Insecticide Usage on Desert Lettuce, 2016-17

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Introduction: The development of accurate data on insecticide usage is important to the assessment of IPM programs in Arizona. A reliable estimate of insecticide use patterns is one of our most objective tools for assessing changes in management practices. This information allows us to build relevant databases for measuring user behaviors and adoption of new IPM technologies. For PCAs, it can translate their efforts into economic terms for their clientele and confirms their value to the lettuce industry by showing the importance of their cost-effective management in desert lettuce production. This summary provides estimates of insecticide use trends on lettuce over the past 10 years.

Methods: Growers and PCAs attended a Head Lettuce Insect Losses and Impact Assessment Workshops in Yuma on April 12, 2017 and completed surveys in a guided process. The workshops were conducted in an interactive manner where participants were given a presentation that established the incentives for participation, explained the crop insect loss system, and further walked the participants through the estimation process. This summary presents results from the insecticide use surveys for lettuce produced in Yuma County, AZ and Imperial County, CA.
The data were generated by requesting that PCAs estimate the use frequency of various products and the percentage of treated acres for each product. Estimates of total treated acreage were generated using the acreage reported from each survey participant. This data has allowed us to track changes in insecticide use patterns over time in greater detail in both fall and spring lettuce.

Summary: A total of 20 surveys were completed in the 2016 workshop, representing an estimated total of 33,562 fall acres and 33,469 spring lettuce acres from Yuma and neighboring Imperial County (Holtville/Brawley/Bard/ Winterhaven). In general, the most commonly used insecticides in fall and spring lettuce correspond directly to the key pests that typically occur during these growing periods.

When compared by class of chemistry using the IRAC mode of action classification system, the pyrethroids applied both as foliar sprays and through sprinkler chemigation were the most commonly used insecticide class in fall and spring lettuce **(Tables 1 and 2)**.The reason for this is quite evident; pyrethroids are the most safe and inexpensive broad spectrum insecticide still available for use in tank-mixtures for effective control of flea beetles, crickets, plant bugs and some Lepidopterous larvae (cabbage looper and earworm). Over the past 12 years, pyrethroid usage has remained consistently high **(Fig 5)**, and accounts for the bulk of broad spectrum chemistry used to control insects in lettuce **(Fig 6)**.

Organophosphate/carbamate usage continues to decline. Lannate (methomyl) and acephate usage was down on spring lettuce this season due to lighter thrips pressure. However, both of these products remain important rotational alternatives for Radiant (**Fig 5 and 6**). Their use for control of lepidopterous larvae and aphid control has been displaced primarily by several reduced-risk chemistries.

The spinosyns remain the second most commonly used class of insecticides, where 100% of the lettuce acreage was treated with Radiant or Success in 2016-17 **(Table 1 and 2).** Their use against both lepidopterous larvae **(Figure 1)** and thrips **(Figure 5)** has remained steady over the past 13 years, averaging over 2 sprays per treated acre **(Tables 1 and 2)**. The Diamides (Coragen, Voliam Xpress, Vetica, Belt, Exirel and Verimark) were a commonly used chemistry in fall lettuce **(Table 1).** Since they were first registered in 2008, PCAs have steadily incorporated this new chemical class into their Lepidopterous larvae management programs **(Fig 1)**. The use of foliar diamides was down in 2016, presumably because of the loss of the flubendiamide tolerance; this is evident by the reduced use of Belt and Vetica **(Fig 2)**. It appears that PCAs increased their use of Coragen (both soil and foliar) to offset the losses **(Table 3).** Exirel and Verimark were used for the second time in the fall of 2016 on about 5% of the acreage **(Fig 2)**, increasing slightly from the previous year.

