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Insecticide Usage on Desert Lettuce, 2018-2019

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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 9, 2019 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 28 surveys were completed in the 2019 workshop, representing an estimated total of 33,275 fall acres and 35,156 spring lettuce acres from Yuma, Maricopa and neighboring Imperial Counties (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 as foliar sprays sprinkler chemigations) 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 15 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 increased slightly compared to 2017-18 usage. Lannate (methomyl) usage was similar to last year and acephate usage was up slightly on spring lettuce this season due to heavier aphid and late-season 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, and as noted above, pyrethroids provide a more cost-effective broad-spectrum alternative.

The spinosyns remain the second most commonly used class of insecticides, where 100% of the responding PCAs indicated that they used Radiant on fall lettuce in 2018 **(Table 1 and 2).** Radiant usage against both lepidopterous larvae **(Figure 1)** and thrips **(Figure 5)** has remained steady over the past 15 years, averaging over 2 sprays per treated acre, but was down in 2018-19 **(Tables 1 and 2)**. This is presumably due to the lighter Lep pressure experienced in the fall and the late occurring thrips pressure this spring.

The Diamides (Coragen, Besiege, Exirel and Verimark, Vetica, and Belt) were a commonly used chemistry in fall lettuce **(Table 1).** PCAs have steadily incorporated this new chemical class into their Lepidopterous larvae management programs since becoming available in 2008, but usage dropped by about 25% in fall lettuce in 2018 (**Fig 1)**. Among the diamides, Coragen as a foliar spry was the most commonly used and Belt/Vetica use has almost ceased. We presume existing stocks have been exhausted **(Fig 2)**. Coragen soil usage was markedly lower in 2018, and Verimark was used on less than 2% of the fall acers **(Table 3).** The new cyantraniliprole pre-mixture, Minecto Pro, was used on about 7% of the fall acers, significantly more than Exirel and Verimark combined.

Another important class of chemistry used in fall and spring lettuce are the neonicotinoids-4A (the 3rd most commonly used chemistry in lettuce in 2018-19) 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, but usage decreased significantly last season where it was used on less than 80% pf lettuce acers **(Table 3-4).** Foliar neonicotinoid usage decreased last season as well. However, Sivanto (butanolide-4D) and Sequoia (sulfoxamine-4C) accounted for significant usage this spring due to the heavy aphid pressure. Although less Movento was used on fall land spring lettuce in 2018-19, it remains second most commonly used product for aphid and whitefly control **(Fig 3 -4)**. Torac usage was down again last spring for thrips management, used on less than 1% of the acreage **(Fig 5).**

From an IPM perspective, the local produce industry continues to make 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 have been the predominant chemistry applied to lettuce, for the past eight seasons 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 to preserve their susceptibility.

Acknowledgement: *Special thanks go out to all the PCAs and growers who took time away from their busy schedules to participate in these surveys over the 15 years. Without your efforts, this historical data would not exist.*

Table 1. The top insecticide chemistries used on Fall Lettuce, 2018

Insecticide Chemistry	Fall Lettuce, 2018				
	IRAC group	% PCA's Using Products	% treated acres	No. applications	Treated [1] acres
Carbamates	1A	48.1	19.8	1.1	6,487
Organophosphates	1B	14.8	10.5	1	3,450
Pyrethroids - Foliar	3A	96.3	93.0	2.9	96,132
Pyrethroids - Chemigation	3A	92.6	63.9	1	20,875
Pyrethroids - Total	3A	96.3	93.0	3.9	117,007
Neonicotinoids -Soil	4A	96.3	77.0	1	25,250
Neonicotinoids -Seed treatment	4A	3.7	4.5	1	1,500
Neonicotinoids -Foliar	4A	25.9	12.4	1	4,066
Neonicotinoids -Total	4A	96.3	93.9	1	30,816
Sulfoxamines	4C	29.6	4.5	1	1,479
Butenolides	4D	18.5	2.4	1	799
Spinosyns	5	100	88.3	2.2	63,509
Avermectins	6	62.5	48.0	1.1	19,383
JH mimic	7C	0	0	0	0
Selective feeding blocker	9	0	0	0	0
Chitin Synthesis inhibitor	16	3.7	1.1	1	360
Ecdysone agonists	18	29.6	13.4	1	4,383
METI inhibitors	21	3.7	0.6	1	200
Na channel blockers	22	18.5	0.7	1	229
Tetramic acids	23	33.3	10.6	1.1	3,756
Diamides -Soil	28	44.4	10.3	1	3,375
Diamides- Foliar	28	92.6	60.2	1	19,744
Diamides- Total	28	92.6	70.5	1	23,119
Chordotonal organ modulators	29	11.4	2	1.7	1,318

