

Summary of Pesticide Use Report Data 2008



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For information for obtaining electronic data files, see Page iii.

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How to Access the Summary of Pesticide Use Report Data

The *Summary of Pesticide Use Report Data* indexed by chemical or commodity reports for years 1989–2008 can be found on DPR's Web site at <www.cdpr.ca.gov>. The *Summary of Pesticide Use Report Data* is available in two formats. One report is indexed by chemical and lists the amount of each pesticide used, the commodity on which it was used, the number of agricultural applications, and the acres/units treated. The second report is indexed by commodity and lists the chemicals used, the number of agricultural applications, amount of pesticides used, and the acres/units treated.

The Annual Pesticide Use Report Data (the complete database of reported pesticide applications for 1990-2008) are available on CD ROM. The files are in text (comma delimited) format.

The complete PUR database (Zip files by year, 1974 to current year) may be downloaded from DPR's FTP site at <ftp://pestreg.cdpr.ca.gov/pub/outgoing/pur_archives/>.

Questions regarding the Summary of Pesticide Use Report Data should be directed to the Department of Pesticide Regulation, Pest Management and Licensing Branch, P.O. Box 4015, Sacramento, California 95812-4015, telephone (916) 445-3887 or you may email questions to <mvotaw@cdpr.ca.gov>.

I. INTRODUCTION

Development and Implementation of the Pesticide Use Reporting System

This 2008 *Summary of Pesticide Use Report Data* includes agricultural applications and other selected uses reported in California. The report represents a summary of the data gathered under full use reporting. The Department of Pesticide Regulation (DPR) uses the data to help estimate dietary risk and to ensure compliance with clean air laws, as well as ground water protection regulations. Site-specific use report data, combined with geographic data on endangered species habitats, also help county agricultural commissioners resolve potential pesticide use conflicts. Detailed, individual pesticide use report (PUR) data may be obtained from DPR for in-depth, analytical purposes.

Under full use reporting, which began in 1990, California became the first state to require reporting of all agricultural pesticide use, including amounts applied and types of crops or places (e.g., structures, roadsides) treated. Commercial applications—including structural fumigation, pest control, and turf applications—must also be reported. Pesticide use reporting is explained in more detail below.

Types of Pesticide Applications Reported

Partial reporting of agricultural pesticide use has been in place in California since at least the 1950s. Beginning in 1970, anyone who used restricted materials was required to file a pesticide use report with the county agricultural commissioner. The criteria established to designate a pesticide as a restricted material include potential hazard to:

- public health;
- farm workers;
- domestic animals;
- honeybees;
- the environment;
- wildlife;
- other crops.

With certain exceptions, restricted materials may be possessed or used only by, or under the supervision of, licensed or certified persons, and only in accordance with an annual permit issued by a county agricultural commissioner.

In addition, the State required commercial pest control operators¹ to report all pesticides used, whether restricted or nonrestricted. These reports included information about the pesticide applied, when and where the application was made, and the crop involved if the application was in agriculture. The reports were entered into a computerized database and summarized by chemical and crop in annual reports.

With implementation of full use reporting in 1990, the following pesticide uses are required to be reported to the commissioner, who, in turn, reports the data to DPR:

¹ Pest control operators include those in the business of applying pesticides such as agricultural applicators, structural fumigators, and professional gardeners.

- For the production of any agricultural commodity, except livestock.
- For the treatment of postharvest agricultural commodities.
- For landscape maintenance in parks, golf courses, and cemeteries.
- For roadside and railroad rights-of-way.
- For poultry and fish production.
- Any application of a restricted material.
- Any application of a pesticide with the potential to pollute ground water [listed in section 6800(b) of the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1] when used outdoors in industrial and institutional settings.
- Any application by a licensed pest control operator.

The primary exceptions to the use reporting requirements are home and garden use and most industrial and institutional uses.

How Pesticide Data Are Used

DPR undertook the expansion of use reporting primarily in response to concerns of many individuals and groups, including government officials, scientists, farmers, legislators, and public interest groups. It was generally acknowledged that the system for estimating dietary exposure to pesticide residues did not provide sufficient data on which to make realistic assessments; this often resulted in overestimates of risk. Farm worker representatives were also asking for more information to determine exposure and potential risk to those who handle pesticides or who work in treated fields.

There are several key areas in which data generated by full use reporting are proving beneficial.

Risk Assessment

Without information on actual pesticide use, regulatory agencies conducting risk assessment assume all planted crop acreage is treated with many pesticides, even though most crops are treated with just a few chemicals. If the assumptions used by regulatory agencies are incorrect, regulators could make judgments on pesticide risks that are too cautious by several orders of magnitude, reducing the credibility of risk management decisions. The use report data, on the other hand, provides actual use data so DPR can better assess risk and make more realistic risk management decisions.

After the passage of the federal Food Quality Protection Act (FQPA) in 1996, complete pesticide use data became even more important to commodity groups in California and to the U.S. Environmental Protection Agency (U.S. EPA). FQPA contains a new food safety standard against which all pesticide tolerances must be measured. The increased interest in the state's pesticide use data, especially for calculating percent crop treated, came at a time when DPR was increasing the efficiency with which it produced its annual report. DPR was able to provide up-to-date use data and summaries to commodity groups, University of California specialists, U.S. EPA programs, and other interested parties as they developed the necessary information for the reassessment of existing tolerances.

Worker Health and Safety

Under the pesticide regulations [section 6619 of the California Code of Regulations, Title 3, Division 6, Chapter 3, Subchapter 2, Article 1], pest control operators must give farmers a written notice after every pesticide application that includes the pesticide applied, the location

of the application, the date and time the application was completed, and the reentry and preharvest intervals.² This notice gives the farmer accurate information to help keep workers from entering fields prematurely, and also lets the farmer know the earliest date a commodity can be harvested.

DPR's Worker Health and Safety Branch also uses the data for worker exposure assessment as part of developing an overall risk characterization document. Use data help scientists estimate typical applications and how often pesticides are used.

