Alfalfa Weevil and Aphids in California Alfalfa

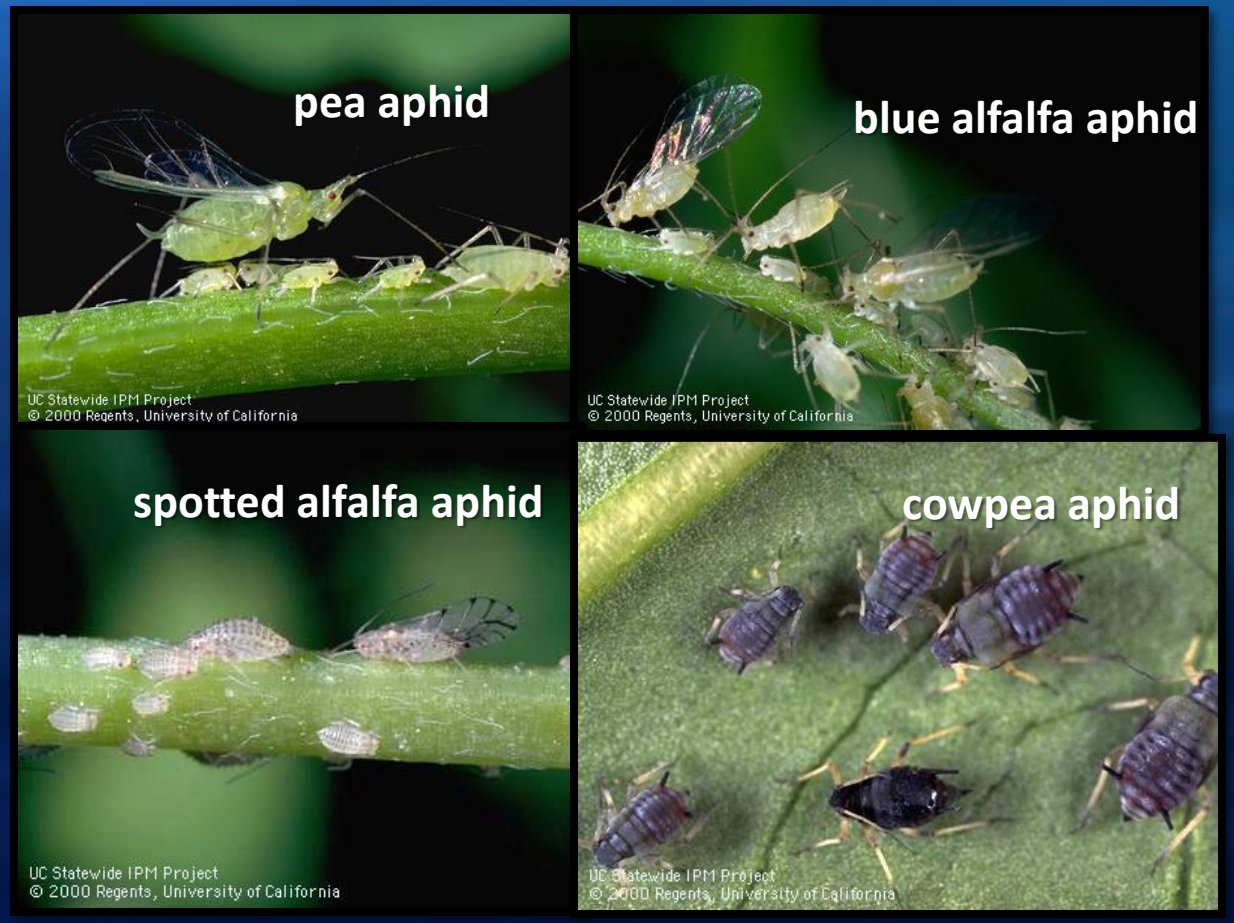
Larry Godfrey
Dept. of Entomology and Nematology
Univ. of California-Davis

Alfalfa Weevil

Weevils

- Egyptian alfalfa weevil in Central Valley, desert areas
- alfalfa weevil in intermountain and coastal areas

Alfalfa Aphid Pests



Pea aphid – some resistance in alfalfa cultivars; common early pest but generally inflicts minimal damage

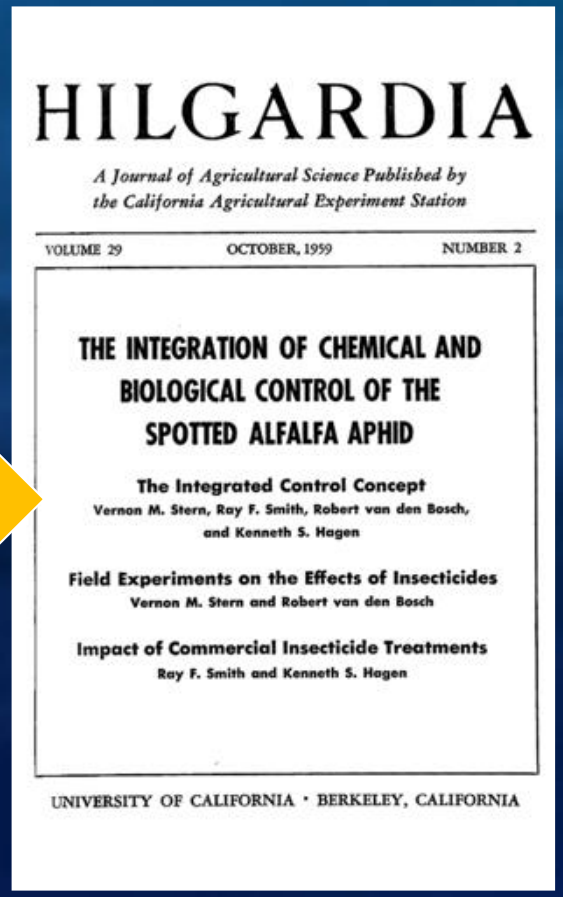
Blue alfalfa aphid and Spotted alfalfa aphid – good resistance in alfalfa varieties, inject a toxin while feeding which stunts growth

Cowpea aphid – "recent" pest of alfalfa; lack of research-based information

Management decisions - economic

Stern et al. (1959)

Economic injury level - lowest number of insects that will cause economic damage



HILGARDIA

A Journal of Agricultural Science Published by the California Agricultural Experiment Station

