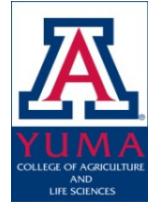


Assessment of Insect Losses and Insecticide Use on Arizona Head Lettuce, 2004-2010



John C. Palumbo, Yuma Agricultural Center

Introduction: The development of accurate “real world” data on insect losses and insecticide usage is important to the assessment of our IPM programs in Arizona. Reliable estimates of insecticide use patterns, costs, and yield/quality losses due to key insect pests are our most objective tools for assessing change in our local systems. This information allow 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 key insect pests and their cost-effective management in desert lettuce production. This report provides real world data on actual insect loss data for head lettuce over the past 6 years and estimates the insecticides used to prevent key insect pests from reducing yield and quality.

Methods: The data was developed through the administration of a three-part survey that was conducted in an interactive process with stakeholder input. Growers, PCAs, Extension personnel and industry professionals attended Head Lettuce Insect Losses and Impact Assessment Workshops in Yuma 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. The three part survey instrument collected the following information:

Part 1: Information was collected on the actual head lettuce acreage represented by the respondent, and overall percent reductions in yields due to several biological, environmental and management factors. In addition, costs associated with aerial and ground applications and insect management fees for scouting were estimated. To provide data consistent with head lettuce production in the desert southwest, separate information was collected for fall lettuce acres (crops grown from September through November) and spring lettuce acres (December-March) because of differences in weather and insect pressures.

Part 2: Information was collected on IPM and crop insect losses through estimates of the percentage of acres where key insect pests were present and insecticide sprays were required to prevent yield reductions. Included with those estimates are the frequency and costs of insecticide applications directed towards those insects. Overall, these costs represent an economic loss to the grower associated with preventing insects from damaging plants and reducing yields. Finally, actual percent yield losses (heads not harvested due to insect damage or reduced quality) for individual insect species were estimated .

Part 3: Data on insecticide use patterns was collected. These data identify the frequency of use of various chemistries (identified by both product name and IRAC mode-of-action classification) and the percentage of treated acres for each product.

Ideally, this data will allow us to track changes in insect crops losses and insecticide use patterns over time in great detail for both fall and spring head lettuce.

Part 1.

Arizona Head Lettuce Insect Losses Survey, 2004-2010

	2004/2005		2005/2006		2006/2007		2007/2008		2008/2009		2009/2010	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Total Acres Reported	19,760	14,210	24,300	21,970	18,370	14,180	16,219	11,000	18,340	16,100	20,133	18,667
Total Annual Yield Losses (%)												
Weather	7.5	9.7	4.8	4.9	2.4	5.8	4.4	3.0	2.9	3.2	3.6	3.6
Chemical injury	0.7	0.6	0.5	0.8	0.3	0.4	0.6	0.7	0.1	0.1	0.7	0.4
Weeds	1.6	1.9	1.8	2	0.7	0.8	1.0	1.1	1.5	1.7	1.0	1.0
Diseases	5.9	13.6	6.2	11.2	2.3	3.8	2.2	4.3	2.8	6.6	1.3	3.1
Insects	1.9	2.5	3.6	1.9	2.1	2.4	1.4	1.4	1.2	1.5	1.3	2.1
Birds	-	-	2.2	2.8	4.3	4.3	1.5	2.9	1.0	1.2	2.1	2.7
Other Factors	3.3	4.5	3.1	2.8	0.9	0.8	0.0	0.1	2.1	2.2	2.4	1.7
Avg. Total Losses	3.5	5.5	22.1	26.4	13.1	18.4	11.1	13.5	11.5	14.9	12.4	14.6
Application Costs:												
Air (% treated acres)	92.5	98.8	88.9	87.3	93.1	91.2	87.7	91.1	87.3	75.0	80.7	89.3
Air (Avg. no. sprays)	3.4	3.5	3.2	2.5	2.4	2.2	2.6	2.3	2.6	2.2	2.4	2.2
Air (\$ cost/spray)	8.88	9.65	8.37	8.45	10.51	11.23	13.30	12.90	14.82	14.70	15.80	16.30
Ground (% treated acres)	93.1	90.6	91.8	92.7	100.0	100.0	96.4	92.2	95.0	94.6	92.3	91.1
Ground (Avg. no. sprays)	2.2	2.1	2.3	2.4	2.3	2.3	2.2	2.0	2.0	2.1	2.2	1.9
Ground (\$ cost/spray)	15.2	15.6	13.53	13.53	16.00	15.00	15.90	16.60	20.15	19.70	18.90	19.00
Insect Management Fees:												
Acres Scouted (%)	100	100	100	100	100	100	100	100	100	100	100	100
Field visits /week	3.4	2.8	4.1	3	4	3	3.7	2.9	4.0	3.1	4.1	3.1
Cost (\$) / acre scouted	21.11	20.89	24.5	24.5	22.10	22.36	22.80	22.50	22.50	22.10	24.00	24.00

