Bloom Period Management of Lygus Bug in Alfalfa Seed

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Bloom period management of Lygus

Lygus is effectively managed only with insecticides

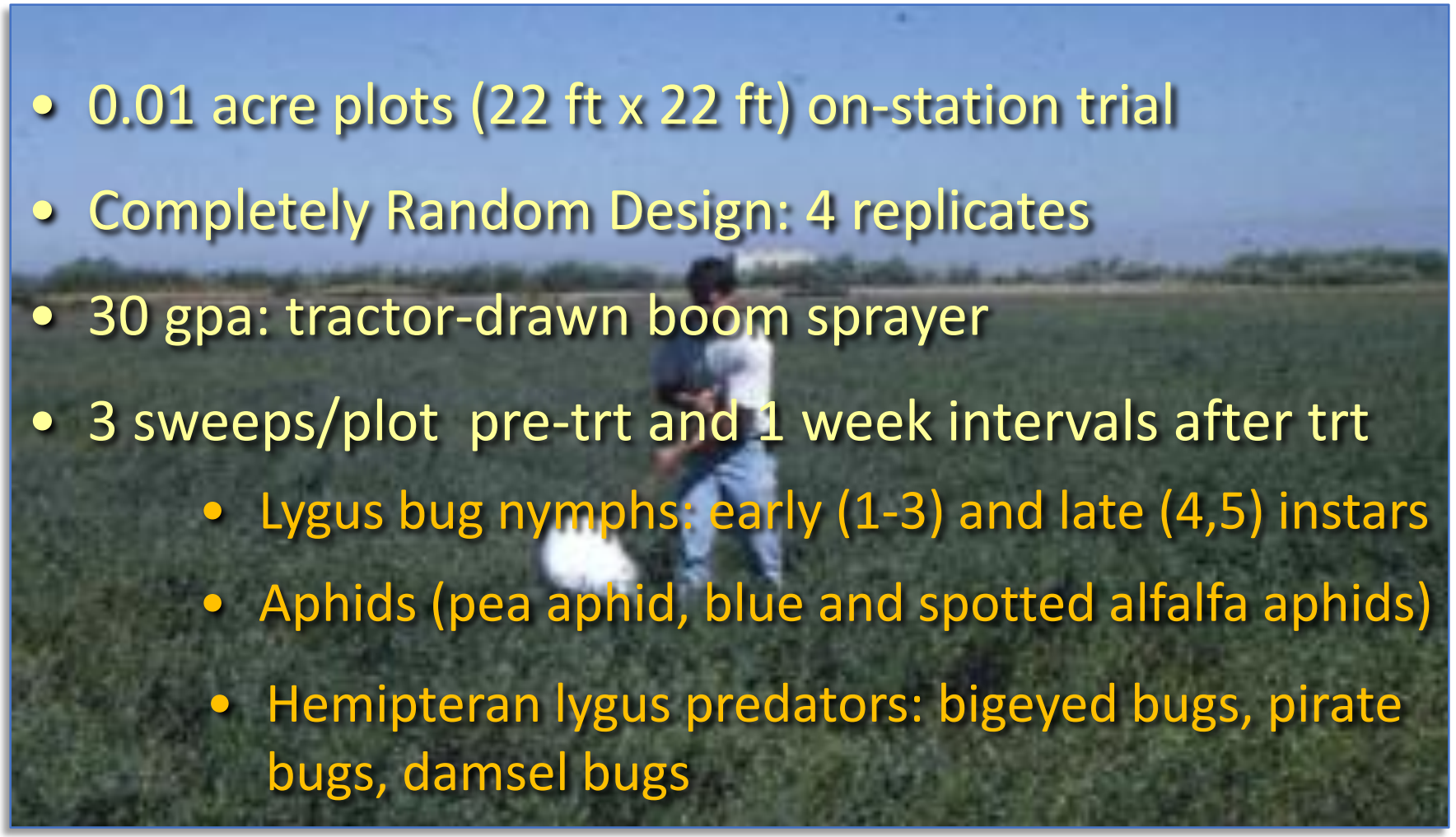
- Insecticides labeled for lygus control include:
  - Broad spectrum OP's, carbamates, pyrethroids
    - Useful for pre-bloom and post-bloom clean-up
  - Several lower-risk insecticides available
    - Useful especially during bloom
      - Efficacy and resistance management issues
      - Toxicity to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

Treatment list for 2017 Lygus efficacy trial

No.	Trade Name	Common name	Rate (oz./ acre	IRAC resistance group
1	UTC	-	-	-
2	Transform (GF-2372	sulfoxaflor	1.50	4C
3	Transform (GF-2372	sulfoxaflor	2.25	4C
4	BeLeaf 50 SG	flonicamid	2.80	9C/ 29
5	Venerate XC	*Burkholderia* A396	32.0	NK
6	Azera	Azadirachtin/ pyrethrins	48.0	NK/ 3A

