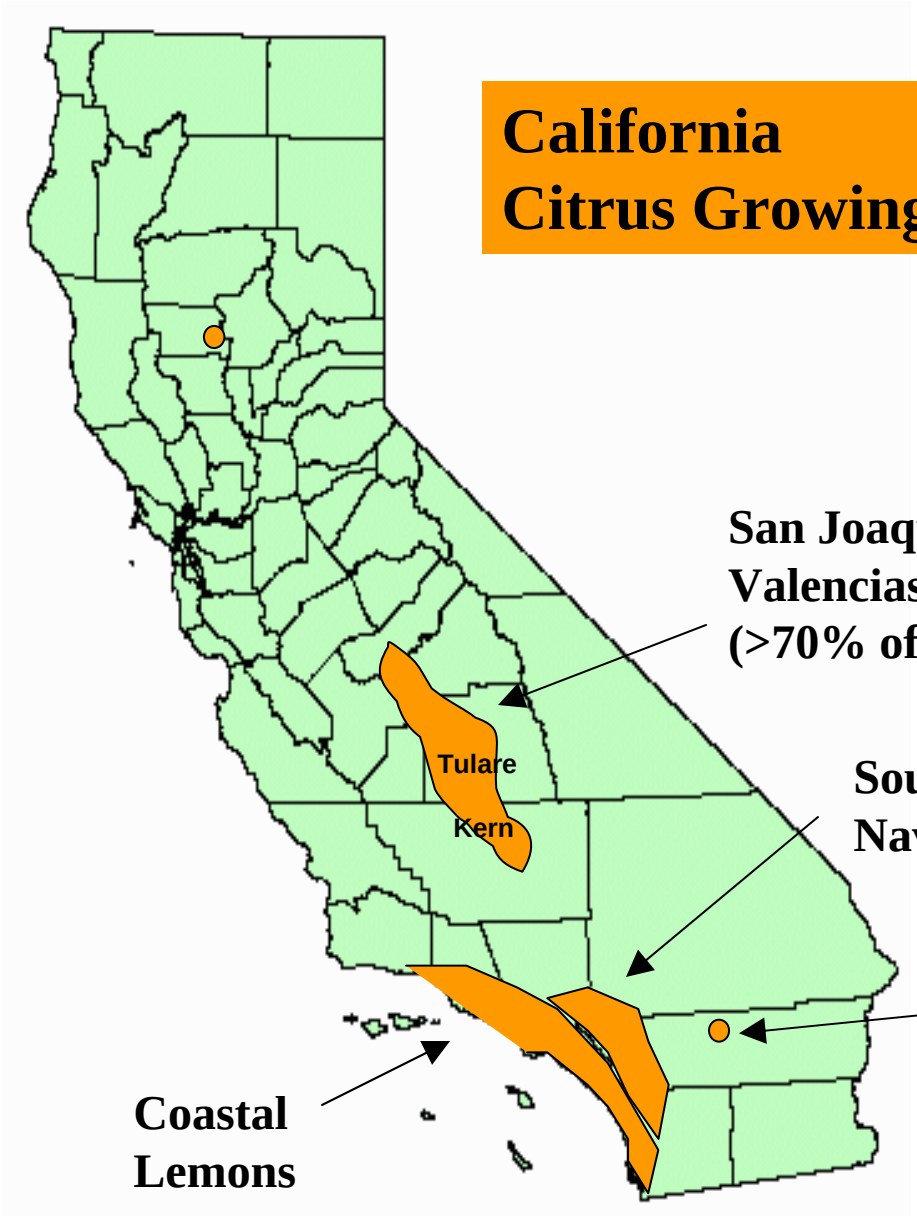
Current Strategies for Reducing VOCs in San Joaquin Valley Citrus

Beth Grafton-Cardwell
Dept. of Entomology, UC Riverside
Stationed at the Kearney Ag Center
& Director of Lindcove Research & Ext. Center

Technical staff:
Chris Reagan, Janet McClain, Janine Lee, and Greg Montez

California
Citrus Growing Regions



San Joaquin Valley Navels, Valencias & Mandarins (>70% of citrus)

Southern Interior Navels & Valencias

Desert Grapefruit

Coastal Lemons

TABLE 6: Top ten pesticide application sites contributing to 2004 May-October ozone season VOC emissions in NAA 2.

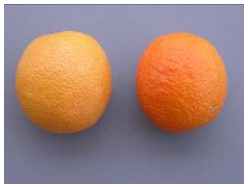
Application site	Emissions (tons/day)	% of all May -Oct 2004 missions
CARROT	3.952	15.4
ALMOND	3.113	12.1
COTTON	2.690	10.5
ORANGE	2.007	7.8
NURSERY OUTDR CONTAINER -FLD GRWN PLANTS	1.779	6.9
GRAPE	1.337	5.2
POTATO	0.985	3.8
WALNUT	0.838	3.3
RIGHTS OF WAY	0.654	2.6
PROCESSING TOMATOES	0.579	2.3

TABLE 5: Top ten primary active ingredients contributing to 2004 May-October ozone season VOC emissions in NAA 2, the San Joaquin Valley.

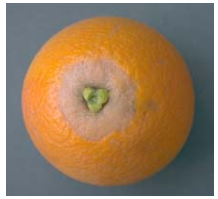
Primary AI	Total product emissions (tons/day)	% of all May -Oct 2004 emissions
METAM-SODIUM	5.749	22.4
1,3-DICHLOROPROPENE	4.887	19.1
CHLORPYRIFOS	2.856	11.1
METHYL BROMIDE	2.694	10.5
DIMETHOATE	0.570	2.2
OXYFLUORFEN	0.569	2.2
POTASSIUM NMETHYLDITHIOCARBAMATE	0.565	2.2
GIBBERELLINS	0.515	2.1
ENDOSULFAN	0.515	2.0
ACROLEIN	0.454	1.8

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Citrus Red Mite, *Panonychus citri*

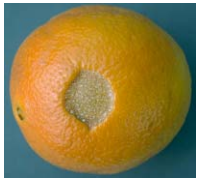


Citrus Thrips, *Scirtothrips citri*



Mar-Jun 1-2 applications/year

Forktailed Bush Katydid, *Scuddaria furcata*

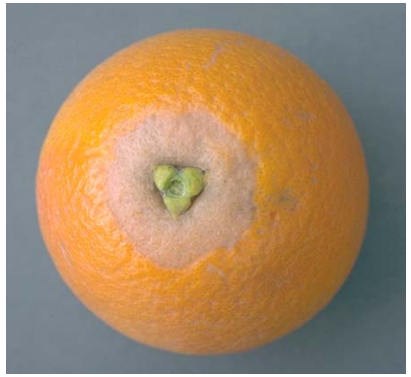


California red scale, *Aonidiella aurantii*

Jun-Sep 1-2 applications/year

Citricola scale, *Coccus pseudomagnoliarum*

Citrus Thrips, *Scirtothrips citri*



Impact of California Red Scale

Direct Damage – dieback of branches

Cosmetic Damage – downgrading of fruit

Pesticide Choices Early 1990s

Target Pest	Conventional Program
Citrus thrips *Scritothrips citri*	OP: dimethoate, chlorpryifos Carbamate: formetanate
California red scale *Aonidiella aurantii*	OP: chlorpyrifos, methidathion Carbamate: carbaryl
Citrus Red Mite *Panonychus citri*	Miticides: dicofol, propargite
Citrus cutworm *Egira curialis*	OP: chlorpyrifos *Bacillus thuringiensis*
Katydid *Scuddaria furcata*	Not needed
Citricola scale *Coccus pseudomagnoliarum*	Not needed