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2004/2005

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	88	42	57	29	1.1	1	11.50	12.91	2.6	1.7
Flea beetles	56	17	32	5	1.2	1	14.40	13.45	0.9	0.8
Leafminers	53	24	7	0.3	1	0	24.50	0.00	0	0
Salt marsh caterpillar	6	0.5	2	0	1	0	27.00	0.00	0	0
Beet armyworm	99	56	94	54	3.6	1.7	30.90	30.90	2.3	1
Cabbage looper	98	86	98	73	3	1.9	27.80	26.00	1.1	1.1
Budworm/bollworm	56	27	41	23	1.8	1.2	24.20	25.30	0.4	0.3
Silverleaf whitefly	97	18	76	12	1.5	1	29.30	14.00	0.6	0.1
Green peach aphid	13	75	12	56	1	2.2	31.00	25.00	0.3	1.1
Foxglove aphid	0.5	16	0.3	14	0	1.4	0.00	26.30	0	0.5
Lettuce aphid	0.5	2.4	0	1.5	0	2	0.00	26.30	0	0
Thrips	75	95	36	86	1.4	2.5	26.40	28.10	0.5	1.4
Lygus /False Chinch Bug	-	-	-	-	-	-	-	-	-	-
3-Cornered Alfafa Hopper	-	-	-	-	-	-	-	-	-	-
Grasshoppers	-	-	-	-	-	-	-	-	-	-
Trash bugs (other)	66	57	28	29	1.3	1.6	19.20	19.20	0.1	0.1

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	65	52	1	1	12.60	14.55
Soil-applied insecticide used (neonicotinoids):	66	63	1	1	64.10	67.20
Soil-applied insecticide used (Coragen or Durivo):	-	-	-	-	-	-

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2005/2006

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	80.6	58.8	66.5	37.9	1.1	1.1	14.50	11.70	0.8	0.4
Flea beetles	59.9	20.4	44.6	14.9	1.1	0.9	14.00	13.50	1	0.4
Leafminers	48.1	29.1	4.5	1.5	1.4	1.5	36.00	36.90	0.2	0
Salt marsh caterpillar	5.4	0.1	1.1	0	2	0	18.00	0.00	0.3	0
Beet armyworm	99.4	61.4	95.7	55.2	3.6	1.5	31.70	31.80	1	0.5
Cabbage looper	93.2	69.3	93.2	65.4	2.9	1.5	31.40	30.90	0.9	0.7
Budworm/bollworm	54.7	34.4	52.3	34.9	1.6	1	31.80	29.90	0.4	0.4
Silverleaf whitefly	91.4	36.2	26.9	7.1	1.4	1	42.20	35.00	0.6	0
Green peach aphid	7.9	61.4	6.9	61.1	1.1	1.9	28.30	33.80	0.3	1.2
Foxglove aphid	3.9	23.1	3.1	21.1	1.1	1.6	28.00	34.30	0.1	0.5
Lettuce aphid	2.5	8.1	1.6	6.8	1.3	1.9	36.30	37.90	0.1	0.4
Thrips	79.9	93.2	38.8	77.8	1.4	2.2	29.90	31.80	0.4	0.6
Lygus /False Chinch Bug	-	-	-	-	-	-	-	-	-	-
3-Cornered Alfafa Hopper	-	-	-	-	-	-	-	-	-	-
Grasshoppers	-	-	-	-	-	-	-	-	-	-
Trash bugs (other)	63.1	57.8	38.5	45.2	1.3	1	13.20	13.20	0.3	0.3