[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, 2019

Insecticide Chemistry	Spring Lettuce, 2019				
	IRAC group	% PCA's Using Products	% treated acres	No. applications	Treated [1] acres
Carbamates	1A	62.9	39.6	1	13,811
Organophosphates	1B	18.5	8.8	1	2,892
Pyrethroids - Foliar	3A	88.9	90.1	3.0	90,013
Pyrethroids - Chemigation	3A	55.6	20.9	1	6,833
Pyrethroids - Total	3A	88.9	90.1	3.0	100,696
Neonicotinoids -Soil	4A	81.5	71.9	1	23,446
Neonicotinoids -Seed treatment	4A	3.7	3.0	1	1,050
Neonicotinoids -Foliar	4A	18.5	13.9	1	4,555
Neonicotinoids -Total	4A	85.2	88.8	1	29,071
Sulfoxamines	4C	63.0	32.4	1.14	12,644
Butenolides	4D	51.9	34.9	1.07	12,308
Spinosyns	5	88.9	84.3	2.2	60,047
Avermectins	6	37.0	12.9	1	4,205
JH mimic	7C	0	0	0	0
Selective feeding blocker	9	3.7	0.2	1	75
Chitin Synthesis inhibitor	16	0	0	0	0
Ecdysone agonists	18	14.8	13.9	1	4,540
METI inhibitors	21	7.4	0.6	1	205
Na channel blockers	22	11.1	1.2	1.2	506
Tetramic acids	23	81.5	52.8	1.3	22,825
Diamides -Soil	28	11.1	1.5	1	509
Diamides- Foliar	28	59.3	43.1	1	14,120
Diamides- Total	28	63.0	44.6	1	14,629
Chordotonal organ modulators	29	48.1	17.7	1.2	7,020

[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, 2018.

Insecticide Product	Fall Lettuce, 2018				
	IRAC group	% PCA's Using Product	% treated acres	No. applications	Treated [1] acres
Pyrethroids (Foliar)	3A	96.3	93.1	3.0	96,552
Radiant	5	100	88.3	2.2	63,509
Imidacloprid	4A	96.3	77.0	1	25,250
Pyrethroids (Chemigation)	3A	92.6	63.9	1	20,875
Proclaim	6	59.3	39.9	1.2	16,738
Coragen (Foliar)	28	63.0	30.6	1	10,469
Lannate (methomyl)	1A	48.1	16.7	1.1	6,487
Beseige	28+3A	3737.0	15.3	1	5,000
Intrepid	18	29.6	13.4	1	4,383
Movento	23	33.3	10.6	1.1	3,756
Acephate	1B	8.1	10.4	1	3,400
Coragen (Soil)	28	33.3	8.5	1	2,800
Minecto Pro	28+6	11.1	7.1	1	2,325
Assail	4A	18.5	6.9	1	2,260
Sequoia	4C	29.6	4.5	1	1,479
Nipsit Seed Treatment	4A	3.7	4.5	1	1500
Endigo	3+4A	14.8	4.2	1	1,380
Beleaf	29	11.4	2.0	1.7	1,318
Belt	28	3.7	2.6	1	840
Sivanto	4D	18.5	2.4	1	799
Exirel	28	11.1	2.3	1	750
Verimark	28	11.1	1.8	1	575
Vetica	28+16	3.7	1.1	1	360
Agri-Mek/ABBA	6	3.7	1.0	1	320
Actara	4A	7.4	0.8	1	256
Avaunt	22	18.5	0.7	1	229
Torac	21	3.7	0.6	1	200
Scorpion (foliar)	4A	3.7	0.5	1.0	170
Malathion	1B	3.7	0.2	1	50
Dimethoate	1B	0	0	0	0
PQZ	9B	0	0	0	0
Fulfill	9B	0	0	0	0
Versys	9D	0	0	0	0
Oberon	23	0	0	0	0
Success	5	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, 2019.