Public Health

The expanded reporting system provides DPR, the State Department of Public Health, and the Office of Environmental Health Hazard Assessment with more complete pesticide use data for evaluating possible human illness clusters in epidemiological studies.

Endangered Species

DPR works with the county agricultural commissioners to combine site-specific use report data with geographic information system-based data on locations of endangered species. The resulting database helps commissioners resolve potential conflicts over pesticide use where endangered species may occur. DPR and the commissioners can also examine patterns of pesticide use near habitats to determine the potential impact of proposed use limitations. With location-specific data on pesticide use, restrictions on use can be better designed to protect endangered species while still allowing necessary pest control.

Water Quality

Since 1983, DPR has had a program to work with the rice industry and the Central Valley Regional Water Quality Control Board to reduce contamination of surface water by rice pesticides. Using PUR data to help in pinpointing specific agricultural practices, more precise alternative use recommendations can be made to assure protection of surface water.

The Pesticide Contamination Prevention Act requires site-specific records to help track pesticide use in areas known to be susceptible to ground water contamination. Determinations can also be made from the records on whether a contaminated well is physically associated with agricultural practices. These records also provide data to help researchers determine why certain soil types are more prone to ground water contamination.

DPR placed certain pesticide products containing pyrethroids into reevaluation on August 31, 2006. The reevaluation is based on recent studies revealing the widespread presence of synthetic pyrethroid residues in the sediment of California waterways at levels toxic to an aquatic crustacean.

Air Quality

Many pesticide products contain volatile organic compounds (VOCs) that contribute to the formation of smog. DPR worked with the state Air Resources Board to put together a State Implementation Plan under the federal Clean Air Act to reduce emissions of all sources of VOCs, including pesticides, in nonattainment areas of the state. DPR's contribution to the plan

² A reentry interval is the time from which a pesticide application is made and when workers may enter a field. A preharvest interval is the time between an application and when a commodity can be harvested.

included accurate data on the amount of VOCs contained in pesticides and the ability to inventory the use of those pesticides through pesticide use reporting.

Beginning in January 2008, regulations went into effect to reduce emissions of VOCs from fumigant pesticides. To help DPR keep track of these smog-producing emissions, PURs are used to monitor fumigant use and methods of fumigant application. This information is then used to compare with targeted emission reduction goals designed to improve air quality.

Pest Management

The Department uses the PUR database to understand patterns and changes in pest management practices. This information can be used to determine possible alternatives to pesticides that are subject to regulatory actions and to help determine possible impacts of different regulatory actions on pest management.

The PUR is used to help meet the needs of FQPA, which requires pesticide use information for determining the appropriateness of pesticide residue tolerances. As part of this process many commodity groups have created crop profiles, which include information on the pest management practices and available options, both chemical and nonchemical. Pesticide use data is critical to developing these lists of practices and options.

The PUR data have been used to support and assess grant projects for a grant program conducted by DPR to develop, demonstrate, and implement reduced-risk pest management strategies from 1995 to 2003. The grants were temporarily suspended due to the statewide budget shortfall, but funds were reinstated in 2007, and the grant program is currently ongoing. The PUR data have been used in several other projects that build on work conducted in the almond and stonefruit industries. In these and other projects, the PUR data are used to address regional pesticide use patterns and environmental problems such as water and air quality. The data are also used to better understand current changes in pesticide use.

DPR has published general analyses of statewide pesticide use patterns and trends. The first analysis covered the years 1991 to 1995, and the second more detailed analysis covered 1991 to 1996. These analyses identified high-use pesticides, the crops to which those pesticides were applied, trends in use, and the pesticides most responsible for changes in use. In addition, since 1997, the annual Summary of Pesticide Use Report Data include summary trends of pesticides in several different categories such as carcinogens, reproductive toxins, and ground water contaminants.

Processor and Retailer Requirements

Food processors, produce packers, and retailers often require farmers to submit a complete history of pesticide use on crops. DPR's use report form often satisfies this requirement.

II. COMMENTS AND CLARIFICATIONS OF DATA

The following comments and points should be taken into consideration when analyzing data contained in this report:

Terminology

The following terminology is used in this report:

Number of agricultural applications – Number of applications of pesticide products made to production agriculture. More detailed information is given below under "Number of Applications."

Pounds applied – Number of pounds of an active ingredient.

Unit type – The amount listed in this column is one of the following:

A = Acreage

C = Cubic feet (of commodity treated)

K = Thousand cubic feet (of commodity treated)

P = Pounds (of commodity treated)

S = Square feet

T = Tons (of commodity treated)

U = Miscellaneous units (e.g., number of tractors, trees, tree holes, bins, etc.)

Commodity Codes

DPR's pesticide product label database is used to cross-check data entries to determine if the product reported is registered for use on the reported commodity. The DPR label database uses a crop coding system based on crop names used by the U.S. EPA to prepare official label language. However, this system caused some problems until DPR modified it in the early 1990s to account for U.S. EPA's grouping of certain crops under generic names. Problems occurred when the label language in the database called a crop by one name, and the use report used another. For example, a grower may have reported a pesticide use on "almonds," but the actual label on the pesticide product--coded into the database--stated the pesticide was to be used on "nuts." DPR modified the database to eliminate records being rejected as "errors" because the specific commodity listed on the use report is not on the label. A qualifier code is appended to the commodity code in the label database to designate a commodity not specifically listed on the label as a correct use. A qualifier code would be attached to the "almond" code when nuts are only listed on the label. This system greatly reduces the number of rejections.

Plants and commodities grown in greenhouse and nursery operations represented a challenge in use reporting because of their diversity. Six commodity groupings were suggested by industry in 1990 and incorporate terminology that are generally known and accepted. The six use reporting categories are: greenhouse-grown cut flowers or greens; outdoor-grown cut flowers or greens; greenhouse-grown plants in containers; outdoor-grown plants in container/field-grown plants; greenhouse-grown transplants/propagative material; and outdoor-grown transplants/propagative material.