11 New Pesticides Registered for California Citrus during 1994-2005

Insect Growth Regulators (California red scale, peelminer)

- *pyriproxifen (Esteem 0.86 EC) 2000 (section 18: 1998-99)
- buprofezin (Applaud 70WP) 2002 (section 18: 1997-99)
- diflubenzuron (Micromite 80WSG)2003

Pyrethroids (citrus thrips, katydid)

- cyfluthrin (Baythroid 2E) 1997 (section 18: 1991-96)
- fenpropathrin (Danitol 2.4 EC)2001

Fermentation products (citrus thrips)

- abamectin (Agri-Mek 0.15 EC)1994
- *spinosad (Success) 1998

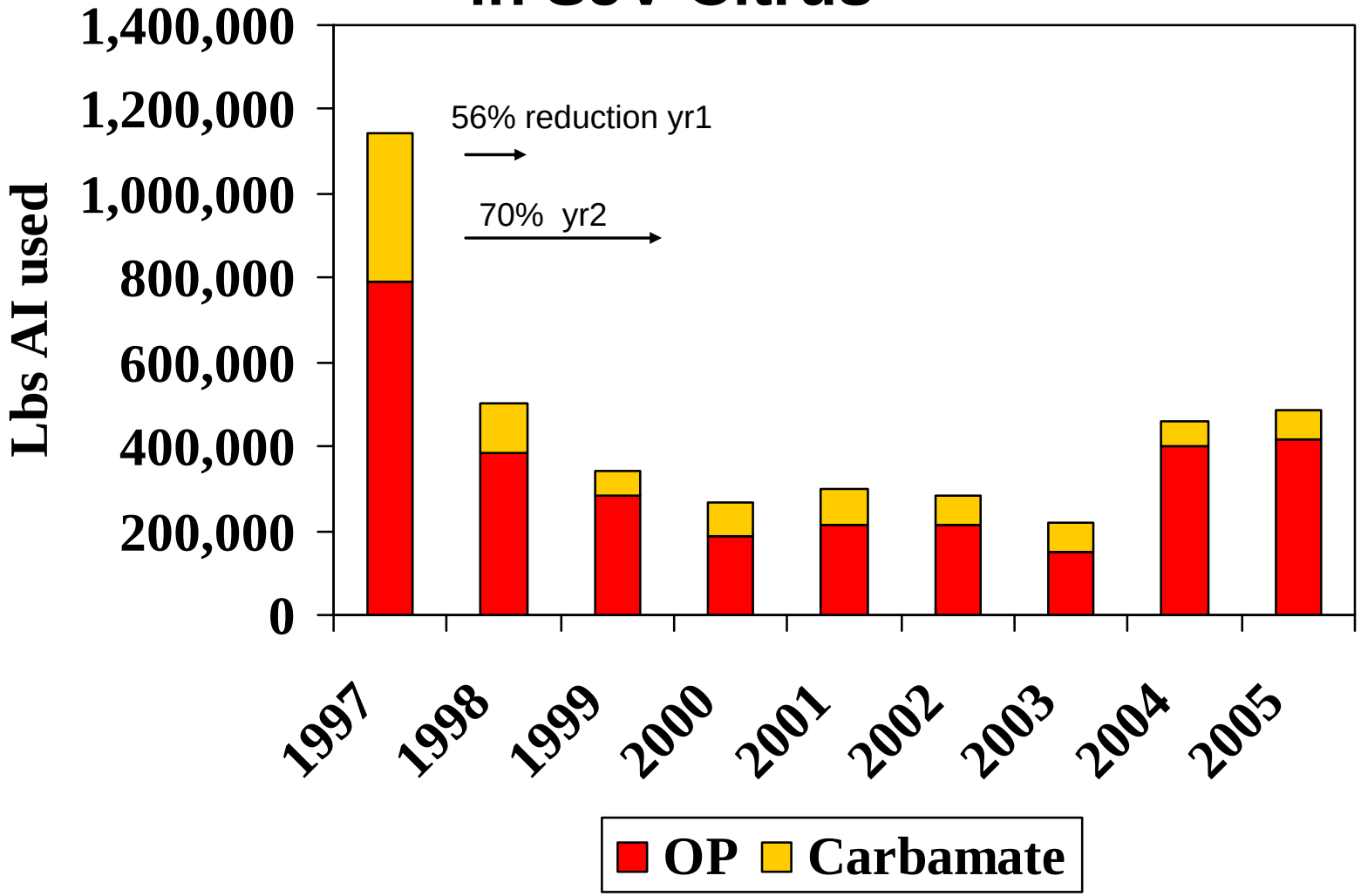
Neonicotinoids (glassy-winged sharpshooter, citricola scale)

- imidacloprid (Admire 2F, Provado 1.6F) 2001
- acetamiprid (Assail 70 WP)2002

Miticides

- pyridaben (Nexter WP)1998
- acequinocyl (Kanemite)2005

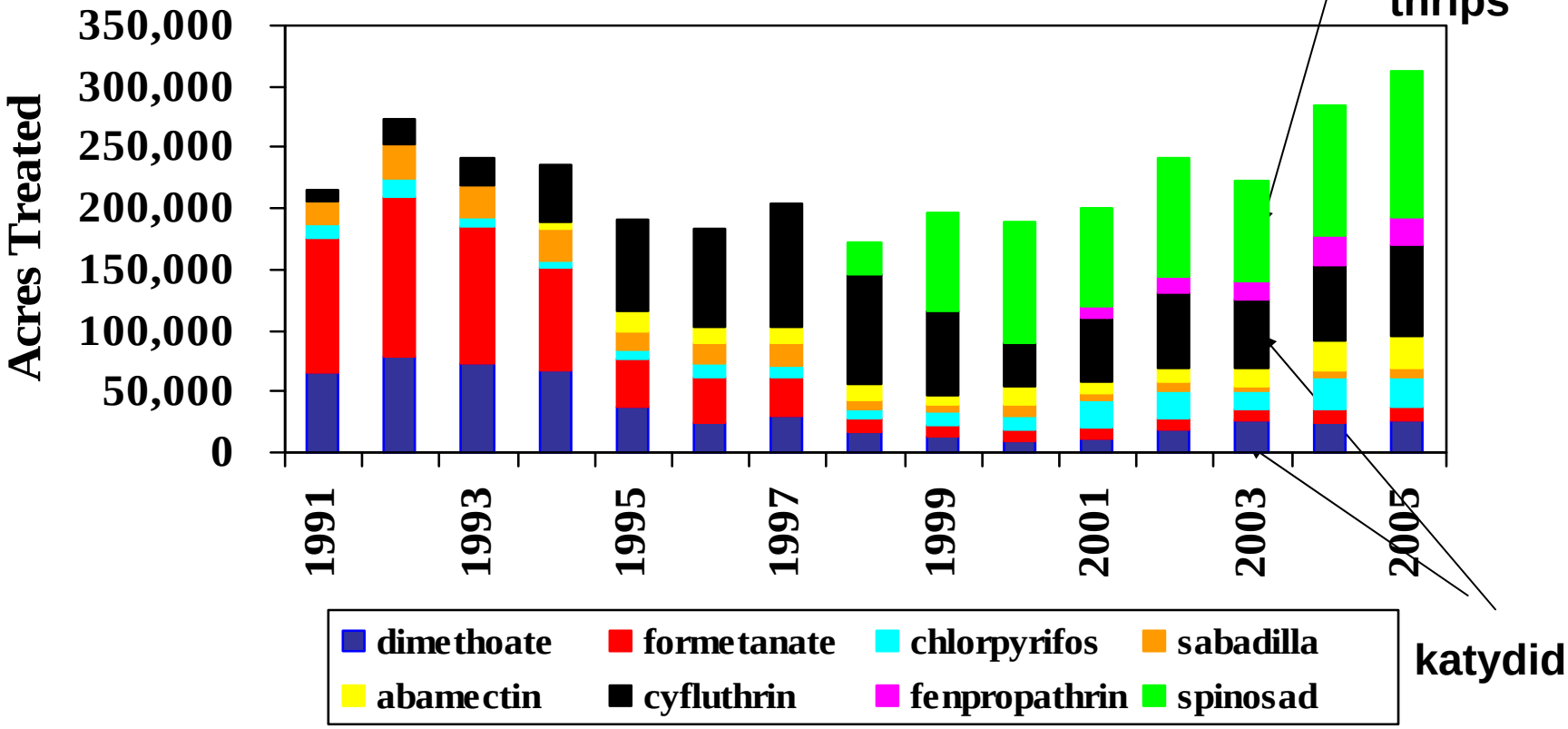
Organophosphate and Carbamate Use in SJV Citrus



