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Insecticide Usage on Desert Lettuce, 2017-18

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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 May 15, 2018 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 25 surveys were completed in the 2018 workshop, representing an estimated total of 44,180 fall acres and 37,720 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 again 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 and adults (cabbage looper and corn earworm). Over the past 14 years, pyrethroid usage has remained consistently high **(Fig 1 and 5)**, and accounts for the bulk of broad spectrum chemistry used to control insects in lettuce **(Fig 6)**.

Overall, organophosphate/carbamate usage continues to decline. Lannate (methomyl) usage was up slightly and and acephate usage was down on spring lettuce this season due to lighter thrips pressure **(Fig 5)**. However, both of these products remain important rotational alternatives for

Radiant. 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 > 95% of the lettuce acreage was treated with Radiant or Success in 2017-18 **(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, Besiege, 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 2017, presumably because of the loss of the flubendiamide tolerance; this is evident by the dramatic reduction in Belt and Vetica use **(Fig 2)**. It appears that PCAs increased their use of Coragen soil applications to offset the losses **(Table 3).** Exirel and Verimark usage increasing slightly from the previous year **(Fig 2)**.

The tetramic acid chemistry (Movento) was used slightly less on fall lettuce in 2016 **(Fig 3)**, but remained about the same on spring lettuce **(Fig 4)** consistent with heavy aphid pressure in both 2017 and 2018. 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 greater that 90% of the acreage in 2017-18 **(Table 3-4).** Foliar neonicotinoid usage decreased last season, whereas Sivanto (butenolide) a usage increased this spring due to the heavy aphid pressure. Torac usage was down again last spring for thrips management **(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 & 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, 2017

Insecticide Chemistry	Fall Lettuce, 2017				
	IRAC group	% PCA's Using Products	% treated acres	No. applications	Treated [1] acres
Carbamates	1A	62.5	33.4	1.2	25,750
Organophosphates	1B	8.3	6.2	1.0	2,750
Pyrethroids - Foliar	3A	95.8	95.4	2.9	120,400
Pyrethroids - Chemigation	3A	87.5	77.5	1.1	36,015
Pyrethroids - Total		95.8	95.4	2.9	156,415
Neonicotinoids -Soil	4A	100.0	90.8	1.0	40,110
Neonicotinoids -Foliar	4A	25.0	26.7	1.0	11,780
Neonicotinoids -Total		100.0	90.8	1.0	51,890
Sulfoxamines	4C	16.7	4.9	1.0	2160
Butenolides	4D	12.5	11.2	1.3	8,950
Spinosyns	5	91.6	96.2	2.1	87,995
Avermectins	6	62.5	40.8	1.1	20,045
JH mimic	7C	0.0	0.0	0.0	0
Selective feeding blocker	9	0.0	0.0	0.0	0
Chitin Synthesis inhibitor	16	12.5	3.2	1.0	1,400
Ecdysone agonists	18	45.8	22.0	1.0	9,740
METI inhibitors	21	8.3	1.8	1.0	800
Na channel blockers	22	25.0	2.2	1.0	960
Tetramic acids	23	20.8	16.5	1.2	7,575
Diamides -Soil	28	41.7	36.9	1.0	15,855
Diamides- Foliar	28	41.7	33.9	1.0	15,233
Diamides- Total		41.7	70.8	1.0	31,088
Chordotonal organ modulators	29	16.7	10.0	1.0	4,410

*[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, 2018

	Spring Lettuce, 2018				
Insecticide Chemistry	**IRAC group**	**% PCA's Using Products**	**% treated acres**	**No. applications**	**Treated [1] acres**
Carbamates	1A	8.3	9.9	1.0	23,730
Organophosphates	1B	66.7	39.5	1.3	3,750
Pyrethroids - Foliar	3A	87.5	90.7	2.6	81,100
Pyrethroids - Chemigation	3A	62.5	41.7	1.0	15,730
Pyrethroids - Total		87.5	90.7	2.6	96,830
Neonicotinoids -Soil	4A	100.0	92.7	1.0	34,950
Neonicotinoids -Foliar	4A	29.2	26.4	1.1	9,955
Neonicotinoids -Total		100.0	92.7	1.0	44,905
Sulfoxamines	4C	58.3	29.0	1.1	12,348
Butenolides	4D	62.5	39.8	1.1	17,872
Spinosyns	5	95.8	95.4	2.1	73,735
Avermectins	6	37.5	17.9	1.2	9,530
JH mimic	7C	0.0	0.0	0.0	0
Selective feeding blocker	9	8.3	3.8	1.0	1,425
Chitin Synthesis inhibitor	16	8.3	3.8	1.0	1,425
Ecdysone agonists	18	33.3	10.0	1.0	3,790
METI inhibitors	21	8.3	4.3	1.0	1,622
Na channel blockers	22	12.5	1.7	1.0	625
Tetramic acids	23	87.5	63.1	1.2	23,817
Diamides -Soil	28	20.8	13.6	1.0	5,120
Diamides- Foliar	28	25.0	29.5	1.0	10,882
Diamides- Total		25.0	43.1	1.0	16,002
Chordotonal organ modulators	29	54.2	25.8	1.1	11,635