Efficacy of Transform, Venerate and Azera against Lygus, 2017

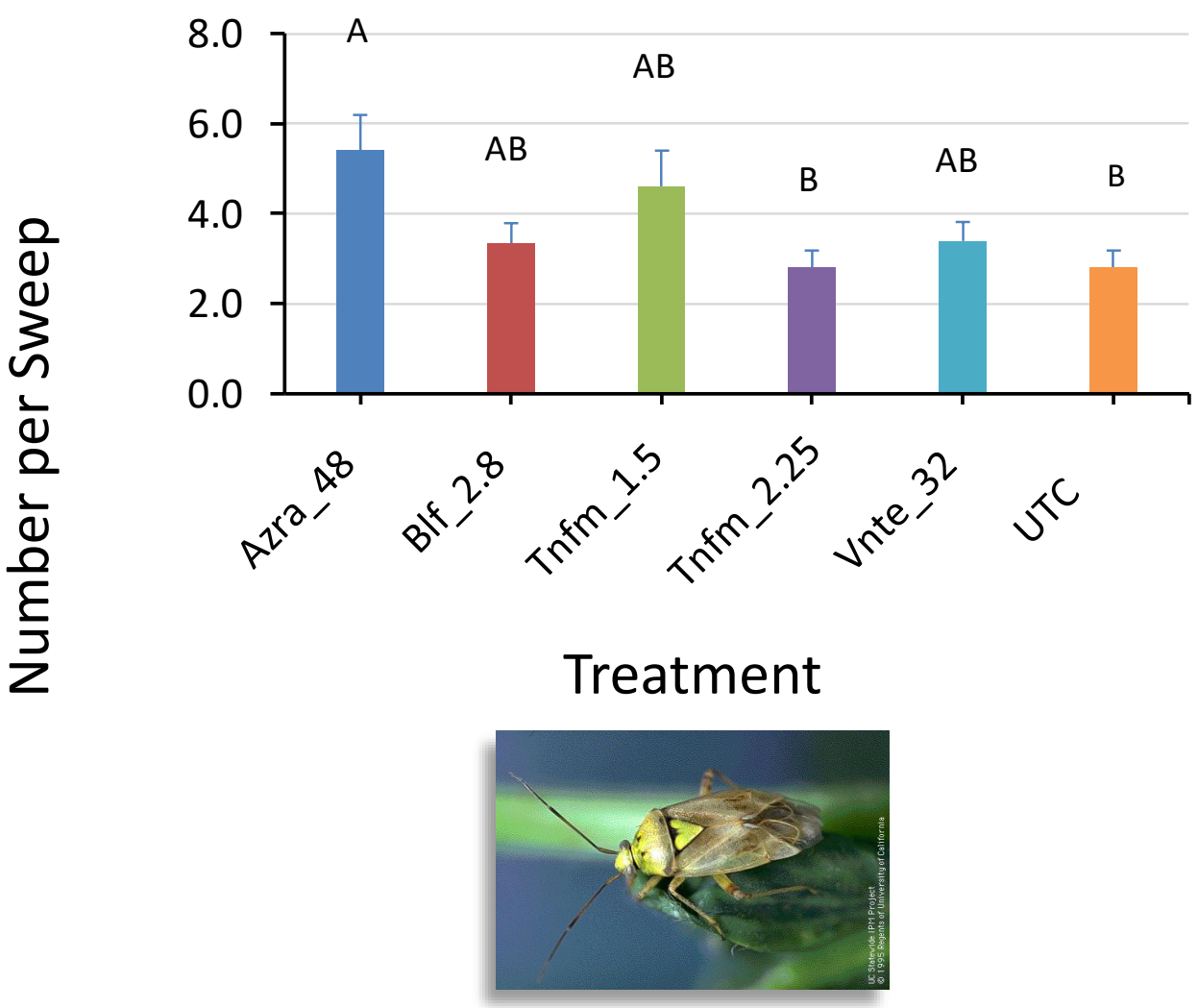
Pesticide trial methods

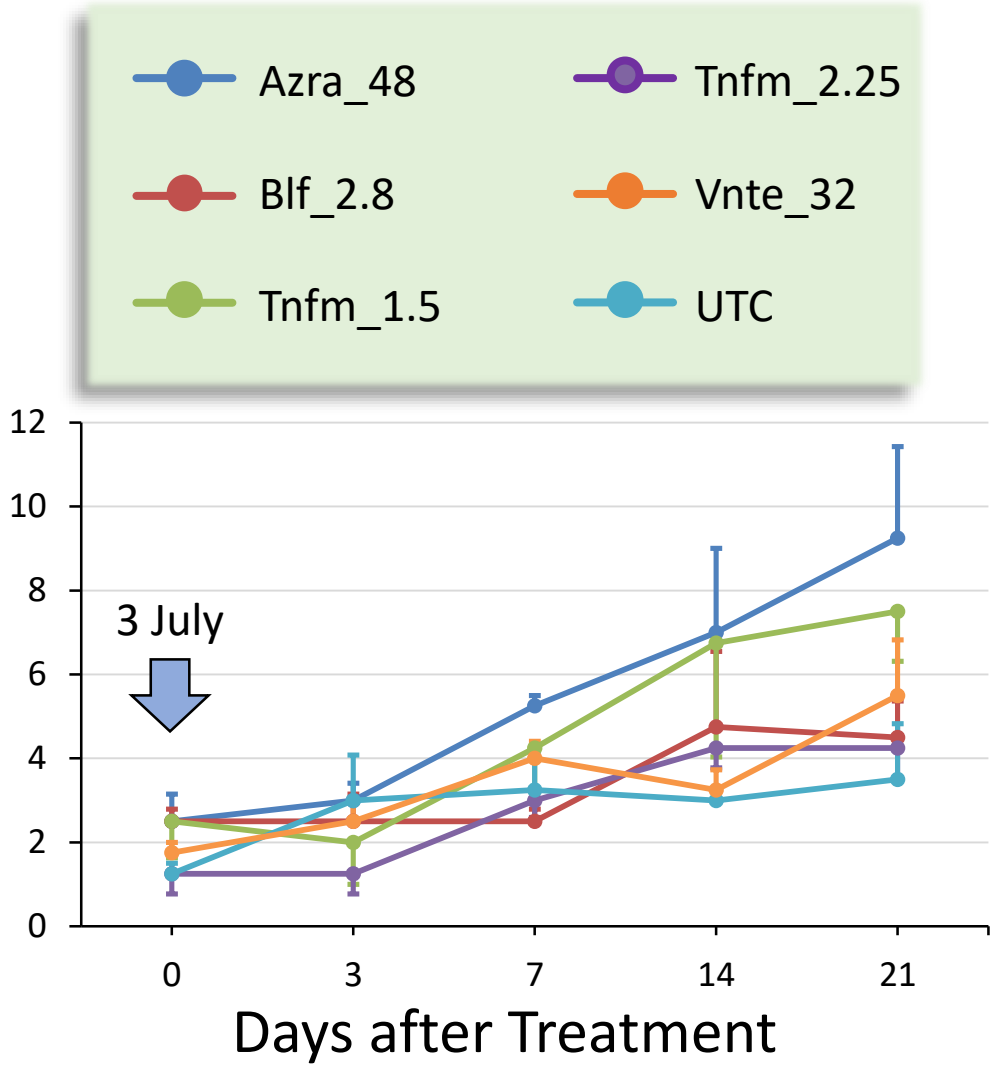


- 0.01 acre plots (22 ft x 22 ft) on-station trial
- Completely Random Design: 4 replicates
- 30 gpa: tractor-drawn boom sprayer
- 3 sweeps/plot pre-trt and 1 week intervals after trt
  - Lygus bug nymphs: early (1-3) and late (4,5) instars
  - Aphids (pea aphid, blue and spotted alfalfa aphids)
  -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

2017 Lygus efficacy trial

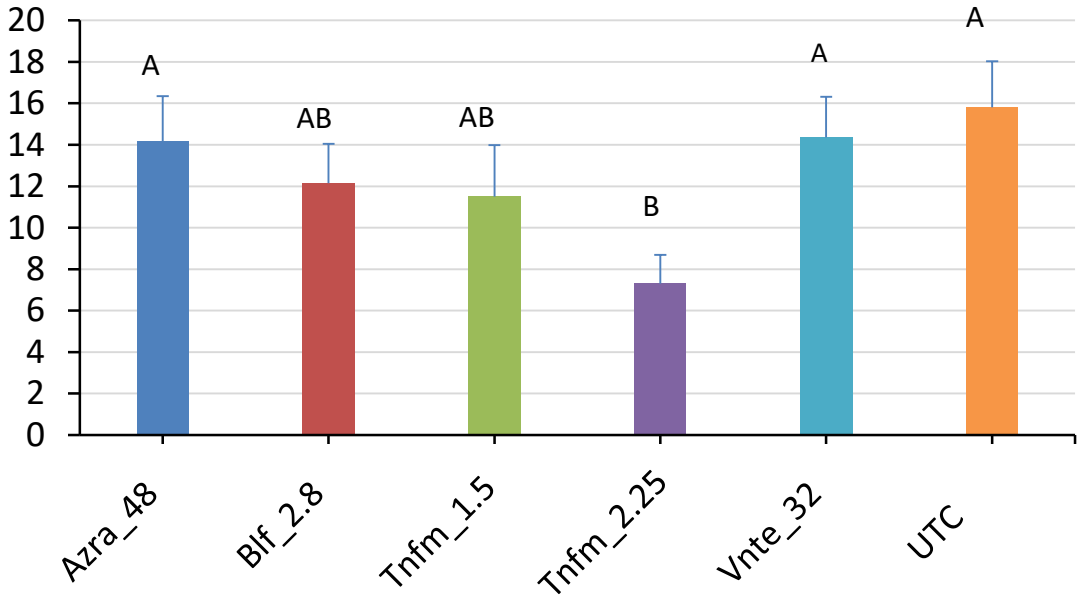
Mean number of Adult *Lygus* on each sample day and over all sample days on treated and untreated plots

