INSECT PEST MANAGEMENT ISSUES IN ALFALFA--APHIDS

UC Cooperative Extension
University of California
Agriculture and Natural Resources

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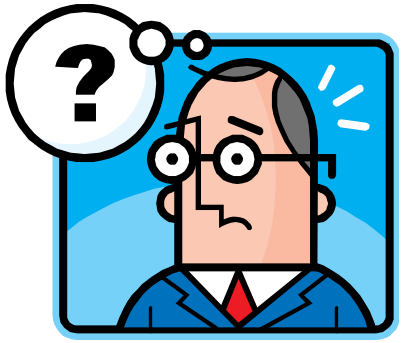
Overview

- Recent challenges in alfalfa IPM
  - Lep. larvae
  - Cowpea aphids
  - Alfalfa weevil
  - Alfalfa stem nematode
- 2013-14 alfalfa IPM
  - Egyptian alfalfa weevil/alfalfa weevil
  - Blue alfalfa aphid
  - Other aphid species

Pest Management in Alfalfa

2013-14



Origin of Integrated Pest Management (IPM)

- basic ideas setting the groundwork for IPM
- some of these came from observations in the alfalfa system

HILGARDIA

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THE INTEGRATED CONTROL CONCEPT[1]

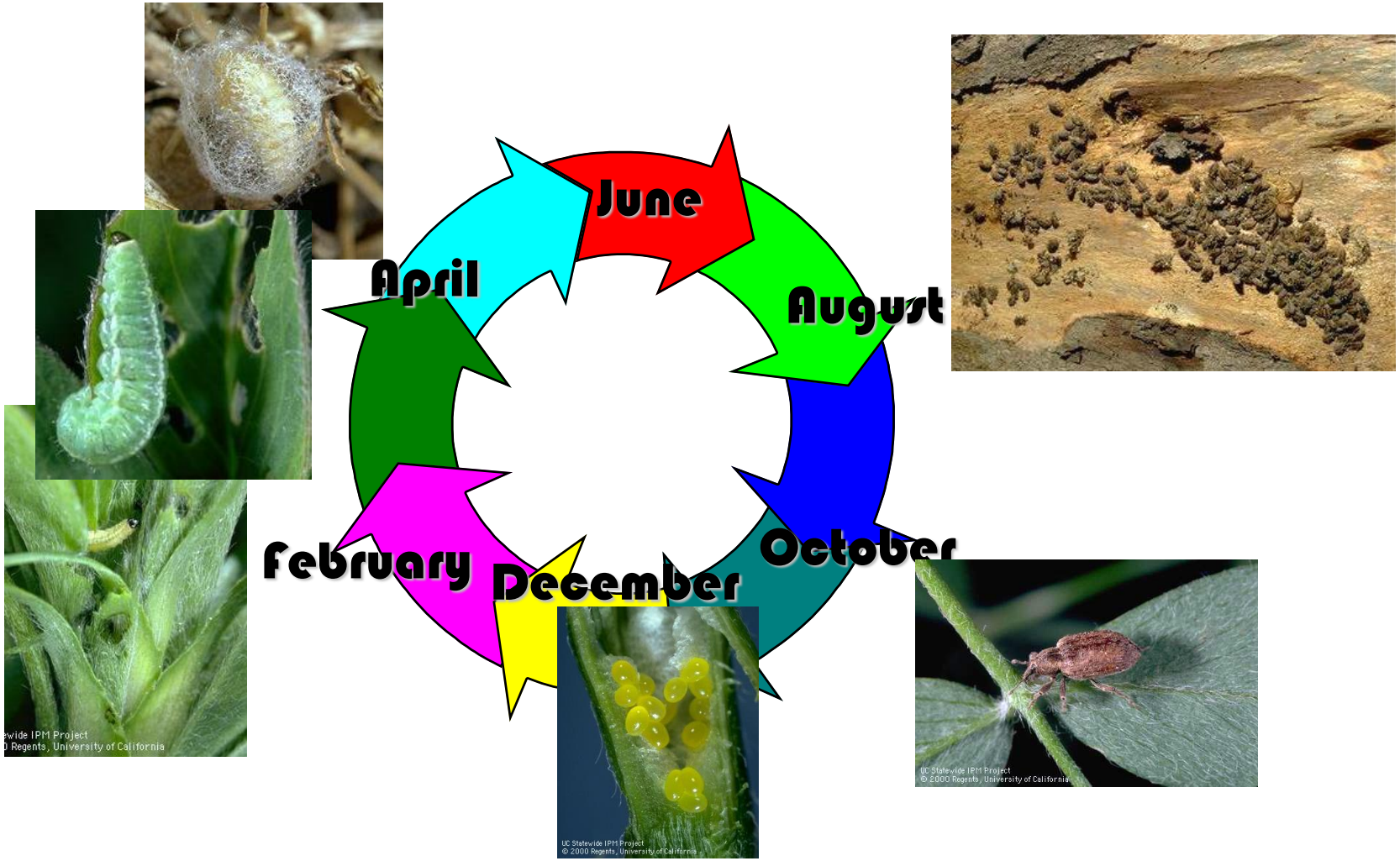
VERNON M. STERN, RAY F. SMITH, ROBERT van den BOSCH, and KENNETH S. HAGEN[2]

ALL ORGANISMS are subjected to the physical and biotic pressures of the environments in which they live, and these factors, together with the genetic make-up of the species, determine their abundance and existence in any given area. Without natural control, a species which reproduces more than the parent stock could increase to infinite numbers. Man is subjected to environmental pressures just as other forms of life are, and he competes with other organisms for food and space.

Weevil Concerns

Difficulties Controlling Alfalfa Weevil

Multiple Generations of Alfalfa Weevil



Aphids in Alfalfa

Blue Alfalfa Aphid Outbreak 2013-14

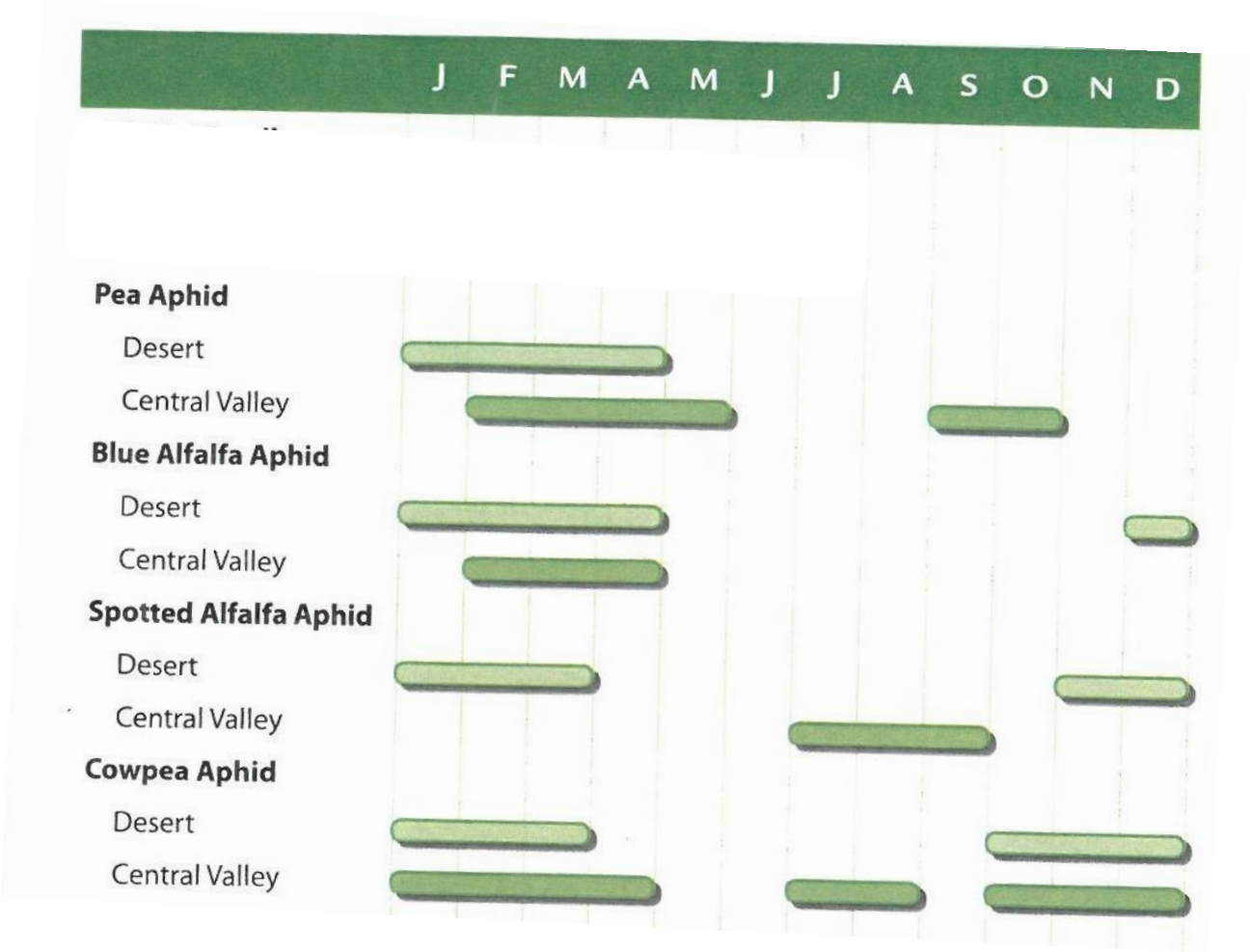
Aphids in Alfalfa

Spotted Alfalfa Aphid populations 2013

Aphid Biology

- Many species do not require sexual reproduction
- Rapid generation turnover
  - “Telescoped generations”
  - Viviparous female
  - Live birth
- Phloem feeders
  - Extract nitrogen
  - Concentrate sugars in excrement (honeydew)