The tetramic acid chemistry (Movento) was used slightly more on fall lettuce in 2016 **(Fig 3)**, but was up significantly on spring lettuce **(Fig 4)** due to the heavy aphid pressure in 2017 associated with unusually wet weather conditions. Another important class of chemistry used in fall and spring lettuce are the neonicotinoids driven primarily by soil-applied imidacloprid for whiteflies and aphids **(Figures 3 and 4)**. The usage of imidacloprid on both fall and spring lettuce has increased markedly since 2009 and was used on about 90% of the fall acreage in 2016 **(Table 3-4),** albeit at top of the label rates (0.375 lb AI/ac). Foliar neonicotinoid usage also increased slightly last season, whereas Sivanto (butenolide) and Sequoia (sulfoxamine) usage increased sharply this spring due to the heavy aphid pressure. Torac usage was down last spring for thrips management again due to the lighter thrips pressure in 2017 **(Fig 5).**

From an IPM perspective, the local produce industry has made great strides in minimizing environmental impacts in lettuce production by continuing to incorporate the newer reduced-risk insecticides into their insect management programs. To date there have been no been no major incidents of field failures or measurable lack of insect susceptibility with these compounds in lettuce due largely to the judicious usage of the key products. This has occurred due to the availability of multiple modes of actions with cost-effective activity against most key pests, and the conscientious efforts of PCAs to alternate application of these chemistries during the crop season. Although the broad spectrum, consumer–friendly pyrethroids were by far the predominant chemistry applied to lettuce, for the seventh season in a row, PCAs treated a greater percentage of their lettuce acreage with selective, reduced-risk products than with the broadly toxic, OP/ carbamate and chemistries **(Fig 6 and 7)**.

In conclusion, selective, reduced risk insecticides will continue to play an increasing role in management of insect pests in desert lettuce. As new active ingredients become available, the industries reliance on the broadly toxic organophosphate and carbamate compounds will likely decline. The availability of new modes of action with activity against western flower thrips would certainly reduce the industries reliance on OPs and carbamates. However, because of the intensive pest spectrum that PCAs face in the desert coupled with the demands for high quality lettuce, there will still be a need for broad spectrum products (i.e., pyrethroids). A note of caution though, given the importance of the pyrethroids and the trends in their heavy usage, PCAs should only use them when necessary in an attempt to preserve their susceptibility in the future.

Table 1. The top insecticide chemistries used on Fall Lettuce, 2016

Insecticide Chemistry	Fall Lettuce, 2015				
	IRAC group	% PCA's Using Products	% treated acres	No. applications	Treated [1] acres
Pyrethroids - Foliar	3A	100	100	3.7	127,403
Spinosyns	5	100	100	2.4	81,153
Neonicotinoids -Soil	4A	100	90.7	1	30,440
Diamides- Foliar	28	94	75.3	1.2	29,504
Pyrethroids - Chemigation	3A	100	76.3	1	25,617
Avermectins	6	90	52.0	1.2	19,168
Carbamates	1A	53	21.9	1.1	8,115
Neonicotinoids -Foliar	4A	47	23.9	1	8,026
Tetramic acids	23	42	16.1	1.2	7,578
Diamides -Soil	28	47	22.5	1	7,552
Ecdysone agonists	18	42	12.2	1.2	4,913
Chitin Synthesis inhibitor	16	32	14.4	1	4,833
Organophosphates	1B	16	7.1	1	4,649
METI inhibitors	21	21	7.4	1.2	4,600
Chordotonal organ modulators	29	26	6.4	1.2	3,306
Butenolides	4D	16	5.2	1	1,745
Sulfoxamines	4C	11	1.5	1	503
Na channel blockers	22	16	2.1	1	705
JH mimic	7	0	0	0	0
Selective feeding blocker	9	0	0	0	0

[1] *Total acres treated estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in the 2016 survey.*