Insecticide Product	Spring Lettuce, 2019				
	IRAC group	% PCA's Using Product	% treated acres	No. applications	Treated [1] acres
Pyrethroids (Foliar)	3A	88.9	90.1	3.0	90,013
Radiant	5	88.9	84.3	2.2	59,757
Imidacloprid	4A	81.5	71.9	1	23,466
Movento	23	81.5	52.8	1.3	22,825
Lannate (methomyl)	1A	62.9	39.6	1	13,811
Sequoia	4C	63.0	32.4	1.14	12,644
Sivanto	4D	51.9	34.9	1.07	12,308
Coragen (Foliar)	28	29.6	24.0	1	7,915
Beleaf	29	48.1	17.7	1.2	7,020
Pyrethroids (Chemigation)	3A	55.6	20.9	1	6,833
Intrepid	18	14.8	13.9	1	4,540
Besiege	28+3A	37.0	11.8	1	3,850
Assail	4A	11.1	9.8	1	3,200
Acephate	1B	18.5	7.4	1	2,426
Minecto Pro	28+9	7.4	7.2	1	2,350
Proclaim	6	29.6	5.6	1	1,815
Nipsit Seed Treatment	4A	3.7	3.0	1	1,050
Endigo	4A	11.1	33.0	1	970
Dimethoate	1B	7.4	1.2	1	391
Avaunt	22	11.1	1.2	1.2	506
Actara	4A	7.4	1.2	1	385
Verimark	28	3.7	1.0	1	340
Success	5	7.4	0.9	1	290
Torac	21	7.4	0.6	1	205
Coragen (Soil)	28	7.4	0.5	1	169
Malathion	1B	3.7	0.2	1	75
Fulfill	9B	3.7	0.2	1	75
Agri-Mek/ABBA	6	3.7	0.1	1	40
Exirel	28	3.7	0.1	1	5
Venom (foliar)	4A	0	0	0	0
Belt	28	0	0	0	0
Vetica	28+16	0	0	0	0
PQZ	9B	0	0	0	0
Versys	9D	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.*