Seasonal Occurrence of Aphids in Alfalfa



Common Aphids in Alfalfa

- **Blue Alfalfa Aphid**
  - Antenna uniformly brown

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

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

Which of These Aphids is **Blue Alfalfa Aphid?**

Blue Alfalfa

Cowpea

Pea Aphid

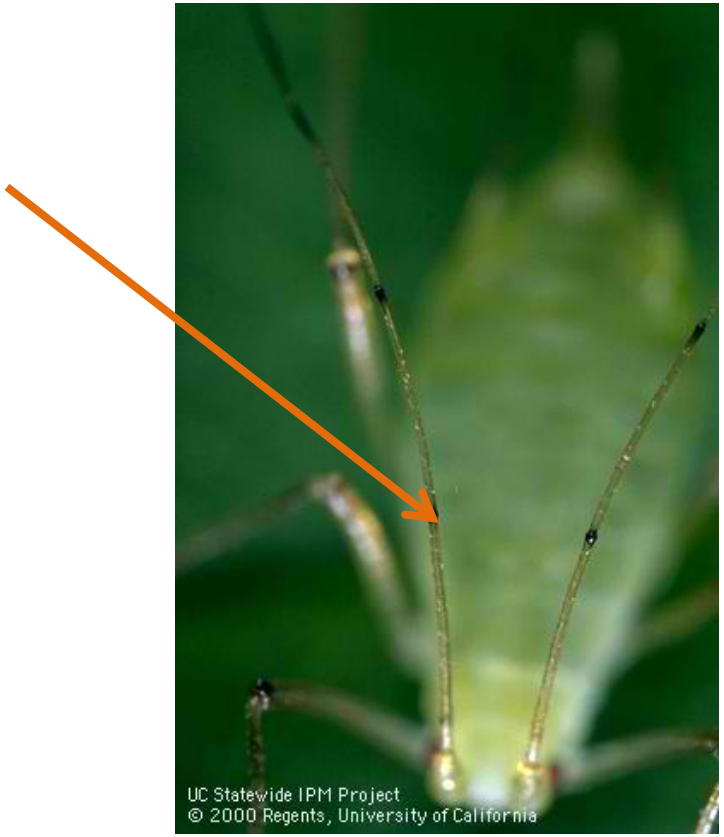
Pink Form Pea

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/

Antennal Difference Between Aphids

Pea Aphid



Blue Alfalfa

Pea Aphid –

Acyrthosiphon pisum

- Antenna have a dark band at the tip of each segment
- Spring and Fall populations
- More widely distributed on plant
- Feeding does NOT result in stunting

Blue Alfalfa –

Acyrthosiphon kondoi

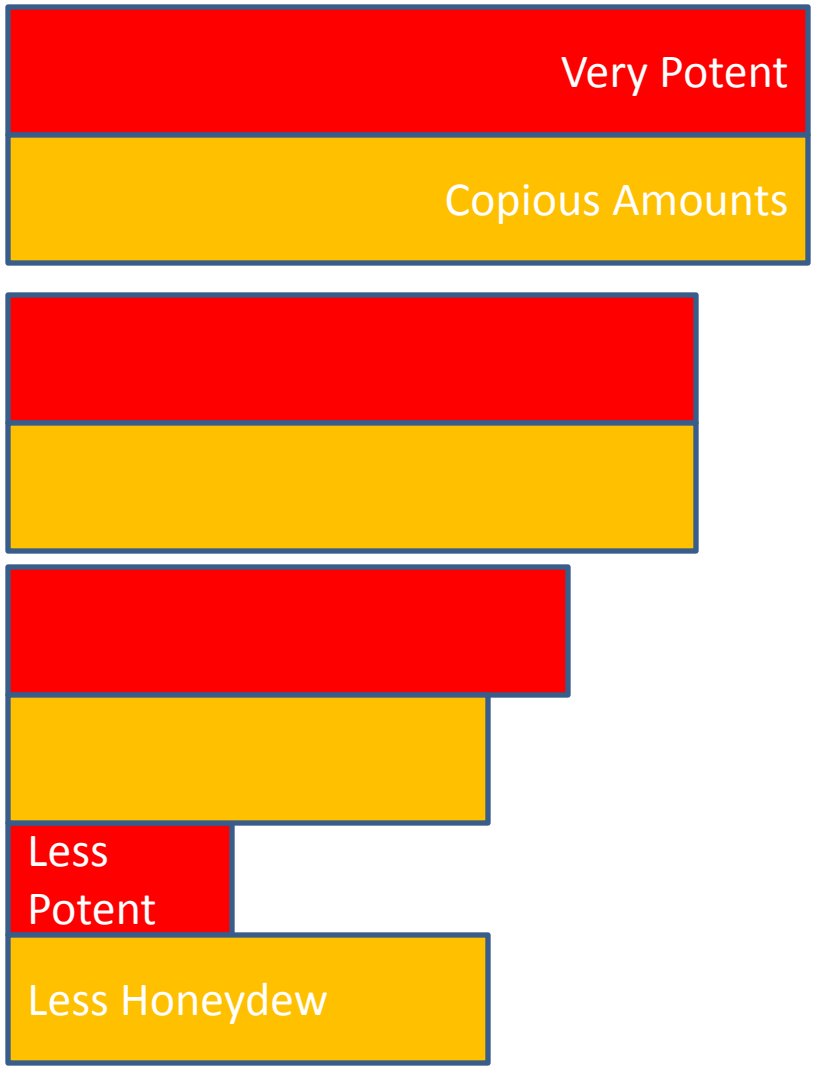
- Antenna are uniformly dark brown in color
- Late winter or spring only
- More tolerant of cool temperatures
- Prefers terminal area of plant
- Injects feeding toxin, stunts plants, especially young plants

Action Thresholds
Aphids per Stem

Plant Height	Pea Aphid	Blue Alfalfa Aphid	Cowpea Aphid
Under 10 in.	40 to 50	10 to 12	10 – 12
10 to 20 in.	70 to 80	40 to 50	40 - 50
Over 20 in.	100 +	40 to 50	40 - 50

Aphids Can Inject **Toxins** and Produce **Honeydew**

- **Spotted Alfalfa Aphid**
- **Cowpea Aphid**
- **Blue Alfalfa Aphid**
- **Pea Aphid**