Table 2. The top insecticide chemistries used on Spring Lettuce, 2017

Insecticide Chemistry	Spring Lettuce, 2016				
	IRAC group	% PCA's Using Products	% treated acres	No. applications	Treated [1] acres
Pyrethroids - Foliar	3A	100	100	3.4	113,960
Spinosyns	5	100	93.7	2.3	72,129
Neonicotinoids -Soil	1A	95	82.0	1	27,311
Diamides- Foliar	4A	85	55.6	1	18,621
Pyrethroids - Chemigation	28	60	42.8	1	14,339
Avermectins	23	65	24.0	1	8,033
Carbamates	21	15	11.1	1	3,707
Neonicotinoids -Foliar	18	70	26.8	1	9,407
Tetramic acids	3A	95	66.0	1.35	29,738
Diamides -Soil	1B	10	2.4	1	812
Ecdysone agonists	16	20	11.0	1	3,682
Chitin Synthesis inhibitor	4A	15	1.5	1	502
Organophosphates	29	15	11.1	1	3,707
METI inhibitors	28	20	17.5	1.3	7,582
Chordotonal organ modulators	6	75	31.1	1.4	14,581
Butenolides	4C	70	31.9	1.2	12,812
Sulfoxamines	4D	85	32.6	1.1	12,001
Na channel blockers	9	20	2.3	1	770
JH mimic	22	0	0	0	0
Selective feeding blocker	7	0	0	0	0

[1] *Total acres treated estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in the 2016 survey.*

Table 3. The top 15 insecticides applied to Fall lettuce, 2016.

		Fall Lettuce, 2015				
	Insecticide Product	**IRAC group**	**% PCA's Using Product**	**% treated acres**	**No. applications**	**Treated [1] acres**
1	**Pyrethroids** - Foliar	3A	100	100	3.8	127,403
2	**Radiant**	5	100	100	2.4	80,549
3	**Imidacloprid**-Soil	4A	100	89.2	1	29,937
4	**Pyrethroids** - Chemigation	3A	100	76.3	1	25,617
5	**Proclaim**	6	89.5	51.0	1.2	19,168
6	**Coragen** - Foliar	28	68.4	42.7	1.2	17,197
7	**Lannate** (methomyl)	1A	52.6	21.9	1.1	8,115
8	**Movento**	23	42.1	18.3	1	6,142
9	**Coragen** - Soil	28	42.1	18.3	1	6,142
10	**Voliam Xpress**	28+3A	47.3	15.1	1	5,068
11	**Intrepid**	18	42.1	12.2	1.2	4,913
12	**Torac**	21	21.1	7.4	1.2	4,600
13	**Vetica**	28+16	26.3	13.1	1	4,397
14	**Assail**	4A	36.8	10.1	1.14	3,864
15	**Belt**	28	36.8	10.4	1	3,490

[1] *Total acres treated estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in the 2016 survey.*

Table 4. The top 15 insecticides applied to Spring lettuce, 2017.

		Spring Lettuce, 2016				
	Insecticide Product	**IRAC group**	**% PCA's Using Products**	**% treated acres**	**No. applications**	**Treated [1] acres**
1	**Pyrethroids** - Foliar	3A	100	100	3.4	113,960
2	**Radiant**	5	100	93.7	2.3	72,129
3	**Movento**	23	95	65	1.35	29,738
4	**Imidacloprid**-Soil	4A	95	81.6	1	27,311
5	**Beleaf**	29	75	30.6	1.3	14,581
6	**Pyrethroids** - Chemigation	3A	60	42.8	1	14,339
7	**Lannate** (methomyl)	1A	75	36.6	1.1	14,214
8	**Sivanto**	4D	70	31.9	1.2	12,812
9	**Sequoia**	4C	85	32.6	1.1	12,001
10	**Coragen** - Foliar	28	55	28.7	1	9,606
11	**Proclaim**	6	65	24.0	1	8,033
12	**Torac**	21	20	17.5	1.3	7,582
13	**Assail**	4A	55	20.5	1	6,887
14	**Belt**	28	30	13.3	1	4,451
15	**Intrepid**	18	20	11	1	3,682

*[1] Total acres treated estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in the 2016 survey.*