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	78.3	47.4	1	1	11.50	11.00
Soil-applied insecticide used (neonicotinoids):	80.1	79.6	1	1	57.85	57.08
Soil-applied insecticide used (Coragen or Durivo):	-	-	-	-	-	-

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2006/2007

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	58.2	38.9	54.8	24.8	1.3	1.2	15.90	16.40	0.6	0.3
Flea beetles	29.9	40.6	37.4	26.1	1.4	1.2	18.00	16.60	0.3	0.3
Leafminers	48.1	33.1	0	0	0	0	0.00	0.00	0	0
Salt marsh caterpillar	2.6	0.7	0.2	0	1	0	35.00	0.00	0	0
Beet armyworm	95.1	54.2	95.1	52.2	2.5	1.6	41.80	38.20	0.6	0.2
Cabbage looper	83.7	73.1	83.3	64.7	2.3	1.5	41.70	38.20	0.4	0.3
Budworm/bollworm	60.6	48.4	58.5	38.1	2	1.5	40.10	30.50	0.5	0.4
Silverleaf whitefly	61.9	23.6	25.1	4.5	1.5	2	48.30	47.00	0.1	0
Green peach aphid	24.5	79.6	24.2	79.3	1.5	2.5	33.80	38.20	0.4	1
Foxglove aphid	3.4	12.2	3.4	11.8	1.3	2.4	40.00	38.90	0.2	0.7
Lettuce aphid	3.3	12.5	3.3	12.3	2	2.5	60.00	38.70	0.2	0.7
Thrips	80.6	98.6	47.4	89.7	1.8	2.5	35.20	37.30	0.7	0.9
Lygus /False Chinch Bug	-	-	-	-	-	-	-	-	-	-
3-Cornered Alfafa Hopper	-	-	-	-	-	-	-	-	-	-
Grasshoppers	-	-	-	-	-	-	-	-	-	-
Trash bugs (other)	73.2	64.7	25.4	29.8	1.7	1.8	20.00	26.30	0.1	0.1

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	63.6	41.5	1.1	1	12.54	13.51
Soil-applied insecticide used (neonicotinoids):	56.7	39.4	1	1	52.35	48.62
Soil-applied insecticide used (Coragen or Durivo):	-	-	-	-	-	-

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2007/2008

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	80.6	68.1	50.1	28.8	1	1	16.00	18.50	1.4	0.7
Flea beetles	68.1	20.7	46.2	5.8	1.1	1	15.60	19.00	0.4	0.2
Leafminers	66.6	30.4	19.7	3.4	1.1	1	37.50	45.00	0.3	0.1
Salt marsh caterpillar	3.5	1.2	2	0	1	0	27.70	0.00	0.1	0
Beet armyworm	100	67.5	100	50.6	3.1	1.3	42.10	39.80	1.2	0.4
Cabbage looper	100	93	96.9	80	2.8	1.8	41.20	38.70	1	0.5
Budworm/bollworm	82	60.5	66	38.3	2	2.1	37.10	37.00	0.7	0.4
Silverleaf whitefly	100	46.8	53.1	23.4	1.4	1.3	45.00	48.30	0.6	0.1
Green peach aphid	10.4	67	6.5	62.4	1.6	1.8	48.80	41.90	0.1	0.8
Foxglove aphid	3.8	16.3	2.9	13	1.3	1.1	56.70	40.40	0.1	0.6
Lettuce aphid	1.9	13	1.1	8.7	1.3	1.1	50.00	39.00	0.1	0.4
Thrips	93.8	93.2	63.2	83	2.3	3	46.60	44.30	0.4	1
Lygus /False Chinch Bug	-	-	-	-	-	-	-	-	-	-
3-Cornered Alfafa Hopper	-	-	-	-	-	-	-	-	-	-
Grasshoppers	14.6	5	7.5	2.9	1.1	1	18.80	15.00	0.2	0.1
Trash bugs (other)	67.6	55.6	26.8	11.2	1.2	1	26.70	30.00	0.2	0.3

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	54.2	48.1	1	1	11.30	13.00
Soil-applied insecticide used (neonicotinoids):	50.1	64.3	1	1	35.40	32.60
Soil-applied insecticide used (Coragen or Durivo):	-	-	-	-	-	-