History - Aphids in Alfalfa

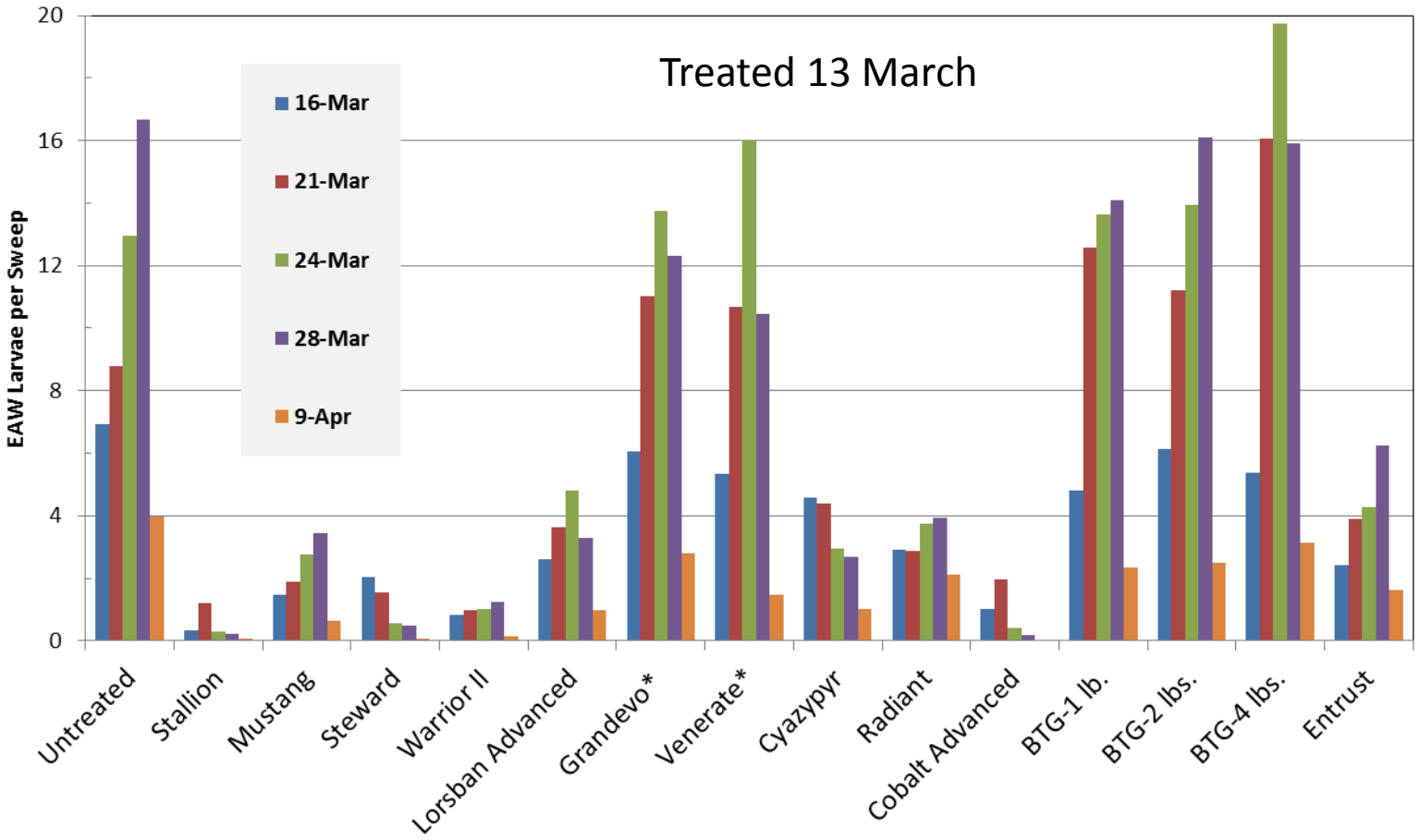
- **Pea Aphid - in the western U.S. for 100+ years**
- **Spotted Alfalfa Aphid – first found in 1950's**
- **Blue Alfalfa Aphid - first found in CA in Kern Co. near Bakersfield in 1974 and Imperial Co. in 1975**
- **Cowpea Aphid – started damaging alfalfa ~10 years ago**

Management - Aphids in Alfalfa

	Insecticides	Cultural	Biological	Host Plant Resistance
Pea Aphid	X		XX	
Blue Alfalfa Aphid	X		XX	XX
Spotted Alfalfa Aphid	X		X	XX
Cowpea Aphid	XX		X	