Tomatoes and grapes were also separated into two categories because of public and processor interest in differentiating pesticide use. Tomatoes are assigned two codes to differentiate between fresh market and processing categories. One code was assigned to table grapes, which includes

grapes grown for fresh market, raisins, canning, or juicing. A second code was assigned to wine grapes.

Unregistered Use

The report contains entries that reflect the use of a pesticide on a commodity for which the pesticide is not currently registered. This sometimes occurs because the original use report was in error, that is, either the pesticide or the commodity was inaccurately reported. DPR's computer program checks that the commodity is listed on the label, but nonetheless such errors appear in the PUR, possibly because of errors in the label database. Also, the validation program does not check whether the pesticide product was registered at the time of application. For example, parathion (ethyl parathion) is shown reported on crops after most uses were suspended in 1992. (These records are researched and corrected as time and resources allow.) DPR continues to implement methods that identify and reduce these types of reporting errors in future reports. Other instances may occur because by law, growers are sometimes allowed to use stock they have on hand of a pesticide product that has been withdrawn from the market by the manufacturer or suspended or canceled by regulatory authorities.

Other reporting "errors" may occur when a pesticide is applied directly to a site to control a particular pest, but is not applied directly to the crop in the field. A grower may use an herbicide to treat weeds on the edge of a field, a fumigant on bare soil prior to planting, or a rodenticide to treat rodent burrows. For example, reporting the use of the herbicide glyphosate on tomatoes – when it was actually applied to bare soil prior to planting the tomatoes – could be perceived to be an error. Although technically incorrect, recording the data as if the application were made directly to the commodity provides valuable crop usage information for DPR's regulatory program.

Adjuvants

Data on spray adjuvants (including emulsifiers, wetting agents, foam suppressants, and other efficacy enhancers), not reported prior to full use reporting, are now included. Examples of these types of chemicals include the "alkyls" and some petroleum distillates. (Adjuvants are exempt from federal registration requirements, but must be registered as pesticides in California.)

Zero Pounds Applied

There are a few entries in this report in which the total pounds applied for certain active ingredients are displayed as zero. This is because the chemical (active ingredient) made up a very small percentage of the formulated product that was used. When these products are applied in extremely low quantities, the resulting value of the active ingredient is too low to register an amount.

Acres Treated

The summary information in this annual report cannot be used to determine the total number of acres of a crop. However, it can be used to determine the cumulative acres treated. The problem is that the same field can be treated more than once in a year with the same active ingredient. A similar problem occurs when the product used contains more than one active ingredient. (In any pesticide product, the active ingredient is the component that kills, or otherwise controls, target pests. A pesticide product is made up of one or more active ingredients, as well as one or more inert ingredients.) For example, if a 20-acre field is treated with a product that contains three different pesticide active ingredients, a use report is filed by the farmer correctly recording the application of a single pesticide product to 20 acres. However, in the summary tables, the three

different active ingredients will each have recorded 20 acres treated. Adding these values results in a total of 60 acres as being treated instead of the 20 acres actually treated.

Number of Applications

The values for number of applications include only production agricultural applications. Applicators are required to submit one of two basic types of use reports, a production agricultural report or a monthly summary report. The production agricultural report must include information for each application. The monthly summary report, for all uses other than production agriculture, includes only monthly totals for all applications of pesticide product, site or commodity, and applicator. The total number of applications in the monthly summary reports is not consistently given so they are no longer included in the totals. In the annual PUR reports before 1997, each monthly summary record was counted as one application.

In the annual summary report by commodity, the total number of applications given for each commodity may not equal the sum of all applications of each active ingredient on that commodity. As explained above, some pesticide products contain more than one active ingredient. If the number of applications were summed for each active ingredient in such a product, the total number of applications would be more than one, even though only one application of the product was made.

Errors

In any database with millions of records there will almost certainly be errors. Most of the values in the PUR are checked for errors and where possible corrections are made. However, some errors will remain. If a value is completely unknown the value will either be left blank for numeric fields or replaced with a “?” or “UNKNOWN” in character fields.

If a reported rate of use (pounds of pesticide per area treated) was so large it was probably in error, the rate was replaced with an estimated rate equal to the median rate of all applications of the pesticide product on the same crop or other site treated. Since the error could have been in the pounds reported or the area or unit treated, the value that was most unusual was the one replaced with an estimate. In some cases, a reasonable estimate could not be made, for example, if there were no or few other reported applications of the product on the site. In these cases, the pounds value was set equal to 0.

Pesticide rates were considered outliers if (1) they were higher than 200 pounds of active ingredient per acre (or greater than 1,000 pounds per acre for fumigants); (2) they were 50 times larger than the median rate for all uses with the same pesticide product, crop treated, unit treated, and record type (that is, production agricultural or all other uses); or (3) they were higher than a value determined by a neural network procedure that approximates what a group of 12 scientists believed were obvious outliers. Although these criteria identified as outliers less than one percent of the rate values in the PUR, some rates were so large that if included in the sums, they would have significantly affected total pounds applied of some pesticides.

III. DATA SUMMARY

This report is a summary of data submitted to DPR. Total pounds may change slightly due to ongoing error correction. The revised numbers, when available, will more accurately reflect the total pounds applied.

Pesticide Use In California

In 2008, there were 161,531,155 pounds of pesticide active ingredients reported used in California. Annual use has varied from year to year since full use reporting was implemented in 1990. For example, reported pesticide use was 172 million pounds in 2007, 190 million pounds in 2006, and 195 million pounds in 2005.

Such variances are, and will continue to be, a normal occurrence. These fluctuations can be attributed to a variety of factors, including changes in planted acreage, crop plantings, pest pressures, and weather conditions. For example, extremely heavy rains result in excessive weeds, thus more pesticides may be used; drought conditions may result in fewer planted acres, thus less pesticide may be used.

