### Trends in Neonicotinoid Usage in CA and Agricultural Invasive Species Control

by

#### Karen M. Jetter, Economist, UC Ag Issues Center

Neonicotinoids and their Impact on Pollinators Conference UC Davis September 9, 2015



# Background

- Neonicotinoids became commercially available for agricultural crops in California in 1994.
- Since then its use has steadily increased, in part due to the expansion of agricultural activities, in part due to the invasion and establishment of invasive species.
- Changes in the use of neonicotinoids in California can be tracked from the Pesticide Use Report (PUR) database maintained by the California Department of Pesticide Regulation.



### Background

- To examine trends in the use of neonicotinoids data on acreage treated by region and type were analyzed for neonicotinoid usage from 1993 to 2013 using the PUR data.
- Case studies on the use of neonicotinoids to manage invasive species will then be presented from previous and current research projects.

# Total amount of active ingredient in neonicotinoids applied1994 – 2013.

Total ai applied per year



# Total amount of acreage treated 1994 – 2013.

**Acreage Treated** 



Total amount of acreage treated with neonicotinoids as a share of total acreage treated with any insecticide. 1994 – 2013.



Top ten commodities with the highest amount of acreage treated for select years between 1994 – 2013.

1994	1999	2004	2009	2013
LETTUCE, HEAD	GRAPE	COTTON	GRAPE, WINE	COTTON
BROCCOLI	LETTUCE, HEAD	LETTUCE, LEAF	TOMATO, PROCESSING	TOMATO, PROCESSING
LETTUCE, LEAF	GRAPE, WINE	GRAPE	GRAPE	GRAPE, WINE
CAULIFLOWER	LETTUCE, LEAF	LETTUCE, HEAD	LETTUCE, LEAF	GRAPE
RAPINI	COTTON	GRAPE, WINE	COTTON	LETTUCE, LEAF
CABBAGE	BROCCOLI	TOMATO, PROCESSING	LETTUCE, HEAD	LETTUCE, HEAD
	CANTALOUPE	BROCCOLI	BROCCOLI	ORANGE
	CAULIFLOWER	PEPPER, FRUITING	ORANGE	WALNUT
	ΤΟΜΑΤΟ	CAULIFLOWER	STRAWBERRY	BROCCOLI
	PEPPER, FRUITING	G CANTALOUPE	PEPPER, FRUITING	STRAWBERRY

# Acreage treated of neonicotinoids by chemical 1994 to 2013.



# Case Study: Silverleaf Whitefly in Southern California

- The silverleaf whitefly reached economically damaging levels in the Imperial Valley in 1991 and 1992.
- In 1993 Admire, the soil formulation of imidacloprid was granted an emergency use permit for applications on the vegetables and melon crops on which the silverleaf whitefly feeds.

Case Study: Silverleaf Whitefly in Southern California. Use of Admire under Emergency Use Permits.

Year	Crop	Pounds ai	Area Treated
1993	Cole crops	1,900	8,400
1993	Lettuce	2,548	10,177
1994	Cole crops	1,796	7,117
1994	Lettuce	3,649	13,472
1994	Tomatoes	351	1,050
1995	Cucurbits	3,538	20,942

Case Study: Silverleaf Whitefly in Southern California. Use of Admire under Emergency Use Permits.

In 1995 Admire became registered for use in Southern California, and use of Admire of lettuce, broccoli, cauliflower, tomatoes and melons increased.

Year	Area Treated
1995	34,963
1996	45,977
1997	43,678

# Case Study: Silverleaf Whitefly in Southern California

- The silverleaf whitefly caused various types of damages.
  - Lowered yields
  - Delayed harvesting times to window when prices were lower(!)
  - Changed the aesthetic appearance of many of the vegetables grown on plants on which the whitefly feeds. This wasn't always a bad thing.
  - Increased pest management costs.

