



2016 AGRICULTURAL CHEMICAL USE SURVEY

Vegetable Crops

99 percent . . .

. . . of vegetable acres were monitored for pests by scouting for insects, mites, and diseases.

About the Survey

The Agricultural Chemical Use Program of USDA's National Agricultural Statistics Service (NASS) is the federal government's official source of statistics about on-farm and post-harvest commercial fertilizer and pesticide use and pest management practices. NASS conducts agricultural chemical use surveys as part of the Agricultural Resource Management Survey. NASS collected data on vegetable chemical use in fall 2016.

Access the Data

Access vegetable chemical use data through the Quick Stats 2.0 database (<http://quickstats.nass.usda.gov>).

- In Program, select "Survey"
- In Sector, select "Environmental"
- In Group, select "Vegetables"
- In Commodity, select the vegetable(s) you want data for
- Select your category, data item, geographic level, and year

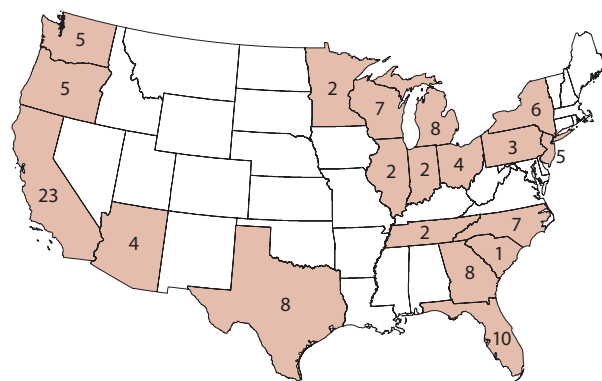
For pre-defined Quick Stats queries that take you to data for a particular vegetable, go to <http://bit.ly/AgChem> and click "Data Tables" under the 2016 Vegetables heading. For survey methodology information, click "Methodology."

The 2016 Agricultural Chemical Use Survey collected data about pesticide use and pest management practices on acres planted to 28 different vegetable crops. NASS conducted the survey among producers in 19 states, focusing on the states that were major producers for the surveyed crops. (Fig. 1) In most cases, the combination of states surveyed represented a significant percentage of the acres planted in 2015. (See the matrix on page 4 for the specific crops surveyed in each state.)

Data are for the 2016 crop year, the one-year period beginning after the 2015 harvest and ending after the 2016 harvest. Data are available online for all 28 vegetables

(see sidebar for how to access). This document highlights five selected vegetables: bell peppers, onions, pumpkins, squash, and watermelons.

Fig. 1. States in the 2016 Vegetable Chemical Use Survey
(number of crops surveyed in state)



Pesticide Use

The pesticide active ingredients used on vegetables are classified as herbicides (targeting weeds), insecticides (targeting insects), fungicides (targeting fungal disease), and other chemicals (targeting all other pests and other materials, including extraneous crop foliage).

Bell pepper growers applied fungicides to more acres (84 percent of planted acres) than insecticides or herbicides (81 and 44 percent of planted acres, respectively). Watermelon and squash growers similarly applied fungicides to more acres than other pesticides. Pumpkin growers, on the other hand,

Who Uses Agricultural Chemical Use Data?

Producers, consumers, suppliers, policymakers, USDA and other federal and state agencies rely on chemical use and other pest management data to make decisions about health, environment, safety, and trade issues. Some examples of how the data are used:

- To evaluate the quality and safety of U.S. food products, providing assurances to both domestic and international customers.
- To establish industry trends and determine the impact of on-farm chemical use and pest management.
- To assess the quality of streams, rivers, and groundwater; the impact of human activities; the benefits of conservation practices; and the effectiveness of integrated pest management.
- To identify which chemicals farmers count on, making it more likely regulators will re-register the product.

applied herbicides to 76 percent of planted acres, but fungicides and insecticides to fewer acres. Onion growers applied the various kinds of pesticides more equally. (Fig. 2)

Tables 1 through 3 show the top herbicides, insecticides, and fungicides applied to each featured vegetable.