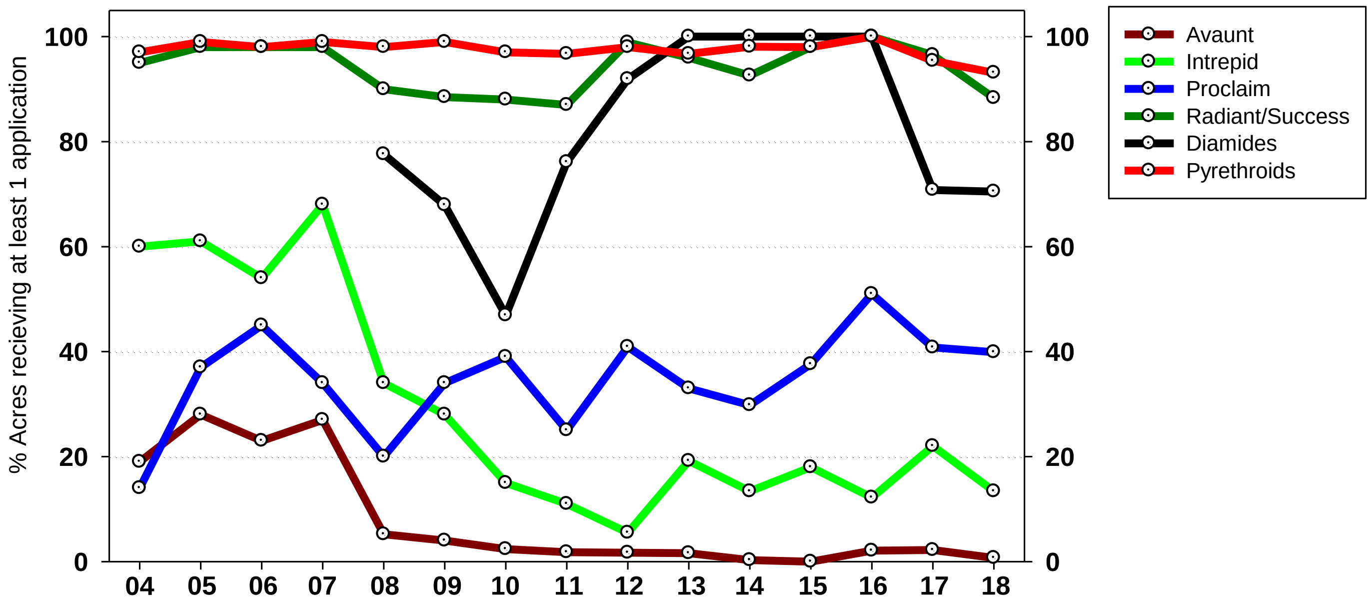

Figure 1. Trends in insecticide use for control of **Lepidopterous larvae** in Fall lettuce, 2004-2018.

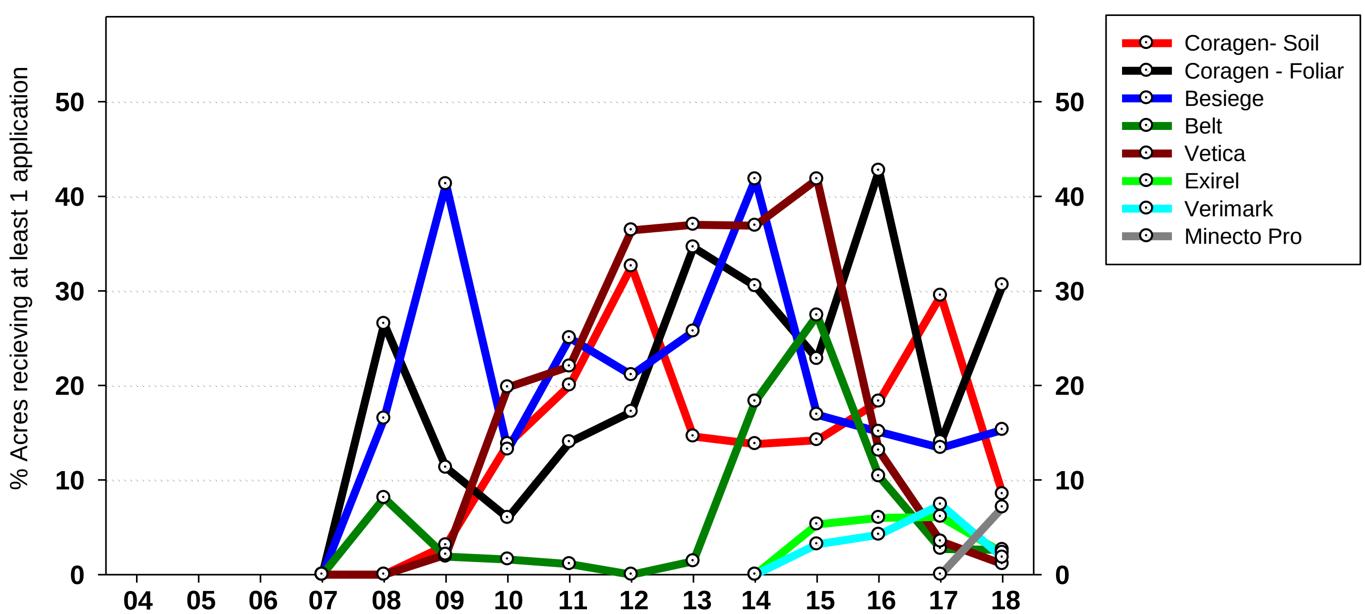

Figure 2. Trends in **Diamide** insecticide use for control of **Lepidopterous larvae** in Fall lettuce, 2004-2018.