VOLUME 29 OCTOBER, 1959 NUMBER 2

THE INTEGRATION OF CHEMICAL AND BIOLOGICAL CONTROL OF THE SPOTTED ALFALFA APHID

The Integrated Control Concept

Vernon M. Stern, Ray F. Smith, Robert van den Bosch, and Kenneth S. Hagen

Field Experiments on the Effects of Insecticides

Vernon M. Stern and Robert van den Bosch

Impact of Commercial Insecticide Treatments

Ray F. Smith and Kenneth S. Hagen

UNIVERSITY OF CALIFORNIA · BERKELEY, CALIFORNIA

Alfalfa IPM

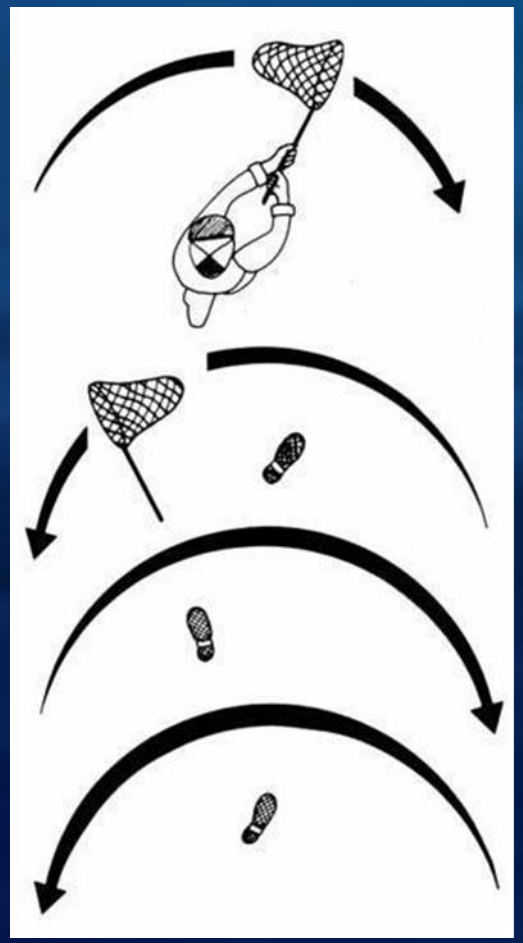
- Pest management in alfalfa has increasingly depended on insecticides over the last 20 year
- Alfalfa has gone from a system known for a strong IPM program to one that now is associated with having a large “footprint”
- Research efforts in alfalfa IPM have been limited in the last 20 years due to
  - needs in competing crops,
  - reductions in research/extension personnel,
  - a perceived strength in alfalfa IPM,
  - limited research support from the industry, i.e., a commodity board
- Alfalfa had the highest chlorpyrifos usage in CA production agriculture at 440,000 acre-treatments in 2013 (CA-DPR data)
- Lambda-cyhalothrin applied on >500,000 acre-treatments in 2013, more than twice the next highest usage

Seasonal occurrence of the major alfalfa pests in the Imperial Valley and the Central Valley of California.

	J	F	M	A	M	J	J	A	S	O	N	D
Alfalfa Weevil												
Desert	■	■	■	■								
Central Valley		■	■	■	■	■						
Pea Aphid												
Desert	■	■	■	■								
Central Valley		■	■	■	■				■	■		
Blue Alfalfa Aphid												
Desert	■	■	■	■								■
Central Valley		■	■	■								
Spotted Alfalfa Aphid												
Desert	■	■	■								■	■
Central Valley							■	■	■			
Cowpea Aphid												
Desert	■	■	■							■	■	■
Central Valley	■	■	■	■	■		■			■	■	■

Present Alfalfa Weevil Management Plan

- Sample fields weekly after larvae begin to appear
- As thresholds are approached, sample every 2 to 4 days
- Sample method
  - sweep net – 180^{o} sweep
  - many times population develops before alfalfa is tall enough to sweep



Present Alfalfa Weevil Management Plan

- Treatment threshold = 20 larvae per sweep
- Developed in the 1970's (Koehler and Rosenthal 1975)
  - questioned by agricultural professionals
  - this research limited by assumptions of
    - hay values of $50-$70 per ton,
    - treatment costs of $6-8 per acre
    - low yielding (2500 lbs./A) alfalfa cultivars such as 'Lahontan'.

Present Alfalfa Weevil Management Plan

Alfalfa Weevil Resistance to Pyrethroid Insecticides Found in Scott Valley

Author: Steve Orloff
Author: Larry Godfrey
Author: Kevin Goding
Editor: Laurie Askew