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

Table 3. Insecticides applied to Fall lettuce, 2017.

Insecticide Product	Fall Lettuce, 2017				
	IRAC group	% PCA's Using Product	% treated acres	No. applications	Treated[1] acres
Pyrethroids (Foliar)	3A	95.8	95.4	2.9	123,000
Radiant	5	91.6	95.9	2.1	87,800
Imidacloprid (Soil)	4A	100.0	90.8	1	40,110
Pyrethroids (Chemigation)	3A	87.5	77.5	1.1	36,015
Lannate (methomyl)	1A	62.5	33.4	1.2	25,750
Proclaim	6	62.5	40.8	1.1	20,045
Coragen (Soil)	28	41.7	29.5	1	13,055
Intrepid	18	45.8	22.0	1	9,740
Sivanto	4D	12.5	11.2	1.3	8,950
Movento	23	20.8	16.5	1.2	7,575
Coragen (Foliar)	28	41.7	13.4	1.1	6,658
Voliam Xpress/Beseige	28+3A	41.7	13.4	1.1	6,658
Assail	4A	25.0	10.8	1	4,775
Beleaf	29	16.7	10.0	1	4,410
Venom/Scorpion (foliar)	4A	13.4	7.7	1	3,405
Verimark	28	8.3	7.4	1	2,800
Exirel	28	29.2	6.1	1	2,675
Endigo	4A	8.3	5.9	1	2,600
Sequoia	4C	16.7	4.9	1	2,160
Acephate	1B	8.3	3.6	1	1,600
Vetica	28+16	12.5	3.2	1	1,400
Belt	28	25.0	2.7	1	1,190
Avaunt	22	25.0	2.2	1	960
Dimethoate	1B	4.2	2.0	1	900
Torac	21	8.3	1.8	1	800
Imidacloprid (foliar)	4A	4.2	1.4	1	600
Venom/Scorpion (soil)	4A	4.2	0.9	1	400
Malathion	1 B	8.3	0.6	1	250
Minecto Pro	28+9	4.2	0.1	1	20
Abamectin	9	4.2	0.1	1	20
Actara	4A	0	0	0	0
Fulfill	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 4. Insecticides applied to Spring lettuce, 2018.

Insecticide Product	Spring Lettuce, 2018				
	IRAC group	% PCA's Using Product	% treated acres	No. applications	Treated [1] acres
Pyrethroids (Foliar)	3A	87.5	90.7	2.6	84,455
Radiant	5	95.8	95.2	2.1	73,645
Imidacloprid (Soil)	4A	100.0	92.7	1	34,950
Movento	23	87.5	63.1	1.2	23,817
Lannate (methomyl)	1A	66.7	39.5	1.3	23,730
Sivanto	4D	62.5	39.8	1.1	17,872
Pyrethroids (Chemigation)	3A	62.5	41.7	1	15,730
Sequoia	4C	58.3	29	1.1	12,348
Beleaf	29	54.2	25.8	1.1	11,635
Proclaim	6	37.5	17.9	1.2	9,530
Assail	4A	29.2	14.0	1	5,295
Coragen (Soil)	28	20.8	13.6	1	5,120
Coragen (Foliar)	28	25.0	10.1	1	3,805
Intrepid	18	33.3	10.0	1	3,790
Voliam Xpress/Beseige	28+3A	16.7	8.9	1	3,355
Imidacloprid (foliar)	4A	8.3	5.3	1.5	2,000
Acephate	1B	8.3	4.8	1	1,800
Endigo	4A	4.2	4.6	1	1,750
Torac	21	8.3	4.3	1	1,622
Belt	28	16.7	3.9	1	1,465
Vetica	28+16	8.3	3.8	1	1,425
Fulfill	9	8.3	3.8	1	1,425
Dimethoate	1B	8.3	3.4	1	1,300
Exirel	28	16.7	2.2	1	812
Malathion	1 B	8.3	1.7	1	650
Avaunt	22	12.5	1.7	1	625
Venom/Scorpion (foliar)	4A	4.2	1.2	1	450
Venom/Scorpion (soil)	4A	4.2	1.1	1	400
Actara	4A	4.2	0.2	1	60
Minecto Pro	28+9	4.2	0.1	1	20
Abamectin	9	4.2	0.1	1	20
Verimark	28	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.*