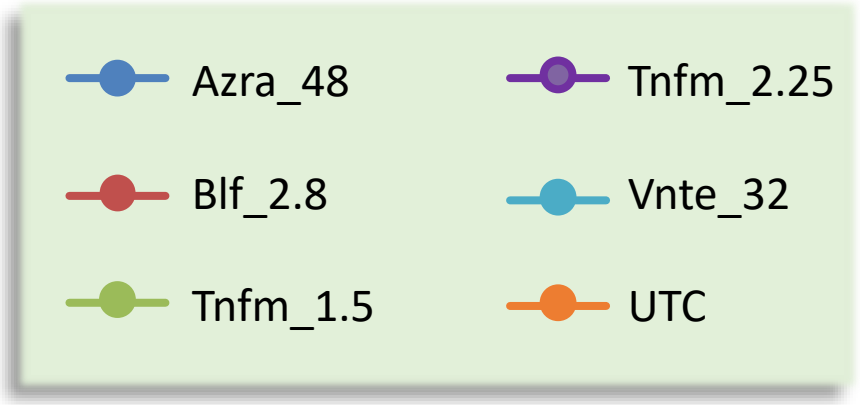


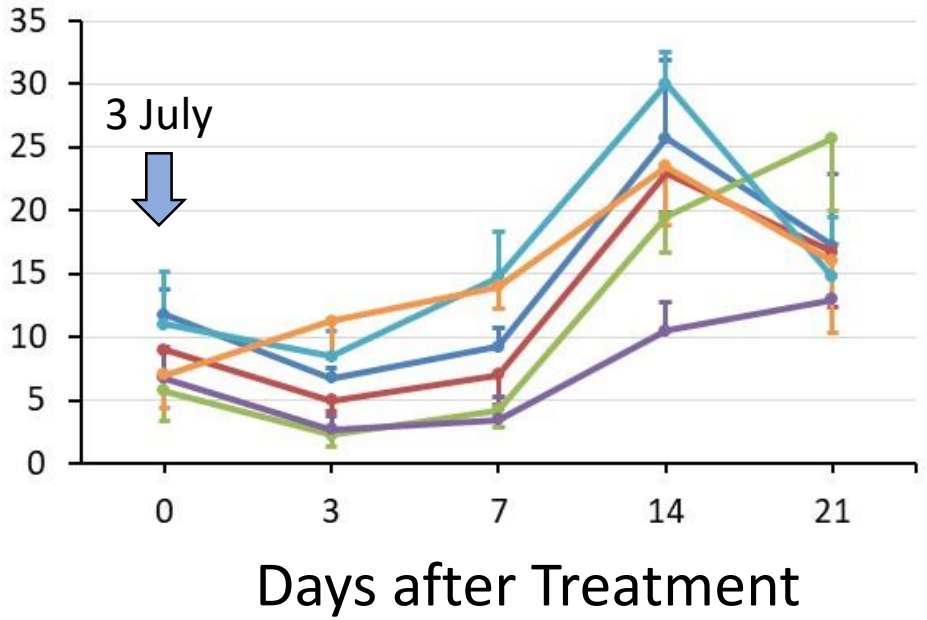


2017 Lygus efficacy trial

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

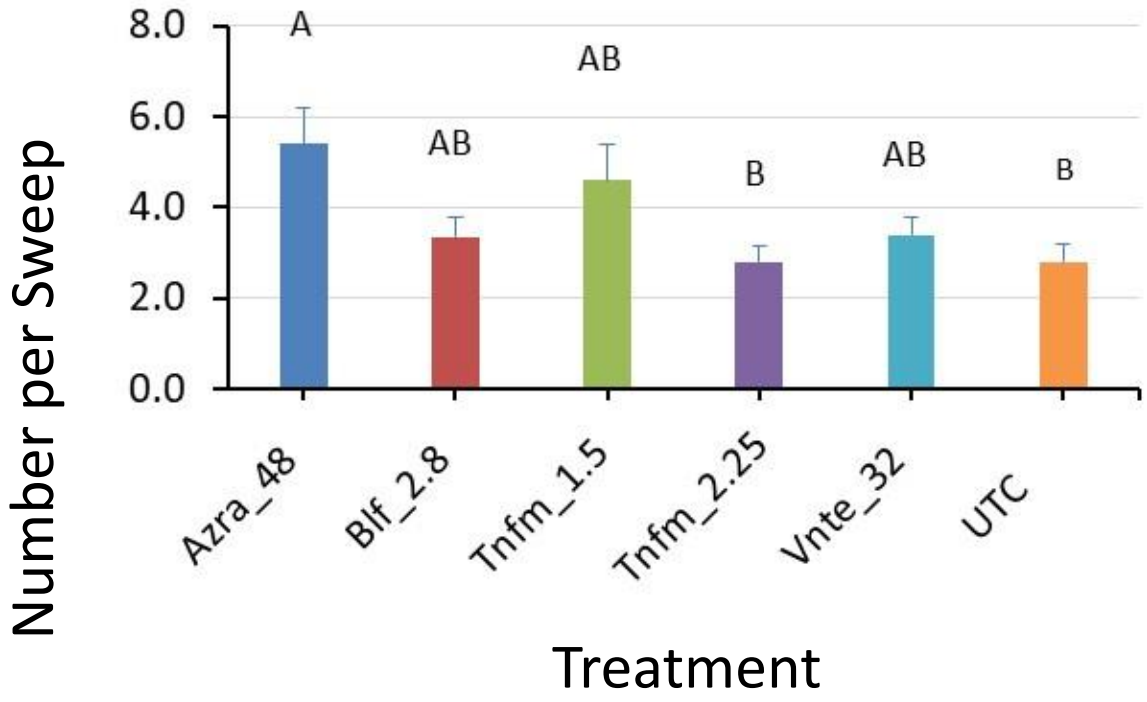


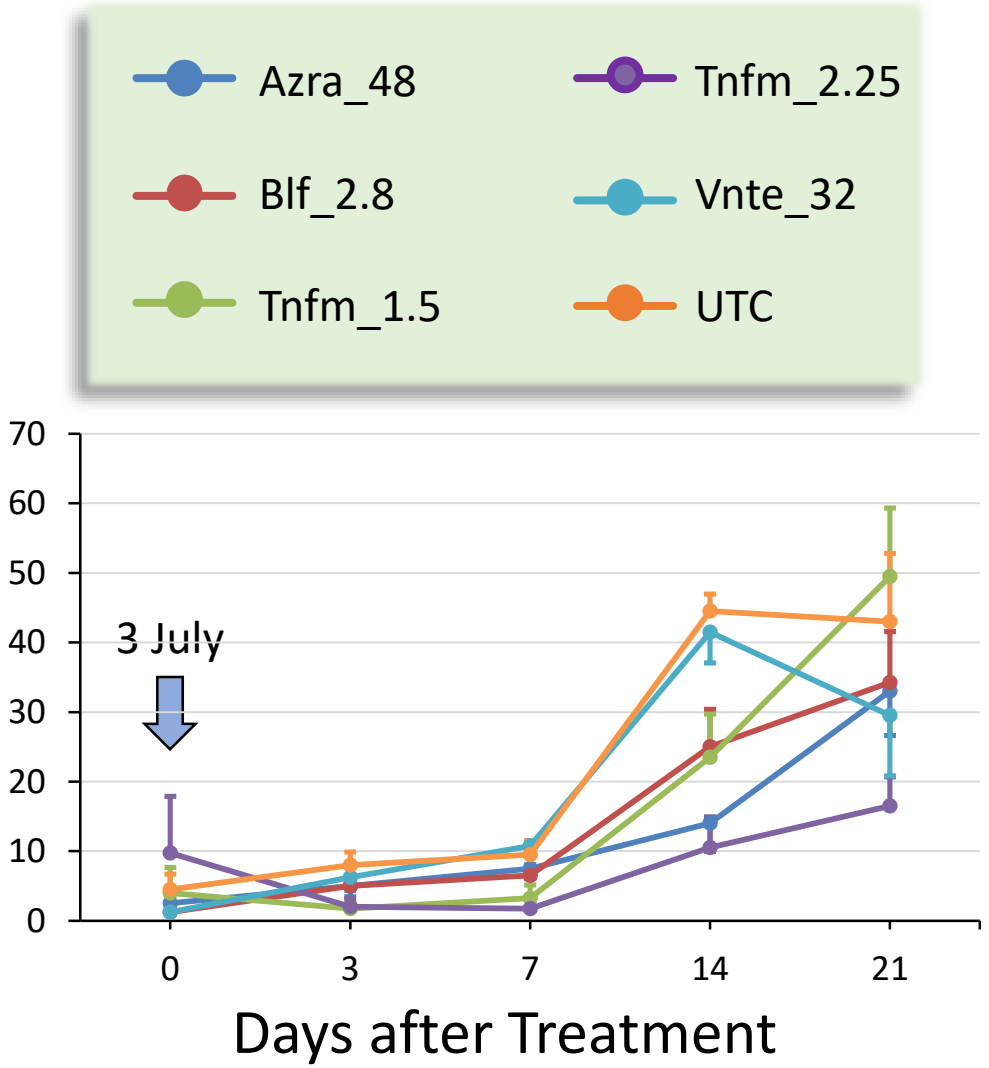




2017 Lygus efficacy trial

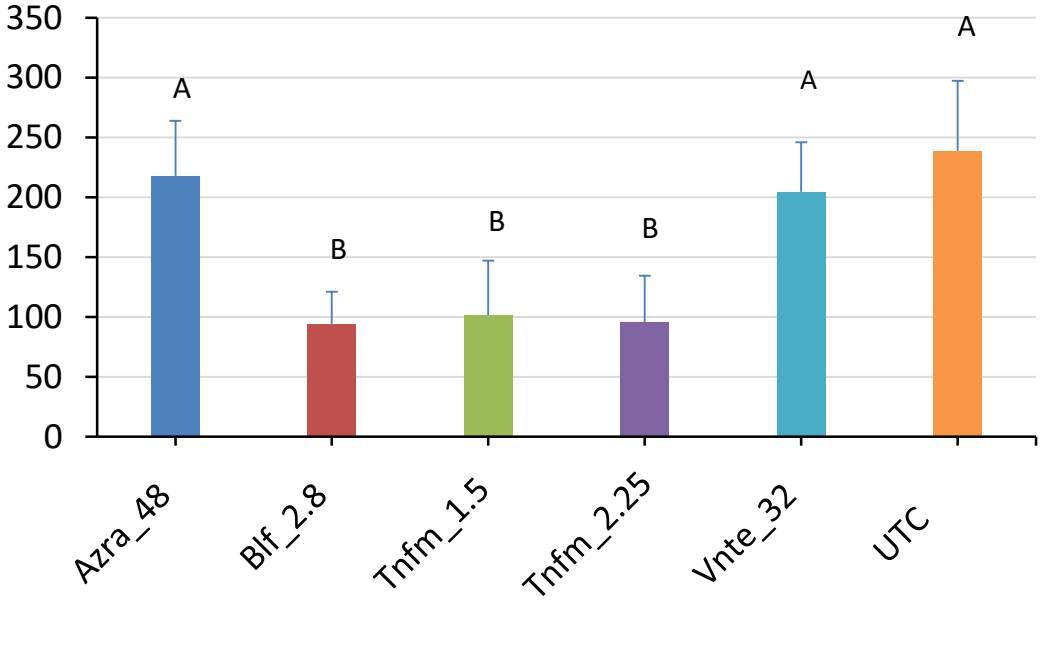
Mean number of large *Lygus* nymphs on each sample day and over all sample days on treated and untreated plots