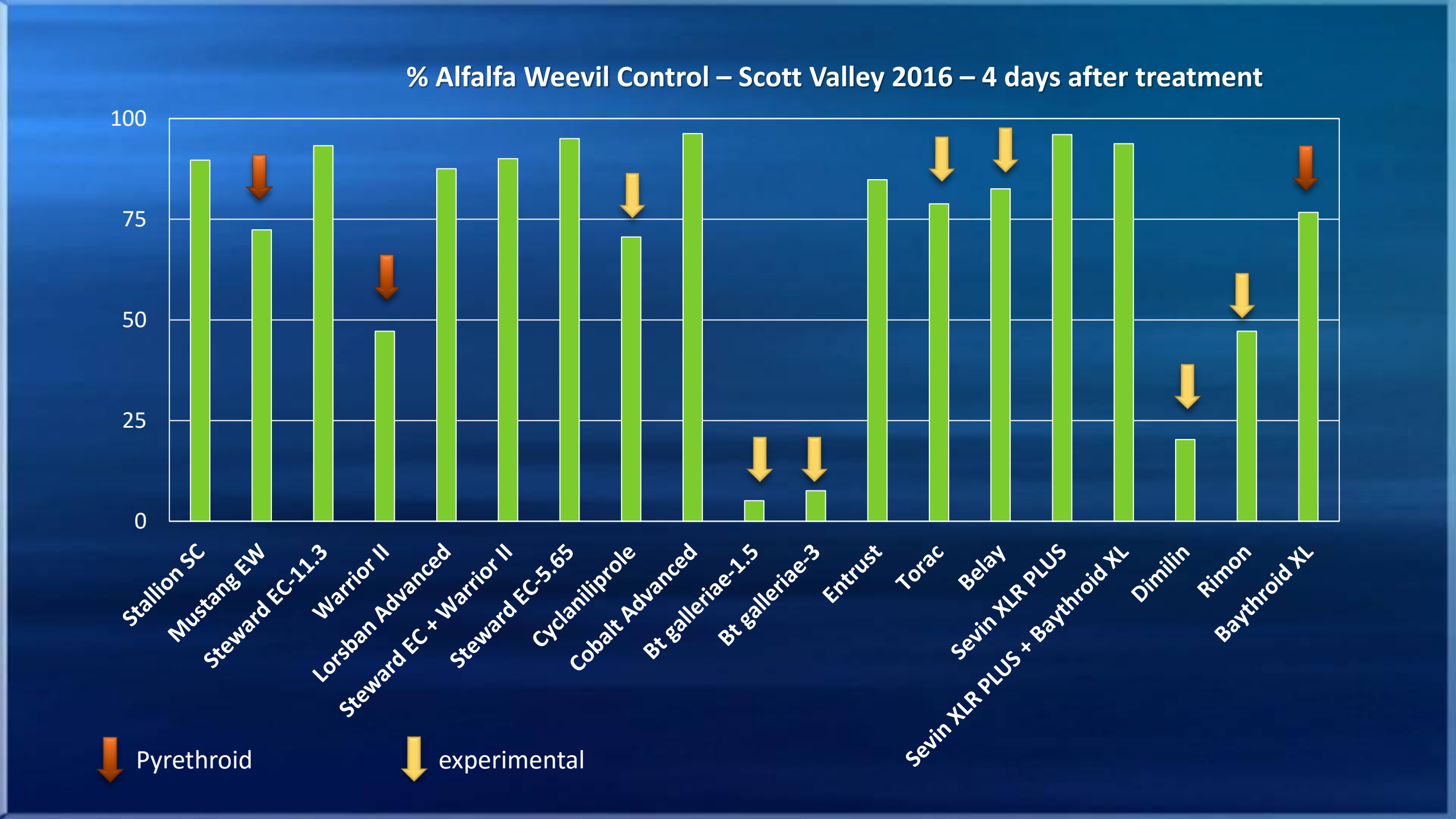
Published on: May 10, 2016

Farming sure can be challenging. I guess that is what keeps it so interesting...but a little less interesting might be good sometimes. Last year Klamath Basin alfalfa growers had to deal with blue alfalfa aphid (BAA) and the associated cost of insecticide sprays as well as the yield loss. Fortunately, aphids have not been a problem this year. This may be due to the relatively wet year we have had (especially this spring) providing more favorable conditions for fungi that can keep aphids in check.

While aphids have not been a problem, this has been an incredible year for alfalfa weevil (especially in Scott Valley). Over 100 larvae per sweep have been reported in some fields. In addition to the high populations, emergence has been staggered, making control difficult. It was possible to see weevils at all growth stages in a field at the same time, including overwintering adults, all four instars (larval growth stages) and the new pupating adults from this year's population (Figure 1). This situation makes weevil control especially challenging because they are feeding on fields for such a long time.

	% Weevil Mortality – Avg. of Baythroid and Warrior - Scott Valley				
	0.25X rate	0.5X rate	recommended field rates 1X	2X rate	4X rate
Organic field	62%	65%	92%	82%	88%
Conventional Field 1	5%	8%	5%	10%	23%
Conventional Field 2	0	5%	10%	13%	23%
Conventional Field 3	23%	3%	3%	10%	35%
Conventional Field 4	0	0	15%	8%	23%

Would like to extend this pyrethroid resistance monitoring in alfalfa weevils statewide in 2017


% Alfalfa Weevil Control – Scott Valley 2016 – 4 days after treatment
100
75
50
25
0
Stallion SC
Mustang EW
Steward EC-11.3
Warrior II
Lorsban Advanced
Steward EC + Warrior II
Steward EC-5.65
Cyclaniliprole
Cobalt Advanced
Bt galleriae-1.5
Bt galleriae-3
Entrust
Torac
Belay
Sevin XLR PLUS
Sevin XLR PLUS + Baythroid XL
Dimilin
Rimon
Baythroid XL
Pyrethroid
experimental

Objective 3. reduced risk insecticides

Identifying and Managing Critical Uses of Chlorpyrifos Against Key Pests of Alfalfa, Almonds, Citrus and Cotton

UC IPM




CDPR Agreement Number 13-C0054

A Report Submitted to the California Department of Pesticide Regulation

October 31, 2014

Alfalfa Weevil Active Products

chlorpyrifos	Lorsban	1B	1.0	Many regulatory issues
carbaryl	Sevin	1A		Phytotoxicity

Alternative Active Ingredients (AI)

Active Ingredient	Trade Name(s)	IRAC Mode of Action Group	Cost Comparison Relative to Lorsban	Comment
Beta-cyfluthrin	Baythroid	3A	1.22	Can be disru… natural enemie…
Spinosad	Entrust (Organic)	5	7.60	Suppression not con… short residual
Phosmet	Imidan	1B	3.03	Shorter residual, …e disruptive to n… …l enemies
Malathion	Malathion	1B	2.24	Activity is te…perature dependent; higher temperatures give greater efficacy
Indoxacarb	Steward	22A	5.32	More selective, no effect on aphids
Lambda - cyhalothrin	Warrior	3A	1.76	Can be disruptive to natural enemies
Zeta-cypermethrin	Mustang	3A	2.81	Can be disruptive to natural enemies

poor performance/higher rate needed in cool conditions

Improved Management of Alfalfa Weevil in California Alfalfa to Facilitate Water Quality Protection and Sustainability

Dept. of Pesticide Regulation's (DPR) Pest Management Research Grants Program

July 2016 to June 2019

- Larry Godfrey, Extension Specialist, Entomology, UC-Davis
- Rachael Long, Farm Advisor; Sacramento, Solano, Yolo Co.
- Dan Putnam, Extension Specialist, Plant Sciences, UC-Davis
- Nicholas Clark, Area Farm Advisor, Kings, Tulare & Fresno Counties
- Konrad Mathesius, Farm Advisor, Sutter-Yuba Counties
- Michelle Leinfelder-Miles, Farm Advisor, San Joaquin County

Objectives:

1. establish a dynamic treatment threshold for alfalfa damage, weevil larval populations, and an alfalfa weevil monitoring plan.
2. study alfalfa weevil biology/life history and assess reported/observed changes in these traits throughout the Central Valley.
3. investigate the efficacy and cost-effectiveness of reduced risk insecticides.
4. assess the incidence and timing of alfalfa weevil biological control.
5. study the impacts of changes in alfalfa plant characteristics on susceptibility to alfalfa weevil larvae in laboratory bioassays including reduced lignin trait.