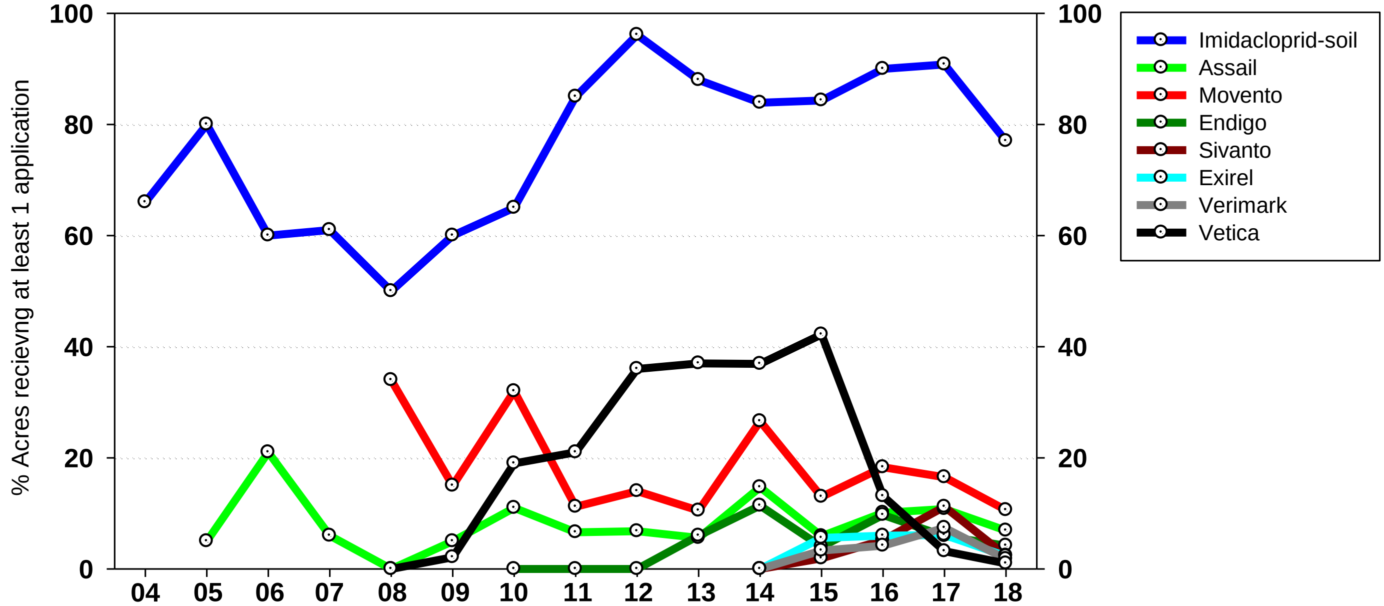

Figure 3. Trends in insecticide use for control of ***Bemisia* Whiteflies i**n Fall lettuce, 2004-2018.