Growers shift from OPS and carbamates to pyriproxyfen for scale and spinosad for thrips in 1998

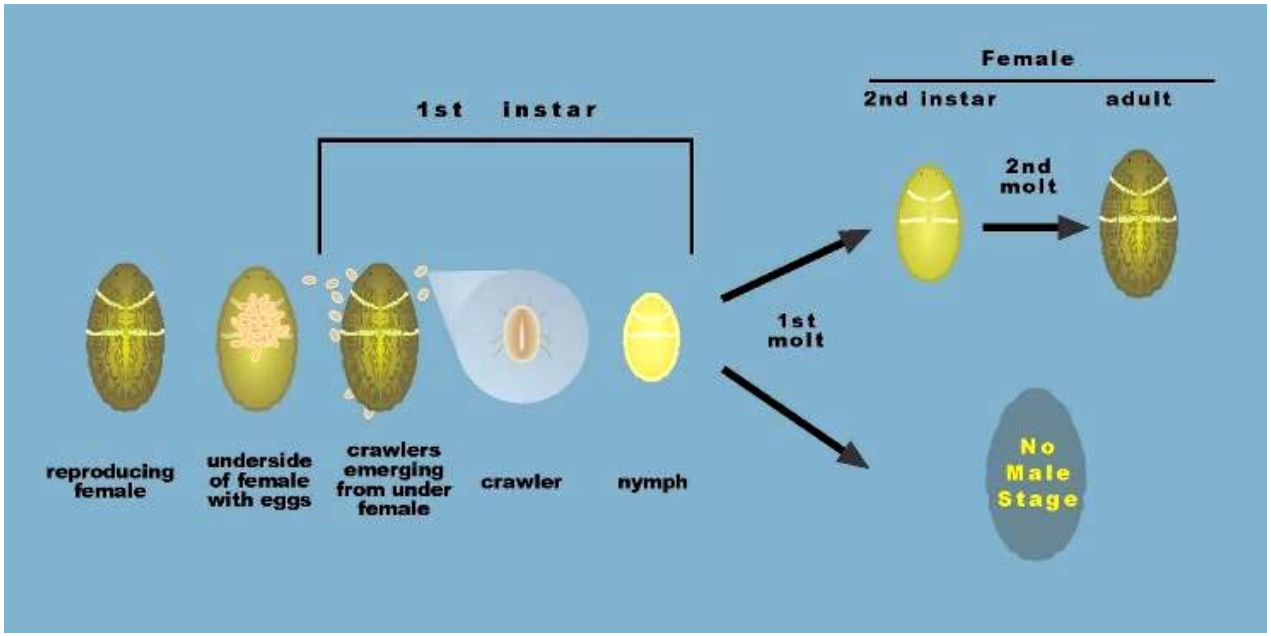
Insecticides Used for Citrus Thrips & Katydid Contro
the San Joaquin Valley