Objective 1:

- goal of determining relationship between weevil numbers and hay yield and quality
- dynamic threshold will be placed on-line
- treatment costs and hay values change significantly and that will change threshold

Aphids in Alfalfa

Blue Alfalfa

Cowpea

Pea Aphid

Green Form

Pink Form

Spotted Alfalfa

Integrated Pest Management (IPM)

Management tactics emphasized

1.) biological controls
2.) cultural control measures
3.) host plant resistance
4.) insecticides

Common Aphids in Alfalfa

- **Cowpea Aphid**
  - Adult: shiny black
  - Nymph: slate grey

- **Spotted Alfalfa Aphid**
  A small, pale-yellow or grayish aphid with four to six rows of spined black spots on its back

Common Aphids in Alfalfa

- **Blue Alfalfa Aphid**
  - Antennae uniformly brown

- **Pea Aphid**
  - Narrow dark bands at tip of each segment

How Would You Know?

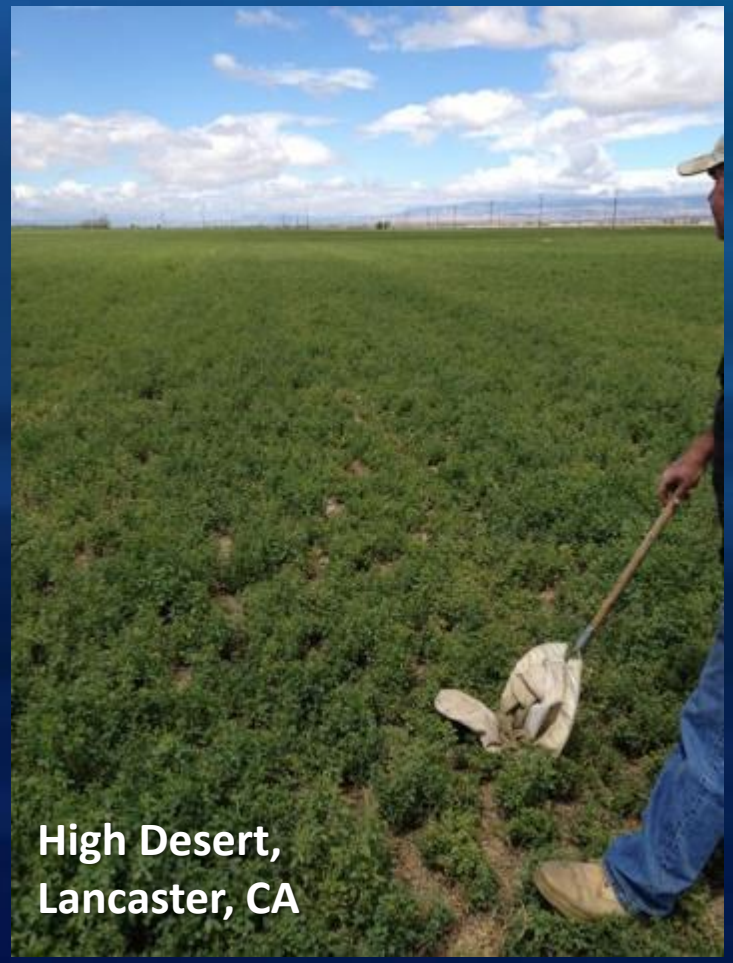
- Alfalfa Blog, UC Davis - http://ucanr.edu/blogs/Alfalfa/index.cfm
- IPM Identification Tips in Alfalfa PMG
  - http://www.ipm.ucdavis.edu/PMG/r1300211.html
- Additional Guides:
  - Barlow & Godfrey Aphid Guide
  - http://ucanr.edu/sites/CottonIPM/Useful_Reources/

Pea Aphid – *Acyrthosiphon pisum*	**Blue Alfalfa –** *Acyrthosiphon kondoi*
Spring and fall populations	Late winter or spring only
More widely distributed on plant	Prefers terminal area of plant
Feeding does NOT result in stunting	Injects feeding toxin, stunts plants, especially young
Action Threshold (under 10”) – 40-50 aphids per stem	Action Threshold (under 10”) – 10-12 aphids per stem
Less tolerant of cool temperatures	More tolerant of cool temperatures
Some resistance in commercial alfalfa varieties	Resistance common in commercial alfalfa varieties