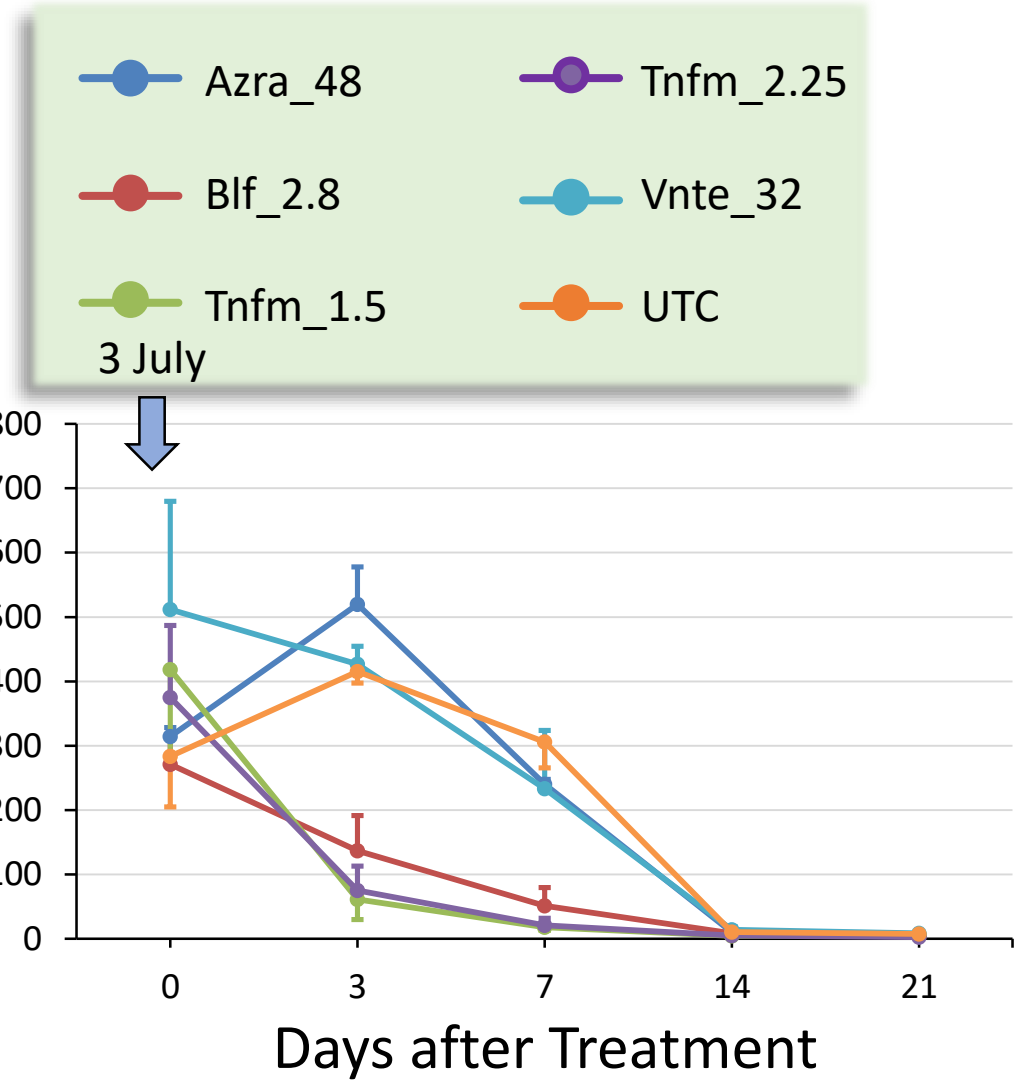




2017 Lygus efficacy trial

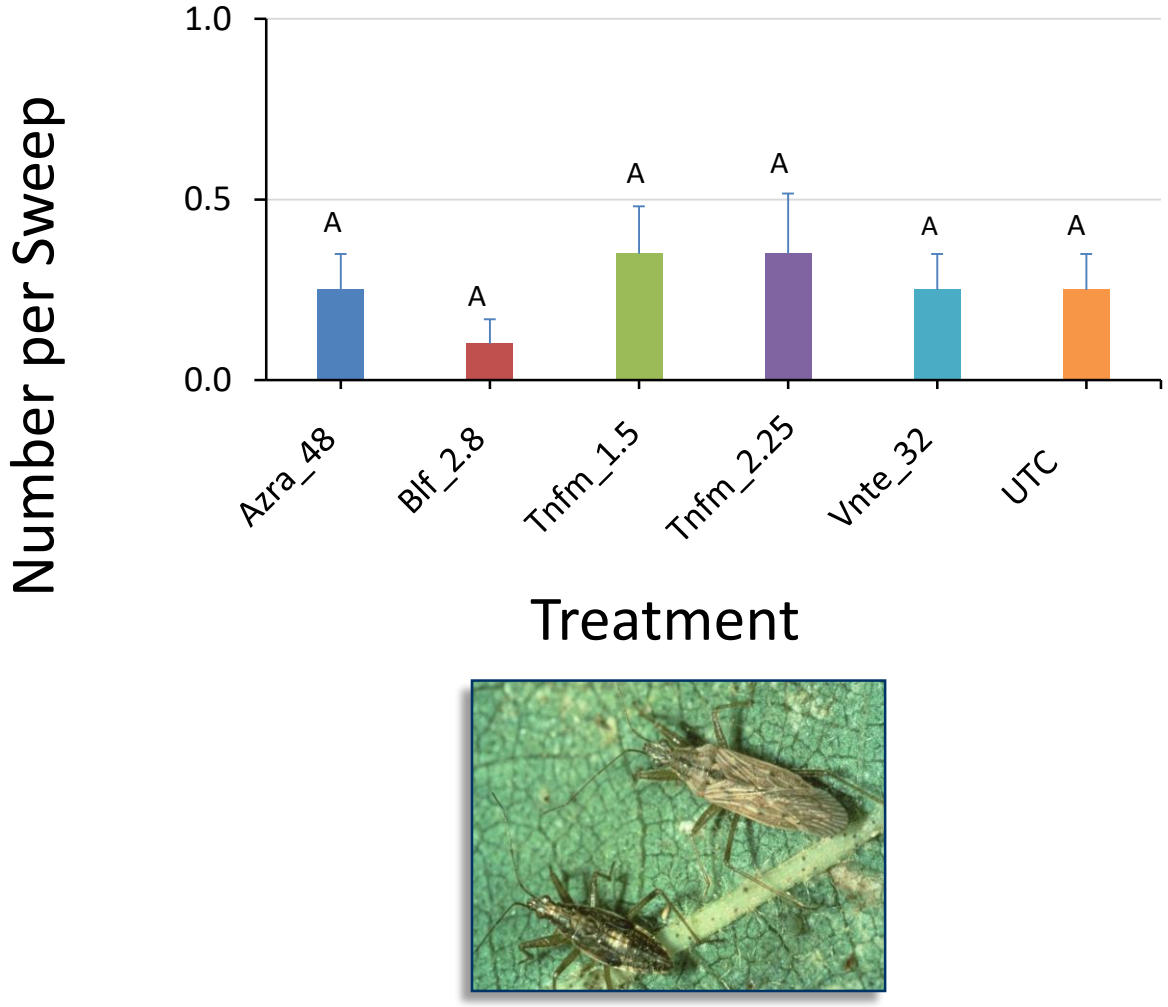
Mean number of pea and blue alfalfa aphids on each day and over all sample days on treated and untreated plots

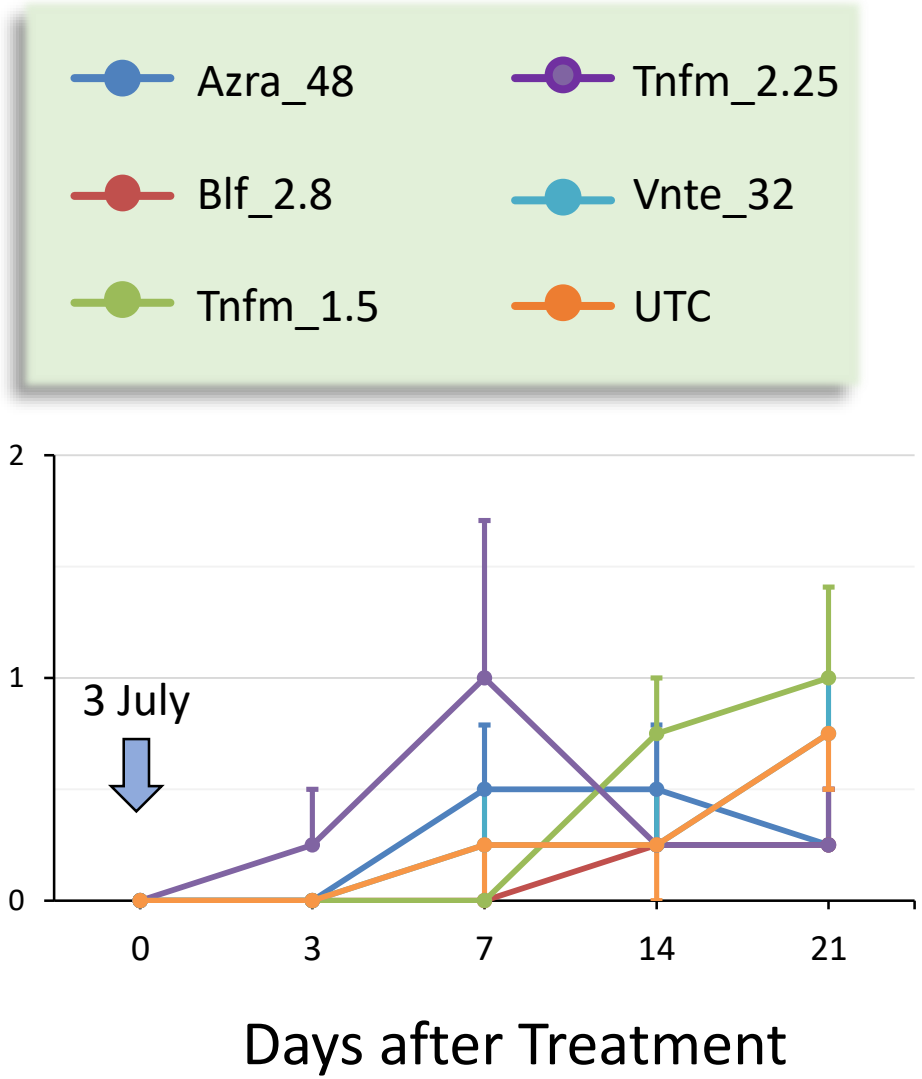




2017 Lygus efficacy trial

Mean number of damsel bugs on each day and over all sample days on treated and untreated plots