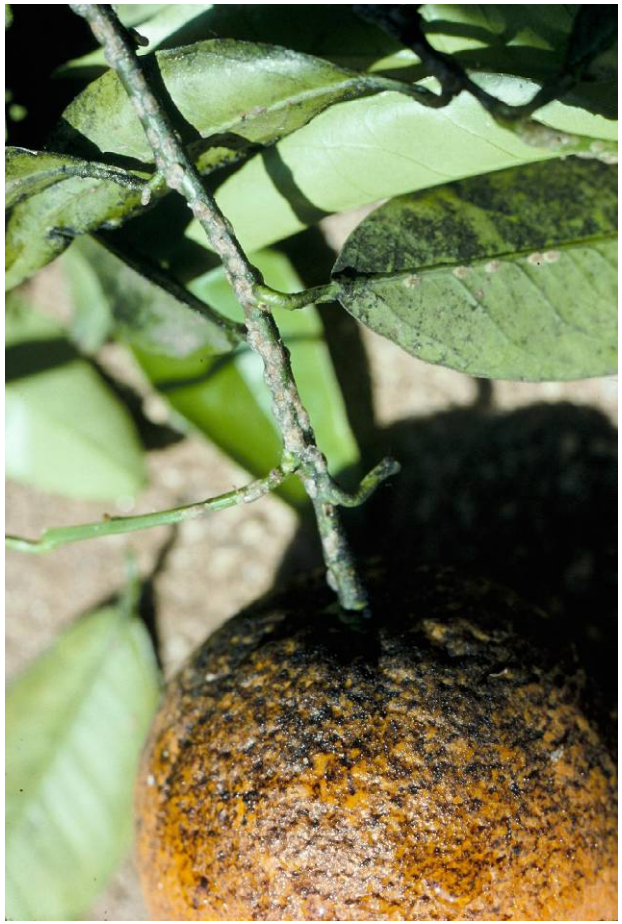
thrips



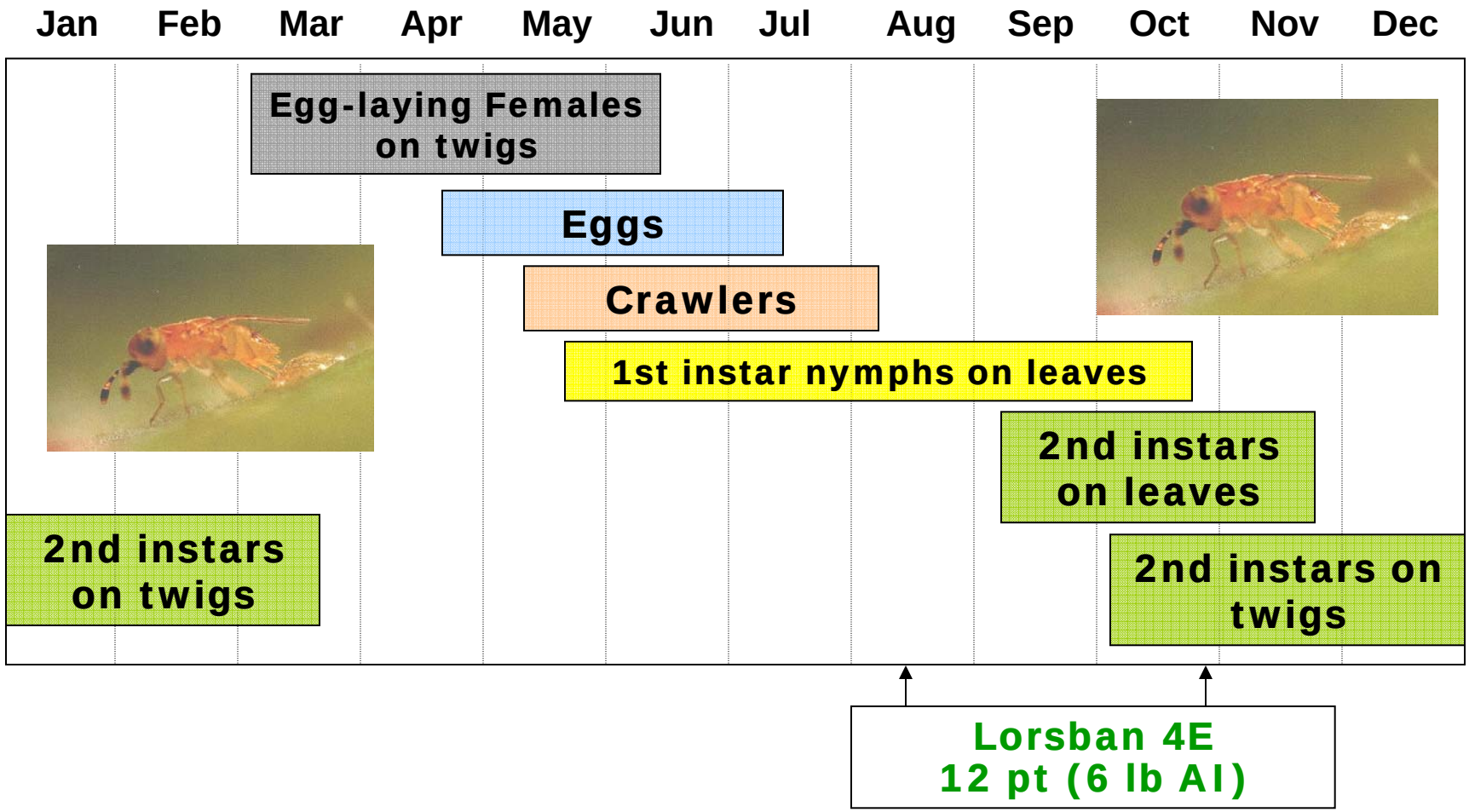
katydid

Citricola Scale Lifecycle

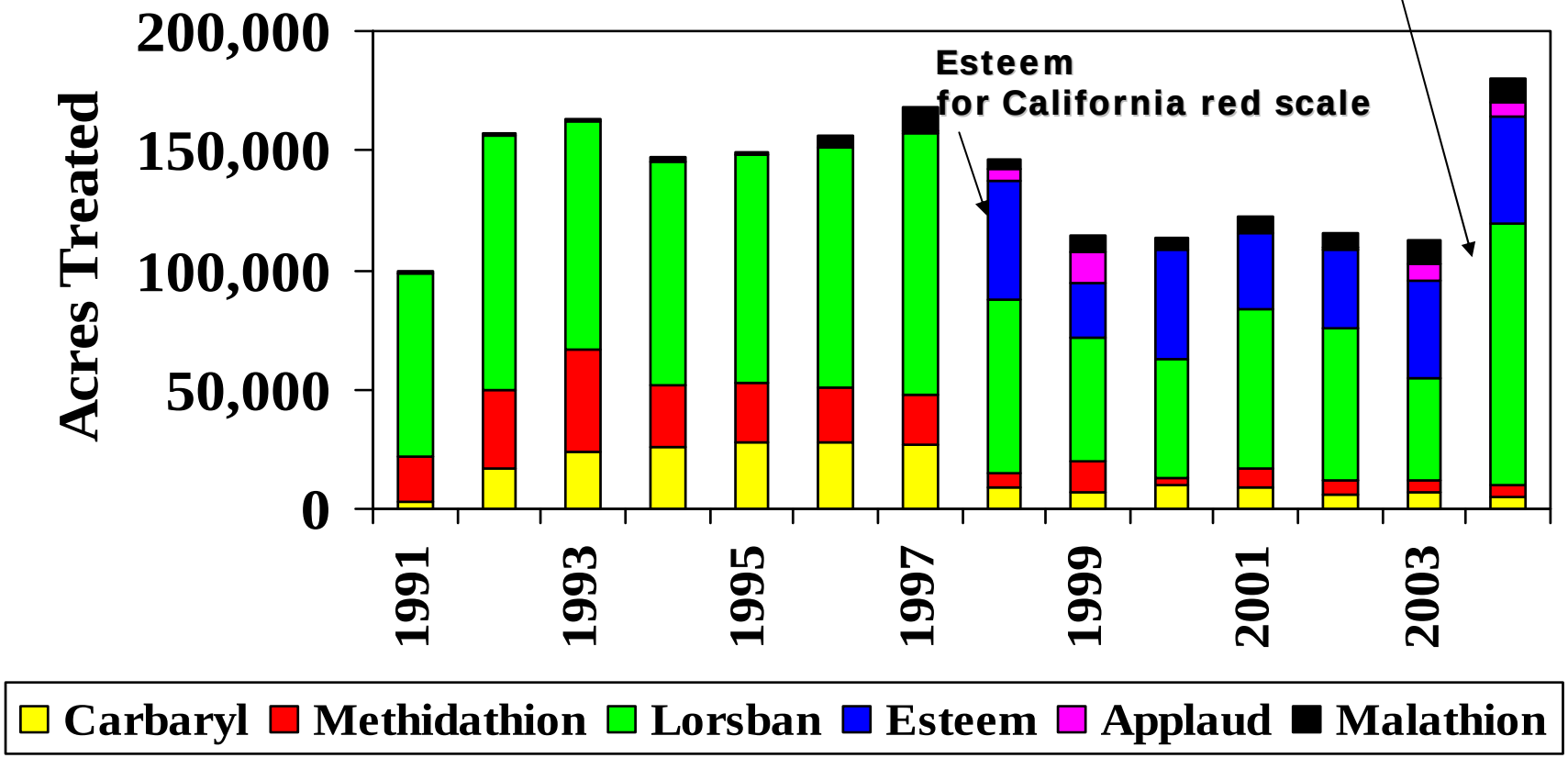




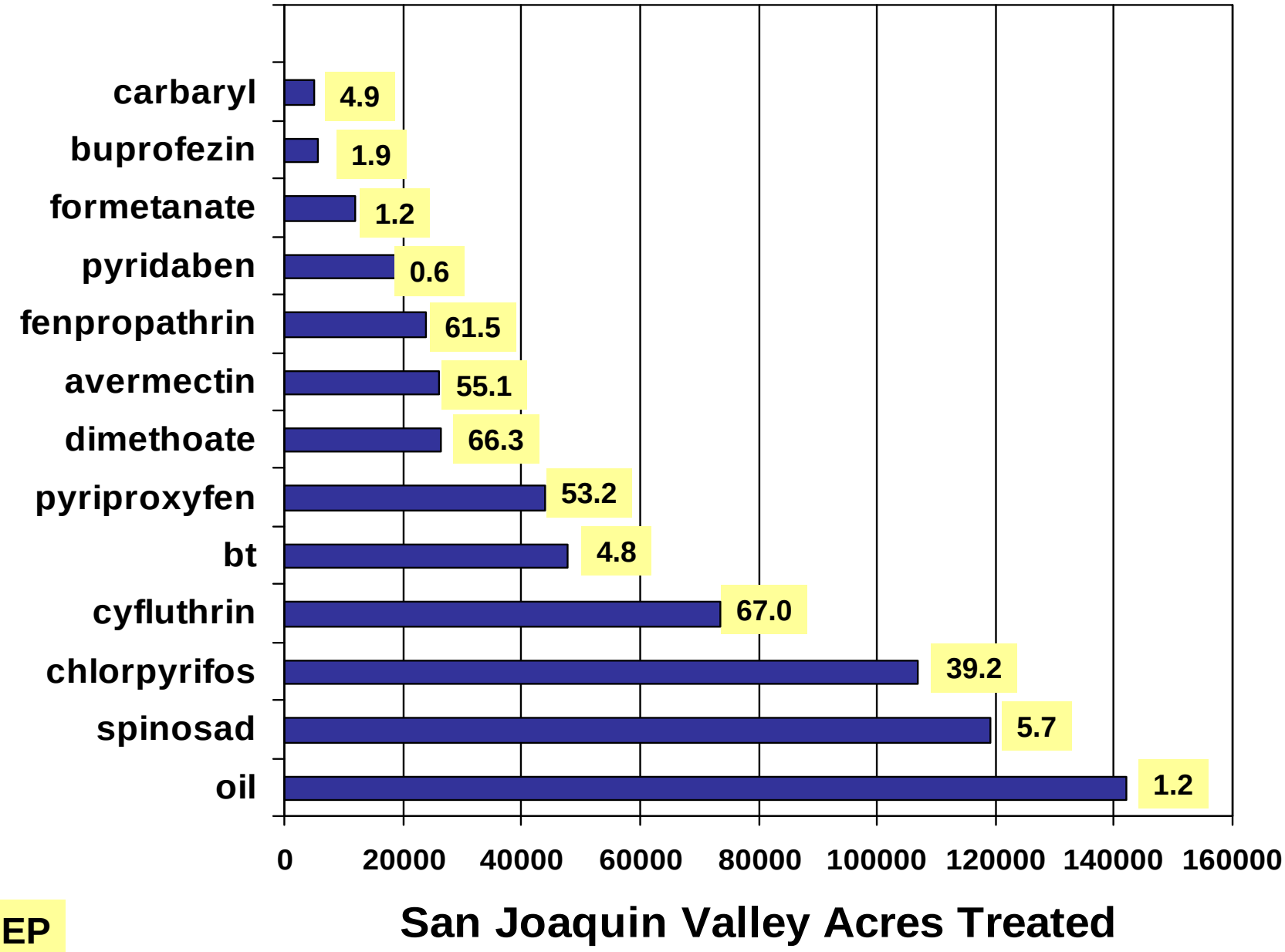
Citricola Scale Lifecycle – San Joaquin Valley