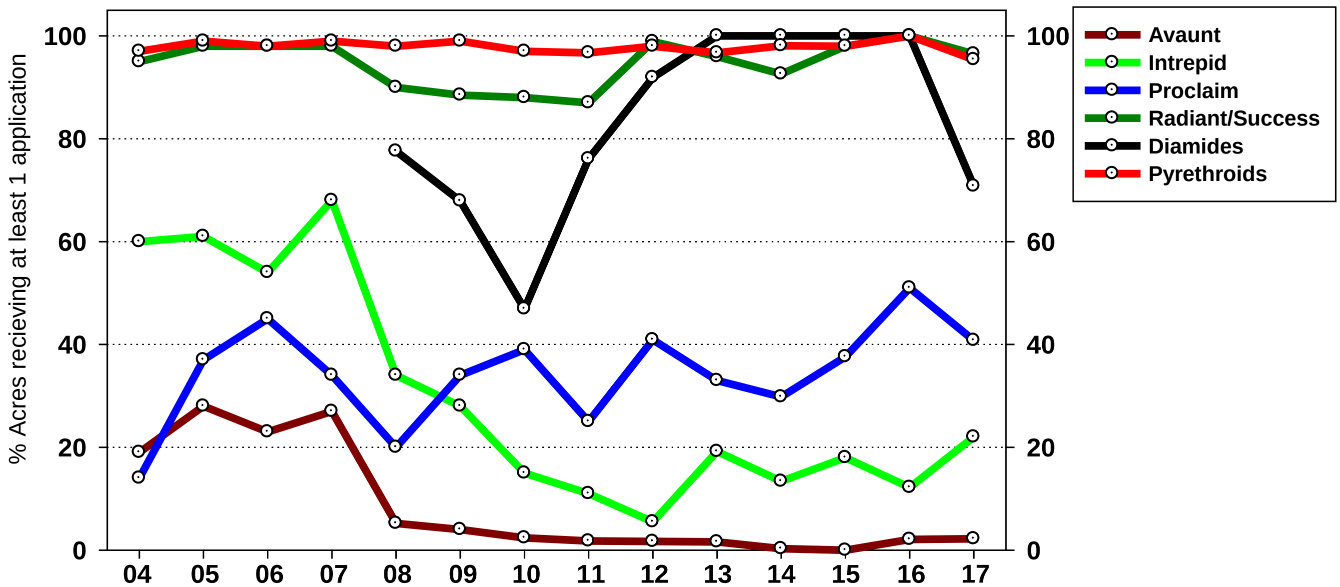

Figure 1. Trends in insecticide use for control of **Lepidopterous larvae** in Fall lettuce, 2004-2017.