Conclusions

For lygus adults

- No strong effects of pesticides on lygus adults

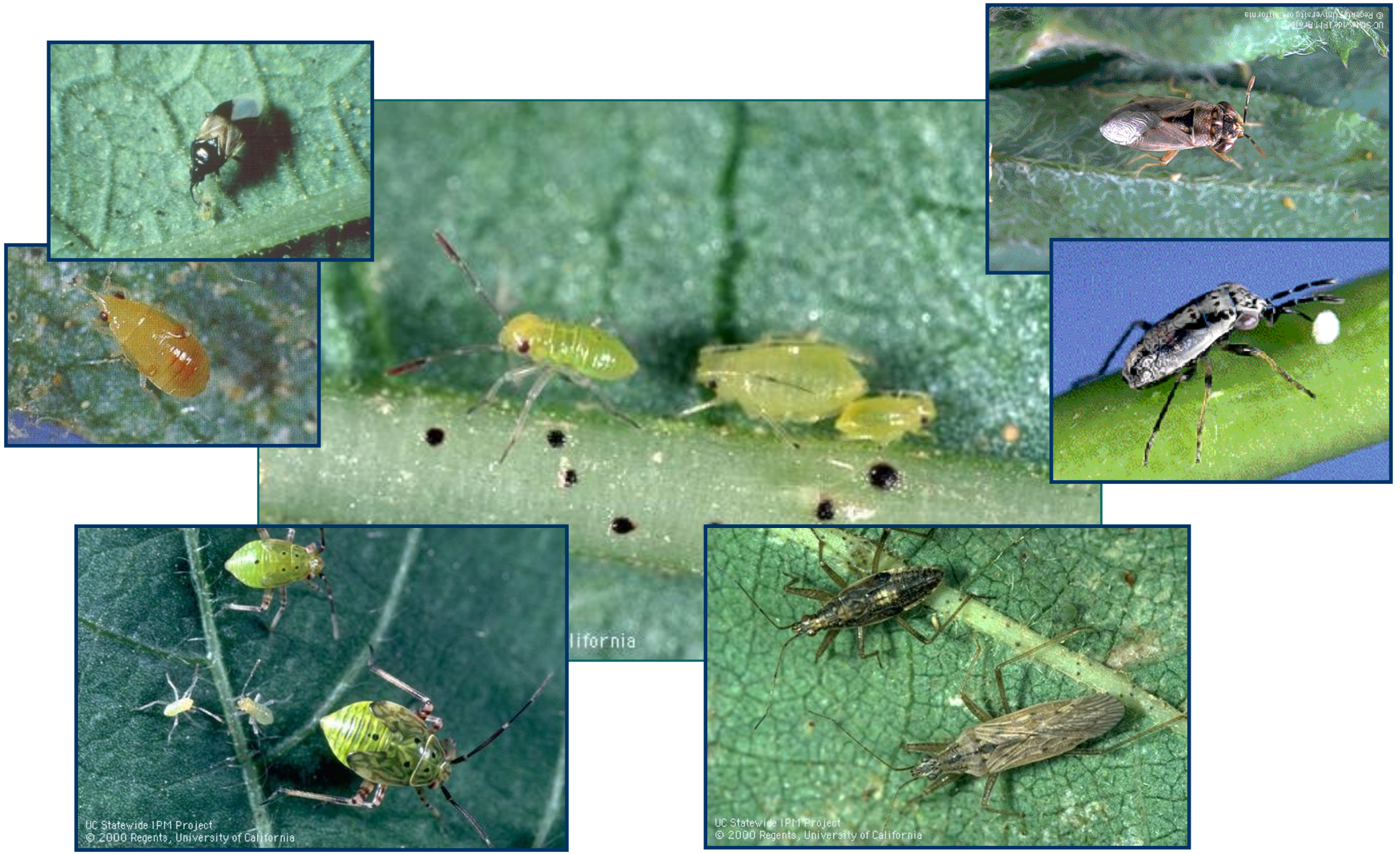
For lygus small and large nymphs

- 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

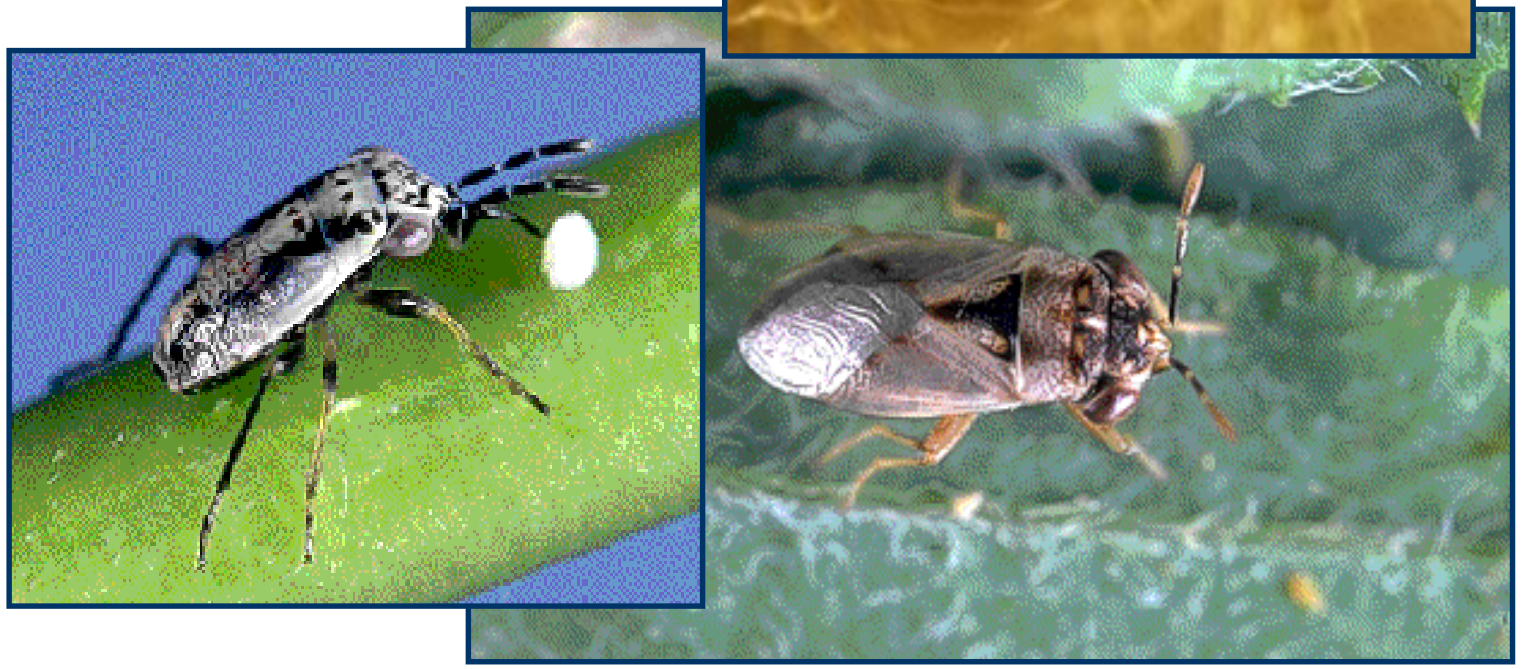
Bigeyed bug (*Geocoris* spp.)	Damsel bug (*Nabis* spp)	Minute pirate bug (*Orius* spp.)	Parasitic Wasps (*Peristenus* ssp.)
			
Generalist predators (small caterpillars, caterpillar eggs, aphids, sider mites and lygus			Specialist on Lygus
Prefer instars 1-3		Attacks instars 1-2?	Attacks early instars
Will switch to aphids and others when present in numbers		Prefers aphids, mites and thrips	Attacks only Lygus
A few to 10's per predator per day			0% to 100% parasitism
Immediate mortality			Delayed mortality

Predators: Big-eyed bugs (Hemiptera, Geocoris spp)

Feed on

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

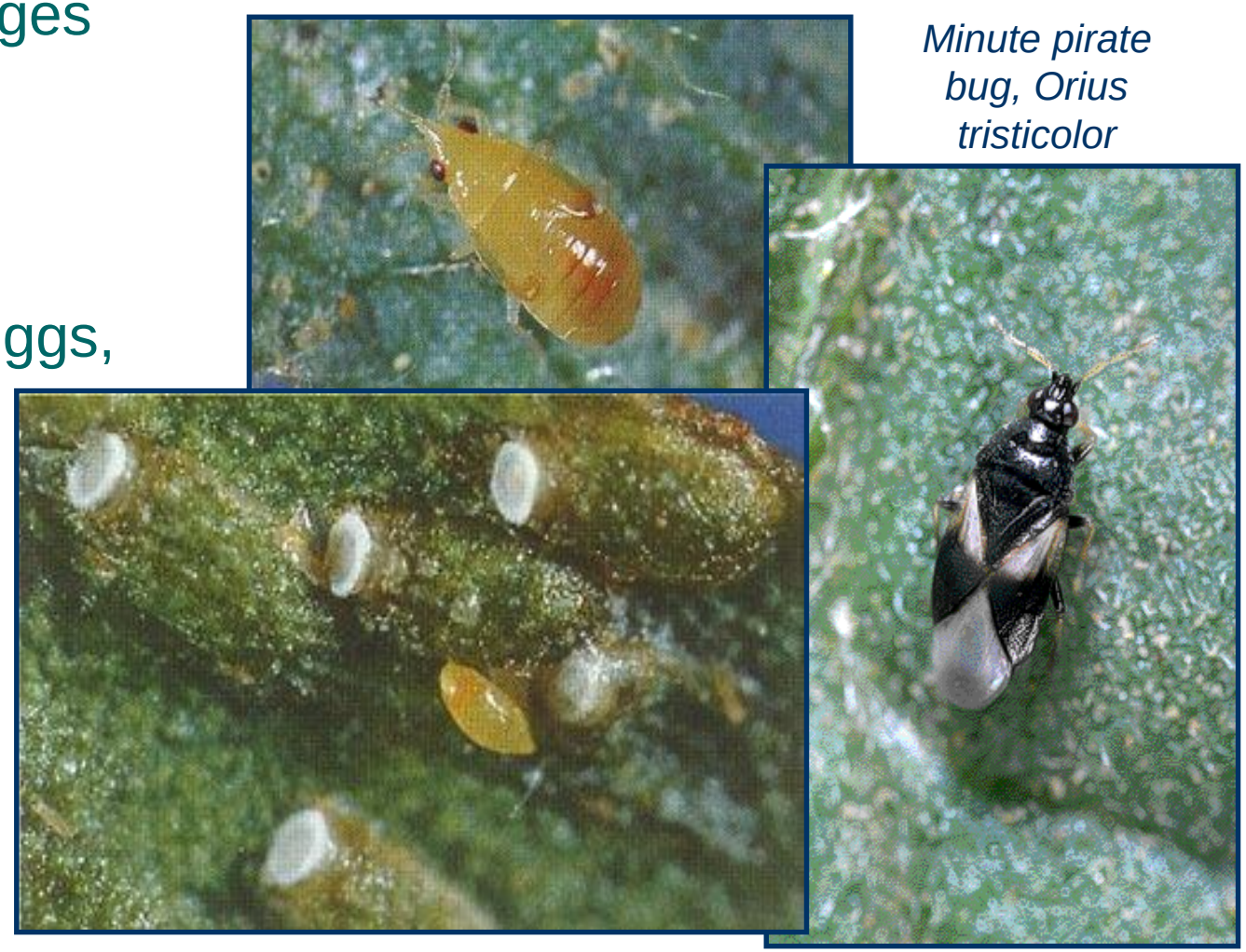
- Small, gray and black to black
- < 1/16 to 3/16 inches
- Oval with bulging eyes
- Needle-like mouth parts



Predators: Pirate bugs (Hemiptera, Orius spp.)

Feed on

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



Minute pirate bug, Orius tristicolor

- 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

Source: Natural Enemies Handbook. University of California Press

Predators: Lady beetles (Coleoptera)

Sevenspotted lady beetle

Coccinella septempunctata

Convergent lady beetle

Hippodamia convergens

Multicolored Asian lady beetle

Harmonia axyridis

Source: Natural Enemies Handbook. University of California Press

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

Trichogrammatids

Trichogramma spp.

Moth eggs

Mymarids

Anagrus & *Anaphes* spp.

Beetle & fly eggs

Scelionids

Telonomus &*Trissolcus spp*.

Bug eggs

Parasitic Wasps: Aphid parasites

Aphelinids

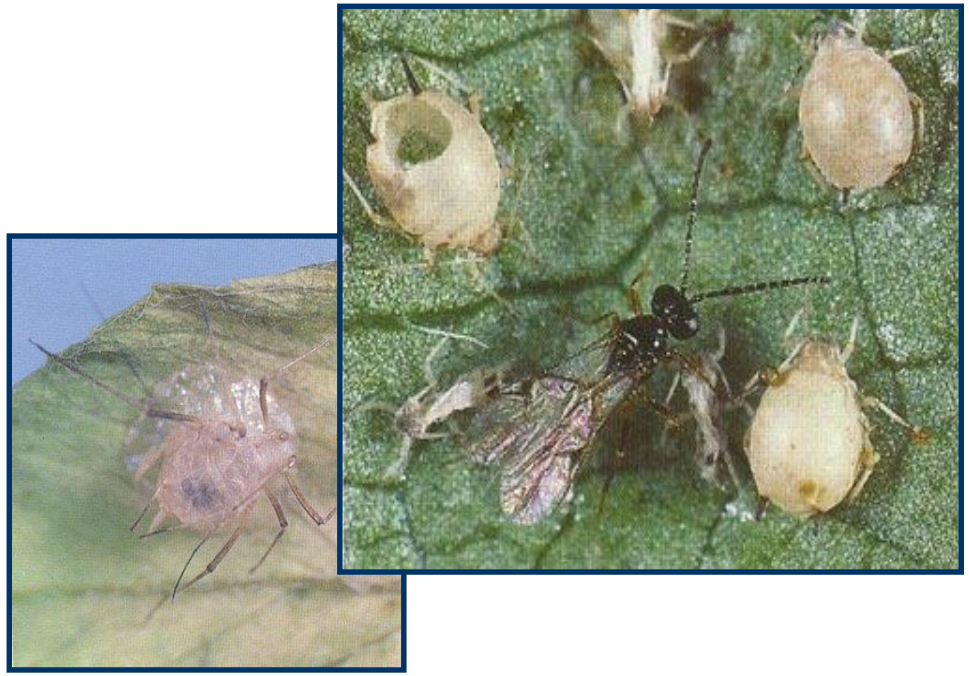
Aphytis & Aphelinus spp.