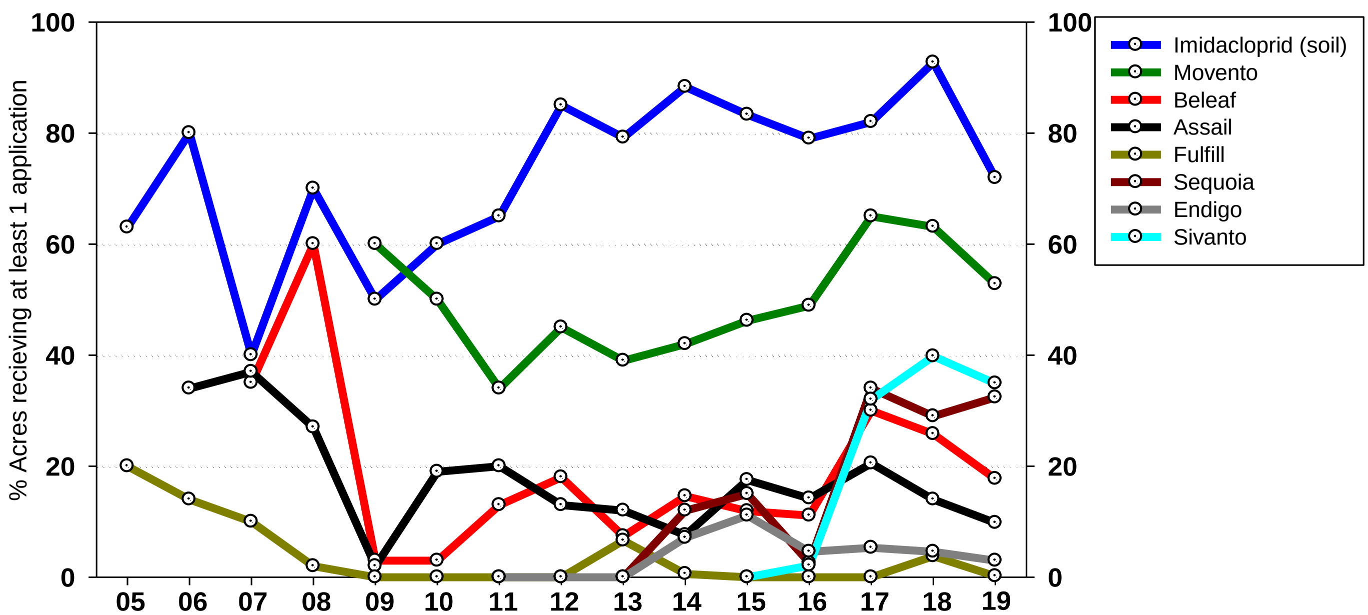

Figure 4. Trends in insecticide use for control of **Aphids** in Spring lettuce, 2005-2019