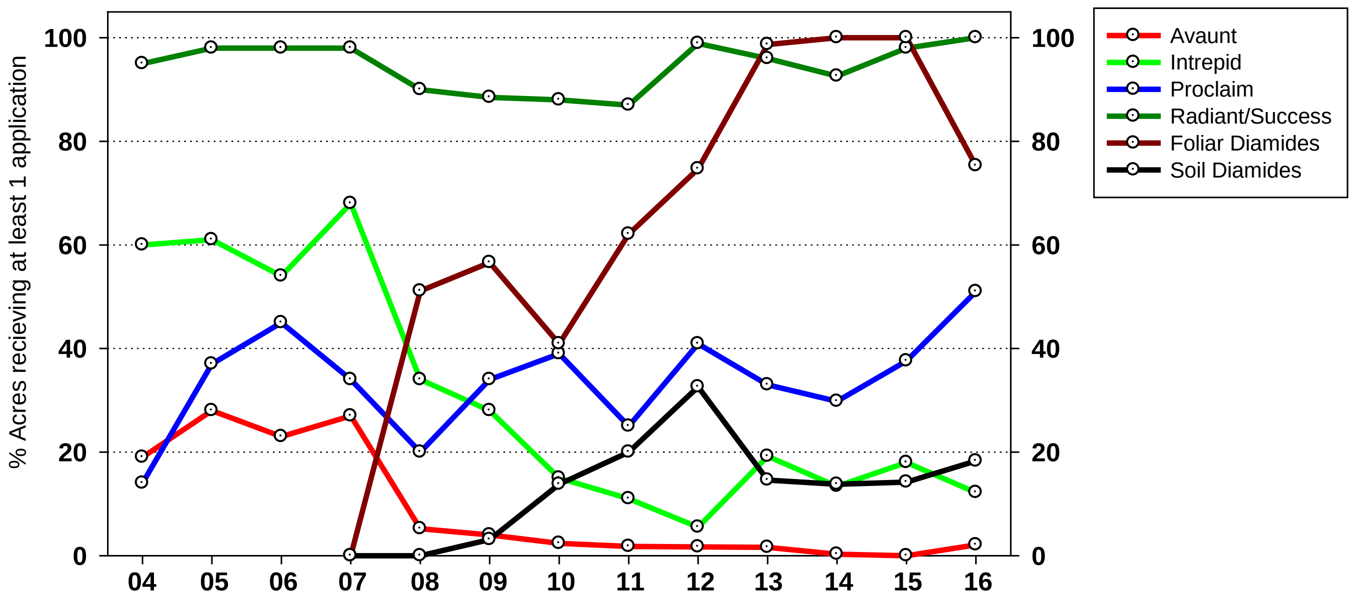

Figure 1. Trends in insecticide use for control of Lepidopterous larvae in Fall lettuce, 2004-2016.