Aphidiids

Aphidius, Diaeretiella Praon, & Trioxys spp.

Black mummies typical

Gold-tan mummies typical



Parasitism of lygus nymphs in the Pacific Northwest

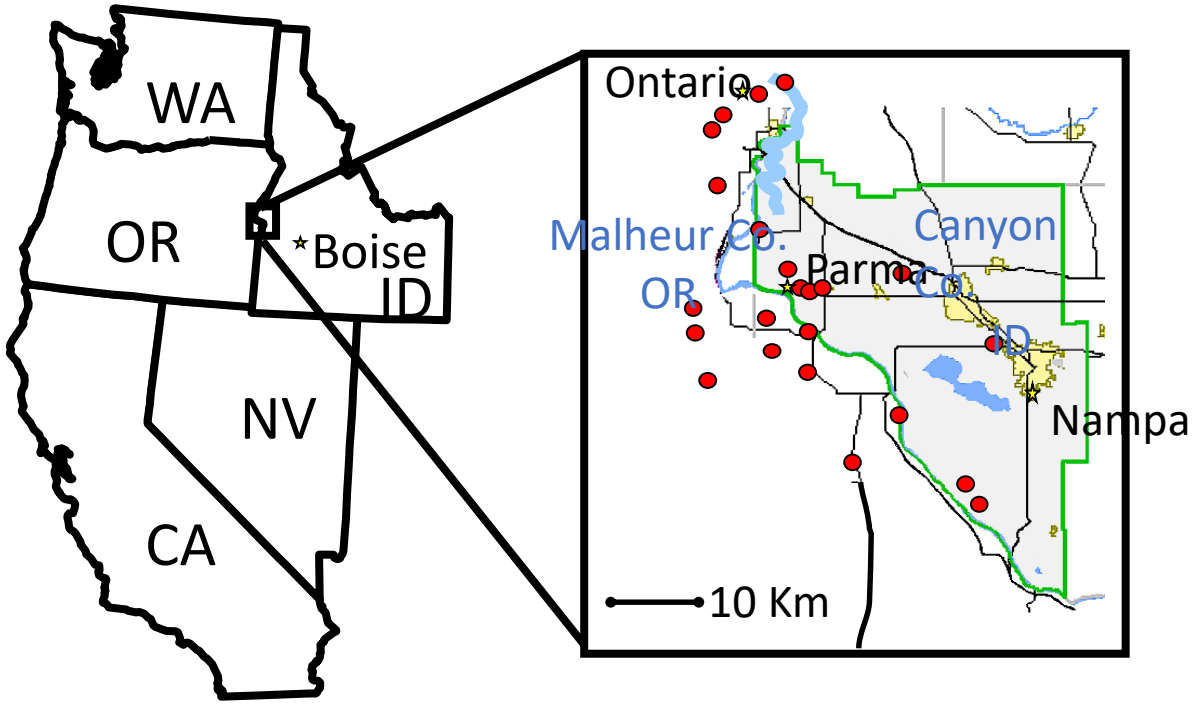
Peristenus howardi, braconid wasp that parasitizes lygus bug nymphs in the Pacific Northwest

- Native to the Pacific Northwest
- Parasitizes early (2nd & 3rd) instar lygus nymphs
- Larvae emerges from 5th instar lygus nymphs
- Potentially high parasitism rates

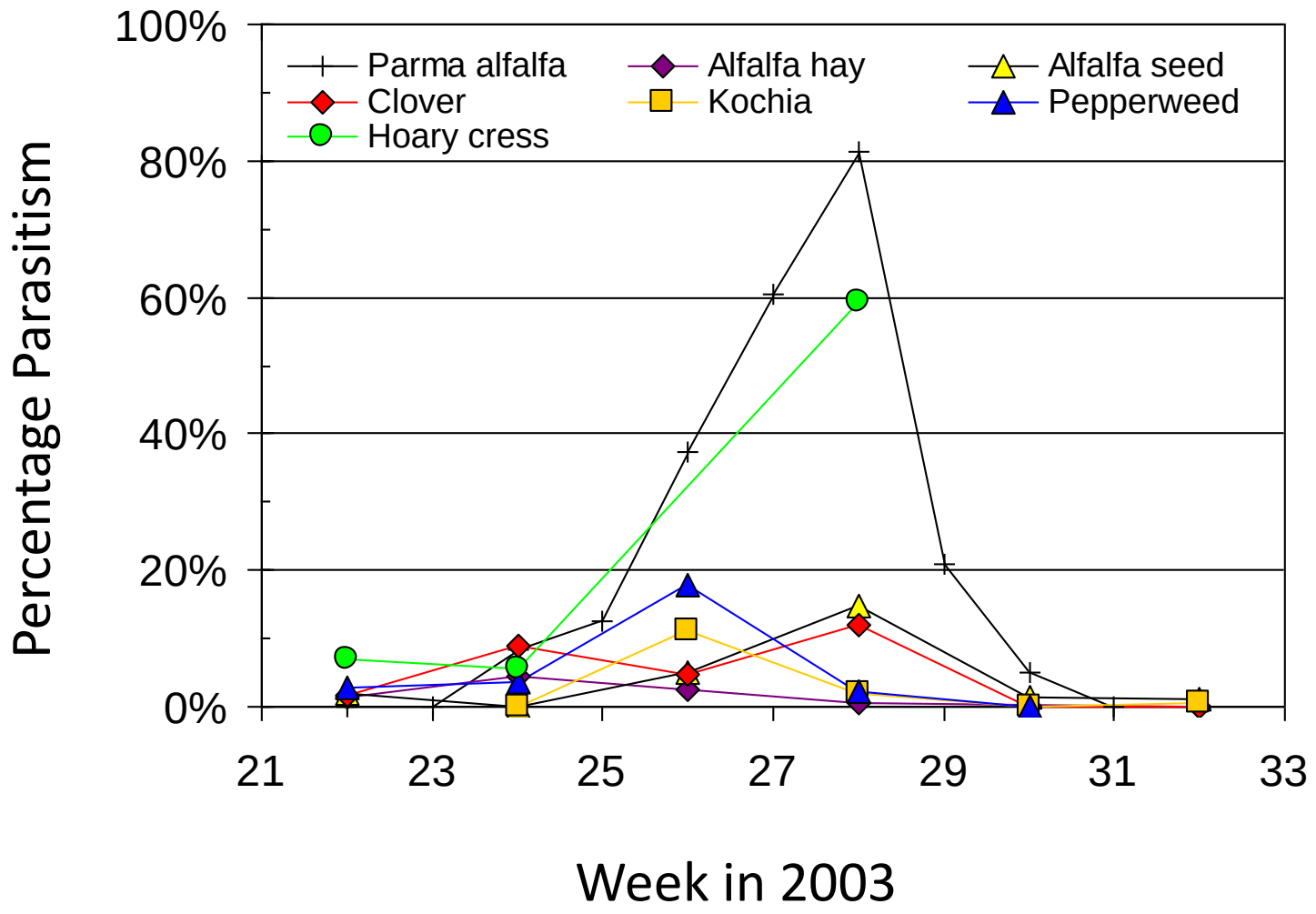
2002-2003 survey: sampling area

- 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



Thank you for your time and support

Questions?

RT_{25} (hrs) for selected insecticides to adult beneficial insects

Pesticide	Beneficial Insect			
	ALCB	Bigeyed bug	Damsel bug	Minute pirate bug
Assail	**4**	4	4	~96
Beleaf	**2**	2	2	2
Capture	**>96**	>96	>96	~96
Carzol	**4**	96	48	>96
Grandevo*	**?**	?	?	?
Rimon	**4**	4	4	4
Transform	**2**	?	?	?