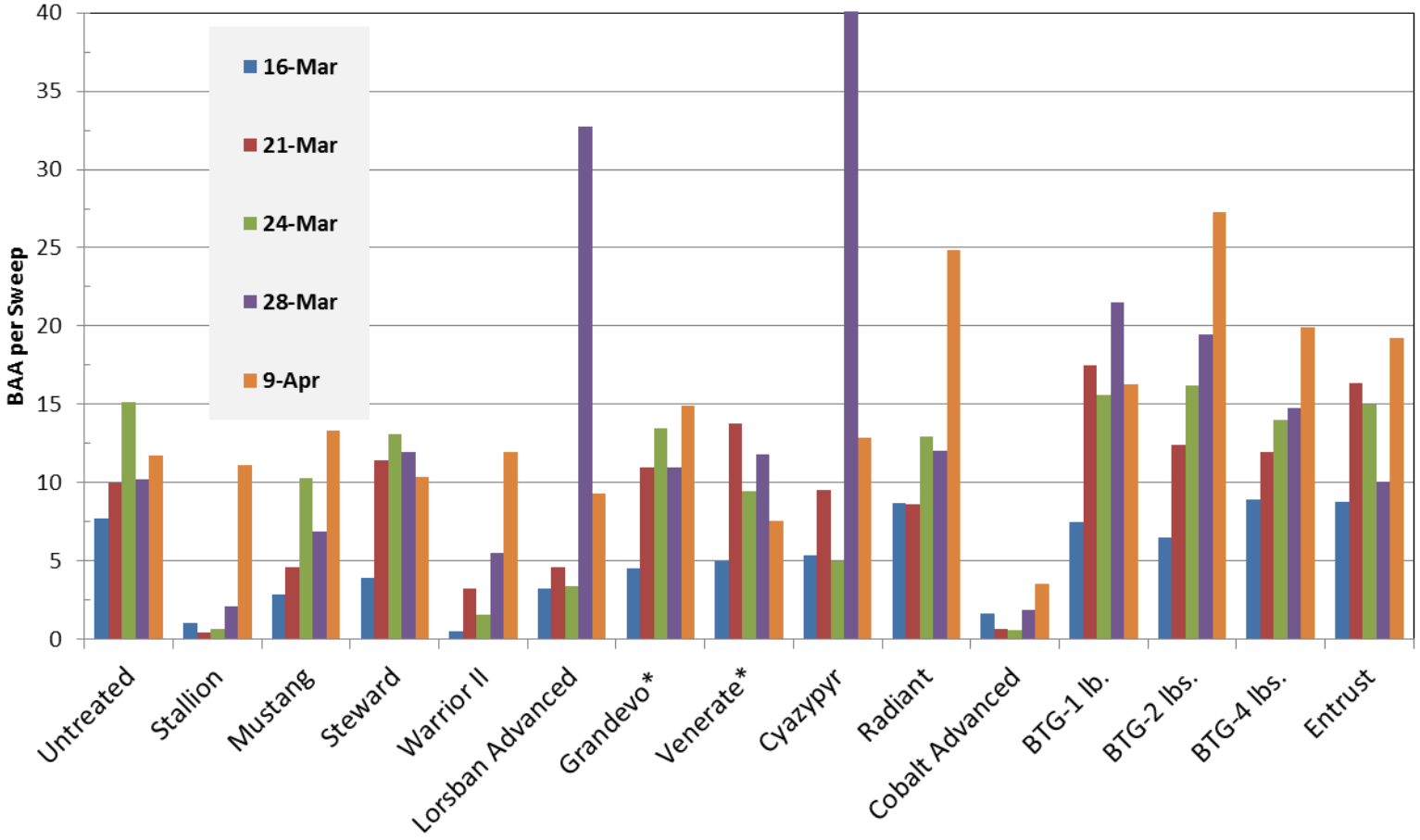
Blue Alfalfa Aphid Outbreak 2013-14

EAW & Aphid Trial, Davis March 2013



Source: Larry Godfrey

EAW & Aphid Trial, Davis March 2013



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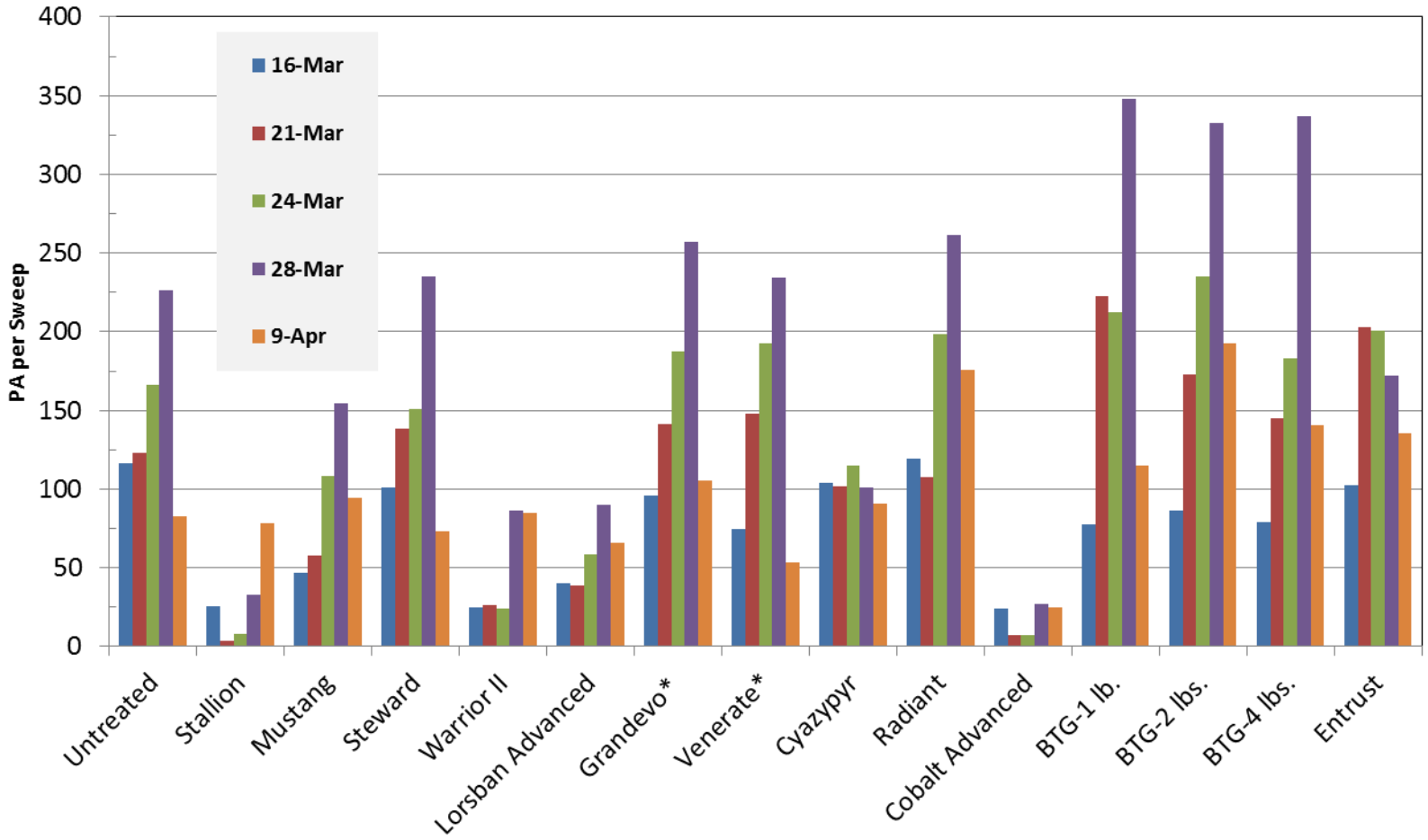
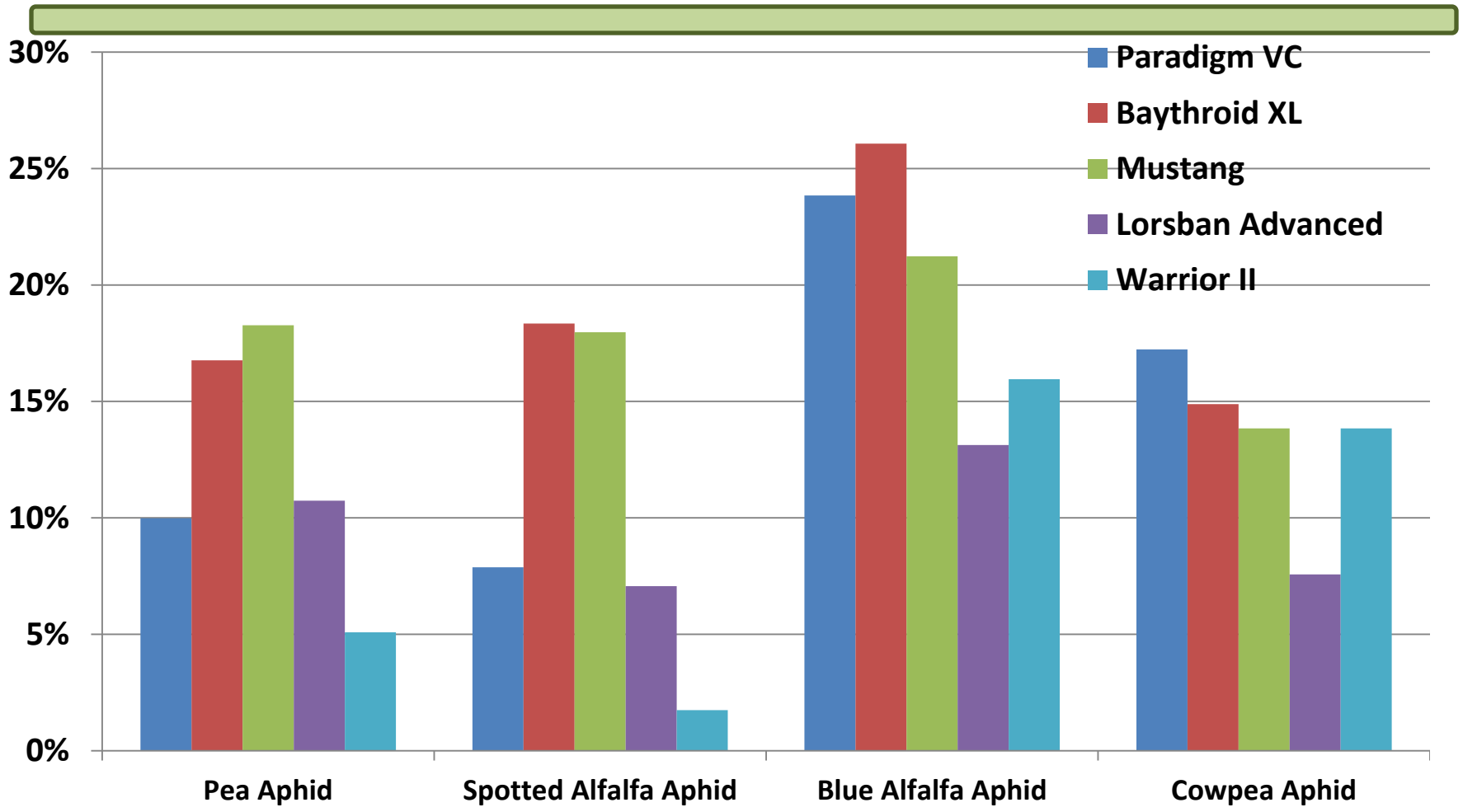


Source: Larry Godfrey

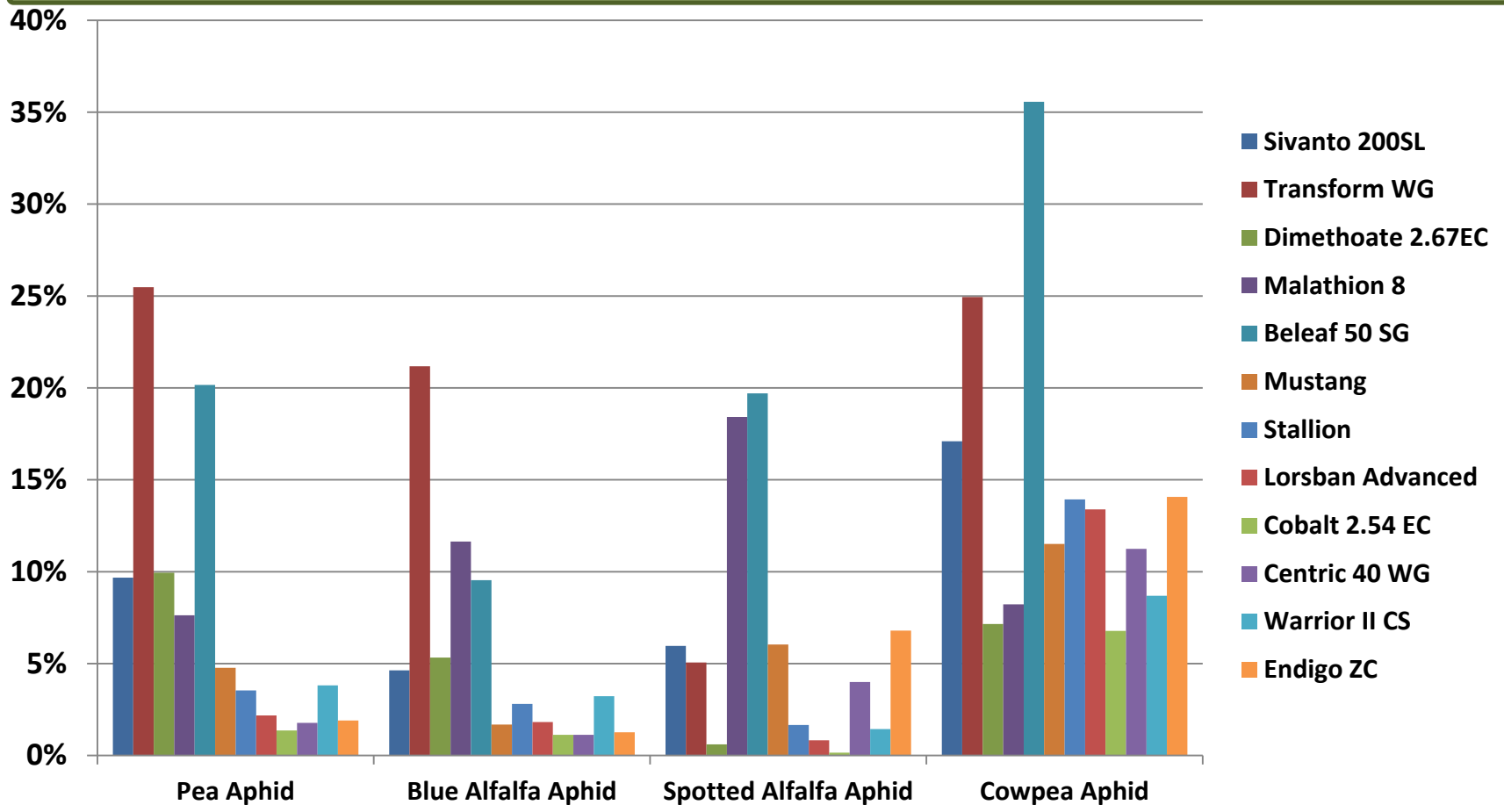
EAW & Aphid Trial, Imperial Valley 28 February 2013



