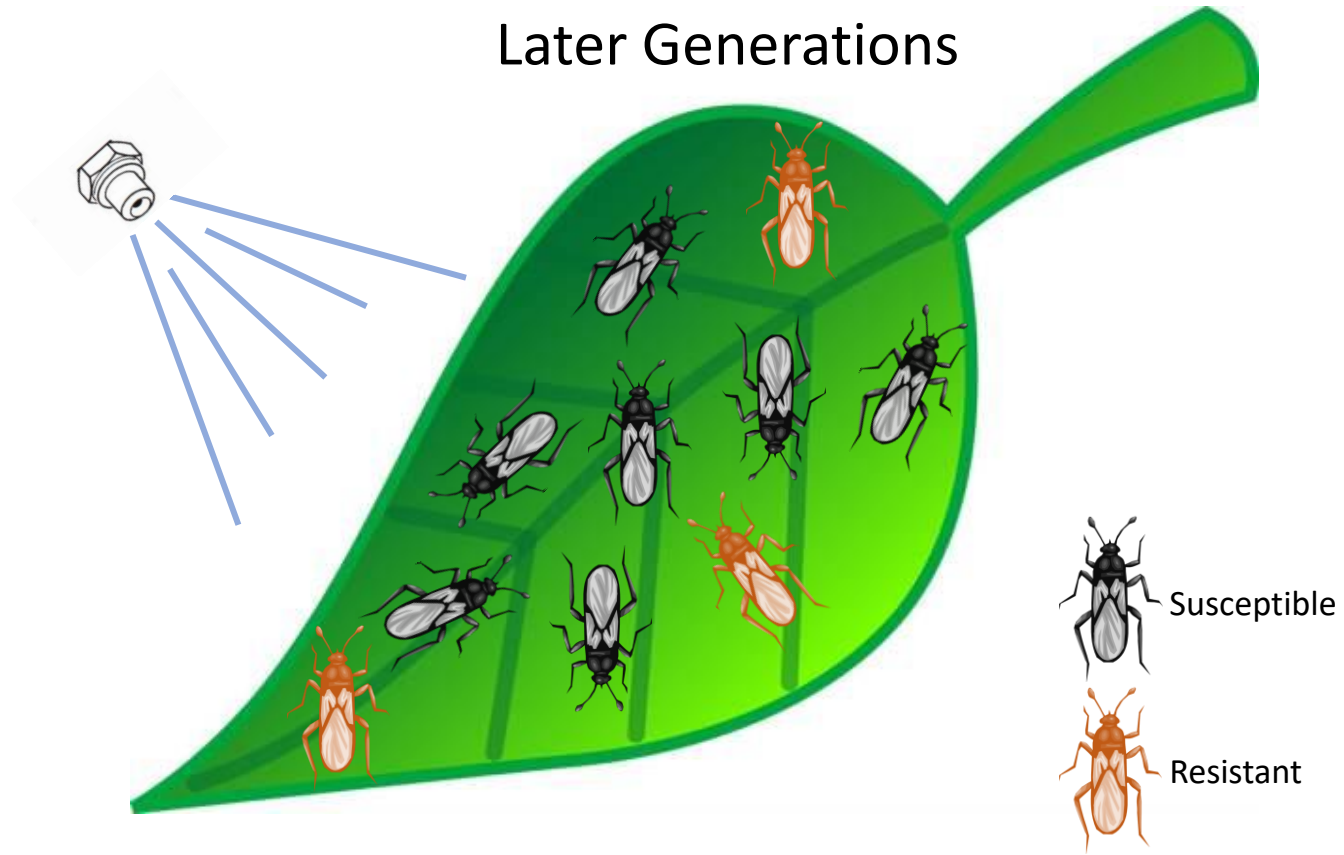
Pesticide Resistance may be defined as ‘a genetically based (heritable) decrease in susceptibility to a pesticide in a population’.



Driving Pesticide Resistance

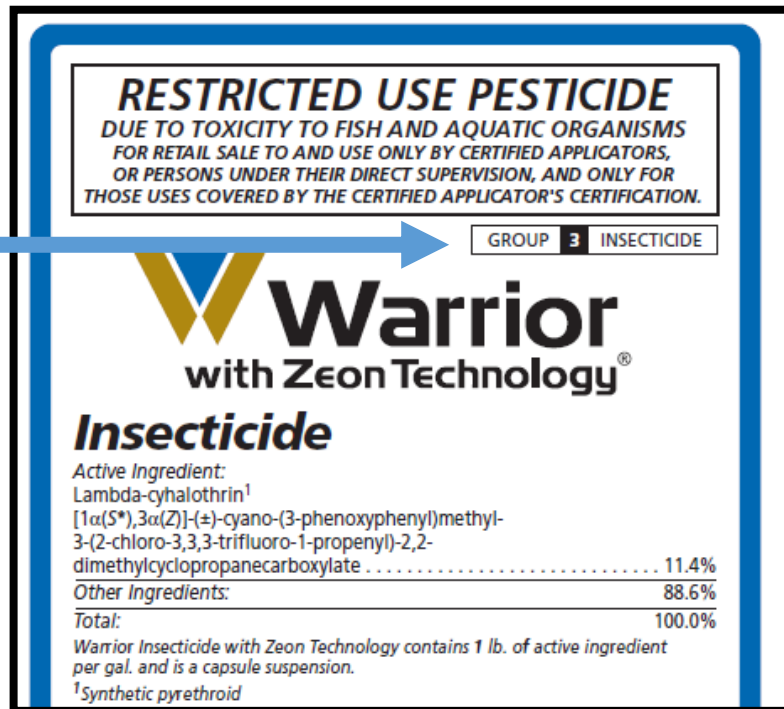


Driving Pesticide Resistance



Lygus bug management

- Chemical control
 - Reduced efficacy because of Lygus resistance issues
 - Need for chemical rotations