As in previous years, the greatest pesticide use occurred in California's San Joaquin Valley (Table 1). Four counties in this region had the highest use: Fresno, Kern, Tulare, and San Joaquin.

Table 2 breaks down the pounds of pesticide use by general use categories: production agriculture, post-harvest commodity fumigation, structural pest control, landscape maintenance, and all others.

Pesticide Sales In California

Reported pesticide applications are only a portion of the pesticides sold each year. Typically, about two-thirds of the pesticide active ingredients sold in a given year are not subject to use reporting. Examples of non-reported active ingredients are chlorine (used primarily for municipal water treatment) and home-use pesticide products.

Sales data for 2008 are not yet available as they are in the process of being reviewed and will be released in January 2010. There were 679 million pounds sold in 2007, 743 million pounds sold in 2006, and 611 million pounds in 2005. Prior years data are posted on DPR's web site at <www.cdpr.ca.gov>; click "A – Z Index", "Sales of pesticides".

In addition, it should be noted that the pounds of pesticides used and the number of applications are not necessarily accurate indicators of the extent of pesticide use or, conversely, the extent of use of reduced-risk pest management methods. For example, farmers may make a number of small-scale "spot" applications targeted at problem areas rather than one treatment of a large area. They may replace a more toxic pesticide used at one pound per acre with a less hazardous compound that must be applied at several pounds per acre. Either of these scenarios could increase the number of applications or amount of pounds used, respectively, without indicating an increased reliance on pesticides.

Table 1. Total pounds of pesticide active ingredients reported in each county and rank during 2007 and 2008.

County	2007 Pesticide Use		2008 Pesticide Use	
	Pounds Applied	Rank	Pounds Applied	Rank
Alameda	278,934	41	320,559	38
Alpine	1,033	58	472	57
Amador	99,692	44	82,304	45
Butte	3,083,724	14	2,481,130	16
Calaveras	45,509	48	33,458	50
Colusa	2,062,102	21	2,067,987	21
Contra Costa	632,000	34	456,573	35
Del Norte	333,059	38	321,641	37
El Dorado	193,053	42	99,682	44
Fresno	26,013,286	1	27,543,587	1
Glenn	2,301,269	20	1,085,894	25
Humboldt	57,950	46	61,943	47
Imperial	5,049,024	11	3,740,014	12
Inyo	2,328	56	5,871	54
Kern	25,984,379	2	25,441,400	2
Kings	5,651,973	10	6,239,993	9
Lake	571,885	35	601,928	34
Lassen	40,027	49	125,312	43
Los Angeles	2,517,364	18	2,741,761	14
Madera	8,965,193	5	7,578,258	5
Marin	46,887	47	68,953	46
Mariposa	8,985	54	5,795	55
Mendocino	1,946,646	22	952,825	29
Merced	7,068,429	7	6,912,082	6
Modoc	163,780	43	389,141	36
Mono	1,274	57	3,669	56
Monterey	8,543,087	6	7,893,327	4
Napa	1,648,774	25	1,137,388	24
Nevada	92,450	45	35,207	49
Orange	1,129,631	28	1,049,118	27
Placer	295,836	39	240,765	41
Plumas	21,902	51	59,385	48
Riverside	2,638,581	17	2,278,421	20
Sacramento	3,265,539	13	3,411,537	13
San Benito	653,829	33	676,656	33
San Bernardino	373,281	36	273,532	40
San Diego	1,477,784	26	868,254	30
San Francisco	14,935	52	10,514	53
San Joaquin	9,135,807	4	6,754,501	7

Table 1 (cont.). Total pounds of pesticide active ingredients reported in each county and rank during 2007 and 2008.

County	2007 Pesticide Use		2008 Pesticide Use	
	Pounds Applied	Rank	Pounds Applied	Rank
San Luis Obispo	1,887,416	23	2,400,818	18
San Mateo	290,190	40	306,063	39
Santa Barbara	4,485,300	12	4,279,799	11
Santa Clara	931,918	31	1,173,078	23
Santa Cruz	1,843,778	24	1,653,785	22
Shasta	336,292	37	206,984	42
Sierra	8,338	55	156	58
Siskiyou	1,317,335	27	1,074,184	26
Solano	813,654	32	818,358	31
Sonoma	2,702,102	16	2,402,744	17
Stanislaus	5,818,539	9	5,677,506	10
Sutter	2,813,006	15	2,613,894	15
Tehama	1,088,398	30	997,693	28
Trinity	9,929	53	13,186	52
Tulare	15,317,559	3	14,310,365	3
Tuolumne	27,890	50	19,407	51
Ventura	6,214,628	8	6,437,899	8
Yolo	2,459,795	19	2,295,955	19
Yuba	1,102,630	29	798,445	32
Total	171,879,918		161,531,155	

Table 2. Pounds of pesticide active ingredients, 1997 – 2008, by general use categories.

Year	Production Agriculture	Post Harvest Fumigation	Structural Pest Control	Landscape Maintenance	All Others*	Total Pounds
1997	192,619,440	1,720,696	5,185,923	1,225,377	6,972,903	207,724,339
1998	200,945,106	1,707,519	5,930,252	1,396,263	6,832,159	216,811,299
1999	186,572,405	2,021,914	5,673,319	1,398,408	7,871,938	203,537,985
2000	173,304,700	2,127,380	5,186,685	1,403,069	6,780,506	188,802,340
2001	139,371,107	1,436,475	4,921,897	1,282,302	6,264,514	153,276,293
2002	154,703,941	1,804,328	5,468,290	1,440,444	6,688,403	170,105,407
2003	160,103,275	1,780,497	5,174,892	1,961,076	7,401,377	176,421,117
2004	164,893,797	1,860,020	5,118,025	1,600,307	6,972,790	180,444,940
2005	177,096,305	2,256,918	5,623,223	1,761,327	8,490,962	195,228,734
2006	167,791,431	2,106,010	5,272,051	2,269,888	10,310,038	187,749,419
2007	156,688,188	2,278,310	3,966,061	1,654,737	7,292,622	171,879,918
2008	147,085,280	2,538,800	3,223,172	1,581,956	7,101,995	161,531,202

* This category includes pesticide applications reported in the following general categories: pest control on rights-of-way; public health which includes mosquito abatement work; vertebrate pest control; fumigation of nonfood and nonfeed materials such as lumber, furniture, etc.; pesticide used in research; and regulatory pest control used in ongoing control and/eradication of pest infestations.