Table 1. Top Herbicides, by percent of planted acres, Selected Vegetables, 2016 Crop Year

	% of Planted Acres	Avg. Rate for Year (lbs/acre)	Total Applied (lbs)
Bell Peppers			
Napropamide	13	1.825	9,800
S-Metolachlor	11	1.373	6,500
Pendimethalin	8	1.047	3,700
Onions			
Oxyfluorfen	83	0.316	28,300
Bromoxynil octanoate	72	0.250	19,500
Pendimethalin	71	1.187	93,500
Pumpkins			
Clomazone	57	0.527	12,100
S-Metolachlor	41	1.244	20,600
Ethalfuralin	15	0.704	4,100
Squash			
Clomazone	35	0.294	3,300
Ethalfuralin	15	0.621	3,000
S-Metolachlor	9	1.060	3,200
Watermelons			
Clethodim	26	0.129	3,600
Trifluralin	17	0.979	17,400
Ethalfuralin	13	0.560	7,900

Fig. 2. Pesticides Applied to Selected Vegetables, 2016
(% of planted acres)

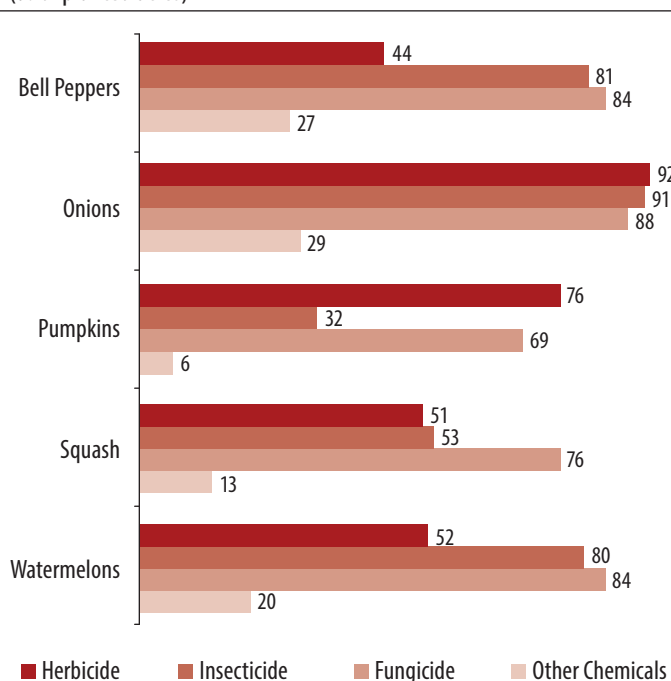


Table 2. Top Insecticides, by percent of planted acres, Selected Vegetables, 2016 Crop Year

	% of Planted Acres	Avg. Rate for Year (lbs/acre)	Total Applied (lbs)
Bell Peppers			
Chlorantraniliprole	49	0.103	2,100
Zeta-cypermethrin	38	0.095	1,500
Imidacloprid	29	0.367	4,400
Onions			
Methomyl	47	1.508	76,100
Spirotetramat	43	0.116	5,400
Spinetoram	41	0.103	4,500
Pumpkins			
Lambda-cyhalothrin	9	0.080	300
Bifenthrin	7	0.122	400
Permethrin	7	0.369	1,100
Squash			
Bifenthrin	23	0.241	1,700
Zeta-cypermethrin	17	0.063	300
Acetamiprid	7	0.332	700
Watermelons			
Flubendiamide	38	0.084	3,400
Imidacloprid	30	0.151	4,700
Chlorantraniliprole	22	0.083	1,900

Table 3. Top Fungicides, by percent of planted acres, Selected Vegetables, 2016 Crop Year

	% of Planted Acres	Avg. Rate for Year (lbs/acre)	Total Applied (lbs)
Bell Peppers			
Copper hydroxide	50	1.818	38,100
Mancozeb	36	2.914	42,300
Azoxystrobin	36	0.237	3,500
Onions			
Mancozeb	57	3.276	219,000
Copper hydroxide	46	0.930	45,700
Chlorothalonil	44	3.080	147,000
Pumpkins			
Chlorothalonil	59	4.438	105,600
Copper hydroxide	34	0.893	12,100
Azoxystrobin	25	0.226	2,300
Squash			
Chlorothalonil	65	3.550	74,300
Copper hydroxide	26	1.466	12,200
Sulfur	17	10.219	56,100
Watermelons			
Mancozeb	56	3.046	176,700
Chlorothalonil	55	4.257	244,300
Copper hydroxide	48	0.534	26,700

Pest Management Practices

The survey asked growers to report on the practices they used to manage pests, including weeds, insects, and diseases. Vegetable growers reported practices in four categories of pest management strategy, widely referred to as PAMS – prevention, avoidance, monitoring, and suppression.