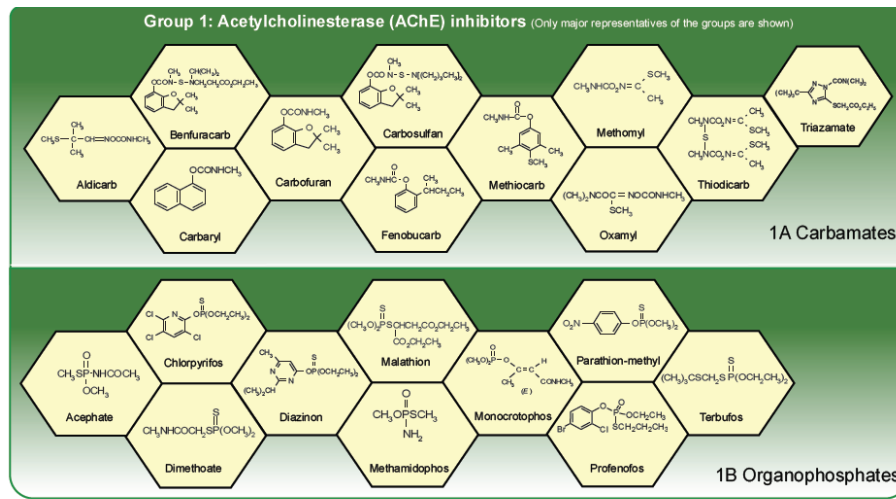
Lorsban* 750 WG Insecticide

ACTIVE CONSTITUENT: 750 g/kg CHLORPYRIFOS (an anticholinesterase compound)

GROUP **1B** INSECTICIDE

For control of certain insect pests in FRUIT and OTHER SITUATIONS as specified in the Directions
For Use Table.

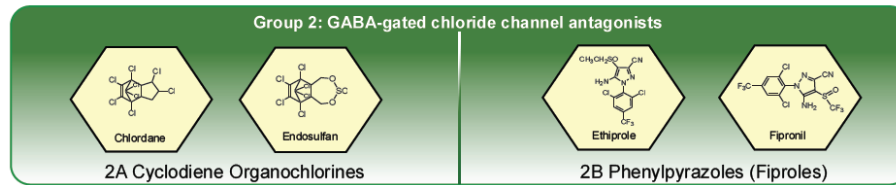
WATER SOLUBLE PACKAGING. KEEP DRY.



Group 1: Acetylcholinesterase inhibitors

1A Carbamates

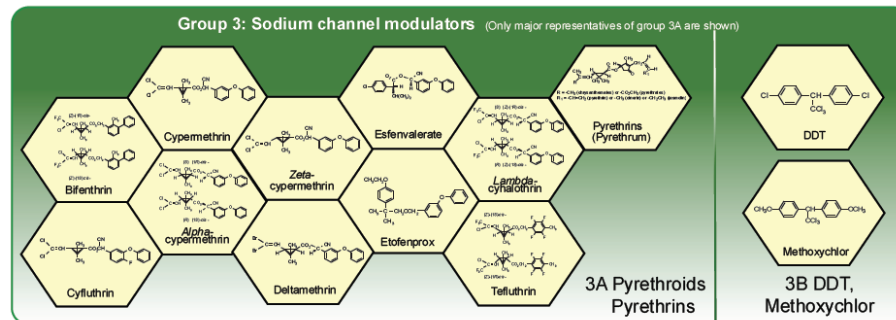
1B Organophosphates



Group 2: GABA-gated chloride channel agonists

2A Cyclodiene Organochlorines

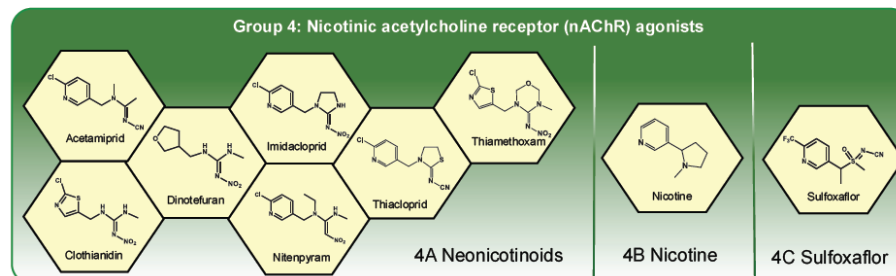
2B Phenylpyrazoles (Fiproles)



Group 3: Sodium channel modulators

3A Pyrethroids/Pyrethrins

3B DDT, Methoxychlor



Group 4: Nicotinic acetylcholine receptor agonists

4A Neonicotinoids

4B Nicotine

4C Sulfoxaflor

Lygus bug management

- Bloom period
 - Options more critical because of insecticide toxicity to pollinators and beneficials.