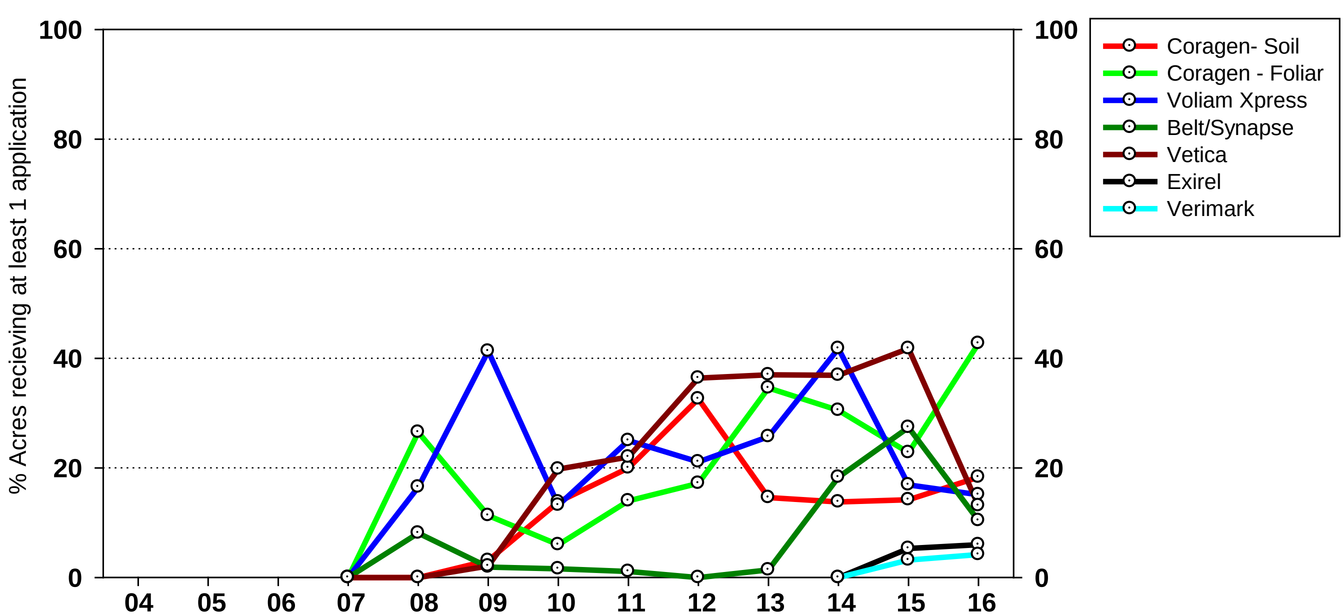

Figure 2. Trends in Diamide insecticide use for control of Lepidopterous larvae in Fall lettuce, 2004-2016.

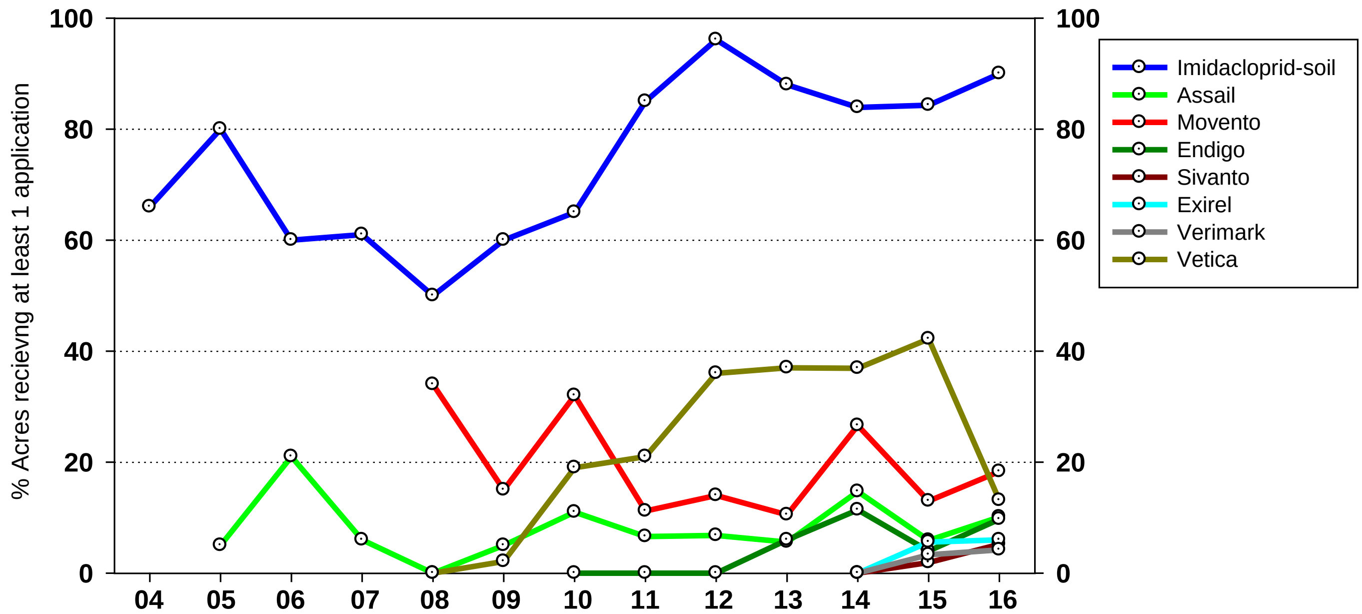

Figure 3. Trends in insecticide use for control of *Bemisia* Whiteflies in fall lettuce, 2004-2016.