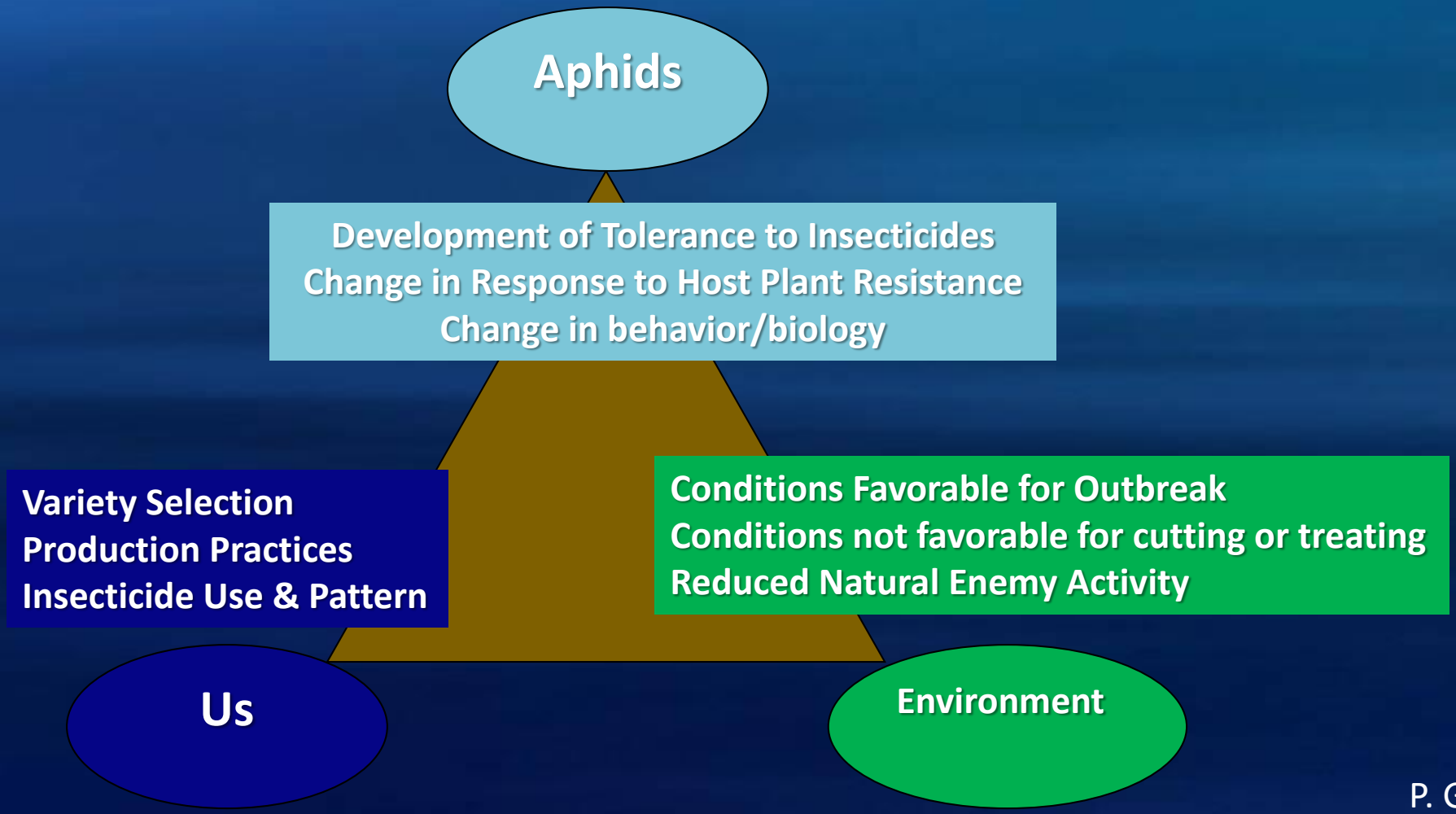
Common Aphids in Alfalfa

Damage: stunting, reduced vigor

Early Season Blue Alfalfa Aphid Damage



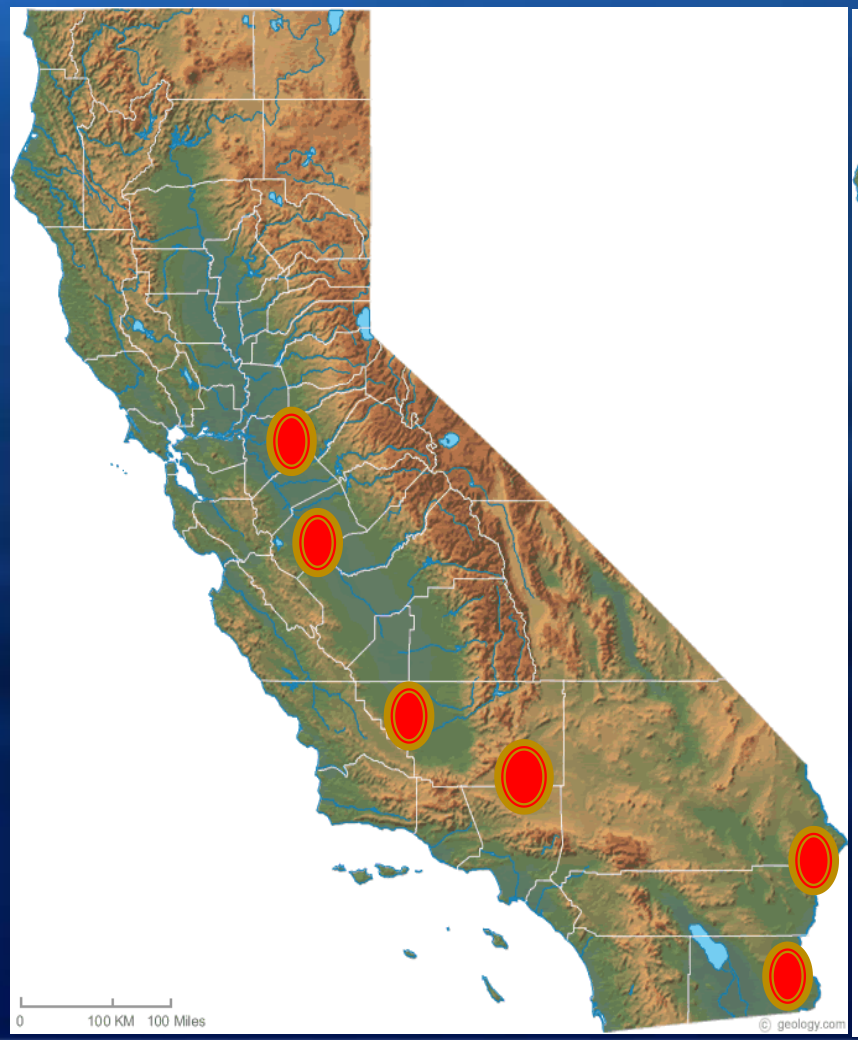
Blue Alfalfa Aphid Outbreak - Why



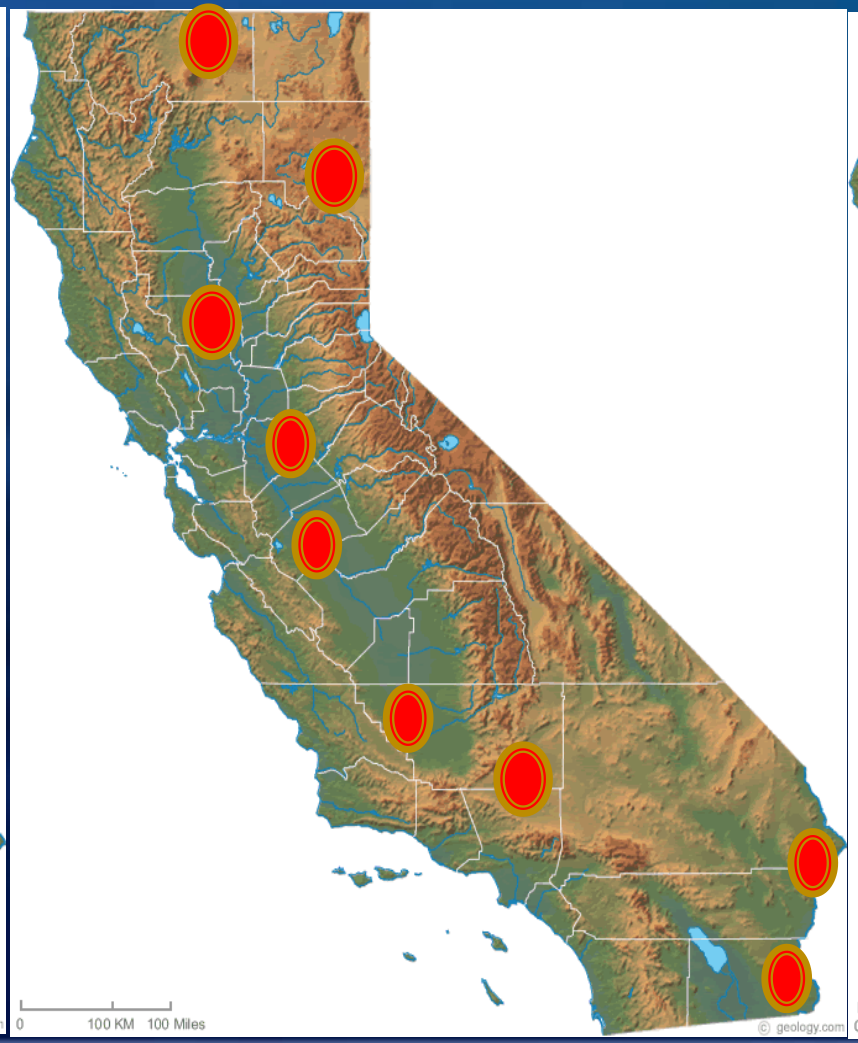
P. Goodell

History of Blue Alfalfa Aphid Outbreaks

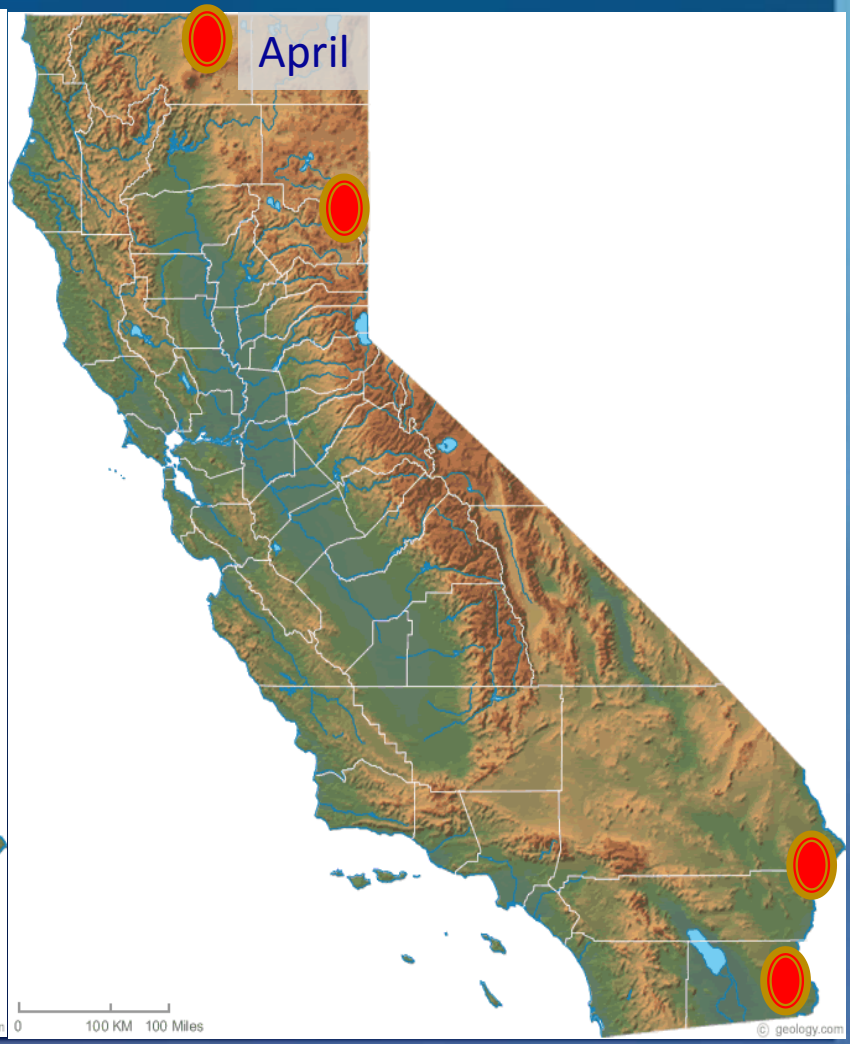
2013



2014



2015



History of Blue Alfalfa Aphid Outbreaks

2016

Blue Alfalfa Aphid Outbreak - Why

Exact reason not known – various possibilities

- Development of Tolerance to Insecticides
- Variety Selection
- Environmental Conditions Favorable for Outbreak

Change in Response to Host Plant Resistance

Crop & Pasture Science, 2012, **63**, 893–901
http://dx.doi.org/10.1071/CP12137

A new biotype of bluegreen aphid (*Acyrthosiphon kondoi* Shinji) found in south-eastern Australia overcomes resistance in a broad range of pasture legumes