Lygus bug management: Trial 1

Idaho pesticide efficacy trials

Trial 1. Insecticide rotations for bloom period lygus control

- Bloom period



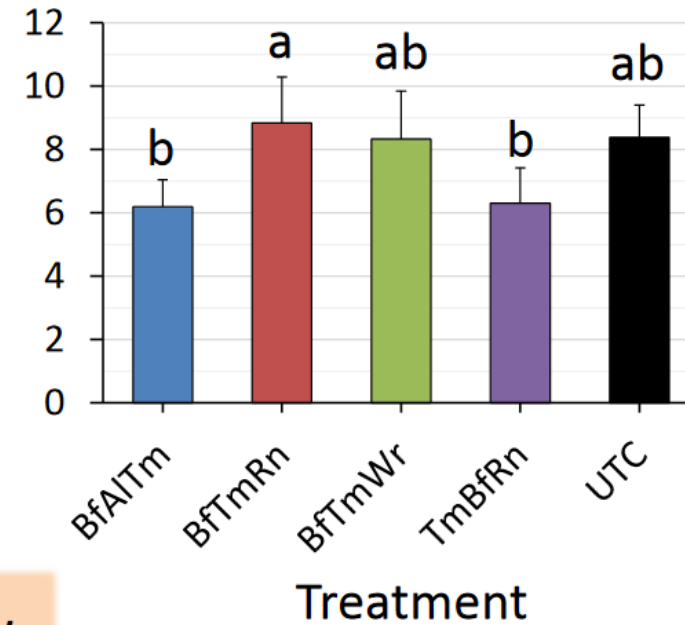
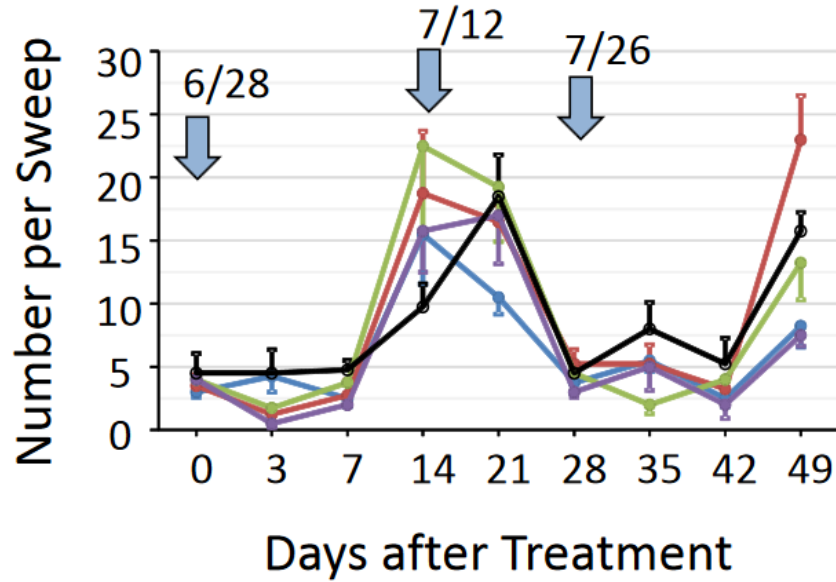
Dr. Jim Barbour
Univ. of Idaho-Parma

No.	Treatment	ai	IRAC group	Rate
1	Transform	sulfoxaflor	4C, neonicotinoid	1.5 oz
	BeLeaf	flonicamid	9C, feeding blocker	2.8 oz
	Rimon	novaluron	15, Chiton synthesis inhib.	12 oz
2	BeLeaf			2.8 oz
	Transform			1.5 oz
	Rimon			12 oz
3	Beleaf			2.8 oz
	Transform			1.5 oz
	Warrior	lambda cyhalothrin		1.9 oz
4	Beleaf			2.8 oz
	Assail	acetomiprid	4A, neonicotinoid	2.3 oz
	Transform			1.5 oz
5	UTC	n/a	n/a	n/a

Applications at 2 week intervals

Bloom-Period Insecticide Trial 1

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

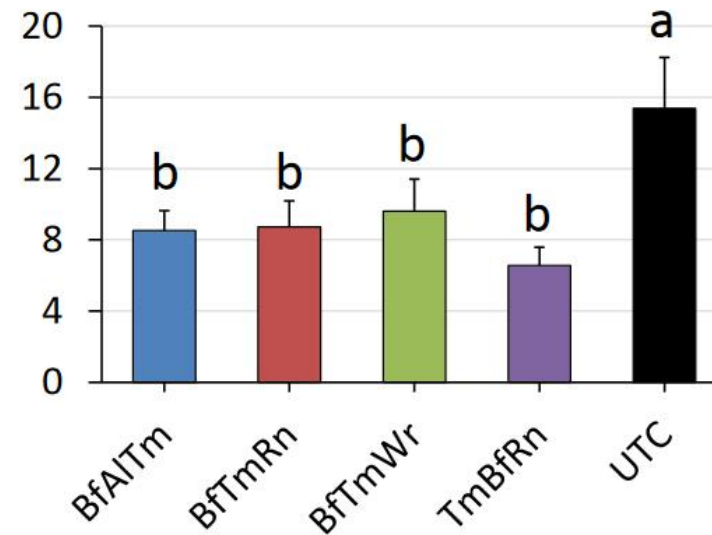
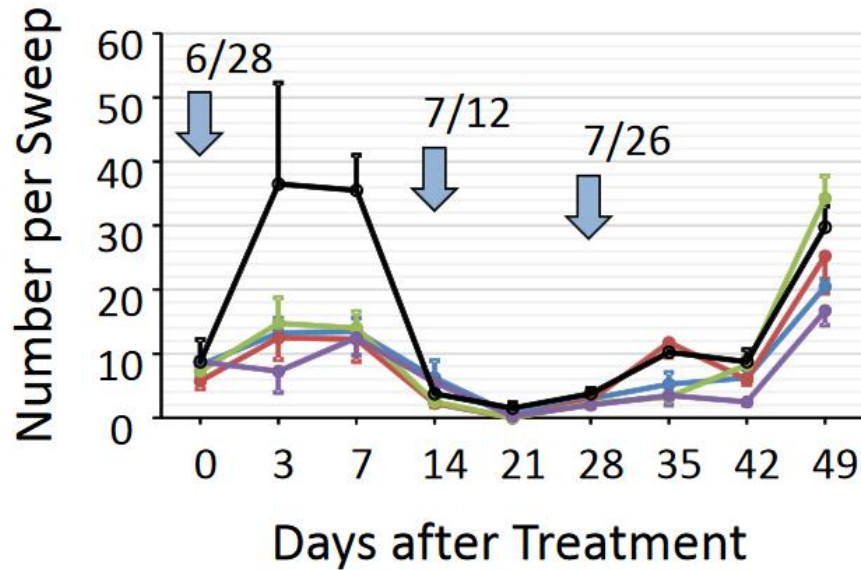