IV. TRENDS IN USE IN CERTAIN PESTICIDE CATEGORIES

Reported pesticide use in California in 2008 totaled 162 million pounds, a decrease of nearly 10 million pounds from 2007. Production agriculture, the major category of use subject to reporting requirements, accounted for most of the overall decrease in use. Applications decreased by 9.6 million pounds for production agriculture. Similarly, there was a 740,000 pound decrease in structural pest control, a decrease of 73,000 pounds in landscape maintenance, and a 190,000 pound decrease of other reported non-agricultural use. However, there was an increase of 260,000 pounds in post-harvest treatments.

The active ingredients (AI) with the largest uses by pounds in 2008 were sulfur, petroleum and mineral oils, 1,3-dichloropropene (1,3-D), metam-sodium, and glyphosate. Sulfur was the most highly used non-adjuvant pesticide in 2008, both in pounds applied and acres treated. By pounds, sulfur accounted for 25 percent of all reported pesticide use. Sulfur is a natural fungicide favored by both conventional and organic farmers.

Most of the decline in all reported pesticide use was from sulfur, which decreased by 5.7 million pounds (12 percent). Other non-adjuvant pesticides that declined in use include copper fungicides (1.2 million pound decrease, 17 percent), methyl bromide (790,000 pound decrease, 12 percent), metam-sodium (680,000 pound decrease, 7 percent), octhilinone (410,000 pound decrease, 92 percent), and glyphosate (320,000 pound decrease, 4 percent).

In contrast, some pesticide use increased. Non-adjuvant pesticides with the greatest increase in pounds applied were potassium n-methyldithiocarbamate (also called metam-potassium) (1.7 million pound increase, 45 percent), calcium hydroxide (520,000 pound increase, 12 percent), chlorine (420,000 pound increase, 49 percent), and pendimethalin (320,000 pound increase, 29 percent).

Major crops or sites that showed an overall increase in pesticide pounds applied from 2007 to 2008 include carrot (1.0 million pounds increase), processing tomato (910,000 pounds increase), preplant soil fumigation (540,000 pounds), fresh market tomato (450,000 pounds), and public health (270,000 pounds). Major crops or sites with decreased pounds applied include wine grape (3.0 million pounds decrease), table and raisin grape, (2.8 million pounds), cotton (1.0 million pounds), lumber (1.0 million pounds), and orange (821,000 pounds). For the crops in this list the change in pounds applied was often different than the change in acres planted. Acreage of most crops decreased, though a few increased slightly (Table 3).

DPR data analyses have shown that pesticide use varies from year to year depending upon pest problems, weather, acreage and types of crops planted, economics, and other factors. Of the different AI types, fungicides had the greatest decrease by both pounds and acres treated. Herbicide use also decreased by pounds and acres treated. Insecticide use declined by pounds applied but acres treated increased marginally. Conversely, pounds of fumigants increased slightly but acres treated decreased slightly.

Pesticide use is reported as the number of pounds of AI and the total number of acres treated. The data for pounds include both agricultural and nonagricultural applications; the data for acres treated are primarily agricultural applications. The number of acres treated means the cumulative number of acres treated; the acres treated in each application are summed even when the same field is sprayed more than once in a year. (For example, if one acre is treated three times in a

season with an individual AI, it is counted as three acres treated in the tables and graphs in Sections IV and V of this report.)

Table 3. *The change in pounds of AI applied and acres planted or harvested and the percent change from 2007 and 2008 for the crops or sites with the greatest change in pounds applied.*

Crop or Site Treated	Change		Percent Change	
	Lbs 08-07	Acres 08-07	Lbs 08-07	Acres 08-07
CARROT	1,048,038	-8,400	13	-11
TOMATO, PROCESSING	909,714	-20,000	9	-7
SOIL FUMIGATION/PREPLANT	535,098		16	
TOMATO, FRESH MARKET	445,502	0	32	0
PUBLIC HEALTH	273,448		18	
ORANGE	-823,708	1,000	-8	1
LUMBER, TREATED	-1,044,112		-83	
COTTON	-1,045,578	-180,000	-30	-40
GRAPE, TABLE AND RAISIN	-2,755,613	-7,000	-16	-2
GRAPE, WINE	-2,987,853	3,000	-12	1

To provide an overview, pesticide use is summarized for eight different pesticide categories from 1998 to 2008 (Tables 4–11) and from 1994 to 2008 (Figures 1–8). These categories classify pesticides according to certain characteristics such as reproductive toxins, carcinogens, or reduced-risk characteristics. Use of most pesticide categories decreased from 2007 to 2008, except for increases in pounds of fumigants and acres treated with oils. Some of the major changes from 2007 to 2008 include:

- Chemicals classified as reproductive toxins decreased in pounds applied from 2007 to 2008 (down 1.7 million pounds or 10 percent) and decreased in acres treated (down 182,000 acres or 10 percent). The decrease in pounds was mostly from the reduced use of the fumigants methyl bromide and metam-sodium and the decrease in acres was mostly from decreases in the use of the miticide propargite and the fungicide myclobutanil. Pesticides in this category are those listed on the State's Proposition 65 list of chemicals "known to cause reproductive toxicity."
- Use of chemicals classified as carcinogens decreased from 2007 to 2008 (down 1.7 million pounds or 7 percent and down 600,000 acres or 17 percent). The decrease in pounds was mainly due to a decrease in use of the fumigant metam-sodium and the fungicides maneb and chlorothalonil. The decrease in acres treated was mostly from decreases in the use of the herbicide diuron and fungicides maneb and chlorothalonil. The pesticides in this category are those listed by U.S. EPA as B2 carcinogens or on the State's Proposition 65 list of chemicals "known to cause cancer".
- Use of cholinesterase-inhibiting pesticides (organophosphate (OP) and carbamate pesticides), which include compounds of high regulatory concern, continued to decline as they have for nearly every year since 1995. Use decreased from 2007 to 2008 both in pounds (down 720,000 or 12 percent) and in acres treated (down 590,000 acres or 12 percent). The AIs with the greatest decreases in pounds were ethephon, diazinon, phosmet, and chlorpyrifos; the AIs with the greatest decreases in acres treated were ethephon, diazinon, and methomyl. Although use of most OPs and carbamates

decreased; the use of oxamyl (insecticide), naled (insecticide), and malathion (insecticide) increased.