- *Prevention* practices involve actions to keep a pest population from infesting a crop or field.
- *Avoidance* practices use cultural measures to mitigate or eliminate the detrimental effects of pests.
- *Monitoring* practices observe or detect pests by sampling, counting, or other forms of scouting.
- *Suppression* practices involve controlling or reducing existing pest populations to mitigate crop damage.

Scouting for insects, mites, and diseases were the most widely reported monitoring practices, used on

99 percent of vegetable planted acres. The most widely used avoidance practice was crop rotation, used on 82 percent of planted acres.

The prevention practice of chopping, spraying, mowing, plowing, or burning field edges, ditches, and fence lines was used on 78 percent of planted acres, and the suppression practice of applying various pesticides to keep pests from becoming resistant was used on 73 percent of acres. (Table 4)

Table 4. Top Practices in Pest Management Category, 2016 Crop Year
(% of planted acres, 28 vegetables)

Prevention	
Chopped, sprayed, mowed, plowed, or burned field edges, ditches or fence lines	78
Cleaned equipment and implements after field work to reduce spread of pests	75
Removed or burned crop residues	68
Cultivated crop acres for weed control	67
Used water management practices	62
Avoidance	
Rotated crops during past three years	82
Chose crop or plan variety for specific pest resistance	45
Planned planting locations to avoid cross infestation of pests	35
Adjusted planting or harvesting dates	31
Adjusted row spacing, plant density, or row directions	24
Monitoring	
Scouted for insects and mites (deliberately or by general observations while performing other tasks)	99
Scouted for diseases (deliberately or by general observations while performing other tasks)	99
Scouted for weeds (deliberately or by general observations while performing other tasks)	96
Scouted for pests (deliberately)	92
Used weather data in decision making	75
Suppression	
Used pesticides with different mechanisms of action to keep pest from becoming resistant to pesticides	73
Maintained ground covers, mulches, or other physical barriers	48
Compared scouting data to published information to assist in decision making	45
Applied biological pesticides	28
Used floral lures, attractants, repellents, pheromone traps, or biological pest controls	17

States and Crops in the 2016 Agricultural Chemical Use Survey

	Arizona	California	Florida	Georgia	Illinois	Indiana	Michigan	Minnesota	New Jersey	New York	North Carolina	Ohio	Oregon	Pennsylvania	South Carolina	Tennessee	Texas	Washington	Wisconsin
Asparagus		X					X											X	
Beans, snap (FM)		X	X	X						X	X					X			
Beans, snap (PR)							X			X			X	X					X
Broccoli		X																	
Cabbage (FM)		X	X	X						X	X						X		X
Cantaloupes	X	X															X		
Carrots (FM)		X					X										X		
Carrots (PR)																			X
Cauliflower		X																	
Celery		X																	
Corn, sweet (FM)		X	X	X	X	X	X		X	X		X	X	X			X		X
Corn, sweet (PR)								X										X	X
Cucumbers (FM)		X	X	X			X		X		X								
Cucumbers (PR)			X				X					X					X		X
Garlic		X																	
Honeydews		X																	
Lettuce, head	X	X																	
Lettuce, other	X	X																	
Onions		X		X						X			X				X	X	
Peas, green (PR)								X					X					X	X
Peppers, bell		X	X	X					X		X								
Pumpkins		X			X		X					X		X					
Spinach (FM)	X	X															X		
Squash		X	X	X			X		X	X	X								
Strawberries		X	X										X					X	
Tomatoes (FM)		X	X						X		X	X				X			
Tomatoes (PR)		X																	
Watermelons		X	X	X		X					X				X		X		
No. of Crops	4	23	10	8	2	2	8	2	5	6	7	4	5	3	1	2	8	5	7

FM = fresh market. PR = processing.