Insecticides Used for Scale Control in the San Joaquin Valley



San Joaquin Valley Citrus Pesticide Uses



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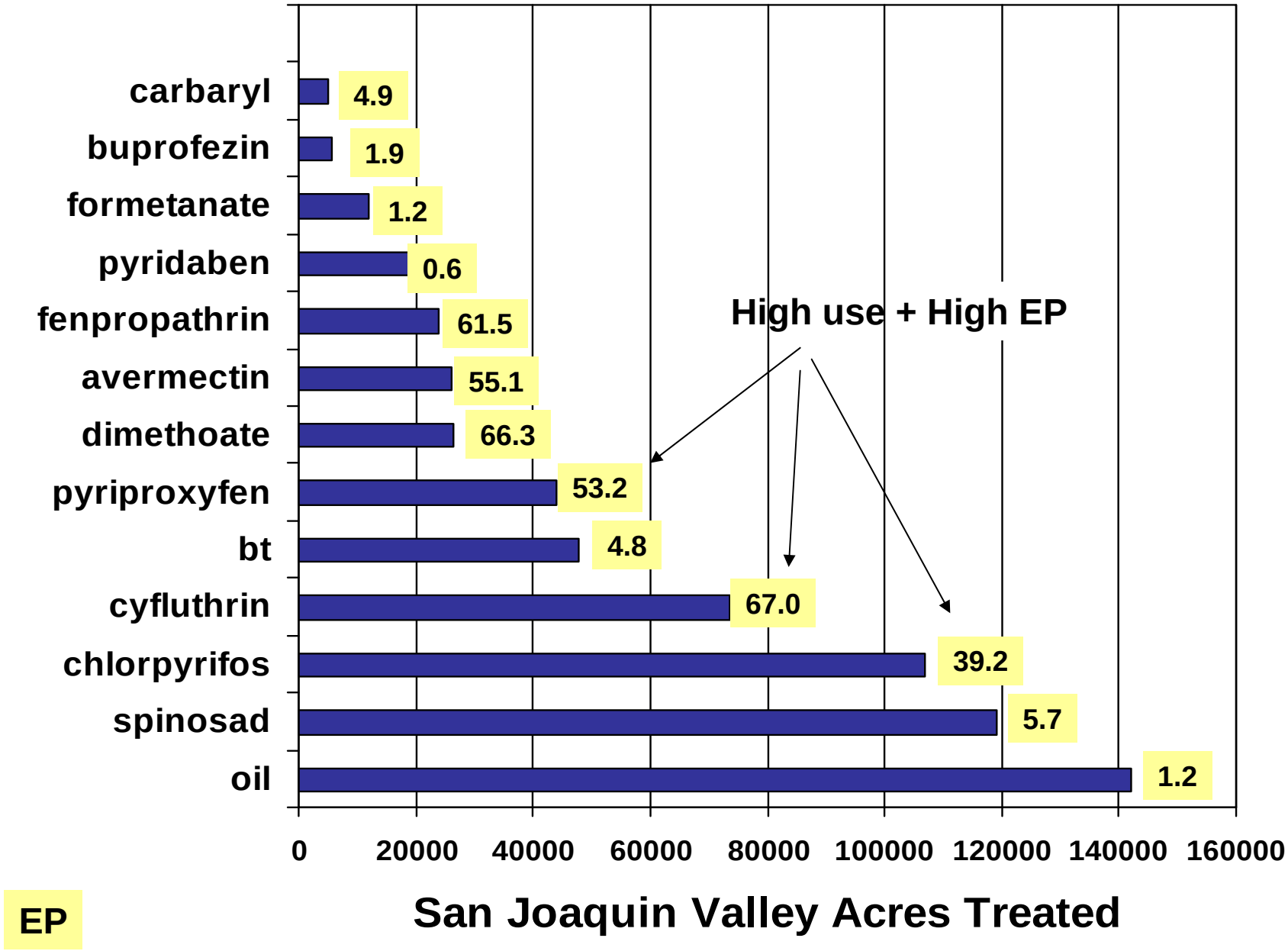
San Joaquin Valley Citrus Pesticide Uses