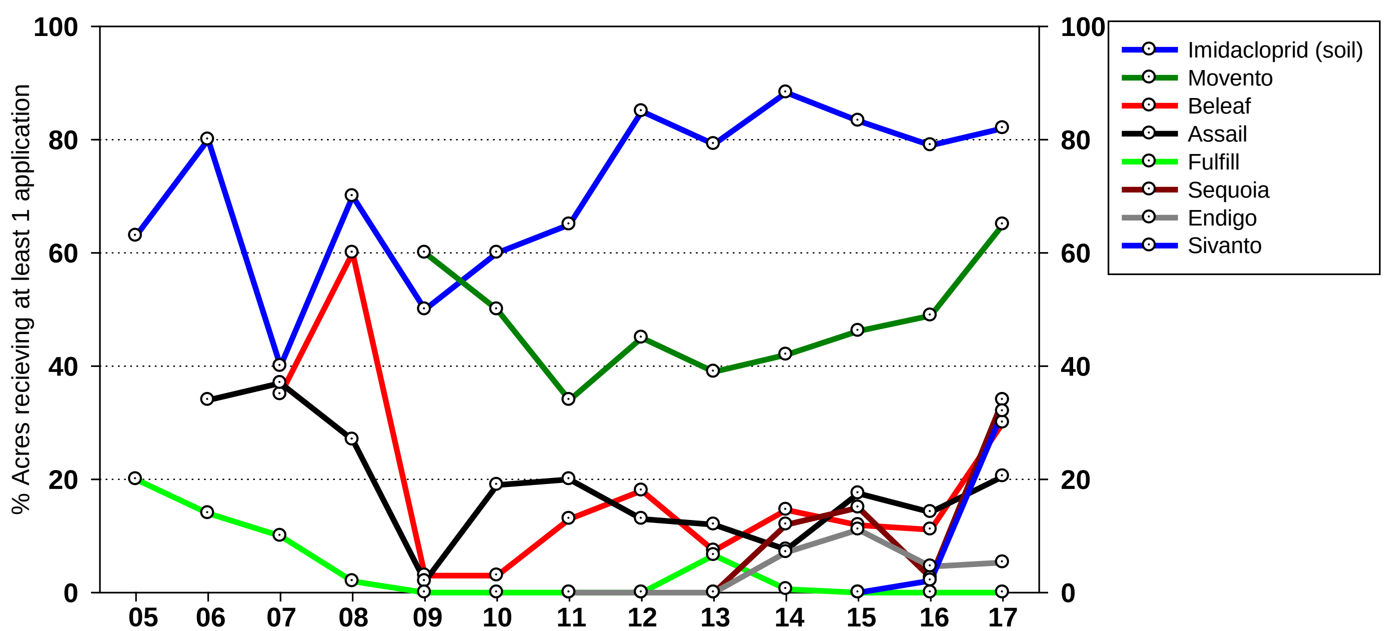

Figure 4. Trends in insecticide use for control of Aphids in Spring lettuce, 2005-2017