Percent of Check, Post Treatment Average

Source: Eric Natwick

Aphid Trial, Imperial Valley
17 January 2013



Percent of Check, Post Treatment Average

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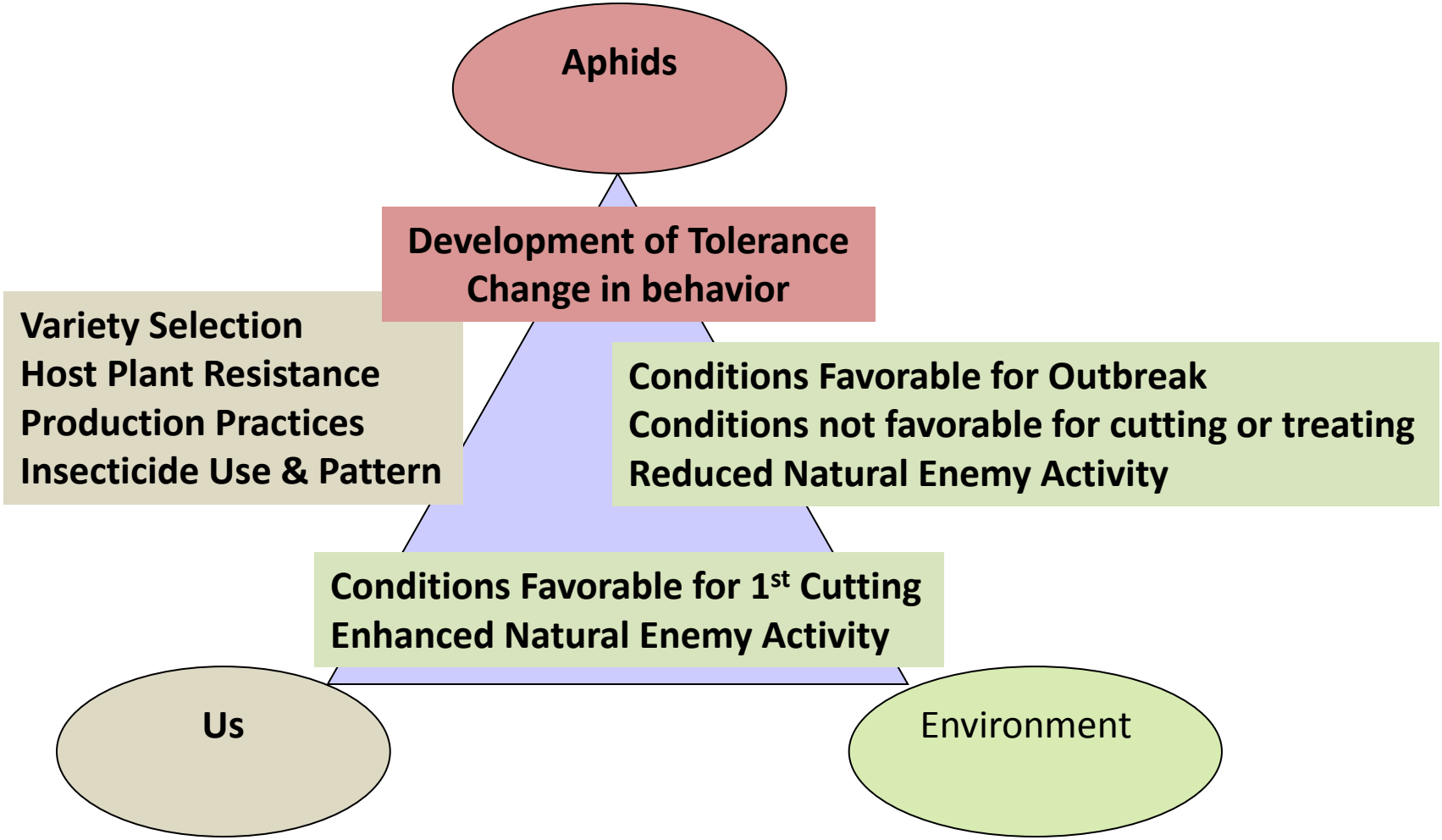
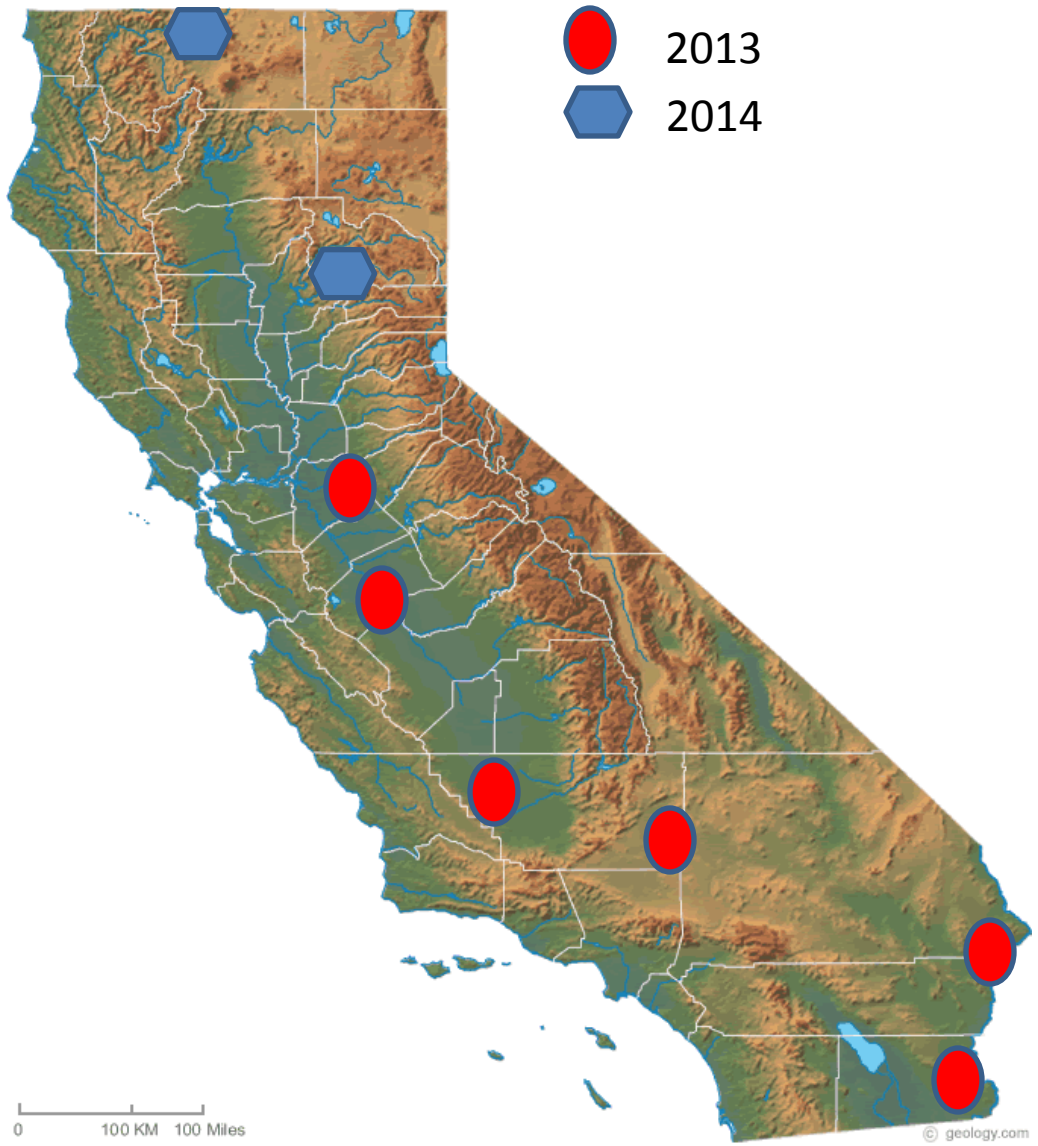
Outbreaks Are Complex Events