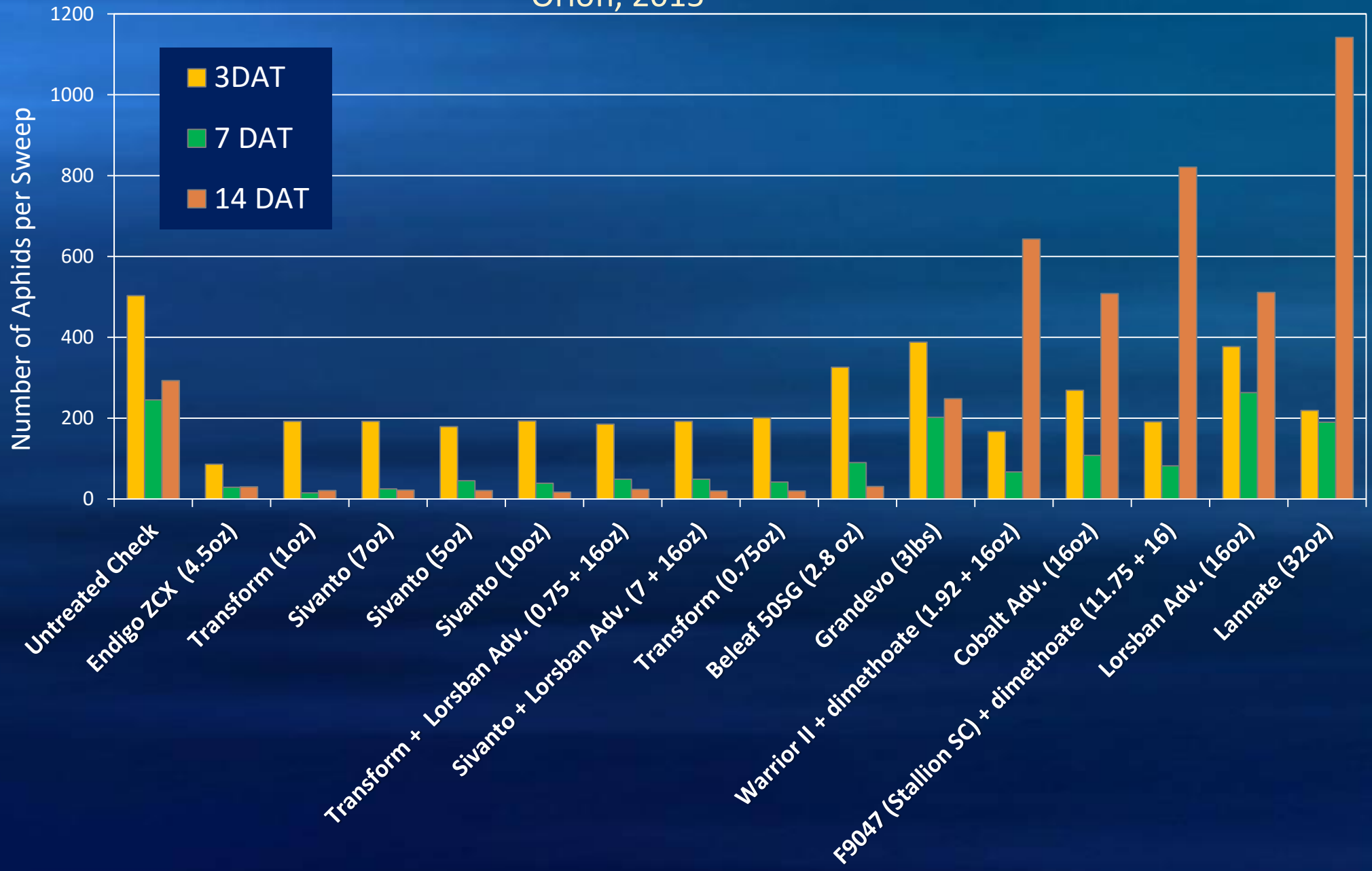
A. W. Humphries[A,B], *D. M. Peck*[A], *S. S. Robinson*[A], *T. Rowe*[A], *and K. Oldach*[A]

[A]SARDI, PO Box 397, Adelaide, SA 5000, Australia.
[B]Corresponding author. Email: alan.humphries@sa.gov.au

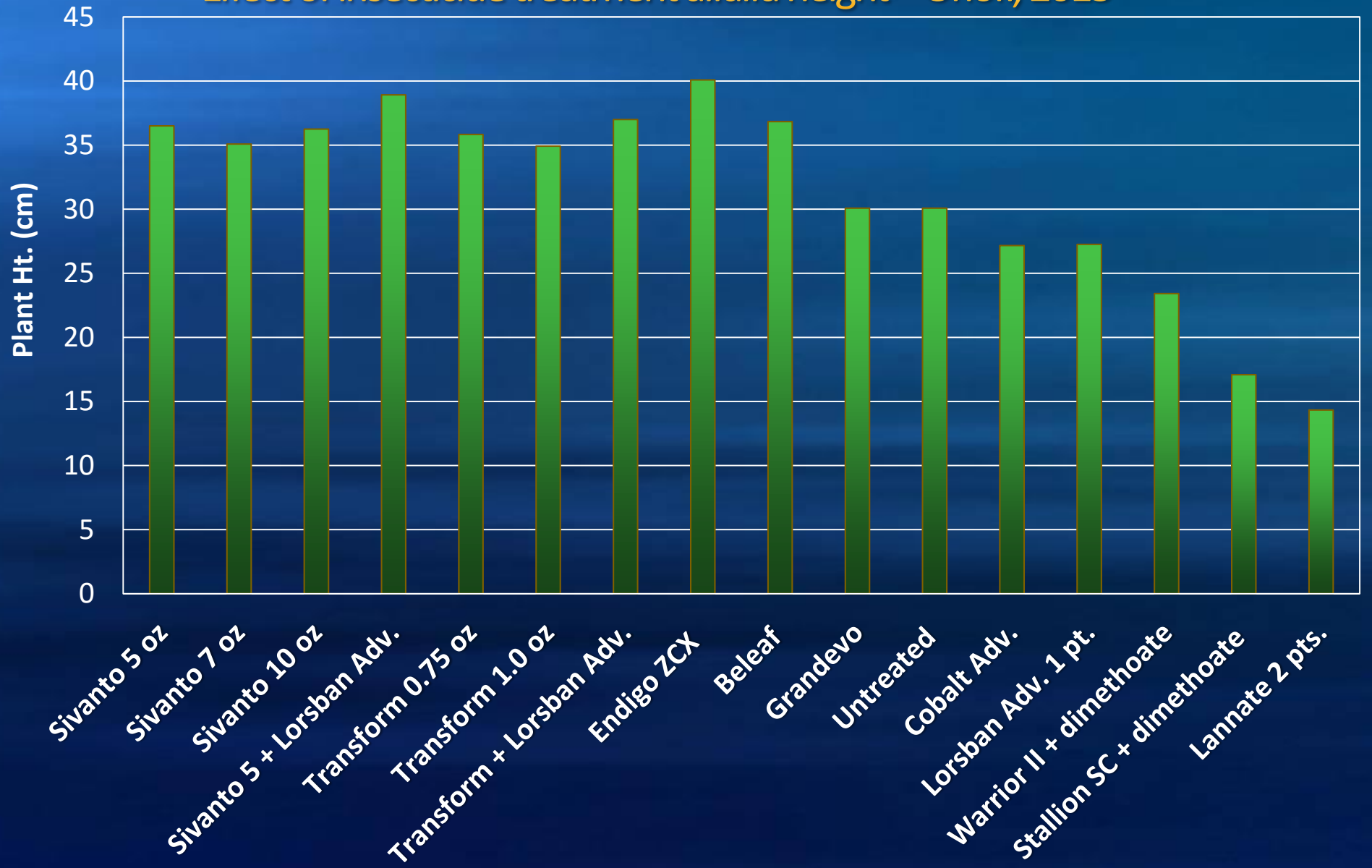
Abstract. A new bluegreen aphid biotype (BGA, *Acyrthosiphon kondoi* Shinji) has been found in south-eastern Australia that causes severe damage and mortality in seedlings of previously resistant pasture legume cultivars. Populations of BGA collected at Urrbrae and Binnum, SA in 2009 caused 100% mortality in 29 cultivars of annual and perennial *Medicago* spp. and annual *Trifolium* spp. Delaying inoculation from the first trifoliate to the 6–8 trifoliate stage and removing susceptible genotypes from experiments had no impact on reducing mortality from 100% in previously resistant barrel medics. A half-sib family of lucerne from the SARDI breeding program has maintained resistance to the Urrbrae 2009 BGA.