- Use of most chemicals categorized as ground water contaminants decreased by pounds (down 270,000 pounds or 17 percent), and by acres treated (down 300,000 acres or 25 percent) in 2008 compared to 2007. The decreases in pounds and acres treated were mostly from decreases in use of the herbicides diuron and simazine.
- Chemicals categorized as toxic air contaminants, another group of pesticides of regulatory concern, decreased from 2007 to 2008 both in pounds (down 50,000 pounds or 0.13 percent) and by acres treated (down 370,000 acres or 12 percent). When summarized by pounds, most toxic air contaminants are fumigants, which are used at high rates. When summarized by acres treated, the main toxic air contaminants were the herbicides trifluralin and 2,4-D, dimethylamine salt and the fungicide maneb.
- The pounds of fumigant chemicals applied increased marginally in 2008 from 2007 (up 228,000 pounds or 0.6 percent) but decreased in cumulative acres treated (down 3,100 acres or 0.9 percent). Pounds of four of the six major fumigants decreased (metam-sodium, sulfuryl fluoride, methyl bromide, and 1,3-D) and pounds of two fumigants increased (potassium n-methyldithiocarbamate, and chloropicrin).
- Pounds of oil pesticides decreased (down 214,000 pounds or less than 1 percent) but increased by acres treated (up 100,000 acres or 3 percent). Oils include many different chemicals, but the category used here includes only ones derived from petroleum distillation. Some of these oils may be on the State's Proposition 65 list of chemicals "known to cause cancer" but most serve as alternatives to highly toxic pesticides. Oils are also used by organic growers.
- Pounds of biopesticides was nearly the same in 2008 as in 2007 but decreased by acres treated (down 160,000 acres or 8 percent) from 2007 to 2008. The most used biopesticide by weight was *Bacillus thuringiensis* (*Bt*) (combining all subspecies) and the most used by acres treated were gibberellins, propylene glycol, and *Bt*. *Bt* also had the largest increase by pounds. The AIs with the largest decreases in pounds were neem oil, *Myrothecium verrucaria*, and potassium bicarbonate. The AIs with the greatest decreases in acres treated were propylene glycol, *Bt*, indole-3-butyric acid (IBA), and 1-naphthalene acetic acid (NAA). AIs with the greatest increase in acres treated were gibberellins and s-methoprene. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds not toxic to the target pest (such as pheromones).

Since 1993, the reported pounds of pesticides applied have fluctuated from year to year. An increase or decrease in use from one year to the next or in the span of a few years does not necessarily indicate a general trend in use; it simply may reflect variations related to various factors (e.g. climate or economic changes). Short periods of time (three to five years) may suggest trends, such as the increased pesticide use from 2001 to 2005 or the decreased use from 1998 to 2001. However, regression analyses on use from 1993 to 2008 do not indicate a significant trend of either increase or decrease in total pesticide use.

To improve data quality when calculating the total pounds of pesticides, DPR excluded values that were so large they were probably in error. The procedure to exclude probable errors involved the development of complex error-checking algorithms, a data improvement process that is ongoing.

Over-reporting errors have a much greater impact on the numerical accuracy of the database than under-reporting errors. For example, if a field is treated with 100 pounds of a pesticide AI and the application is erroneously recorded as 100,000 pounds (a decimal point shift of three places to the right), an error of 99,900 pounds is introduced into the database. If the same degree of error is made in shifting the decimal point to the left, the application is recorded as 0.1 pound, and an error of 99.9 pounds is entered into the database.

The summaries detailed in the following use categories are not intended to serve as indicators of pesticide risks to the public or the environment. Rather, the data supports DPR regulatory functions to enhance public safety and environmental protection. (See “How Pesticide Data are Used” on page 2.)

USE TRENDS OF PESTICIDES ON THE STATE'S PROPOSITION 65 LIST OF CHEMICALS THAT ARE "KNOWN TO CAUSE REPRODUCTIVE TOXICITY"