Characteristics of BAA Outbreak

- Resurgence of BAA, 1-2 weeks post weevil
- Retreatment required
- Control difficult, residual control lacking
- **Spotty, not widespread, not every field**
- Timing of outbreak varies by location
- Some noted low abundance of ladybird beetles
- Damage substantial in some cases
- Lingering effect of toxin into next cutting

Outbreaks Reported 2013-14



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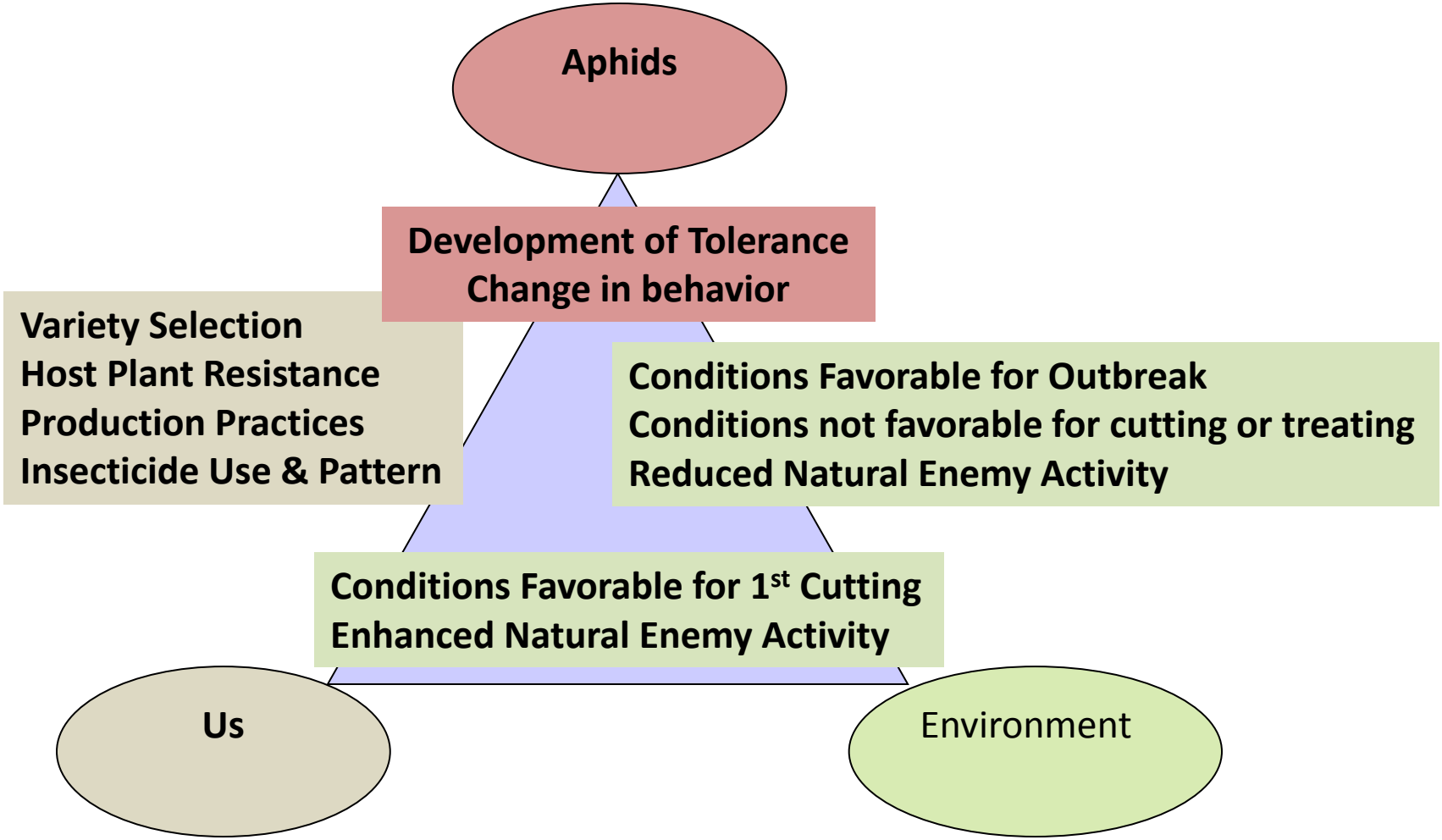

Environment –
Fungus in Aphid Population

Environment – Natural Enemies

- Slow Development of Biological Control

  Dry winter

  Windy spring

- Absence of Big-eyed bugs??

	# per 50 sweeps	
	2012	2013
BEB adults	6.25	0.4
BEB nymphs	1.0	0.1

“Numbers Game”


UC Statewide IPM Project
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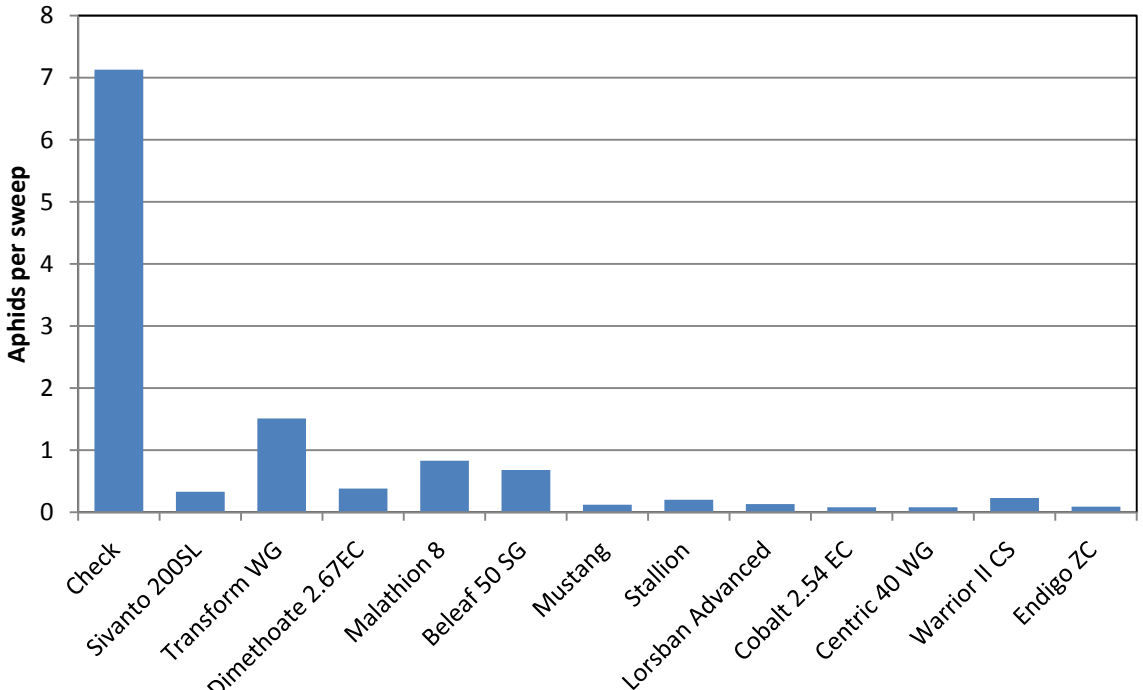
Change in the Aphid

- Insecticide Resistance
- New Biotype of Aphid
- Failure of Host Plant Resistance

Is There Resistance?