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2008/2009

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	96.5	67.1	64.7	17.4	1.3	1.2	21.4	17.2	0.6	0.2
Flea beetles	61.7	25.7	47	11.3	1.1	1	20.7	18.3	0.6	0
Leafminers	61.2	38.8	3	1	1	0	48	0	0	0
Salt marsh caterpillar	5.3	4.2	1.9	0	1	0	35	0	0	0
Beet armyworm	100	55	100	41.3	3	1.4	45.3	44.1	0.3	0.1
Cabbage looper	97.4	87.8	95	73.6	2.9	1.5	45.4	44.4	0.3	0.2
Budworm/bollworm	45.4	26	4.4	1.6	2.8	1.7	40.2	43	0	0
Silverleaf whitefly	87.1	32.3	20.5	9.8	1	1	42	45	0	0
Green peach aphid	18.4	79.3	15.7	78.8	1.7	1.7	40	39.6	0.1	0.2
Foxglove aphid	1.8	12.8	0.4	9.3	1	1.3	46	47.3	0	0.1
Lettuce aphid	0.9	2.2	0.4	2.2	1	1.5	45	47.5	0	0
Thrips	100	100	56.4	87.9	1.5	2.3	45.3	43.8	0.3	0.5
Lygus /False Chinch Bug	-	-	-	-	-	-	-	-	-	-
3-Cornered Alfafa Hopper	-	-	-	-	-	-	-	-	-	-
Grasshoppers	72.7	10.6	60.7	2.8	1.6	1	25.6	15	1.4	0
Trash bugs (other)	50.5	50.4	34.2	21.1	1	1	26.3	18.3	0	0

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	77.2	55.1	1	1	14.55	15.4
Soil-applied insecticide used (neonicotinoids):	38.3	50.8	1	1	35.72	31.4
Soil-applied insecticide used (Coragen or Durivo):	-	-	-	-	-	-

Part 2.

Arizona Head Lettuce Insect Losses Survey - 2009/2010

Pest	% acres where pest was present		% acres treated for this pest		No. of insecticide applications		Cost \$ of one spray per / acre		% reduction in yield	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Seedling Pests	97.0	43.0	73.5	9.5	1.1	1.0	19.50	19.37	0.5	0.6
Flea beetles	66.5	17.2	43.9	16.7	1.1	1.1	21.1	21.4	0.35	0.1
Leafminers	68.7	31.7	20.6	13.6	1	1	41.8	41.7	0.01	0.01
Salt marsh caterpillar	4.2	1	0	0	0	0	0	0	0	0
Beet armyworm	97.4	47.3	97.4	43.9	2.5	1.3	43.16	46.1	0.4	0.2
Cabbage looper	78.8	59.3	78.5	52.9	2.1	1.7	43.9	44.6	0.3	0.1
Budworm/bollworm	43.5	39.5	43.3	32.7	1.8	1.6	41.12	41.7	0.2	0.1
Silverleaf whitefly	87.7	26.4	69.5	12.7	1.4	1	35	28.33	0.6	0
Green peach aphid	3.6	67.3	2.4	66.5	1	1.5	32.5	43.88	0	0.4
Foxglove aphid	2.2	13.9	0	10.2	0	1.1	0	41.4	0	0.04
Lettuce aphid	1.1	4.2	0	2.1	0	1	0	41.4	0	0
Thrips	76.8	96.6	46.7	92.1	1.5	2.1	38.9	40.33	0.1	0.8
Lygus /False Chinch Bug	8.8	4.9	4.7	0.4	1	1	30	20	0	0.6
3-Cornered Alfafa Hopper	14.2	10.9	9.1	4.4	1	1	16.7	20.1	0.01	0.02
Grasshoppers	4.5	0.4	1.8	0	1	0	16.7	0	0	0
Trash bugs (other)	58.4	56.2	22.1	16.6	1.6	1.6	21.7	21.7	0	0

	% acres treated		No. of applications		Cost \$ of a single application per	
	Fall	Spring	Fall	Spring	Fall	Spring
Sprinkler chemigation treatments (pyrethroid/diazinon)	79.8	31.7	1	1	15.3	17.1
Soil-applied insecticide used (neonicotinoids):	63.8	67.5	1	1	21.9	21.9
Soil-applied insecticide used (Coragen or Durivo):	4.1	0.5	1	1	31.8	35