—●— Bf/Al/Tm —●— Bf/Tm/Rn —●— Bf/Tm/Wr
—●— Tm/Bf/Rn —●— UTC



Bloom-Period Insecticide Trial 1

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

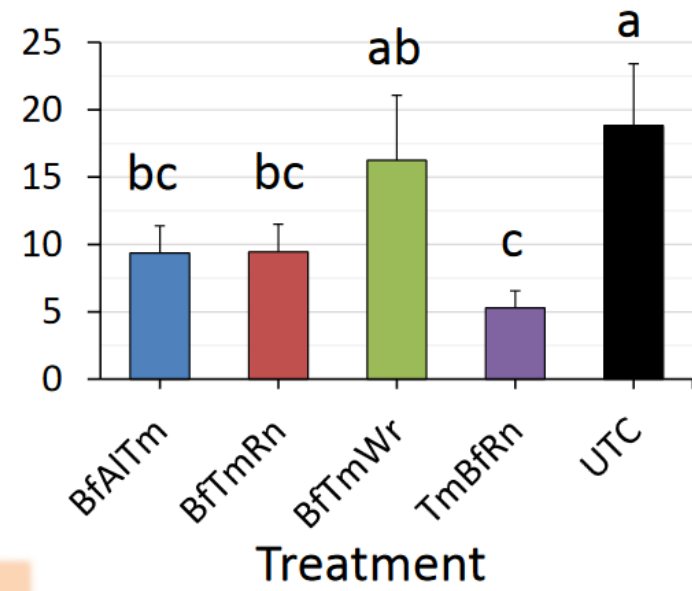
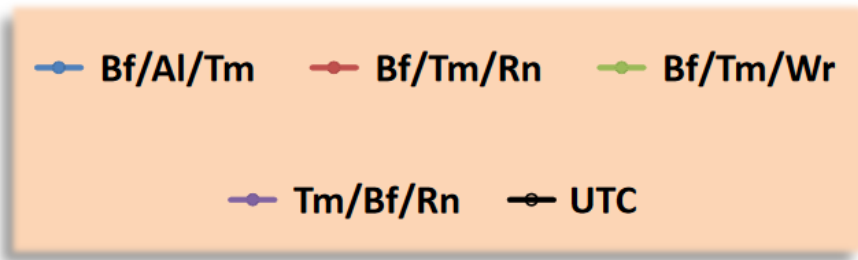
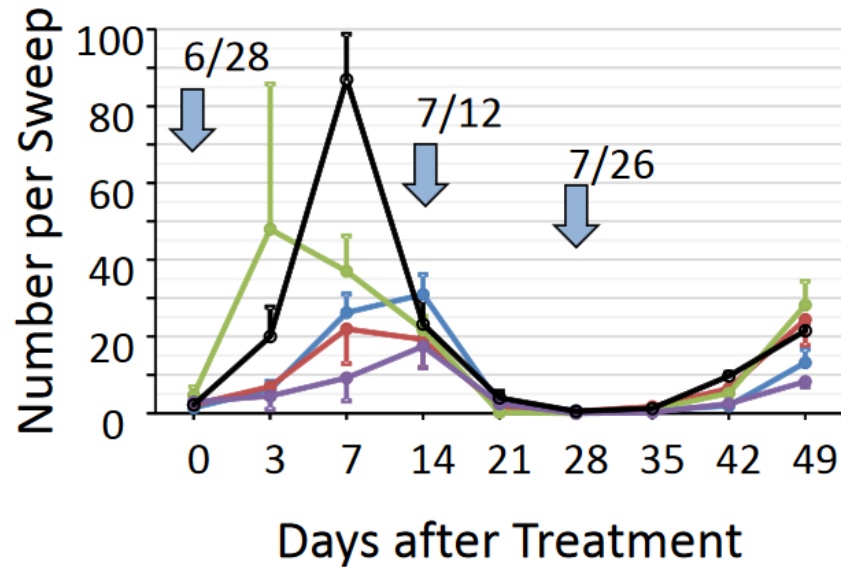


—●— Bf/Al/Tm —●— Bf/Tm/Rn —●— Bf/Tm/Wr
—●— Tm/Bf/Rn —●— UTC



Bloom-Period Insecticide Trial 1

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



Trial Highlights

- Treatments reduced small and large Lygus nymphs.
- Transform-BeLeaf-Rimon provided best suppression
- BeLeaf-Transform-Warrior rotation least suppression
- No major impact on Lygus predators from any rotation treatment

Lygus bug management: Trial 2

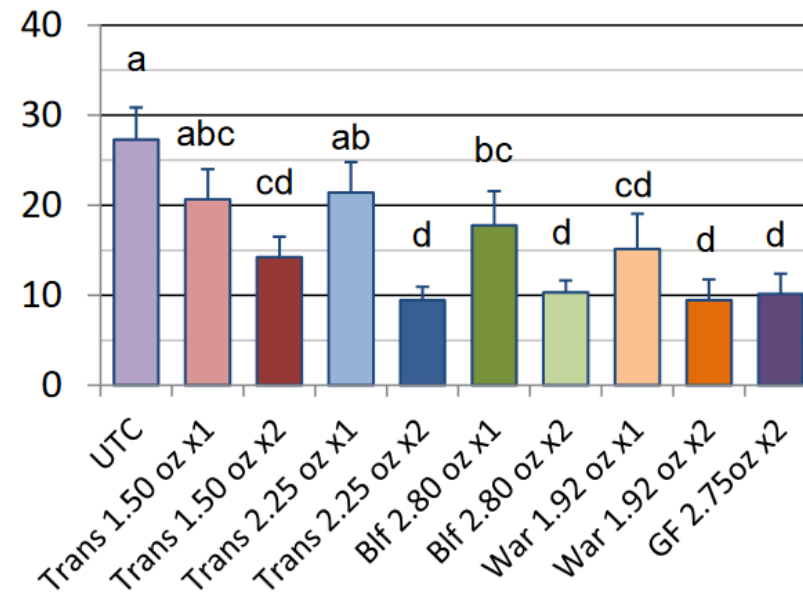
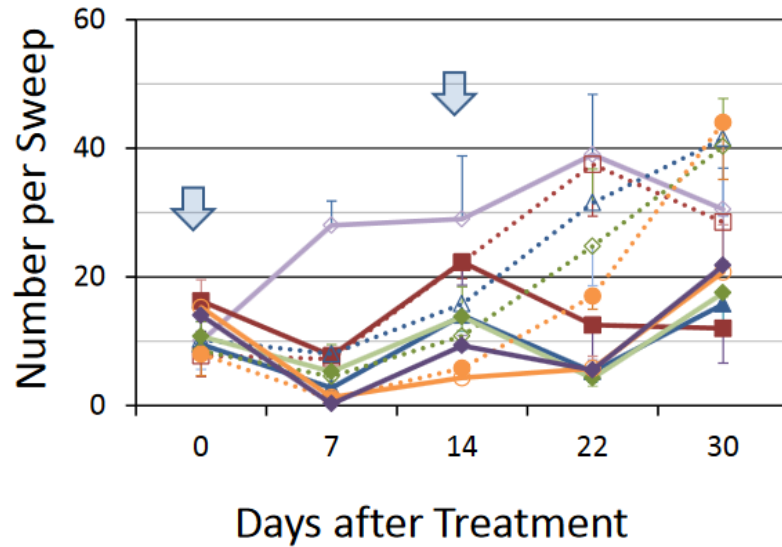
Idaho lygus pesticide trial