RT_{25} ≤ 2: apply when bees are not foraging

RT_{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

alfalfa leafcutting bee

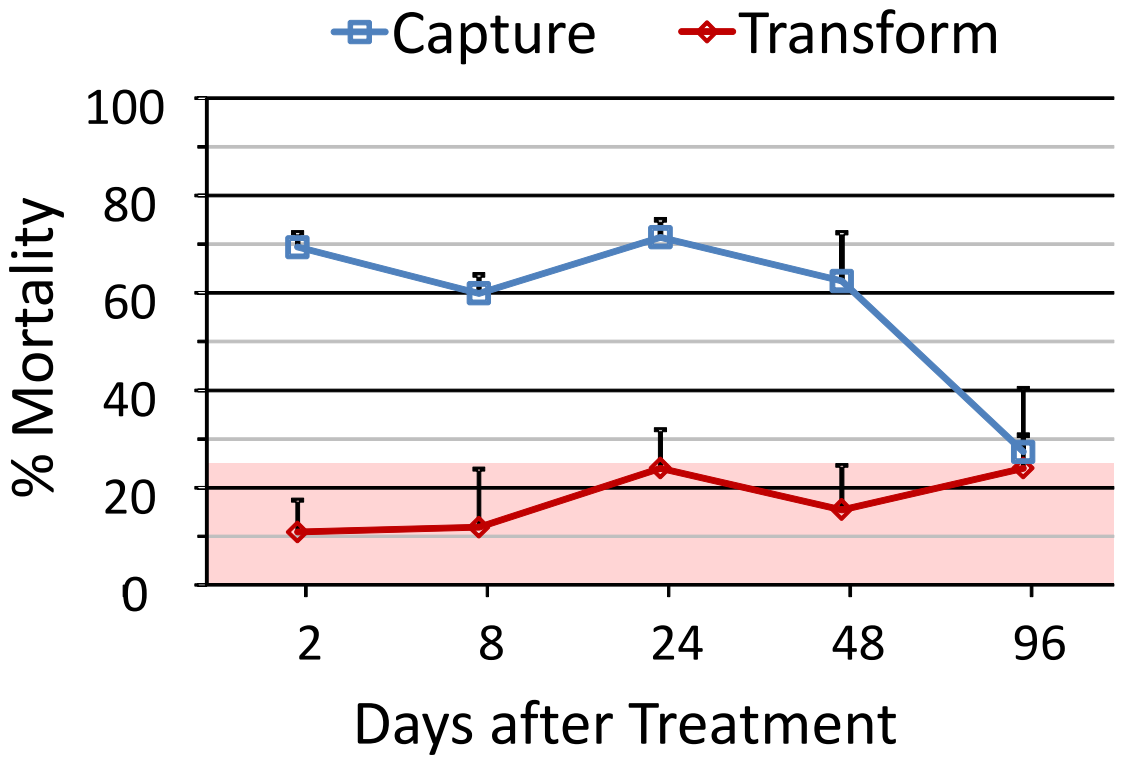
bigeyed bug

damsel bug

minute pirate bug

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

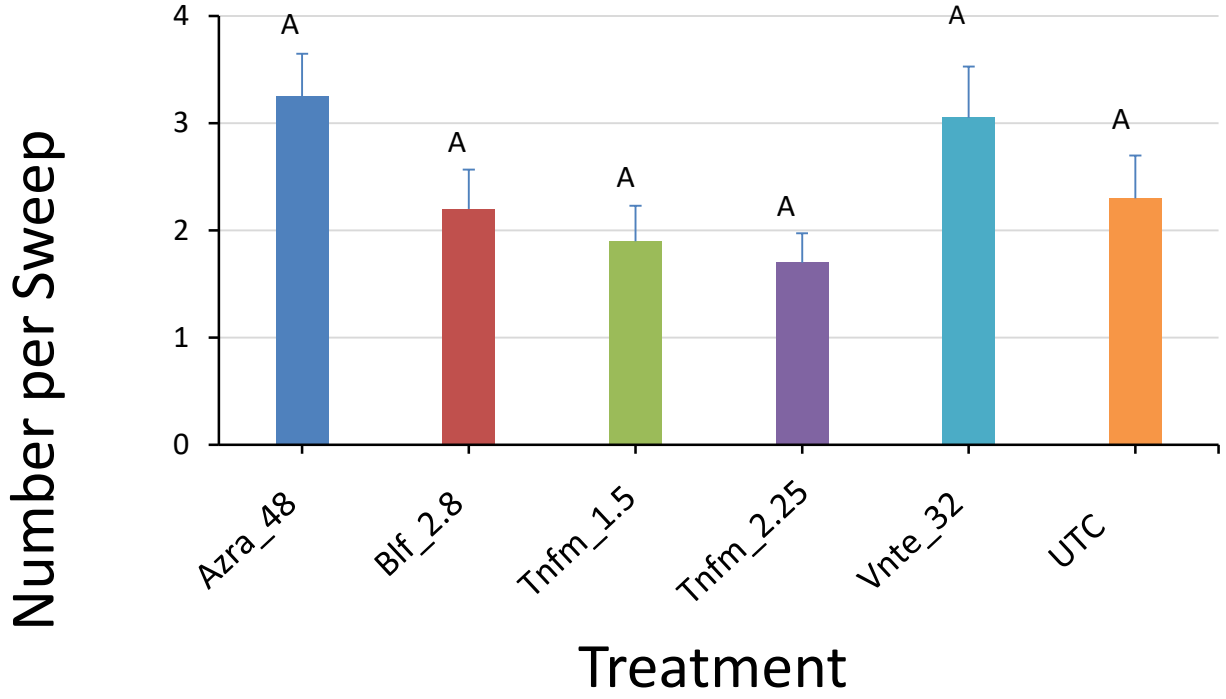
Sub-group 4A Neonicotinoids	**Sub-group 4B Nicotine**	**Sub-group 4C Sulfoximines**	**Sub-group 4D Butenolides**	**Sub-group 4E Mesoionics**
Acetamiprid Clothianidin Dinotefuran Imidacloprid Nitenpyram Thiacloprid Thiamethoxam	Nicotine	Transform Sulfoxaflor*	Sivanto Flupyradifurone	Triflumezopyrim

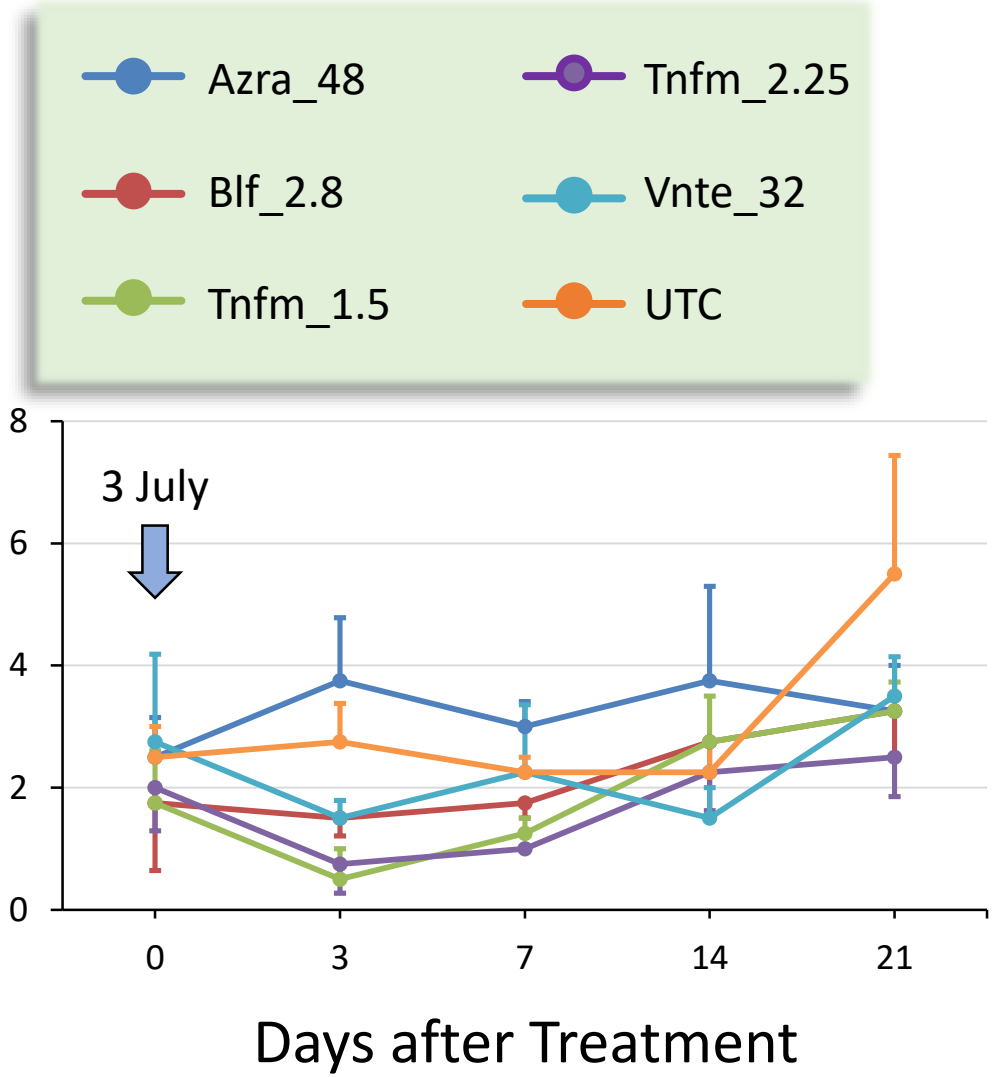
- Sulfoxaflor:
  - Complex, unique target site interactions.
  - Lack of cross resistance.
  - Metabolism differs from neonicotinoids.