Table 4A. The reported pounds of pesticides used which are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity." Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1080	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2,4-DB ACID	6,932	12,397	11,453	16,954	9,393	6,408	4,789	7,655	3,144	2,686	1,295
AMITRAZ	13,563	7,558	8,087	263	154	0	0	0	12	0	0
ARSENIC PENTOXIDE	50,899	245,238	91,267	259,400	194,650	129,889	12,705	180,505	474,517	7,805	7,433
ARSENIC TRIOXIDE	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
BENOMYL	227,715	133,109	118,432	76,713	29,005	7,105	2,210	948	898	590	100
BROMACIL, LITHIUM SALT	4,686	4,162	4,478	3,217	4,016	3,025	1,801	1,059	2,529	1,172	1,851
BROMOXYNIL OCTANOATE	120,877	120,338	115,662	78,454	72,900	75,345	50,223	34,463	37,400	41,210	61,700
CARBARYL	427,546	388,144	363,961	286,199	256,098	205,102	240,135	190,633	157,000	142,010	126,076
CHLORSULFURON	3,102	1,541	2,705	1,312	2,190	8,684	9,967	3,242	3,488	3,668	3,883
CYANAZINE	277,313	180,487	50,018	17,131	7,178	37	8	7	0	0	0
CYCLOATE	62,753	49,096	37,416	31,785	34,387	30,012	43,209	39,709	41,447	31,344	20,841
DICLOFOP-METHYL	24,783	18,710	21,627	11,765	5,058	9,309	5,988	1,413	174	157	0
DINOCAP	1	3	<1	<1	2	<1	2	2	2	2	2
DINOSEB	912	2,174	323	268	577	113	63	131	213	81	166
EPTC	393,031	448,883	323,613	276,724	253,634	141,552	182,532	181,825	108,209	152,707	125,116
ETHYLENE GLYCOL MONOMETHYL ETHER	4,371	1,993	2,024	2,248	3,009	1,782	2,729	2,476	4,186	2,653	1,970
ETHYLENE OXIDE	31	2	6	3	0	0	0	0	0	2	3
FENOXAPROP-ETHYL	1,504	2,048	979	366	106	53	64	161	196	153	219
FLUAZIFOP-BUTYL	1,211	516	205	149	166	31	34	41	26	5	3
FLUAZIFOP-P-BUTYL	13,514	13,860	11,595	9,489	9,985	8,759	10,298	11,638	11,103	10,192	11,077
HYDRAMETHYLNON	3,183	2,267	2,503	2,381	2,741	2,029	1,896	1,381	1,231	887	825
LINURON	82,170	78,046	65,533	58,173	62,006	60,117	69,289	72,031	59,164	58,592	58,985
METAM-SODIUM	14,120,788	17,273,325	13,143,954	12,562,799	15,116,768	14,822,689	14,698,228	12,991,279	11,422,382	9,903,649	9,219,288
METHYL BROMIDE	14,314,983	15,355,845	10,930,893	6,625,336	7,008,644	7,289,389	7,105,612	6,504,576	6,541,159	6,438,044	5,646,742
METIRAM	<1	0	0	2	0	1	5	0	<1	0	0

Table 4A (cont.). The reported pounds of pesticides used which are on the State’s Proposition 65 list of chemicals that are “known to cause reproductive toxicity.”

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
MYCLOBUTANIL	129,775	94,626	95,454	83,668	76,635	83,426	70,908	80,143	71,221	65,169	58,781
NABAM	50	2	1	8	0		10,693	30,440	23,414	9,073	9,635
NICOTINE	83	93	21	17	2	2	4	2	<1	<1	<1
NITRAPYRIN	410	150	122	16	89	117	12	171	0	9	0
OXADIAZON	22,389	19,253	18,280	15,905	16,692	12,566	12,979	13,762	11,714	12,512	9,331
OXYDEMETON-METHYL	90,790	122,912	110,754	99,756	96,363	93,774	102,563	121,910	119,717	121,936	110,786
OXYTHIOQUINOX	1,576	2,705	411	145	117	34	27	8	90	166	170
POTASSIUM DIMETHYL DITHIO CARBAMATE	24,795	0	0	0	23	28	293	0	0	0	0
PROPARGITE	1,390,366	1,502,732	1,324,752	1,159,792	972,382	1,054,691	1,010,874	995,038	570,560	529,536	383,719
RESMETHRIN	796	695	676	542	661	1,561	245	958	676	452	269
SODIUM DIMETHYL DITHIO CARBAMATE	8,279	355	1,315	173	0		10,693	30,440	23,414	9,073	9,800
SODIUM TETRATHIOCARBONATE	900,991	688,701	596,028	375,487	352,342	212,308	259,542	330,886	171,194	386,876	354,294
STREPTOMYCIN SULFATE	14,950	9,405	10,478	7,554	5,989	8,463	4,702	7,790	7,582	5,809	4,324
TAU-FLUVALINATE	2,839	3,315	2,211	2,207	2,117	1,632	1,581	1,162	1,081	1,019	1,059
THIOPHANATE-METHYL	65,158	75,938	68,090	66,985	71,486	125,388	119,063	158,594	112,747	98,653	74,138
TRIADIMEFON	13,029	4,844	3,130	2,764	1,736	1,773	2,111	1,918	1,116	872	1,503
TRIBUTYL TIN METHACRYLATE	113	270	107	106	39	0	0	0	0	0	0
TRIFORINE	2,759	519	365	99	72	88	295	137	452	64	69
VINCLOZOLIN	54,719	52,731	35,728	32,208	22,170	18,581	14,863	3,574	402	390	512
WARFARIN	1	1	1	1	1	3	3	1	9	1	<1
TOTAL	32,879,736	36,918,989	27,574,662	22,168,561	24,691,579	24,415,977	24,063,237	22,002,109	19,983,869	18,039,221	16,305,964