Part 3 - Fall

Arizona Head Lettuce Insect Losses Survey -Insecticide Usage

Insecticide	IRAC MOA	Fall 2004		Fall 2005		Fall 2006		Fall 2006		Fall 2008		Fall 2009	
		Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated
Orthene (acephate)	1B	9	1.0	8.9	1.0	10.9	1.0	23.7	1	20.6	1.5	9.3	1
Dimethoate	1B	5	1.0	6.0	1.3	4.6	1.0	4.6	1	1.0	1	0.0	0
MSR	1B	0	0.0	0.3	1.0	0.0	0.0	0	0	0	0	0	0
Diazinon- Foliar	1B	2	1.0	4.2	1.2	2.9	1.0	2.9	1	1.1	1.5	0	0
Diazinon- Chemigation	1B	41	1.0	42.0	1.2	17.0	1.0	34.9	1.1	17.6	1	10.3	1
Malathion	1B	0	0.0	0.0	0.0	1.3	1.0	0	0	0.2	1	1.3	1
Lannate	1A	47	2.3	54.1	1.6	49.0	1.3	30.7	1.1	33.8	1.2	29.9	1.1
Larvin	1A	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Endosulfan	2A	21	1.1	18.3	1.2	32.5	1.1	26.8	1.1	13.9	1.3	2.3	1
Pyrethroids - Foliar	3	97	3.5	99.8	3.3	97.6	3.0	99.4	3.3	98.2	3.3	99.7	2.8
Pyrethroids - Chem.	3	51	1.0	56.9	1.0	53.1	1.0	47.1	1	59.1	1	78.3	1
Admire Pro	4A	66	1.0	80.1	1.0	34.5	1.0	36.9	1	16.1	1	13.1	1
Generic imidacloprid	4A	-	-	-	-	22.2	1.0	24.4	1	22.4	1	47.1	1
Provado	4A	0	0.0	1.8	1.0	0.8	1.0	0	0	0	0	0	0
Venom (soil)	4A	-	-	-	-	0.0	0.0	0	0	0.2	1	1.9	1
Venom (foliar)	4A	-	-	-	-	0.0	0.0	0	0	0	0	9.7	1
Assail	4A	-	-	4.7	1.0	21.1	1.5	6.4	1.3	0	0	5.3	1
Oberon	23	-	-	1.4	1.0	0.0	0.0	12.8	1	2.6	1	2.8	1
Movento	23	-	-	-	-	-	-	-	-	33.6	1.3	4.5	1.3
Fulfill	7B	9	1.0	1.0	1.0	0.0	0.0	0.3	1	0	0	0	0
Beleaf	7C	-	-	-	-	6.9	1.0	8.1	1.1	0	0	2.1	1

Part 3 - Fall

Arizona Head Lettuce Insect Losses Survey -Insecticide Usage

Insecticide	IRAC MOA	Fall 2004		Fall 2005		Fall 2006		Fall 2006		Fall 2008		Fall 2009	
		Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated
Avaunt	22	19	1.2	27.6	1.1	22.9	1.0	27.1	1.3	5.2	1	3.9	1
Intrepid	18	60	1.4	61.1	1.2	53.8	1.3	68.4	1	33.5	1.3	27.9	1.3
Proclaim	6	14	1.2	36.8	1.0	44.7	1.3	34.3	1	19.8	1.1	34.5	1
Success	5	95	2.8	97.6	2.6	98.2	1.9	55.8	2.6	11.7	1.7	48.9	1.1
Radiant	5	-	-	-	-	-	-	42.2	2	78	1.3	83.9	1.9
Coragen (Foliar)	28	-	-	-	-	-	-	-	-	26.5	1.3	11.3	1
Coragen (Soil)	28	-	-	-	-	-	-	-	-	0	0	3.1	1
Durivo (Soil)	28+4A	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Voliam Xpress	28+3	-	-	-	-	-	-	-	-	16.5	1	41.3	1.1
Voliam Flexi	28+44	-	-	-	-	-	-	-	-	-	-	0.0	0
Synapse	28	-	-	-	-	-	-	-	-	8.1	1	1.9	1
Vetica	28+16	-	-	-	-	-	-	-	-	-	-	2.1	1
Agrimek (Abamectin)	6	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Azadirachtin/Neem	UN	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Bt (Dipel/Javelin)	11	3	1.0	0.4	1.0	0.0	0.0	0	0	0	0	0	0