Pesticide treatments

Pesticide	No. Applications	Rate (oz/acre)	Class/IRAC group	Manufacturer
Transform WG	1	1.50	Sulfoxamine/ 4C	Dow
	1	2.25		
	2	1.50		
	2	2.25		
Beleaf 50 SG	1	2.80	Carboxamide/ 9C	FMC
	2			
Warrior II	1	1.92	Pyrethroid/ 3A	Syngenta
	2			
GF 2628	2	2.75	Not specified	Dow
UTC	n/a	n/a	n/a	n/a

Idaho efficacy trial results

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



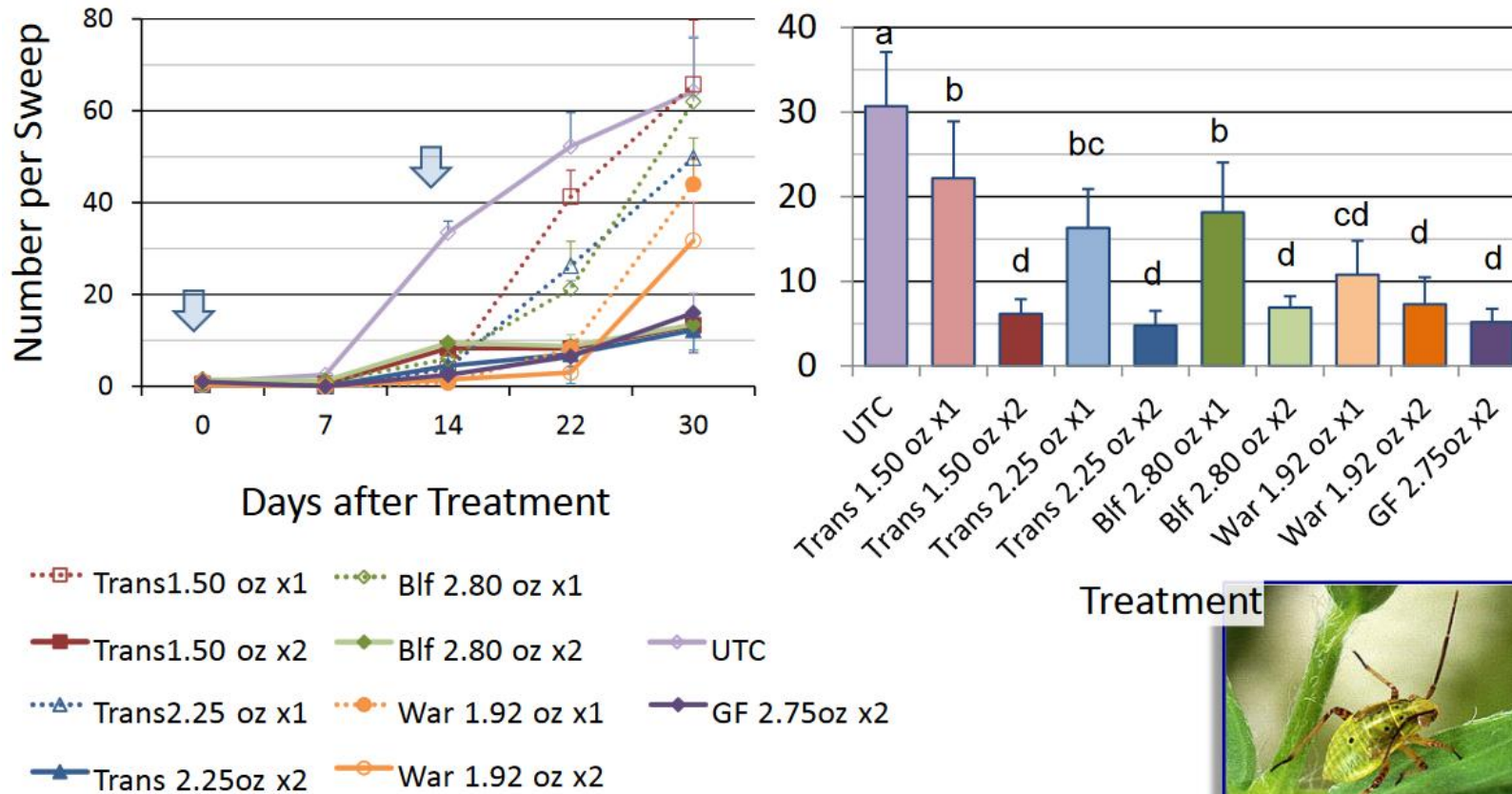
- Trans1.50 oz x1
- Trans1.50 oz x2
- Trans2.25 oz x1
- Trans 2.25oz x2
- Blf 2.80 oz x1
- Blf 2.80 oz x2
- War 1.92 oz x1
- War 1.92 oz x2
- UTC
- GF 2.75oz x2

Treatment



Idaho efficacy trial results

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



Trial Highlights

- Treatments reduced small and large Lygus nymphs.
- 2 applications better than 1 for both low and high rates.
- Transform (2 applications) provided equal or better suppression than 2 applications of BeLeaf or Warrior.