- Dow AgroSciences conducted quick “dip assay’
  - No evidence of increased tolerance to chlorpyrifos
- Field trials - limited evidence of resistance
- Need colony of “untreated” BAA



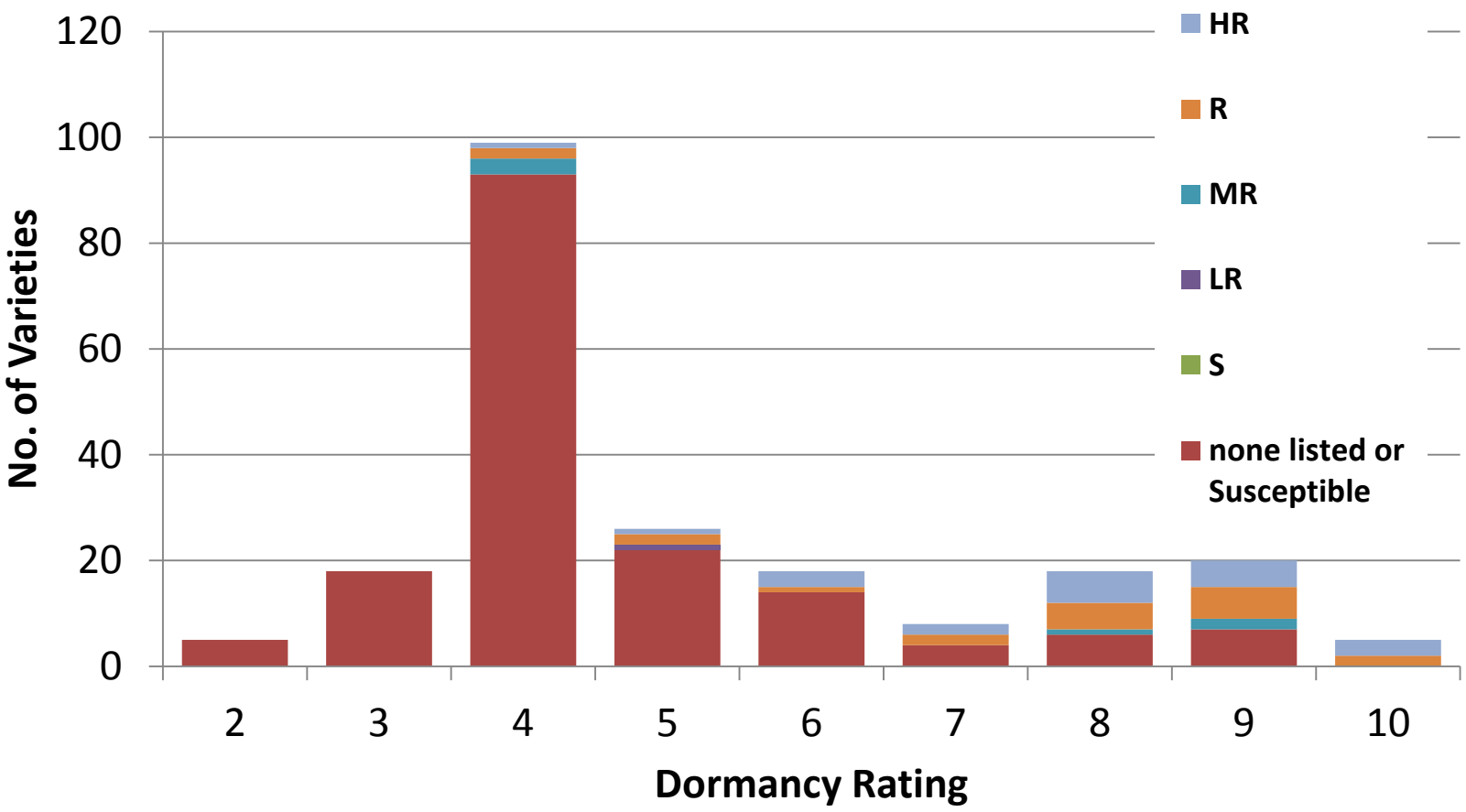
What Are People Speculating Was the Cause of Outbreak?

- Insecticide Resistance - Evidence Not Apparent
- New Biotype
  - “Nebraska”
  - pursued lead but found no evidence
- Failure of Host Plant Resistance
  - usually happens more gradually
  - is a report of this same aphid overcoming host plant resistance in Australia
- RR alfalfa
  - No evidence

What Are People Speculating Was the Cause of Outbreak?

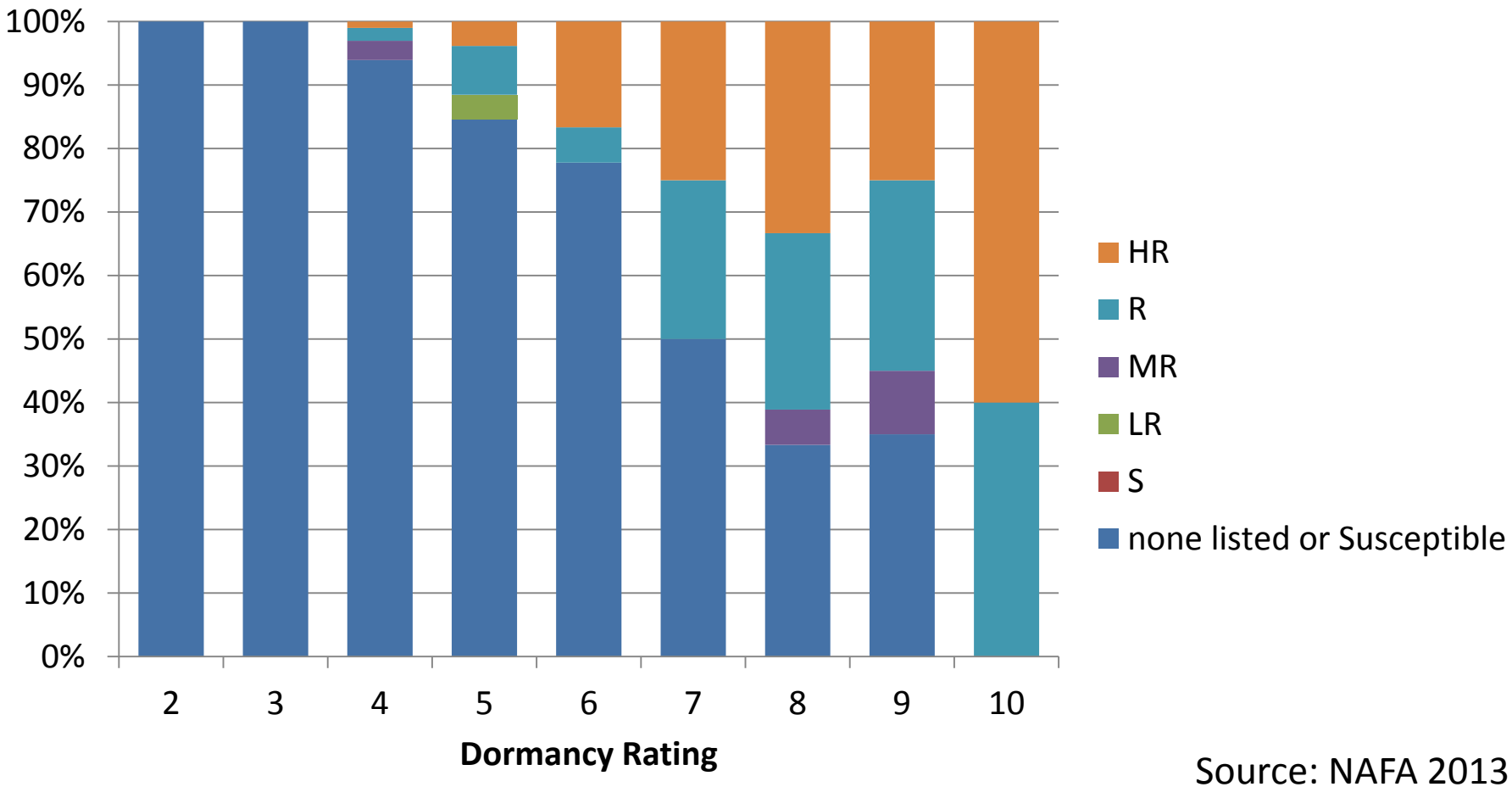
- Failure of Host Plant Resistance
- Mainstay of management since BAA and SAA introductions
  - Host Plant Resistance - antibiosis is involved
  - Resistance is virtually lost at 60 ^{0}F
  - Most active under hot conditions
  - Aphids attempt to “evolve” to overcome resistance