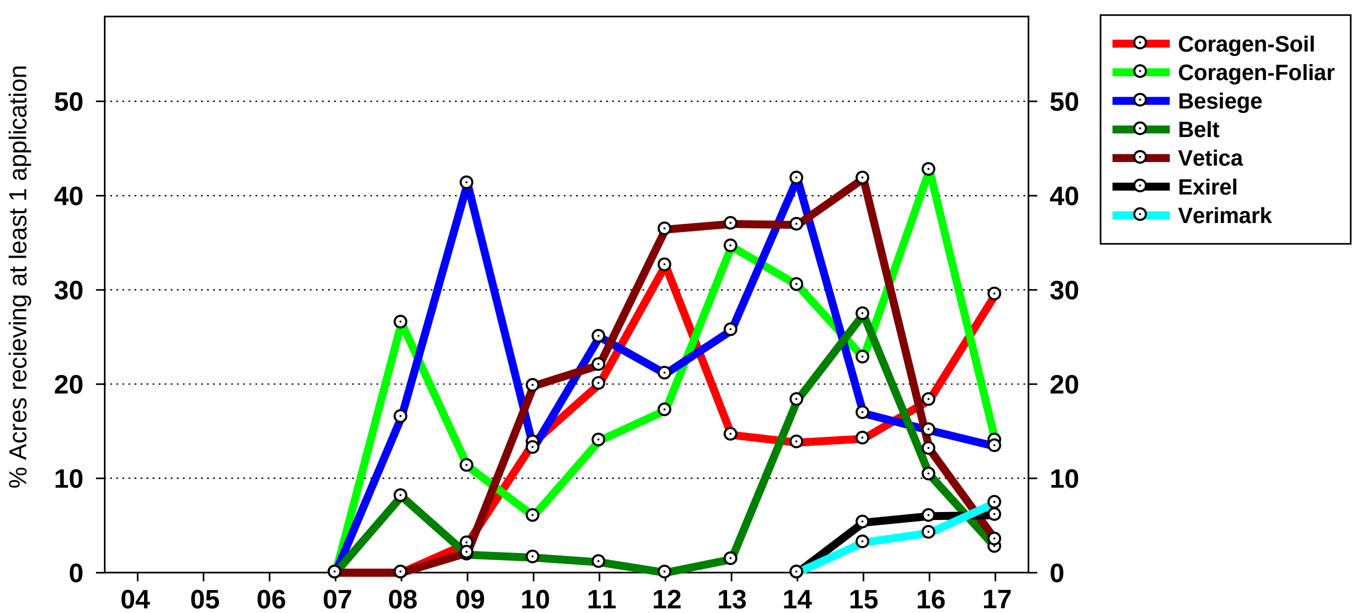

Figure 2. Trends in **Diamide** insecticide use for control of **Lepidopterous larvae** in Fall lettuce, 2004-2017.

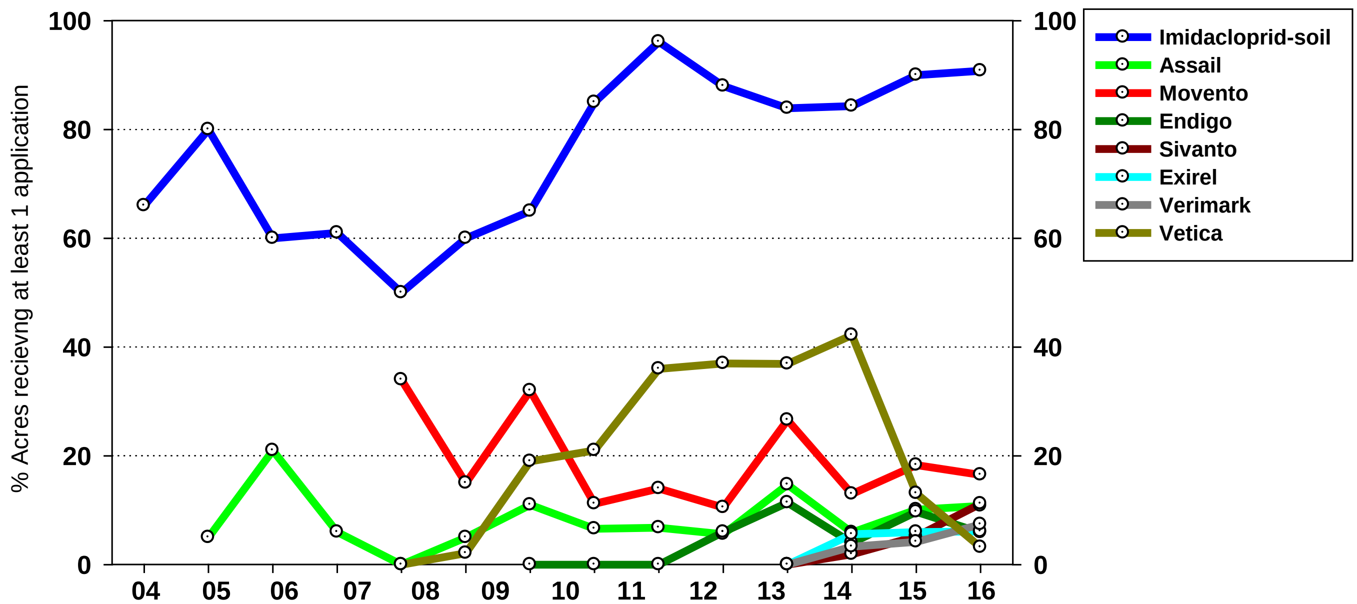

Figure 3. Trends in insecticide use for control of ***Bemisia* Whiteflies i**n Fall lettuce, 2004-2017.