Effective against lygus nymphs in previous trials

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





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

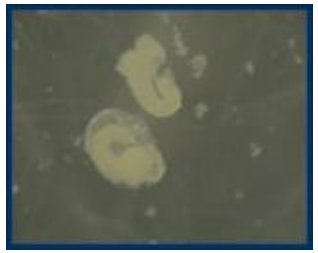
Other Natural Enemies

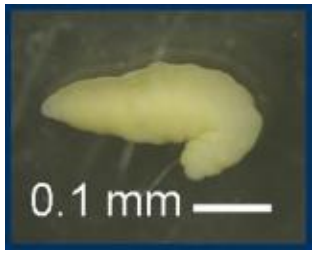
Parasitoids

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

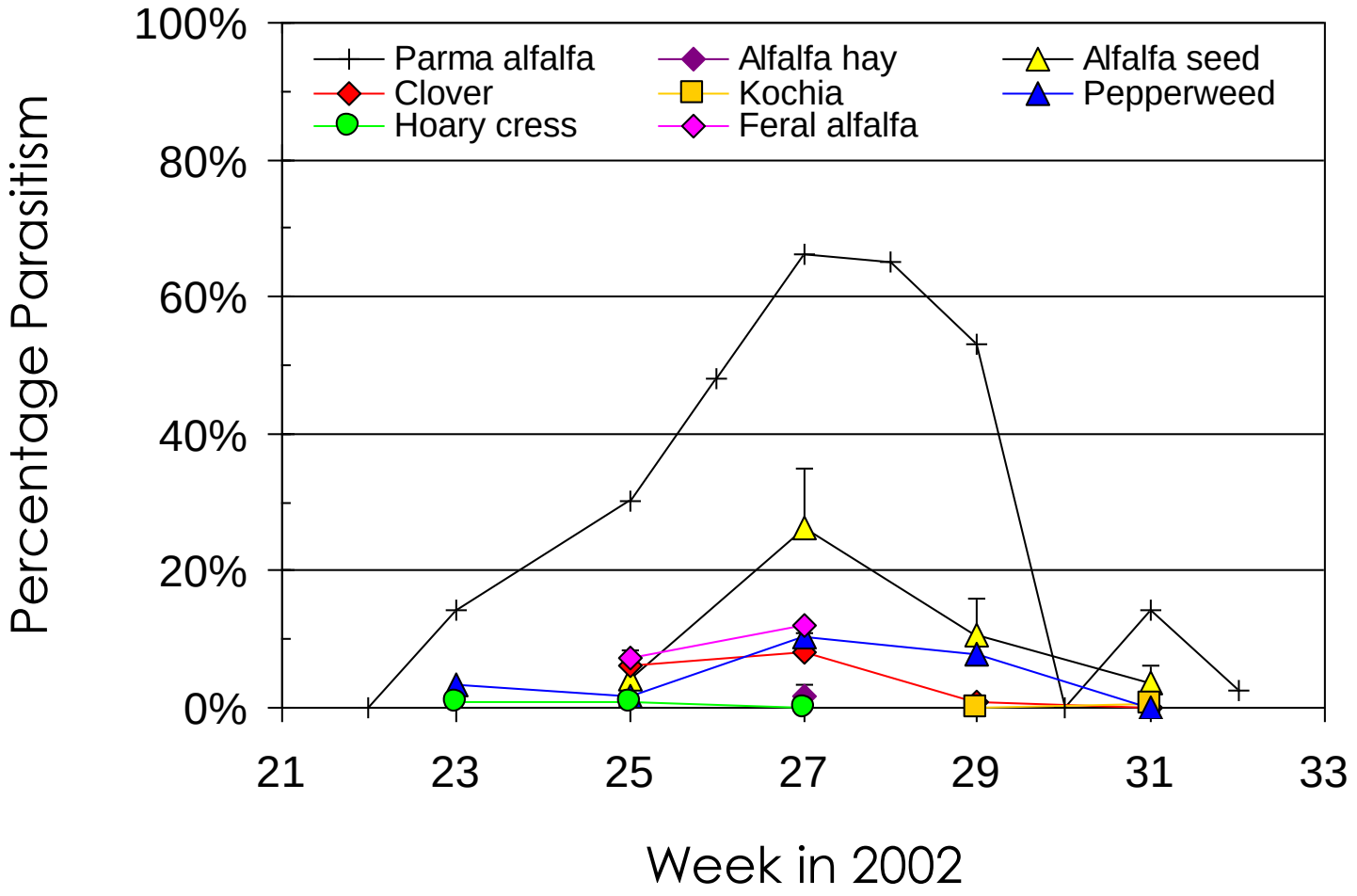
Pathogens

Bacteria

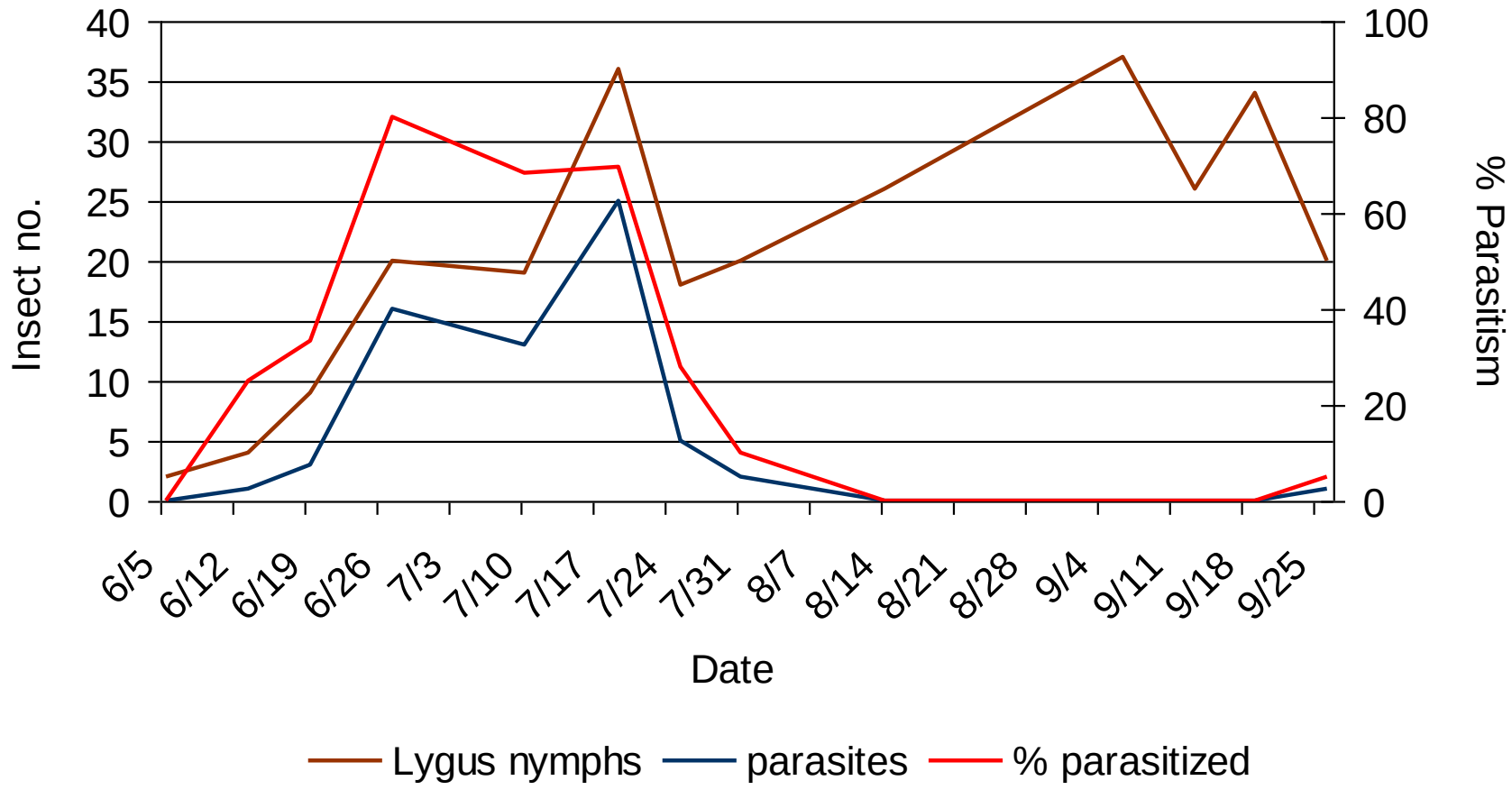
Viruses

Fungi

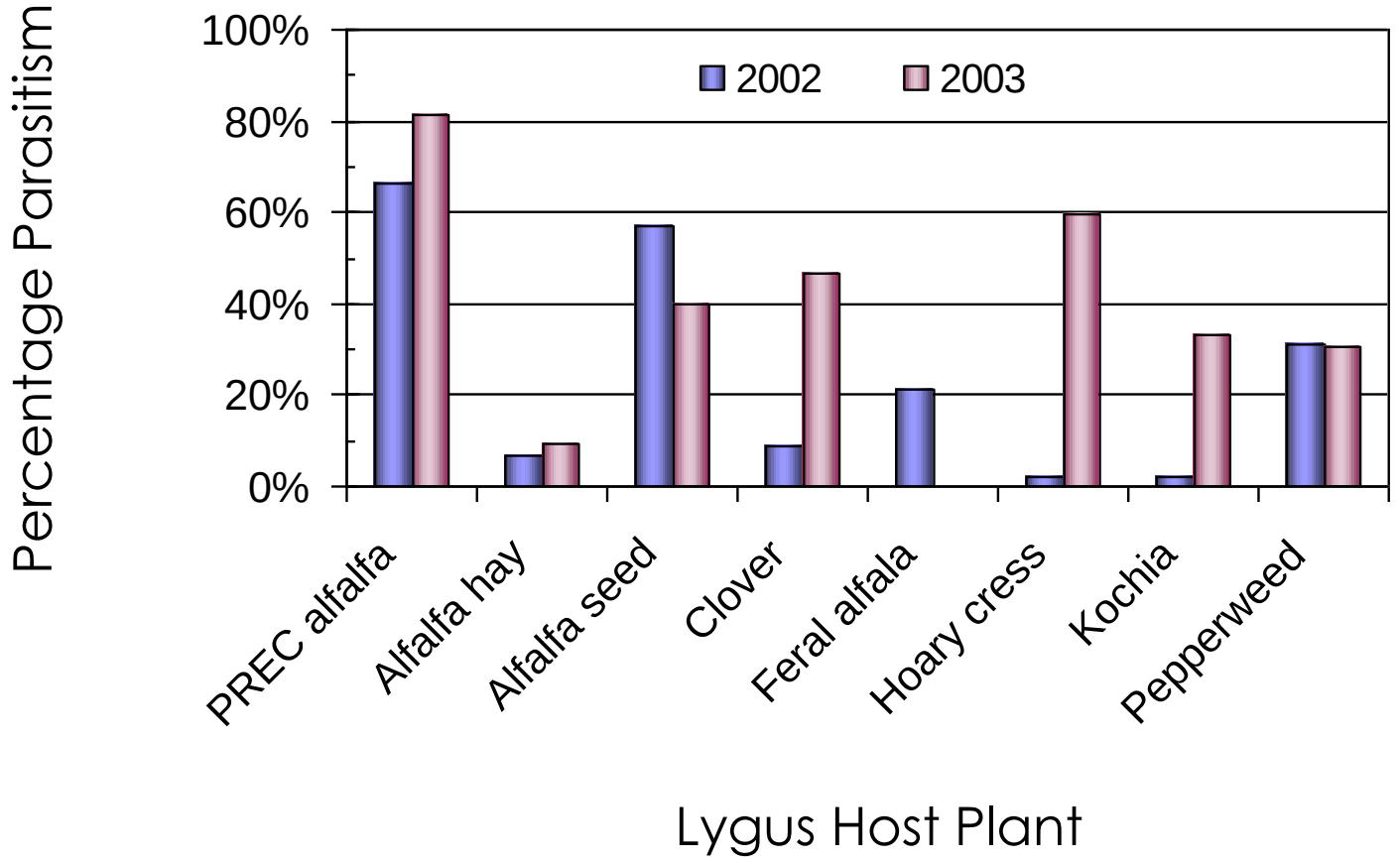
Parasitism of lygus nymphs collected in 2002 from crop and non-crop lygus hosts in the Treasure Valley of SW Idaho and E Oregon



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