# Case Study: Silverleaf Whitefly in Southern California

- Calculated the benefits by estimating the Gross Annual Benefit (GAB)
- GAB = (y + q + t c) \* GVP \* SA where:
  - y = proportional change in yield
  - q = proportional change in quality
  - t = proportional change in revenues due to timing.
  - c = cost of the next best alternative.
  - GVP = gross value of production
  - SA = Share of total acreage treated

# Case Study: Silverleaf Whitefly in Southern California. Estimated benefits.

Table 14: Gross Annual Benefits of Using Admire							
		Gross Value of	Fraction				
		Production	Adopted				
Crop	y-c+t (%)	GVP (\$)	(FA)	Total (\$)			
Broccoli	7.87%	\$32,675,850	0.687	1,766,344			
Cauliflower	8.62%	\$18,251,775	0.557	876,049			
Head Lettuce	8.48%	\$89,711,475	0.569	4,325,917			
Leaf Lettuce	7.43%	\$37,869,300	0.713	2,007,122			
Cantaloupes	7.91%	\$59,100,200	0.776	3,625,125			
Fresh Tomatoes	7.11%	\$46,587,663	0.338	1,118,528			
Total Benefits				13,719,086			

## Case Study: Grape pests

- The grape industries (wine, table, raisin) in California have been beset with a number of invasive pests that have either threatened grape production, or threaten to cause economic damage if they spread and become established in grapes.
- Glassy-winged sharpshooter SSJV and So. Cal 1989
- Vine mealybug California 1994
- European Grapevine Moth Napa and Sonoma 2009
- Of the pests lists above both the glassy-winged sharpshooter and the vine mealybug have imidacloprid listed as a recommended insecticide for control. (UC IPM manual).

## Case Study: Grape pests

- For the glassy-winged sharpshooter it became a pest in the late 1990s when it was identified as a vector of Pierce's Disease.
- During this time growers who didn't already use Admire began to use it for long-term management of GWSS.
- Other growers switched from using Provado (used for grape leafhopper and grapeleaf skeletonizer) to Admire.
- In the early 2000s a voluntary areawide management program was begun whereby GWSS would be treated in citrus during the winter months with Admire.

### Neonicotinoid treatments in the South Desert Counties. 1994 - 2013



### Neonicotinoid treatments in the South San Joaquin Valley. 1994 - 2013



### Neonicotinoid treatments in the N. San Joaquin Valley. 1994 - 2013



# Case Study: Ventura ACP eradication program

- ACP was first found on yellow sticky trap cards in Ventura in 2010 which were treated using the eradication protocol.
- Additional finds (4 in 2011 and 36 in 2012), mostly in residential areas, were discovered and treated using the eradication protocol.
- In 2013 and 2014 the number of finds dramatically increased, and eradication boundaries started to overlap. Finds were still treated using the eradication protocol. Some sites needed more than one treatment.
- In 2015 the eradication program the industry started switching to an areawide management control program.



### Ventura County 2011 ACP Detections (5)







### Ventura County 2012 ACP Detections (72)







### Ventura County 2013 ACP Detections (57)







Case Study: Ventura ACP eradication program

- The eradication protocol consisted of applications of a systemic pesticide (imidacloprid or spirotetramat), followed with a treatment with a pyrethroid.
- In Ventura many places are not conducive to the effective use of systemic imidacloprid.
- In the absence of the systemic, two applications of a pyrethroid can be used.

Case study: Ventura ACP eradication program

- The Department of Pesticide Regulation (DPR) Pesticide Use Reports (PUR) provided the data on treatments and acreage treated for the 2011-2013 years.
  - Used the User Defined Codes dataset to determine unique treatments.
- The County Ag Commissioner for Ventura provided the same information for 2014.

### Total acreage treated by crop.

65% increase for lemons and 120% increase for other citrus from 2010/2011 to 2014



# Pesticide groups with the biggest change in usage for lemons - neonicotinoids

481% increase for lemons and 144% increase for other citrus from 2010/2011 to 2014



### Pesticide groups with a change in usage for lemons – spirotetramat

22% increase for lemons and 32% increase for other citrus from 2010/2011 to 2014



# Pesticide groups with the biggest change in usage for lemons - pyrethroids

3714% increase for lemons and 981% increase for other citrus from 2010/2011 to 2014



## Summary

- Steady increase in the amount of neonicotinoids applied, both in absolute terms and as a share of total insecticide usage.
- In some cases the change in usage can be linked to specific invasive pests or pest control programs (SWF, ACP).
- In other cases it is less clear (GWSS, VMB).
- Relative prices may also play a role as there was an increase in usage when generic brands of imidacloprid became available.