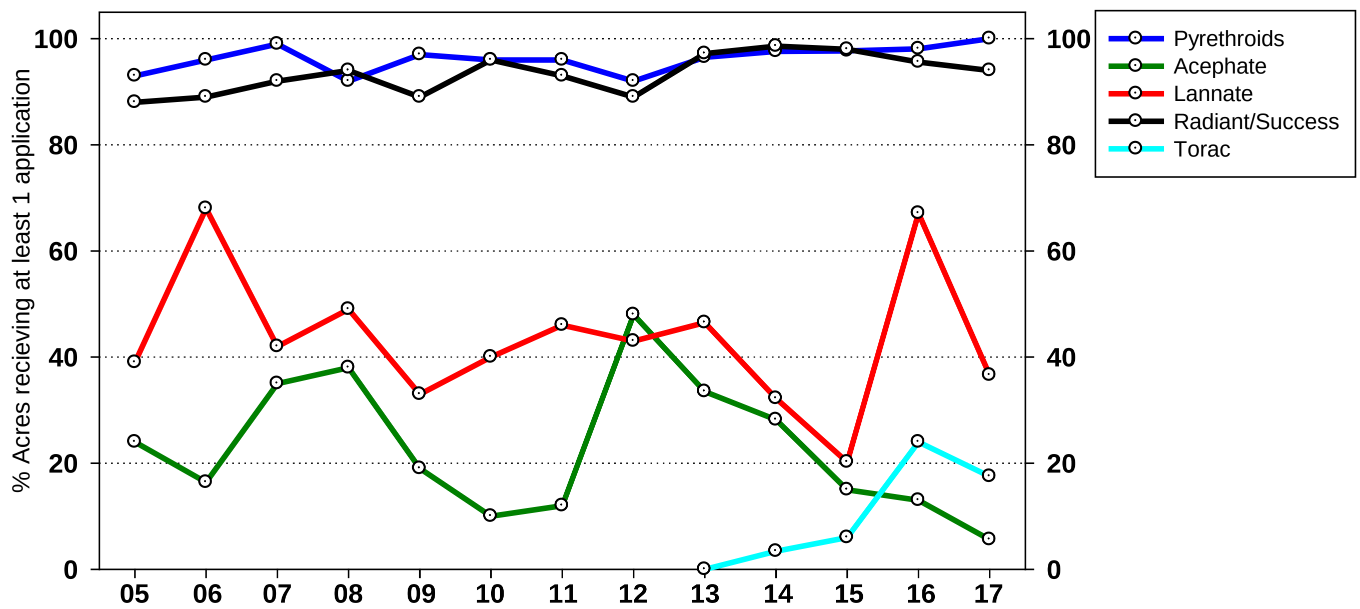

Figure 5. Trends in insecticide use for control of Western Flower Thrips in Spring lettuce, 2005-2017.