Trial Highlights: Beneficials

- Transform (1 application) did not reduce predator numbers.
- BeLeaf treatments (1 or 2 applications) did not reduce predator numbers.
- Two applications of all other insecticides reduced predator numbers.
- Transform at 2.25 oz/acre likely could be applied late evenings, or early mornings without a significant hazard to adult ALCB.



Availability of management

- Transform approved in 2013.
- Sulfoxamine insecticide (IRAC group 4C)
- Acts on nicotinic acetylcholine receptors
- Systemically active
- Good activity on sap feeding insects
- Lower activity on most predators and pollinators.



Availability of management



- Transform approved in 2013.
- Transform revoked in 2015.
- Transform emergency use approval denied in 2016 because No data showing that:
 - Lygus pressure has increased.
 - Available products are not effective.
 - Economic losses on alfalfa seed yield increased dramatically as a result of Lygus pressure.

Lygus management research

- USDA-NIFA-Alfalfa Forage and Research Program Grant
 - Developing an attractant for Lygus derived from host plant volatile compounds.



Zain Syed
Univ. of Kentucky

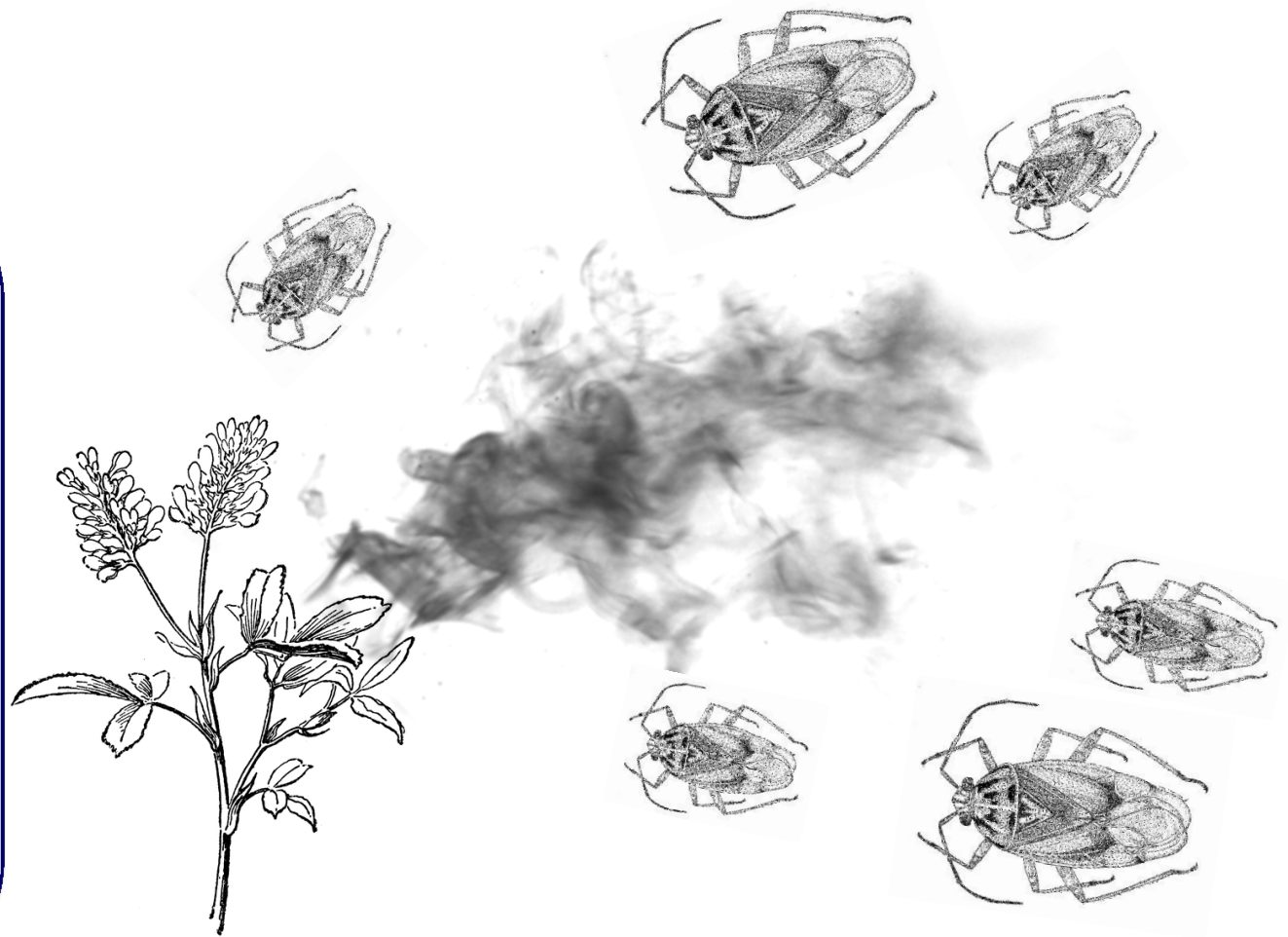
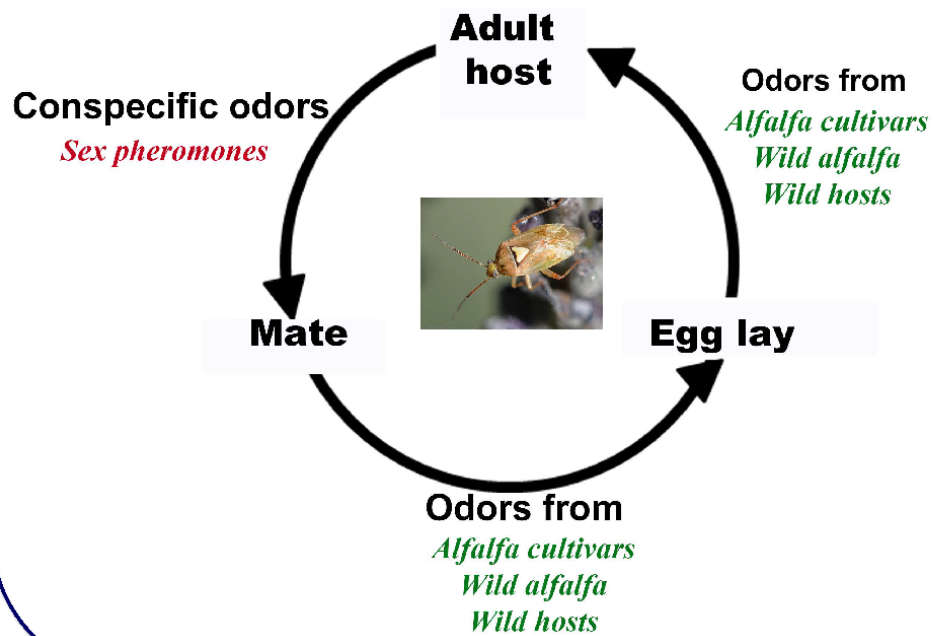


Johanna Brunet
USDA-ARS/Univ. of Wisconsin



Ricardo Ramirez
Utah State Univ.