Host Plant Resistance to Blue Alfalfa Aphid



Source: NAFA 2013

Host Plant Resistance to Blue Alfalfa Aphid



Source: NAFA 2013

Host Plant Resistance to Blue Alfalfa Aphid

Host Plant Resistance to Blue Alfalfa Aphid

Variety	Contact for Marketing Information	= Fall Dormancy	= Winter Survival	= Bacterial Wilt	= Verticillium Wilt	= Fusarium Wilt	= Anthracnose Race 1	= Phytophthora Root Rot	= Spotted Alfalfa Aphid	= Pea Aphid	= Blue Alfalfa Aphid	= Stem Nematode	= Aphanomyces Race 1	= Aphanomyces Race 2	= Southern Root Knot Nematode	= Northern Root Knot Nematode	= Potato Leafhopper	= Multifoliolate Expression (H-High, M-Mod., L-L)	= Continuous Grazing Tolerance (Y-Yes)	= Standability Expression (R-Resistant)	= Salt Tolerance (G-Germination; F-Forage)	= Miscellaneous (R-RFA; H-Population Hybrid)
DKA43-22RR	DeKalb	4	2	HR	HR	HR	HR	HR				HR	HR			R		H				R
Focus	J.R. Simplot	4	3	HR	R	HR	HR	HR	HR	R		HR	HR			R		H				
ForageGold	Tri-West	4	2	HR	HR	HR	HR	HR		R	R	R	HR					M				
FSG 400LH	Farm Science	4	2	HR	HR	HR	HR	HR	MR	R		R	HR			MR	HR					
FSG 406	Farm Science	4	1	HR	HR	HR	HR	HR		R		R	HR			R		H				
FSG 408DP	Farm Science	4	2	HR	R	HR	HR	HR		R		R	R			HR						
FSG 420LH	Farm Science	4	2	HR	HR	HR	HR	HR		R		R	HR				HR	L				
FSG 429SN	Farm Science	4	2	HR	HR	HR	HR	HR	R	HR		HR	HR			R		H				
FSG 505	Farm Science	4	2	HR	HR	HR	HR	HR	R	R			HR			R						
GrandStand	Crop Production	4	1	HR	HR	HR	HR	HR	R	HR		MR	HR			R		H				
HybriForce-2400	Dairyland	4	2	HR	HR	HR	HR	HR		R		HR	HR		R	HR					F	H
HybriForce-2420/Wet	Dairyland	4	2	HR	HR	HR	HR	HR				HR	HR	R	R	HR						H
Integra 8400	Wilbur-Ellis	4	2	HR	HR	HR	HR	HR		HR		R	HR			R						
Integra 8401RR	Wilbur-Ellis	4	2	HR	HR	HR	HR	HR		R		R	HR			R		H				R
Integra 8420	Wilbur-Ellis	4		HR		HR	HR	HR		R		HR	HR					M				
Integra 8444RR	Wilbur-Ellis	4		R	HR	HR	HR	HR	HR			HR	R					M				R
Lancer	Growmark/S.S./TFC	4	2	HR	HR	HR	HR	HR		HR		R	HR				HR	L				
Liberator	Nexgrow Alfalfa	4	2	HR	HR	HR	HR	HR	R	R		R	HR			MR		H				R
Magnitude	Growmark/Allied	4	2	HR	HR	HR	HR	HR	R	R		R	HR					H				
Magnum 7	Dairyland	4	2	HR	HR	HR	HR	HR		R		HR	HR	R	R	HR						
Magnum 7 - Wet	Dairyland	4	2	HR	HR	HR	HR	HR		R		HR	HR	R	HR	HR						
Magnum Salt	Dairyland	4	2	HR	HR	HR	R	HR		R		HR	R		R	HR						
Magnum V	Dairyland	4	2	HR	R	HR	R	HR	R	R	MR	R	MR			MR						
Mariner III	Growmark/Allied	4	2	HR	HR	HR	HR	HR		R		R	HR	R		HR						
Mariner IV	Growmark/Allied	4	2	HR	HR	HR	HR	HR		R		HR	HR	R	HR	HR						
Marvel	Growmark/Allied	4	2	HR	HR	HR	HR	HR	R	HR		R	HR				MR	H				
Medalist	Union	4	3	HR	HR	HR	HR	HR	HR	R		HR	R			HR		M				

What People Were Using to Control Pests

- Weevil
  - Warrior (or other lambda cyhalothrin)
  - Steward
  - Cobalt (chlorpyrifos & lambda cyhalothrin, premix)
- Aphid
  - Chlorpyrifos, malathion with weevil treatment
  - Dimethoate second treatment
  - Lannate in worst conditions

It’s a Numbers Game

- 95% efficacy may leave too many aphids, especially if being concentrated in windrows (e.g. “early cutting”)
- Use of broad spectrum insecticides reduce your biocontrol assets in the field
- Population more likely to rebound

Damage: stunting, reduced vigor

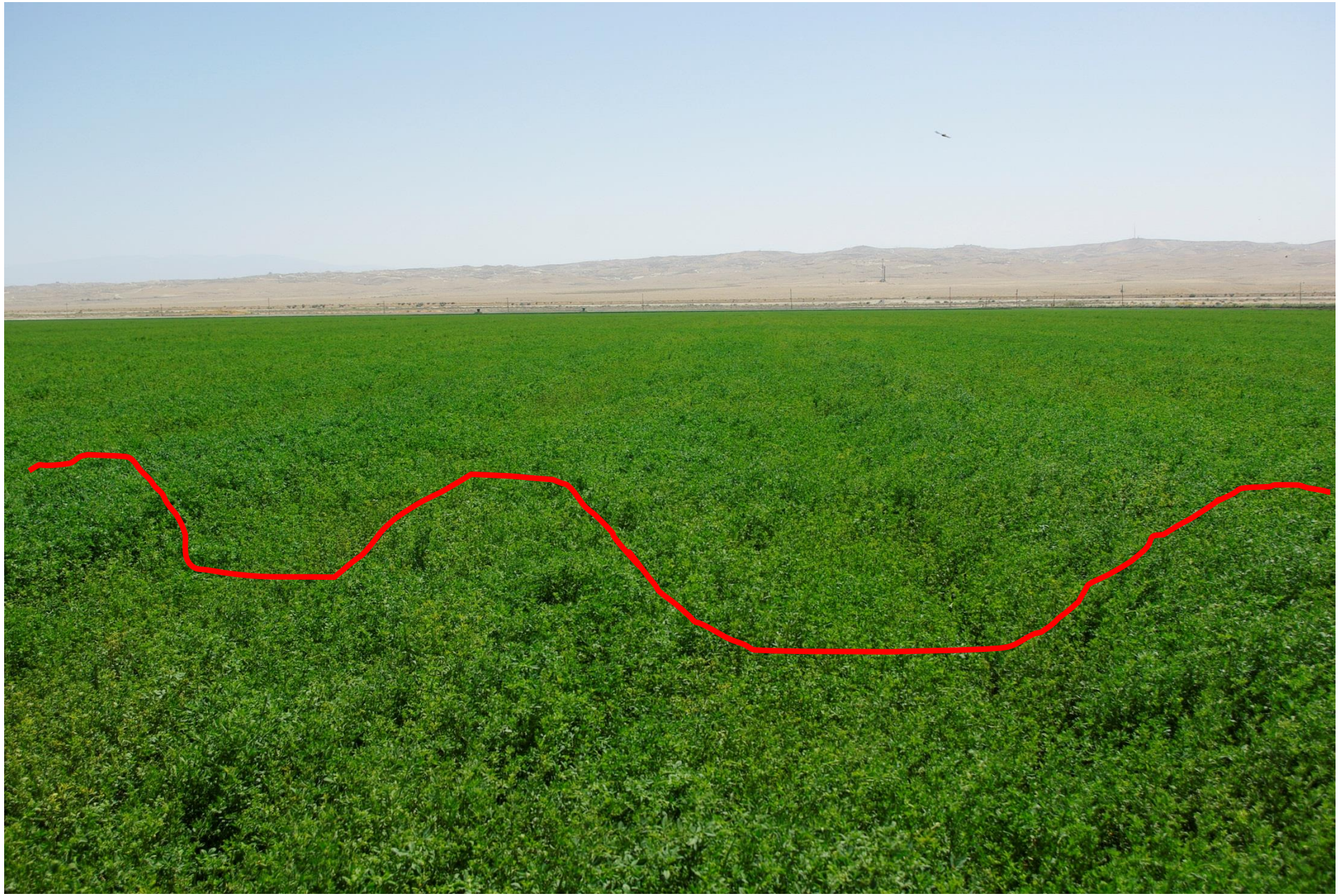
High Desert,
Lancaster, CA

Dos Palos,
Merced Co

9 inches tall
30 days post 1st cutting

What Losses Did People Report Due to BAA?

Region	Acres Infested	Loss	Stand Age	Damage Severity Ranking 1 low, 5 high
Imperial Valley	> 1000 acres	$70/ac, 1/3 ton	3rd Year	4
Dos Palos	500-1000 acres			
Dos Palos	>1000 acres	$250/ac for 2 cuttings	3rd Year	5
Dos Palos		$150/acre	2cd Year	5
Buttonwillow	>1000 acres	½ - ¾ bale	2cd & 3rd Year	3
Dos Palos	85 acres	$90/ac	second	5
Dos Palos	100-500	40% reduction	3-5th	4
Palo Verde Valley	> 1000	$100/acre	2 months to 3rd Year	5
Palo Verde	> 1000	$125/acre	4th Year	5



So What Do We Know?

- Cause of outbreak unknown
- OPs did not sufficiently control BAA
- Low aphid densities were allowed to get into second cutting
- Distribution pattern is odd
  - First year fields, no insecticides (winged)
  - Very spotty
- Damage and loss occurred

Where We Going?

- 24c label for Beleaf 50SG – 62 day preharvest interval
- three other new insecticides with activity on aphids nearing registration
- need for research to provide answers to some of the outstanding questions