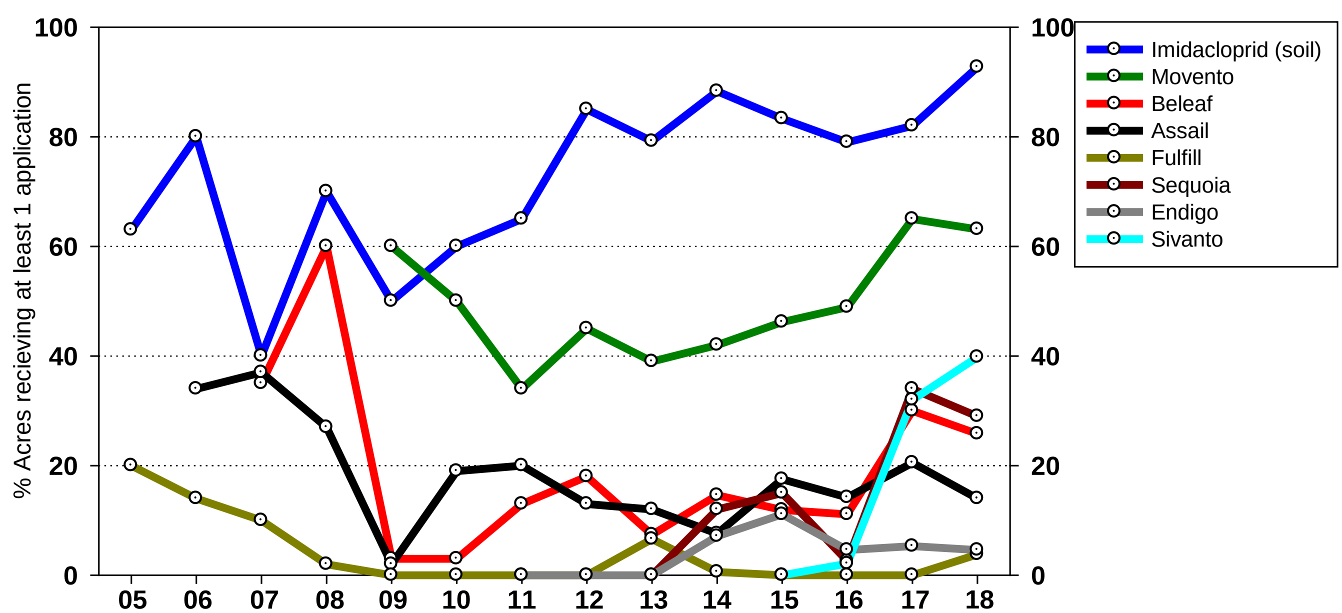

Figure 4. Trends in insecticide use for control of **Aphids** in Spring lettuce, 2005-2018