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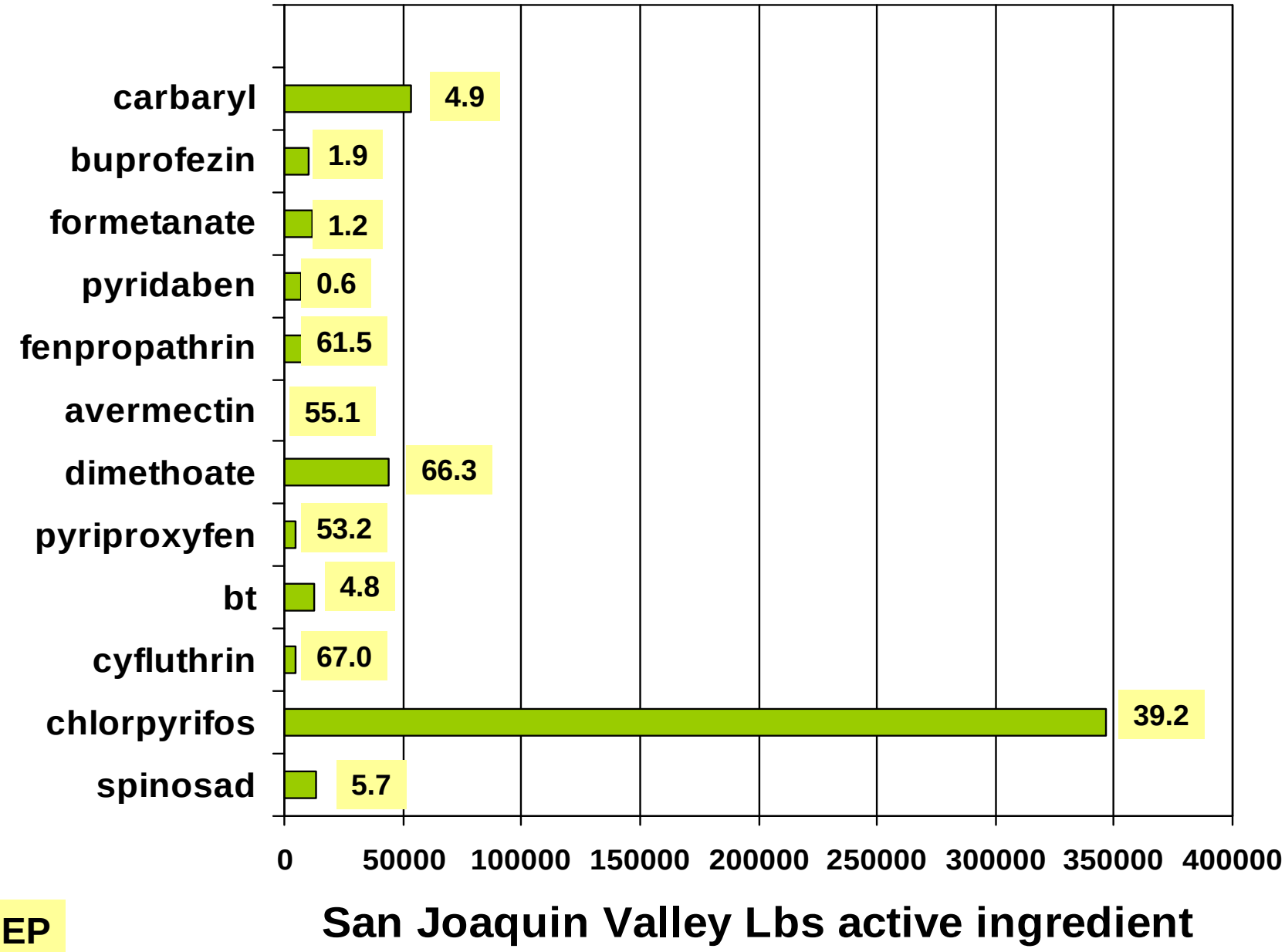
San Joaquin Valley Citrus Pesticide Uses



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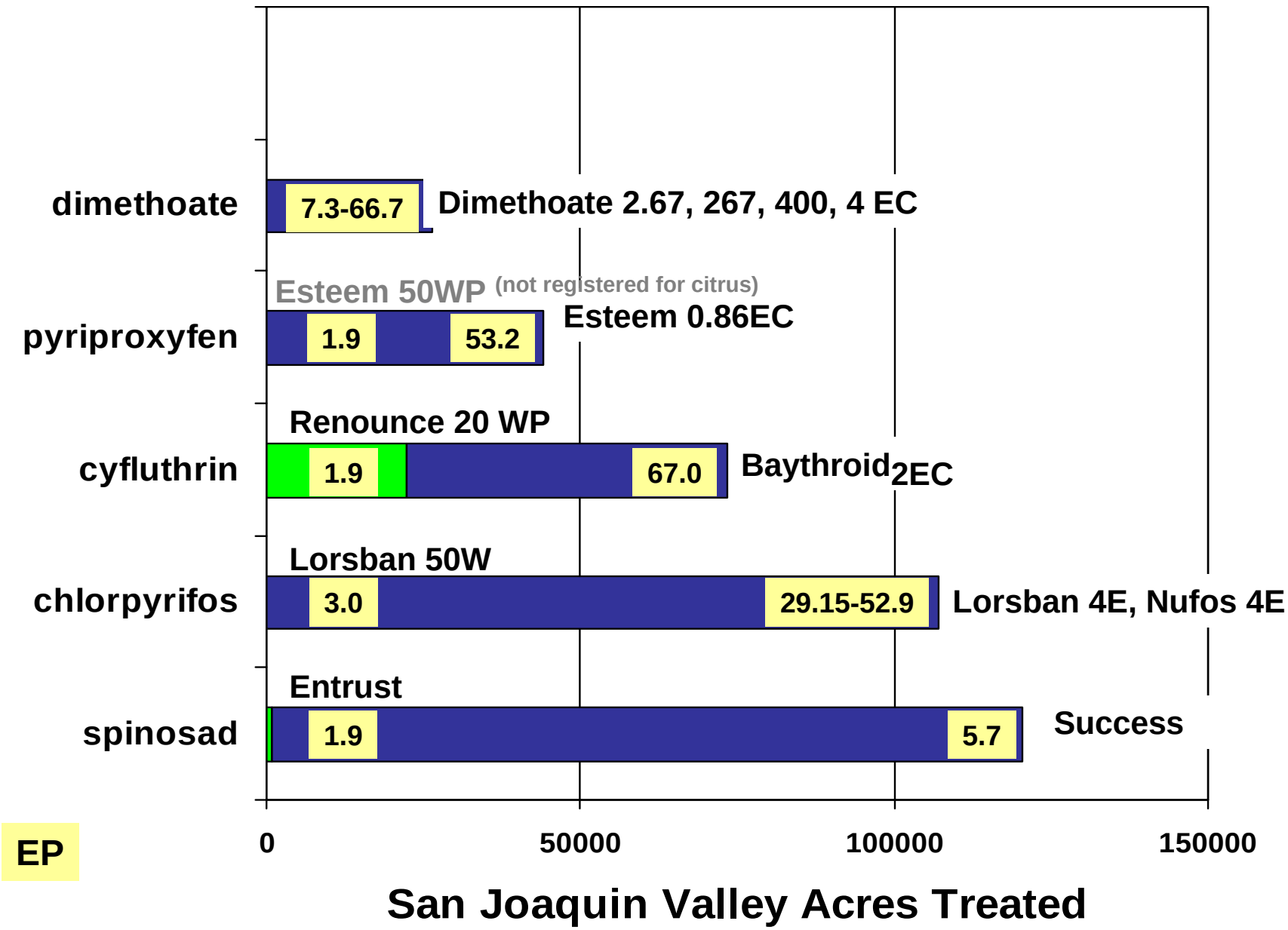
Solution 1: Alternative Formulations: Availability, Efficacy, and Education