Chemical ecology of the bug



Lygus host plants



Goosefoot



Shepherd's purse



Yellow sweet clover

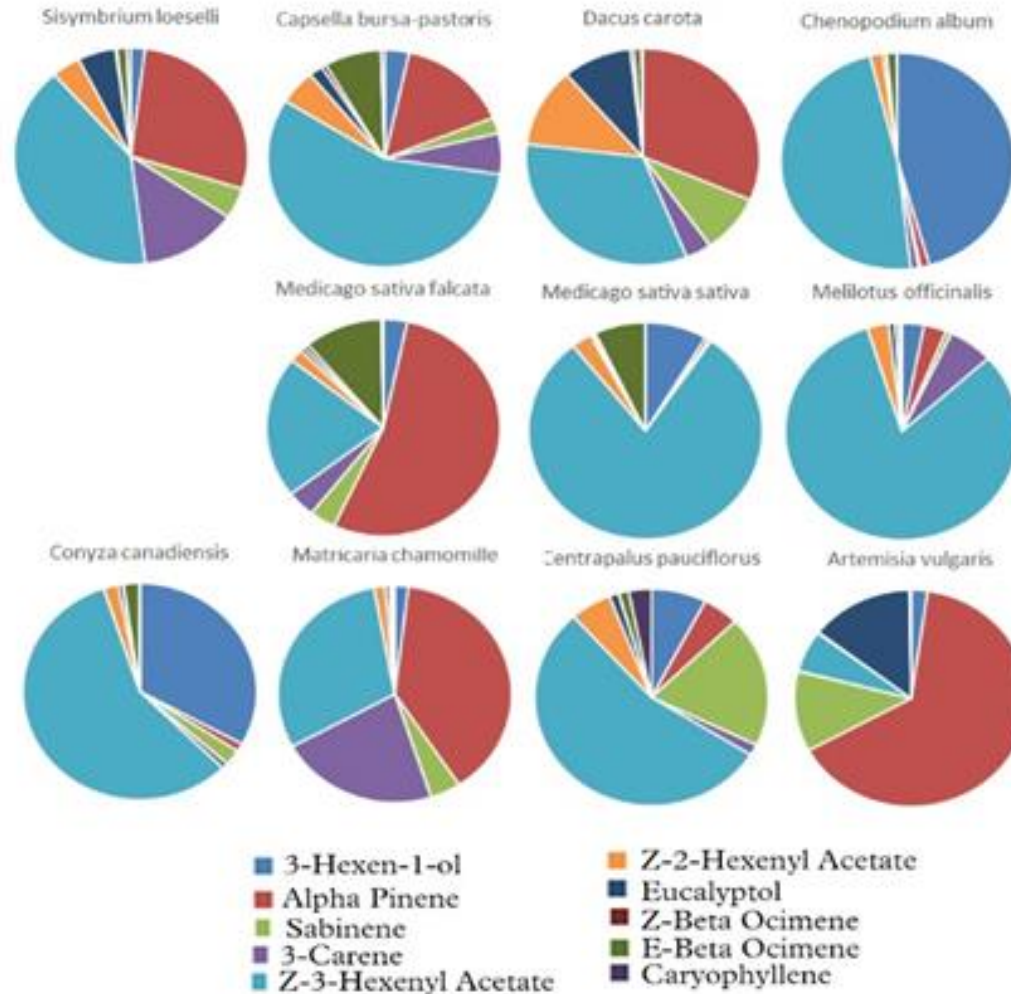


Queen Anne's lace (wild carrot)



Horseweed

What plant smells are out there?



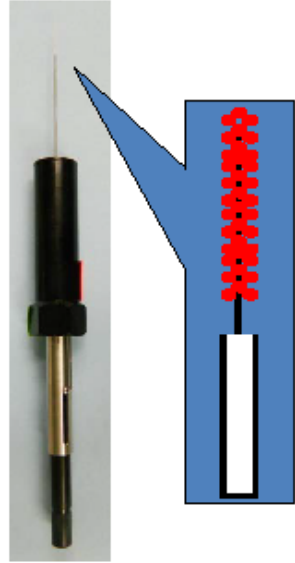
Identifying the attractant (=bait)

Signals
What they smell?

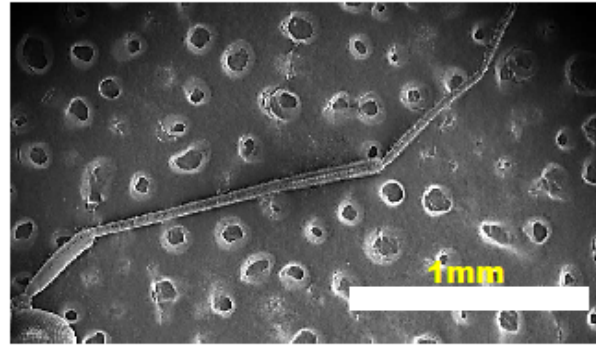


Reception
How they smell?