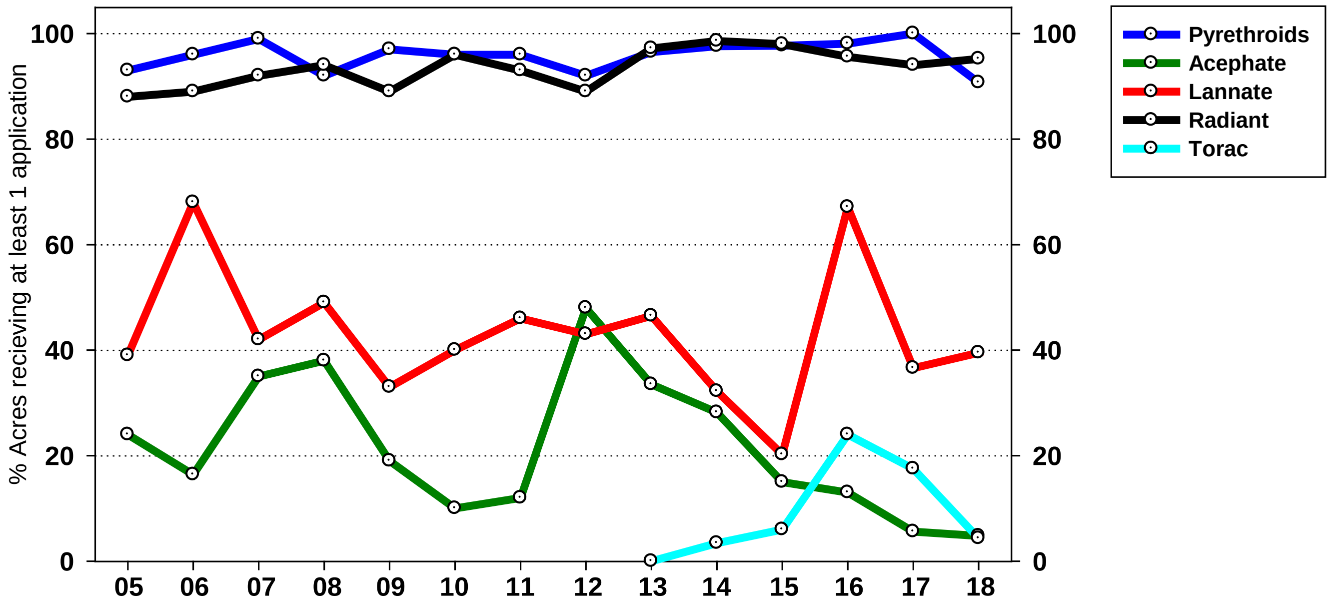

Figure 5. Trends in insecticide use for control of **Western Flower Thrips** in Spring lettuce, 2005-2018.