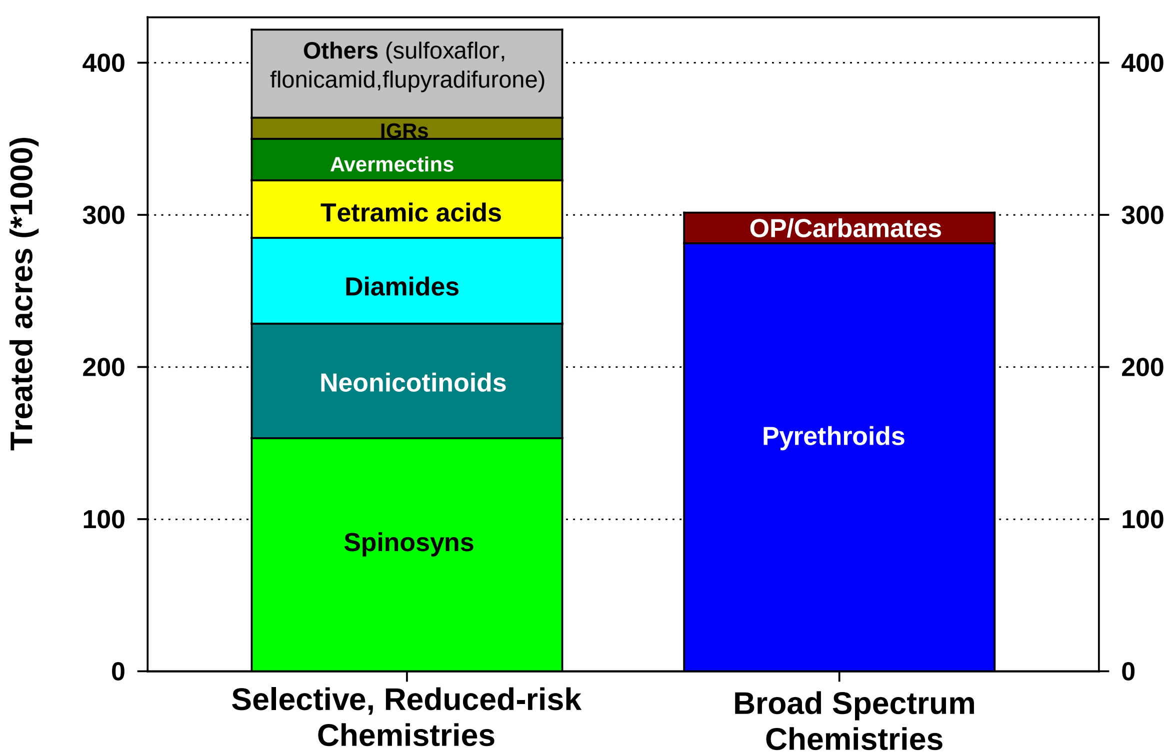

Figure 6. Estimates of total insecticide use for seasonal insect control on Lettuce, 2016-2017.

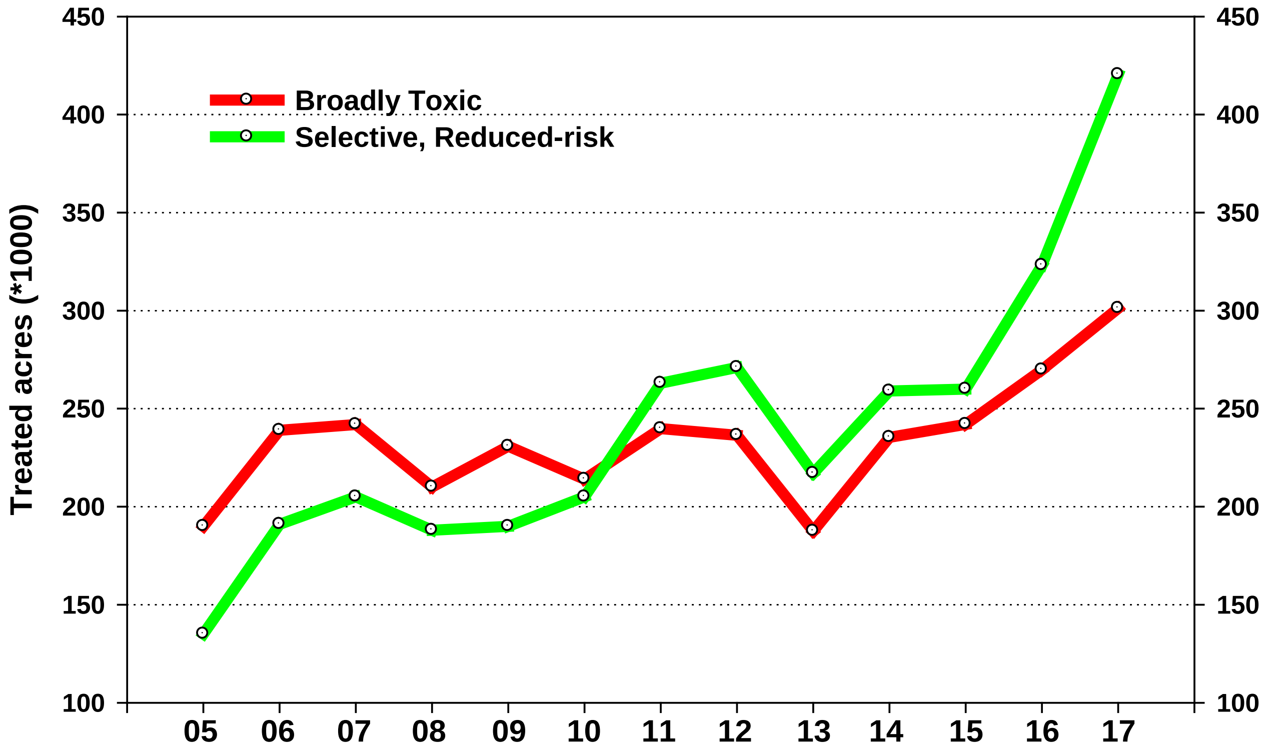

Figure 7. Relative estimates of acreage treated with broad spectrum and selective, reduced -risk insecticides on desert lettuce, 2005-2017. *Note: Treated acreage for each year was estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in that year's survey.*