Part 3 - Spring

Arizona Head Lettuce Insect Losses Survey -Insecticide Usage

Insecticide	IRAC MOA	Spring 2005		Spring 2006		Spring 2007		Spring 2008		Spring 2009		Spring 2010	
		Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated
Orthene (acephate)	1B	25	1.2	16.4	1.1	34.6	1.2	38.4	1	19.2	1.2	10.1	1
Dimethoate	1B	42	1.5	19.8	1.3	10.7	1.2	10.9	1	3.4	1	0	0
MSR	1B	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Diazinon- Foliar	1B	1	1.0	5.1	1.2	1.3	1.0	5.5	1	0	0	0	0
Diazinon- Chemigation	1B	20	1.0	37.5	1.0	21.2	1.0	9.7	1	4.7	1	11.1	1
Malathion	1B	0	0.0	0.0	0.0	3.3	1.0	3.6	1	0	0	1.6	1
Lannate	1A	39	1.9	67.4	1.7	41.8	1.7	48.5	1.4	33	1	39.2	1.1
Larvin	1A	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Endosulfan	2A	38	1.3	37.7	1.4	47.9	1.1	42.2	1	19.4	1	4.5	1
Pyrethroids - Foliar	3	93	3.3	96.1	2.9	99.1	3.0	92.4	2.8	97.2	2.8	96.3	2.3
Pyrethroids - Chem.	3	34	1.0	37.5	1.0	13.6	1.0	30.5	1	42.7	1	18.6	1
Admire Pro	4A	63	1.0	79.6	1.0	21.7	1.0	32.1	1	15.2	1	12.9	1
Generic imidacloprid	4A	-	-	-	-	17.6	1.0	38	1	34.7	1	47.7	1
Provado	4A	24	1.4	7.2	1.0	3.5	1.0	0.7	1	0	0	0	0
Venom (soil)	4A	-	-	-	-	0.0	0.0	0	0	0.2	1	2.1	1
Venom (foliar)	4A	-	-	-	-	0.0	0.0	0	0	0	0	3.2	1
Assail	4A	-	-	33.9	1.3	37.4	1.5	27	1.1	1.1	1	19.4	1.2
Oberon	23	-	-	3.9	1.0	0.0	0.0	0	0	0	0	3.2	1
Movento	23	-	-	-	-	-	-	-	-	57	1.5	45.9	1.1
Fulfill	7B	20	1.1	13.9	1.1	9.5	1.0	1.6	1	0	0	0	0
Beleaf	7C	-	-	-	-	34.6	1.2	59.5	1.3	3.2	1	2.9	1

Part 3 - Spring

Arizona Head Lettuce Insect Losses Survey -Insecticide Usage

Insecticide	IRAC MOA	Spring 2005		Spring 2006		Spring 2007		Spring 2008		Spring 2009		Spring 2010	
		Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated	Acres (%) treated	No. times treated
Avaunt	22	4	1.0	14.5	1.0	14.0	1.0	11.1	1	0.1	1	2.1	1
Intrepid	18	41	1.2	56.7	1.2	46.4	1.2	50.9	1	22.7	1	14.6	1
Proclaim	6	3	1.0	12.9	1.0	12.0	1.2	12.6	1	0.5	1	8.4	1
Success	5	88	2.2	89.2	2.0	92.1	1.8	54.2	2.1	11.8	1.5	32.3	1.3
Radiant	5	-	-	-	-	-	-	40	2.2	11.7	1.3	64	1.5
Coragen (Foliar)	28	-	-	-	-	-	-	-	-	11.7	1.3	9.1	1
Coragen (Soil)	28	-	-	-	-	-	-	-	-	0	0	0.4	1
Durivo (Soil)	28+4A	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Voliam Xpress	28+3	-	-	-	-	-	-	-	-	4.4	1	7.6	1.1
Voliam Flexi	28+44	-	-	-	-	-	-	-	-	-	-	0.0	0
Synapse	28	-	-	-	-	-	-	-	-	8.8	1	0	0
Vetica	28+16	-	-	-	-	-	-	-	-	-	-	1.9	1
Agrimek (ABBA)	6	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Azadirachtin/Neem	UN	0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0
Bt (Dipel/Javelin)	11	2	1.0	0.8	1.0	0.0	0.0	0	0	0	0	0	0