Plant Chemistry



Ultrastructural Studies of the olfactory organs



Visit utahpests.usu.edu

USU Links >> USU Home A-Z Index calendars MyUSU directory contact

UtahStateUniversity
COOPERATIVE EXTENSION

UTAH PESTS

UTAH PESTS Home Utah Plant Pest Diagnostic Lab Integrated Pest Management Bees CAPS Plant Diseases

Google™ Search

Home
Fact Sheets
Frequently Asked Questions
Image Galleries
Slideshows
Video Fact Sheets
Utah Pests News
Quarterly Newsletter
Contact Us

UTAH PESTS[®] is a group of Extension entomologists and plant pathologists that helps to solve the thousands of plant pest issues that concern Utah citizens every day. The UPDDL identifies, the IPM Program educates, and the CAPS Program investigates. Open one of the websites to get answers!

Utah Plant Pest Diagnostic Lab
Just \$7 gets your pest problem diagnosed or insect identified.

Integrated Pest Management
Your source for fruit, vegetable, and landscape pest problems.

Bees
Honey bees aren't the only bees that pollinate plants in Utah.

Cooperative Agriculture Pest Survey
CAPS protects Utah agriculture through statewide monitoring of invasive pests.

Utah State University is an affirmative action/equal opportunity institution. © 2011 Utah State University Utah Pests



UTAH PESTS fact sheet UtahState UNIVERSITY extension

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-108-07 July 2007

Aphids in alfalfa

Erin W. Hodgson
Extension Entomology Specialist

What You Should Know

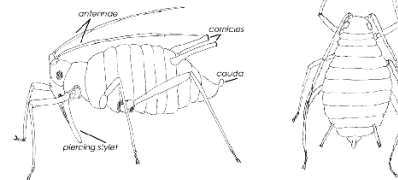
- Aphids are soft-bodied insects that remove plant sap from stems and leaves.
- Heavy infestations can reduce plant vigor, and cause leaves to wilt, curl or become distorted.
- Some aphids can vector disease or plant toxins while feeding, and cause plants to decrease in productivity.
- Aphid-resistant cultivars and natural enemies can help reduce the negative effects of aphids in alfalfa.

Plant Damage

Aphids have piercing sucking mouthparts and remove phloem or plant sap juices with a flexible stylet (Fig. 1). Wingless aphids are not very mobile insects, and tend to stay on one plant. As a result, some plants can become heavily infested as the colony grows over time. Winged aphids locate potential hosts by using visual cues, and will often quickly probe plant tissue before settling to feed. As aphids pierce plant tissue, the stylets pick up small virus particles. Aphids can then vector, or transmit, plant diseases persistently or non-persistently.

Persistently transmitted viruses are incorporated into the salivary glands and can be passed on for the life of the aphid. Non-persistent diseases, sometimes called "dirty needle diseases," are only passed on to the next plant while probing. Alfalfa plants with a large colony of aphids will often look chlorotic or wilted. Sometimes, infested plants will die or become severely stunted. Aphids that vector disease become economically important in agriculture and horticulture because they can significantly reduce quality and yield.

Aphids belong in the order Hemiptera and family Aphididae. Aphids are common insects in leafy and forage crops, with at least six kinds in Utah alfalfa (Table 1). Aphids can be distinguished from other insects in alfalfa with a hand lens. In general, aphids are soft-bodied and pear-shaped, with adults ranging from 1/16 - 1/4" in length. Adults have a pair of long antennae, a pair of cornicles (that resemble tailpipes) towards the end of the abdomen and a cauda at the tip of the abdomen (Fig. 1). The antennae aid in finding suitable host plants and the cornicles release alarm pheromones to alert the colony of predators.



(right) of a general aphid body, showing characteristic features.¹ page 1

BY ERICA STEPHENS AND RICARDO RAMIREZ

EXTENSION UtahStateUniversity

BENEFICIAL AND PEST INSECTS OF UTAH ALFALFA

UTAH PESTS fact sheet UtahState UNIVERSITY extension

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-110-07 September 2007

Lygus bug in alfalfa seed

Erin W. Hodgson
Extension Entomology Specialist

Mike Pace
Box Elder County Extension

What You Should Know

- Lygus bug is the primary pest of alfalfa grown for seed in Utah. When in high numbers, lygus bug can prevent seed production or severely reduce yield potential.
- Early scouting can help make management decisions.
- Lygus bug management often overlaps with flower pollination, and so products should be carefully applied to avoid bee kill.



Fig. 2. Lygus bug nymph.¹

Lygus bug, *Lygus lineolaris*, is a true plant bug in the family Miridae (Fig. 1). Sometimes this insect is also called tarnished plant bug. Lygus bug is native to North America and is distributed throughout Mexico, United States and Canada. Western tarnished plant bug, *L. hesperus*, is closely related to the Lygus bug and has overlapping distributions in the western United States. Lygus bug has a wide host range of more than 300 plants and is considered damaging wherever it occurs. In general, lygus bug prefers crops, vegetables, and weeds near crops. In Utah, lygus bug is considered the main pest of alfalfa seed production. Heavy feeding on all the growing points (e.g., buds, flower, post) can severely reduce seed yield potential.



Fig. 1. Adult lygus bug or tarnished plant bug.¹

Description and life cycle

There are 5-6 generations of lygus bug in Utah. As with all true bugs, lygus bug nymphs and adults have piercing sucking mouthparts. Adults seek shelter in the fall to overwinter and become active again in early spring.

Egg: Lygus bug eggs are whitish, slightly curved, and about 1.7 mm long and 0.5 mm wide. Eggs are individually inserted into plant tissue or at the base of leaf blades. The top of the egg is flattened and is where the hatching nymph escapes. Eggs incubate for 4-14 days depending on temperature.

Nymph: Lygus bugs go through five instars before becoming adults. Young nymphs are greenish with red antennae, and can be misidentified as aphids (Fig. 2). As the nymphs mature, they develop four wing pads and five black spots on the thorax and abdomen. Total development time for all five instars ranges from 15-30 days.

Adult: Fully developed adults reach 4-6 mm in length, have dark, slender antennae and obvious eyes (Fig. 1). Body coloration is variable, but in general is pale green or yellow with brown or black markings on the legs, wings and head. Overwintering adults are darker than spring adults. Adults readily move from plants if disturbed.