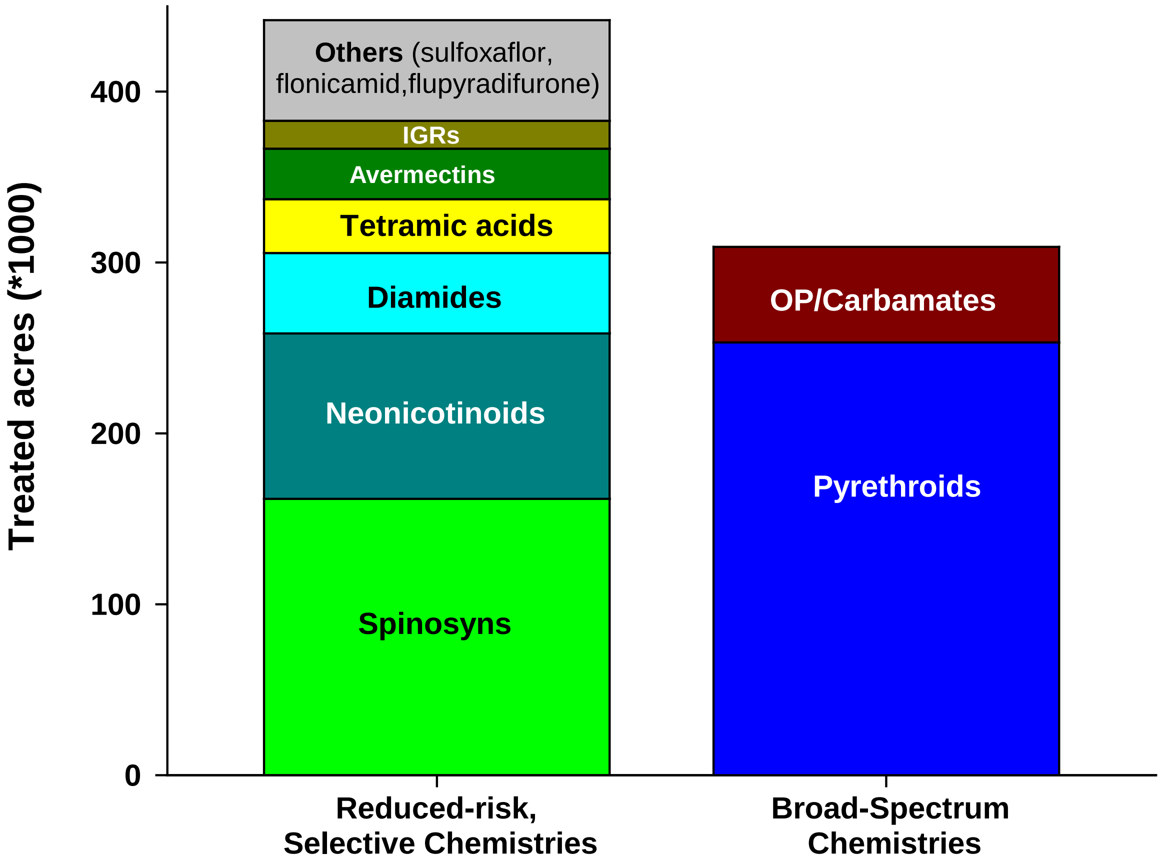

Figure 6. Estimates of total insecticide use for seasonal insect control on Lettuce, 2017-18. *Note: Treated acreage was estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in 2017-18.*

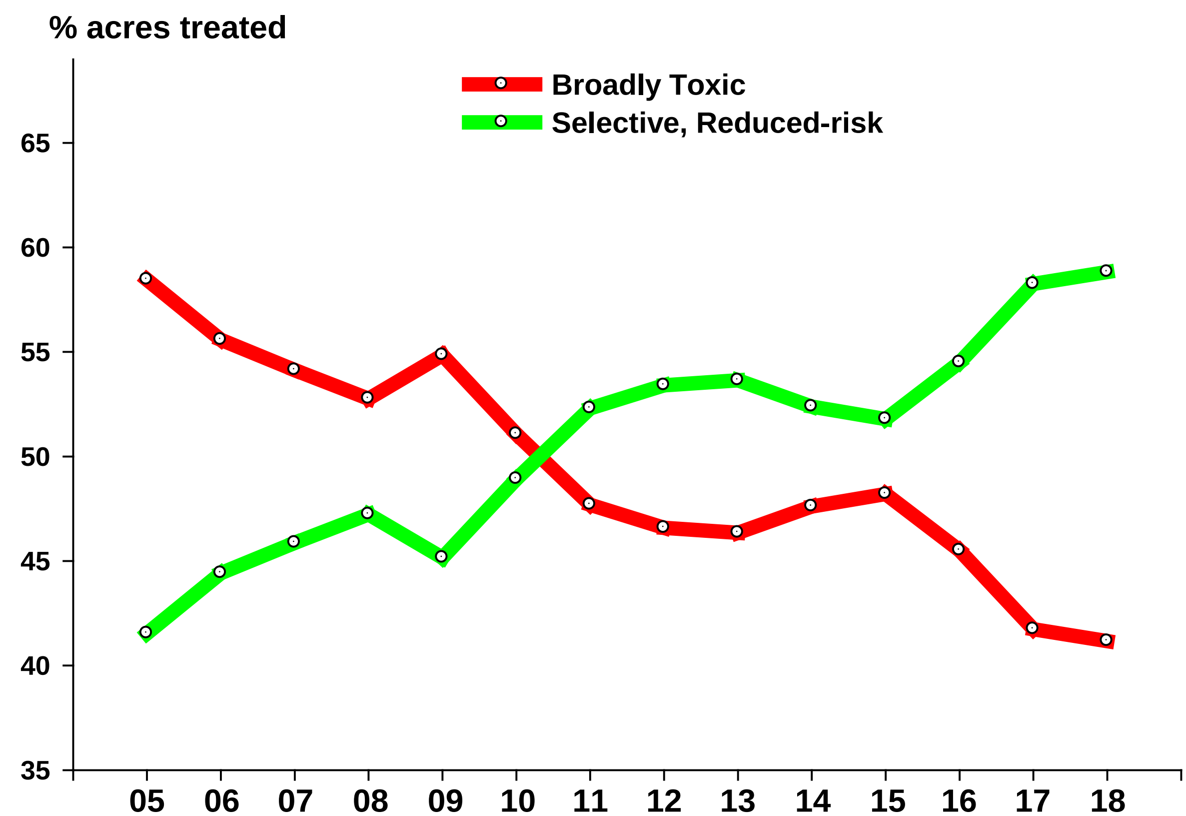

Figure 7. Percentage acreage treated with broad spectrum and selective, reduced -risk insecticides on desert lettuce, 2005-2018. *Note: Treated acreage for each year was estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs in that year's survey.*