A detailed study of the virulence of BGA populations collected from Toowoomba (Qld), Tamworth, Howlong (NSW), Launceston (Tas.), Colebatch, Kimba, Urrbrae and Vivonne Bay (SA) in 2010–11 on 33 pasture legumes provides evidence of new virulent BGA being widespread, despite these populations causing less severe damage and mortality than the two populations collected in 2009.

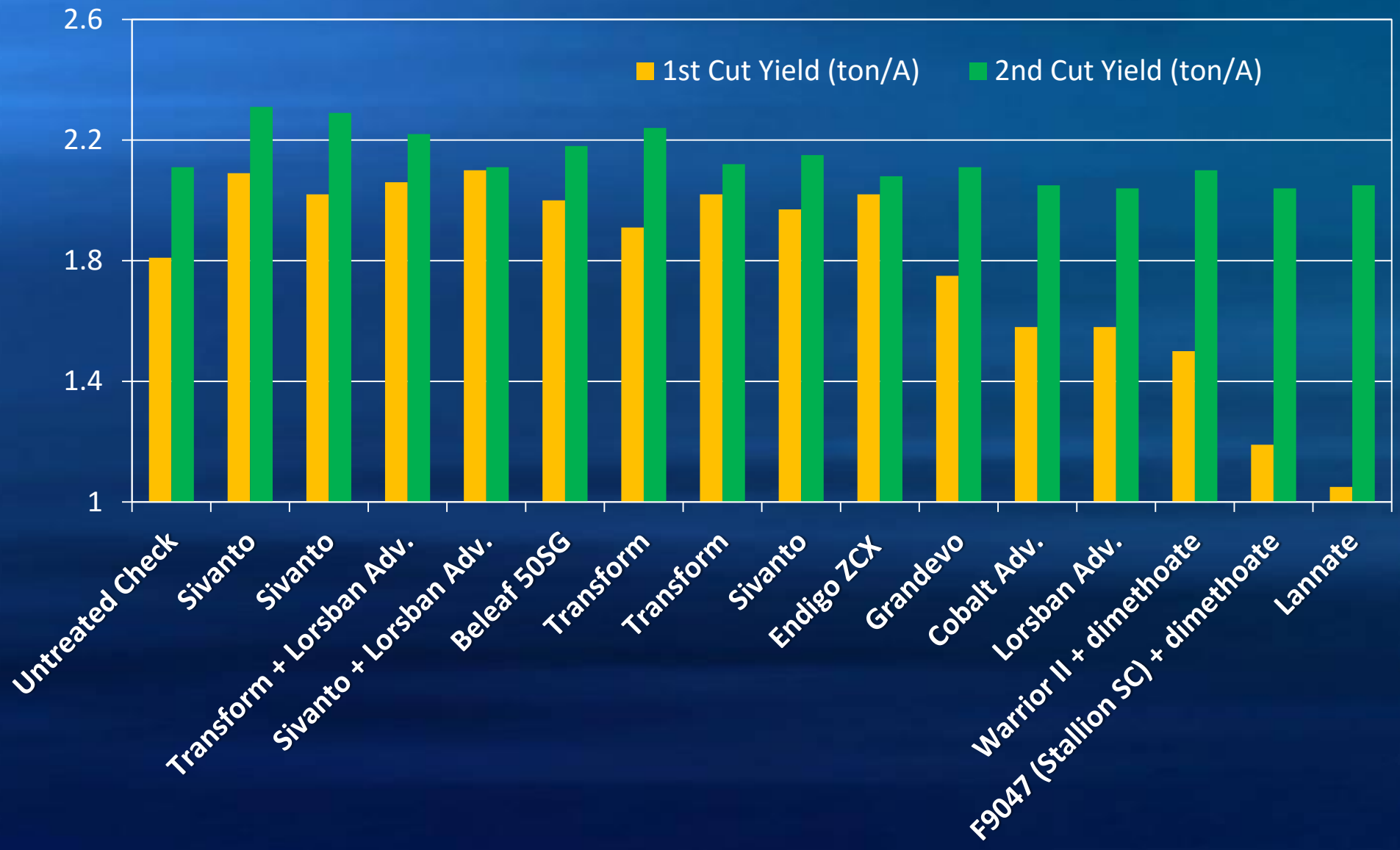
Effect of insecticide treatment and rate on blue alfalfa aphid population
Orloff, 2015



Effect of insecticide treatment alfalfa height – Orloff, 2015



Effect of insecticide treatment and rate on alfalfa yield – Orloff, 2015



Source (Steve Orloff)