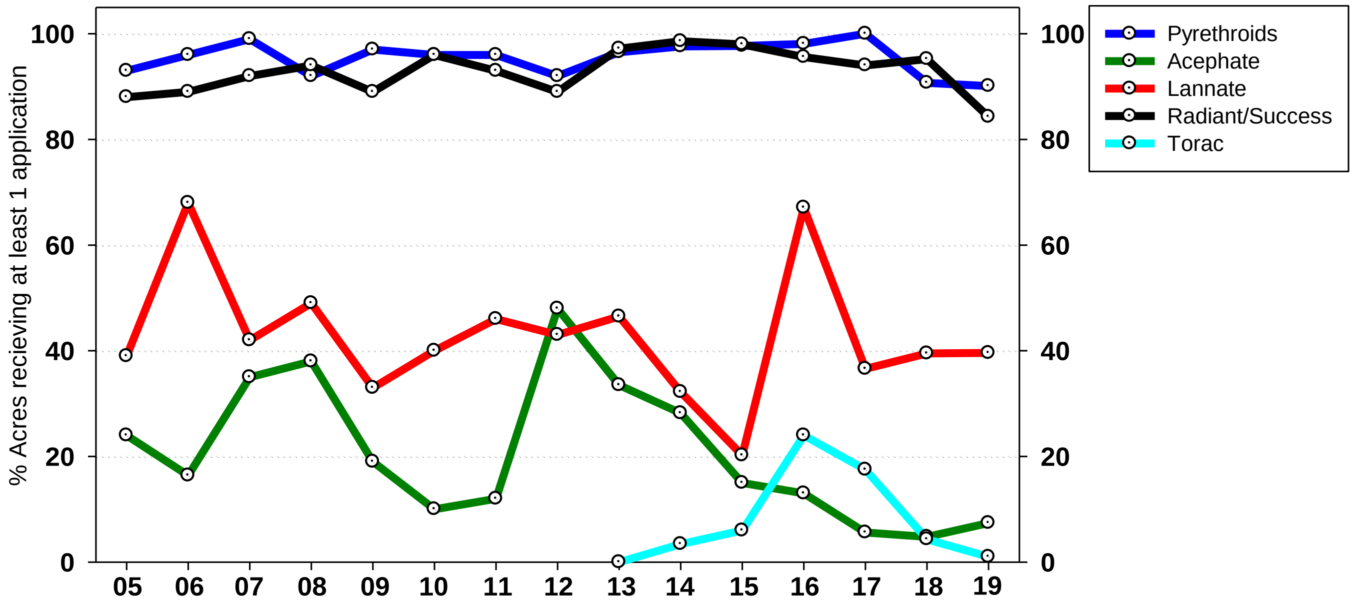

Figure 5. Trends in insecticide use for control of **Western Flower Thrips** in Spring lettuce, 2005-2019.

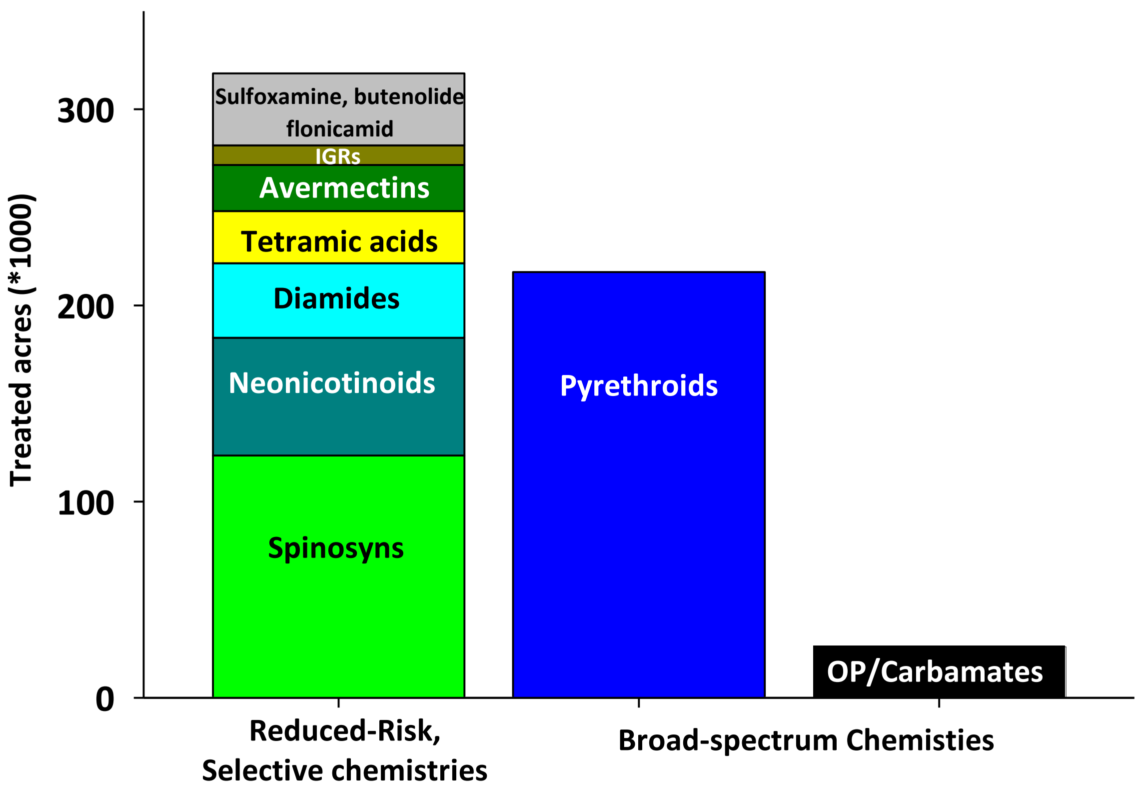

Figure 6. Estimates of total insecticide use for seasonal insect control on Lettuce, 2018-19. *Note: Treated acreage was estimated by multiplying: % acres treated * number of times treated * acreage estimated by participating PCAs.*