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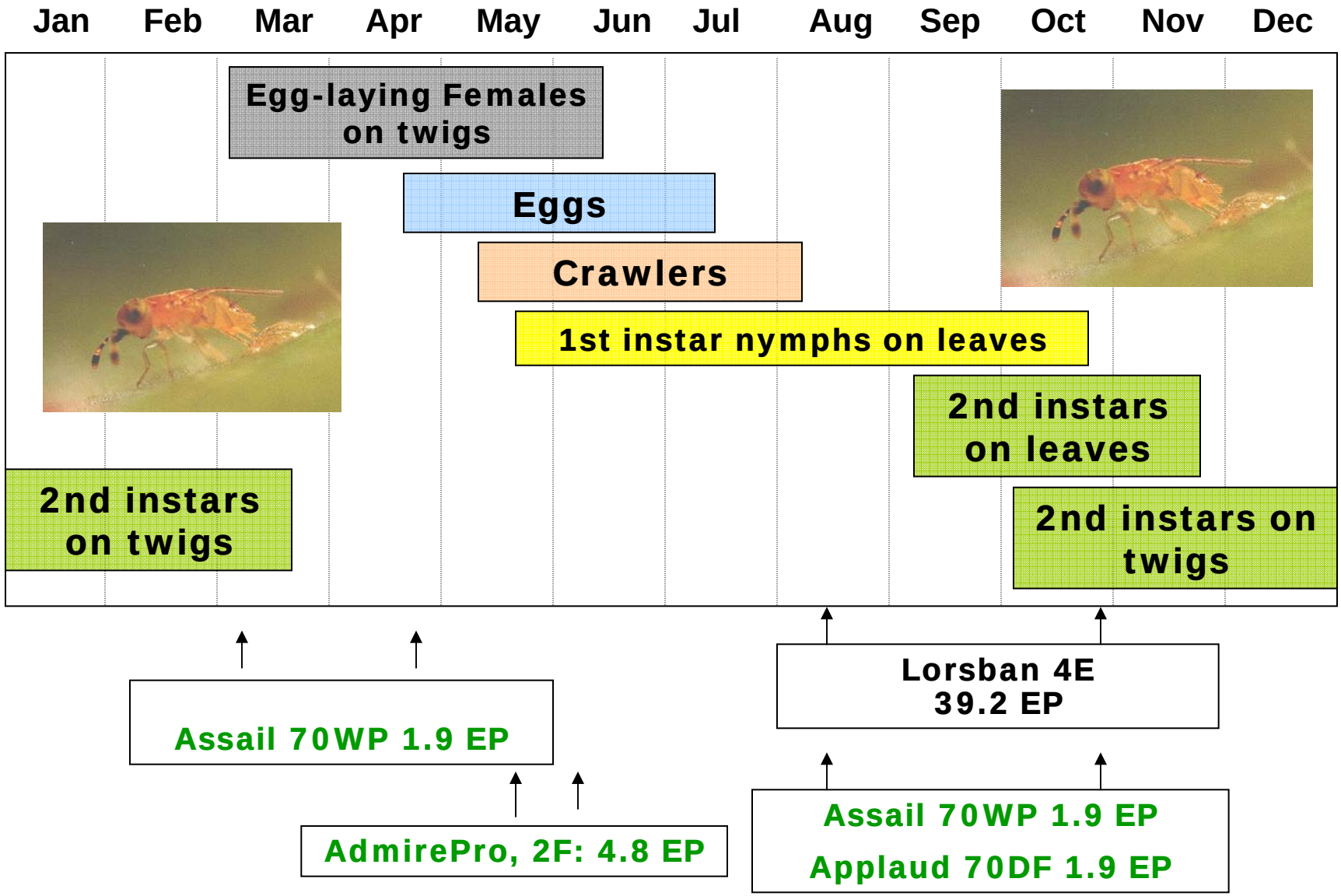
Solution 2. Choose Alternative, Less Effective Chemistries

Citricola Scale Lifecycle – San Joaquin Valley



Solution 3: Improved Spray Technology (reduce rate, no. of applications)

Citrus Red Mite, *Panonychus citri*

overage:
a, 2-3 mph
s

Citrus Thrips, *Scirtothrips citri*

Forktailed Bush Katydid, *Scuddaria furcata*

Thorough Coverage:
500-1500 gpa, 1.2 mph
Esteem
OPs

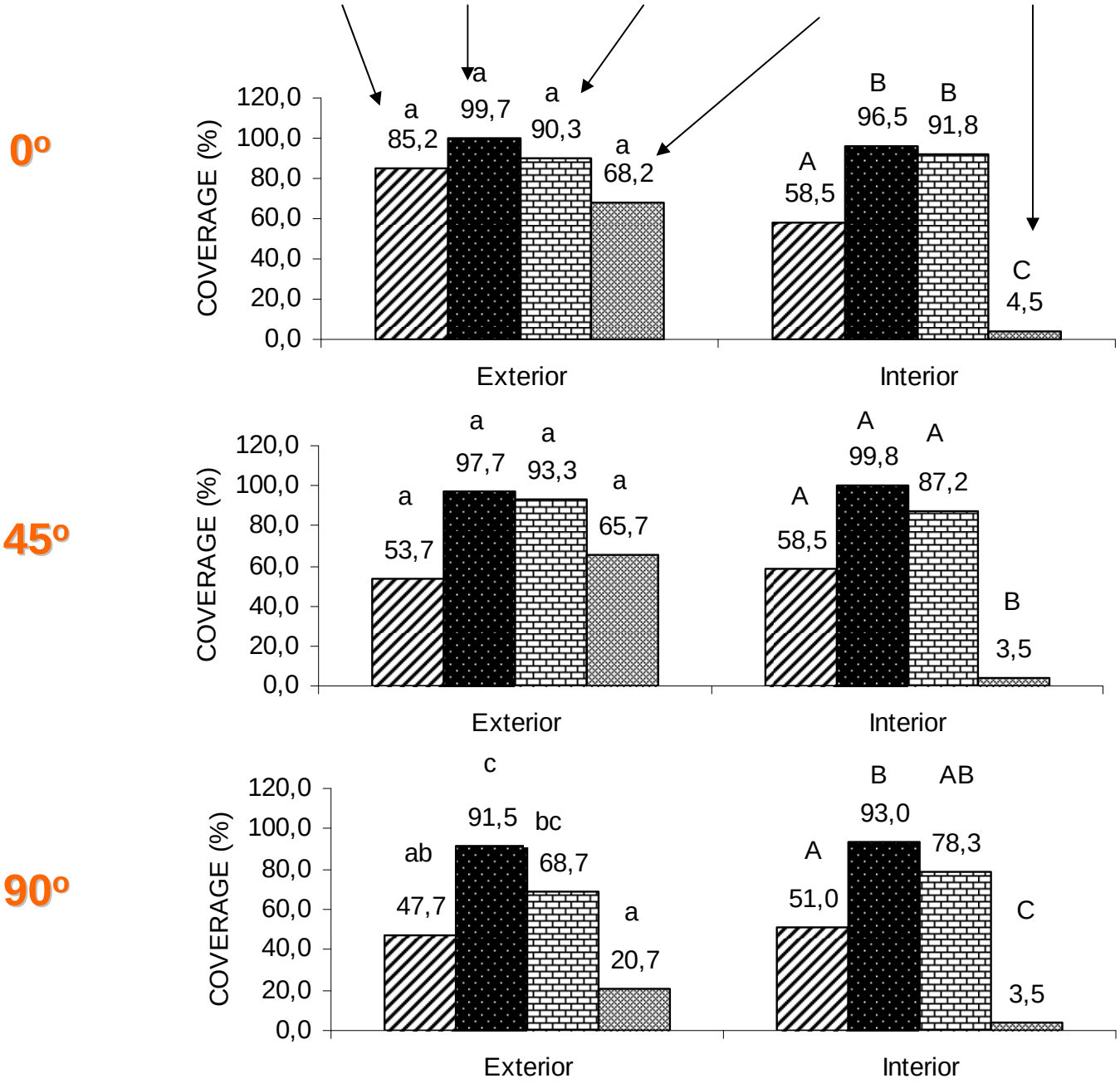
California red scale, *Aonidiella aurantii*

Citricola scale, *Coccus pseudomagnoliarum*

Scale treatments: 1.5-2 mph, 500-2000 gpa

Oil Sensitive Paper and Citricola Scale Monitoring

Airblast 250 gpa, 500 gpa, 750 gpa, Proptec 250 gpa



Solution 4. New Pest Management Technologies

Movento (spirotetramat)

- lipid synthesis inhibitor (new chemistry)
- effective against red scale, but not citricola scale
- reduced risk classification
- soft on beneficials
- expected registration for CA citrus: 2008
- foliar systemic (250 gpa? for scales)

Solution 5. Alternatives to Pesticides

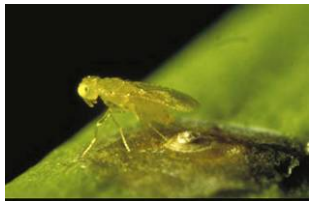
Citrus Red Mite- Predatory mite + virus

Citrus Thrips- Predatory mite

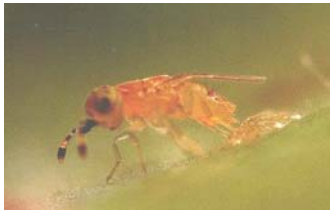
***Forktailed Bush Katydid**

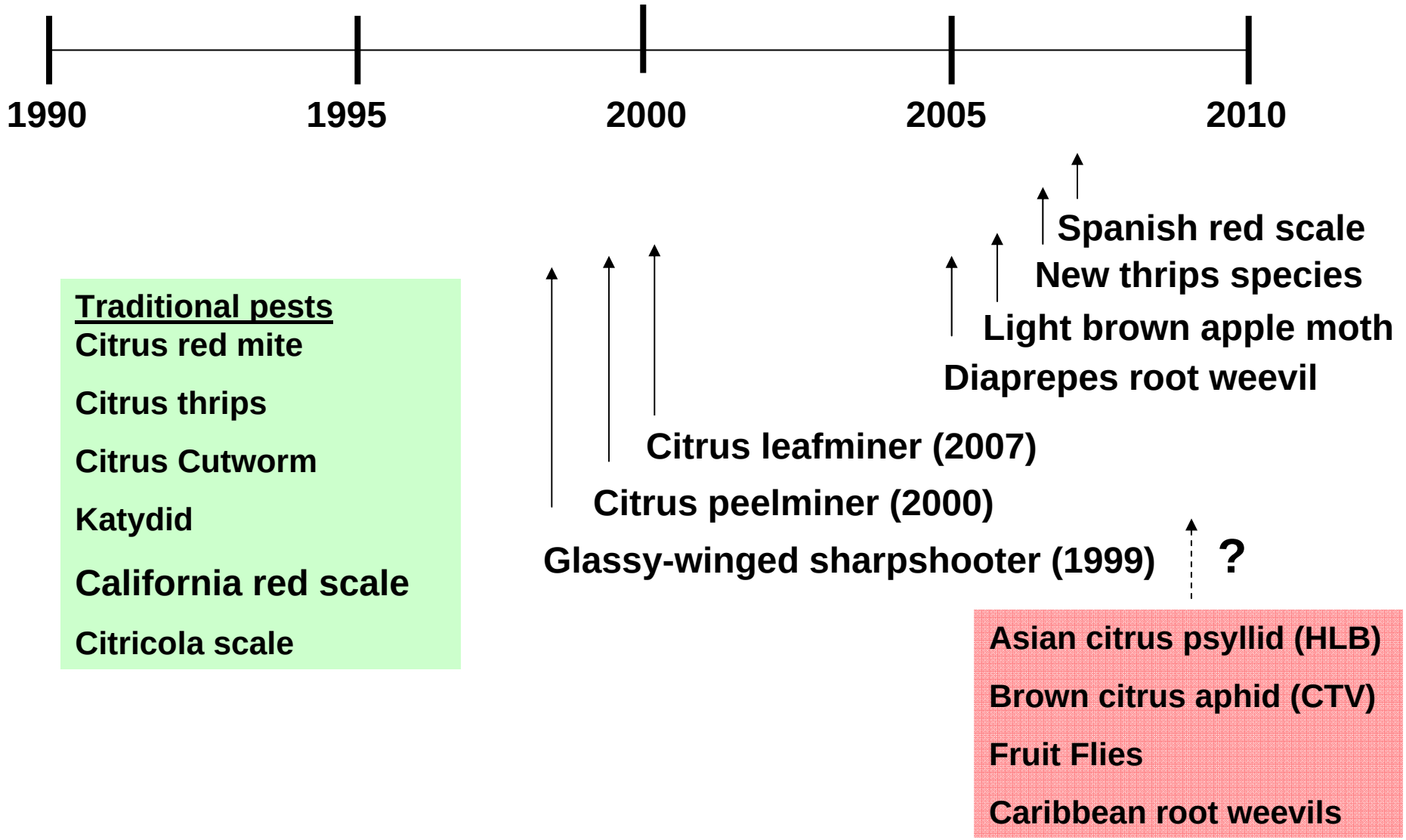
acoustic trap?

California red scale- *Aphytis* releases + High pressure washer



***Citricola scale – provide alternative hosts for parasites, subsidies to release parasites?**



Solution 6. Prevent Establishment of Invasive Pests that Disrupt IPM

Arrival of Invasive Pest in California (Year of Impact on SJV Agriculture)