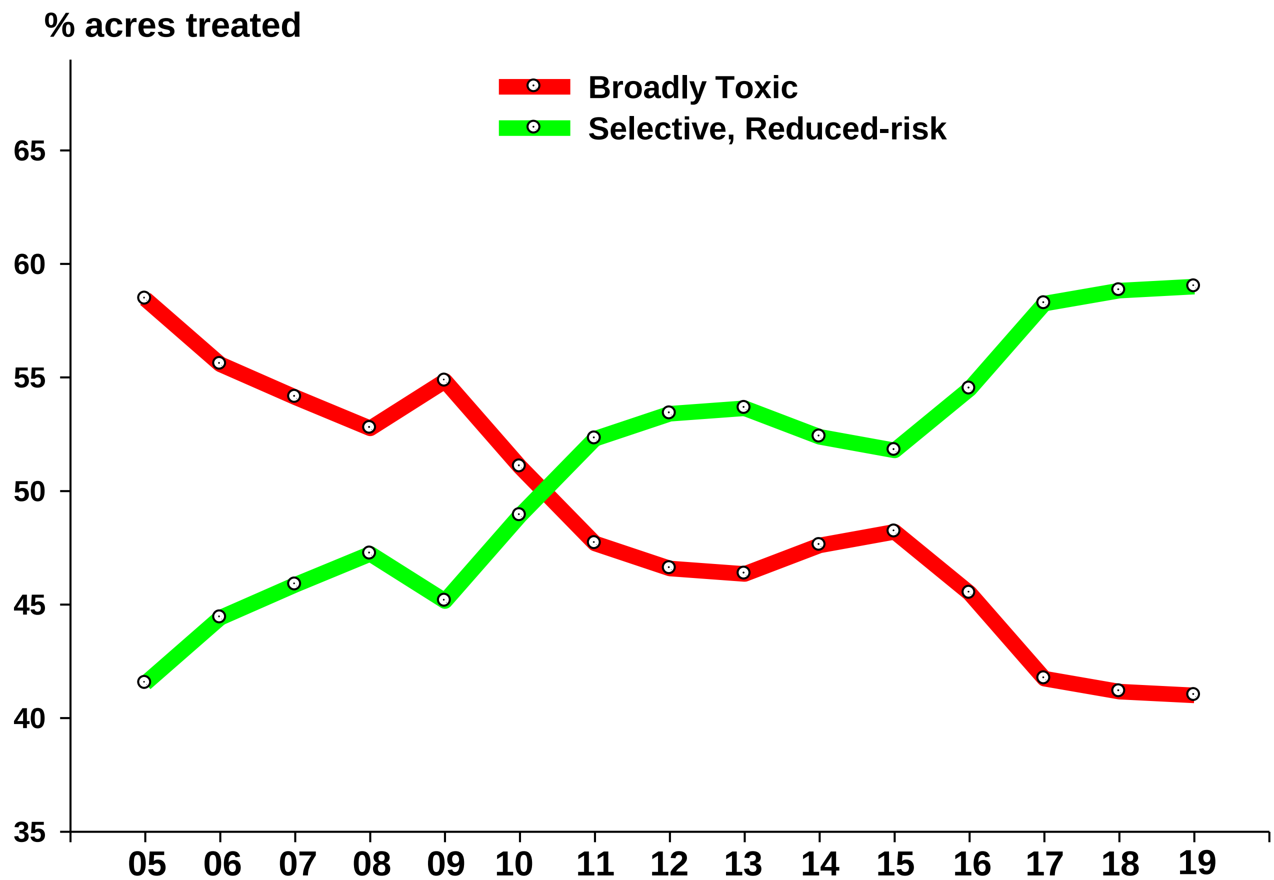

Figure 7. Percentage acreage treated with broad spectrum and selective, reduced -risk insecticides on desert lettuce, 2005-2019. *Note: % acres treated for each year was estimated by: dividing the number of acres treated for reduced risk or broad-spectrum chemistries by the total numbers of acres treated with all insecticides in both fall and spring lettuce.*