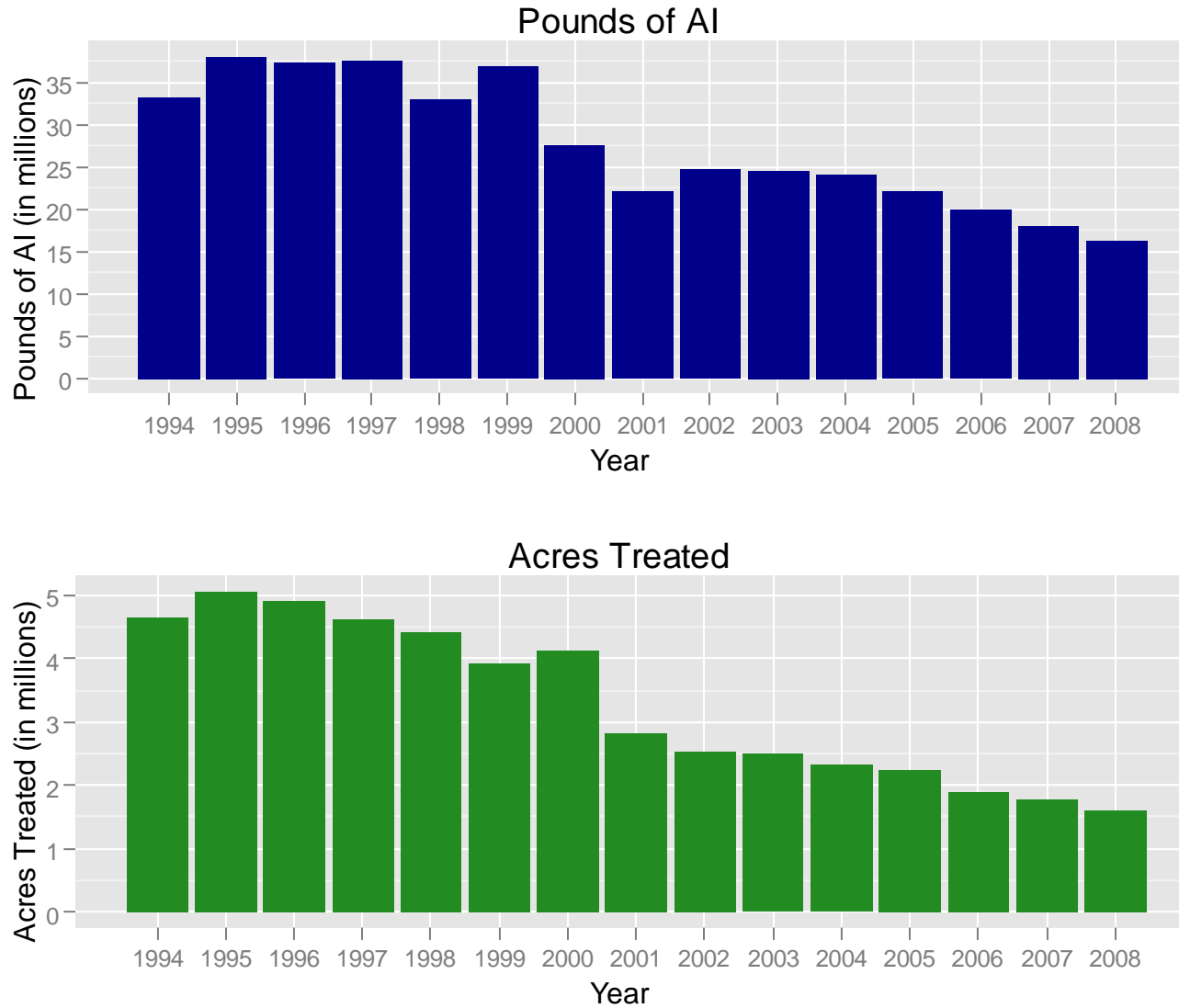
Table 4B. The reported cumulative acres treated with pesticides that are on the State’s Proposition 65 list of chemicals “known to cause reproductive toxicity.” Use includes primarily agricultural applications. The grand total for acres treated may be less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation’s Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1080	<1	<1	42	30	301	50	<1	41	22	170	<1
2,4-DB ACID	12,167	20,063	19,496	25,843	15,584	10,384	8,873	11,777	5,221	4,822	2,419
AMITRAZ	28,945	14,684	16,011	1,269	605	0	0	0	<1	0	0
ARSENIC PENTOXIDE	<1	<1	709,893	56	<1	<1	48	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	1	<1	<1	1	<1	<1	<1
BENOMYL	434,729	242,796	217,613	135,929	47,879	13,340	3,983	2,789	1,674	568	221
BROMACIL, LITHIUM SALT	40	40	30	<1	<1	<1	<1	<1	<1	<1	<1
BROMOXYNIL OCTANOATE	240,997	257,417	313,362	251,527	239,110	218,281	162,572	120,175	134,283	136,831	180,159
CARBARYL	197,664	216,991	196,083	147,612	106,616	97,811	103,261	99,086	87,791	97,016	95,703
CHLORSULFURON	39,873	30,691	34,523	29,079	18,836	26,280	25,745	21,903	26,345	12,653	32,842
CYANAZINE	185,082	129,547	56,059	19,708	8,763	25	5	8	0	0	0
CYCLOATE	29,761	24,555	18,495	15,918	17,228	16,713	20,699	19,319	19,886	15,601	10,448
DICLOFOP-METHYL	28,296	21,442	24,396	14,198	6,259	11,257	7,391	729	186	225	0
DINOCAP	2	6	4	1	3	<1	47	7	9	8	7
DINOSEB	369	822	74	166	167	59	98	310	73	17	453
EPTC	141,511	148,685	107,744	99,953	94,240	56,639	64,194	64,263	38,871	51,706	43,727
ETHYLENE GLYCOL MONOMETHYL ETHER	55,099	26,451	28,880	33,256	36,299	24,249	25,075	16,655	25,655	26,412	14,406
ETHYLENE OXIDE	194	31	41	<1	0	0	0	0	0	<1	2
FENOXAPROP-ETHYL	10,480	13,824	8,847	3,820	1,327	839	1,681	3,247	3,418	2,552	3,444
FLUAZIFOP-BUTYL	3,908	806	137	144	98	<1	<1	3	<1	<1	6
FLUAZIFOP-P-BUTYL	51,826	50,308	41,780	34,283	40,967	28,325	31,739	35,348	34,591	31,920	30,363
HYDRAMETHYLNON	289	1,615	3,744	2,762	2,148	2,057	1,314	1,990	657	931	1,138
LINURON	112,122	111,009	86,376	81,801	86,942	85,412	95,565	101,987	81,535	81,041	79,371
METAM-SODIUM	154,309	186,300	146,847	125,417	141,415	142,406	128,427	97,562	102,451	77,939	70,281
METHYL BROMIDE	90,107	102,115	75,839	60,892	53,140	55,254	57,385	45,700	50,677	45,675	35,497
METIRAM	<1	0	0	7	0	<1	2	0	1	0	0
MYCLOBUTANIL	1,225,372	887,981	843,207	737,643	704,827	742,139	656,020	699,773	644,490	599,343	544,530

Table 4B (cont.). The reported cumulative acres treated with pesticides that are on the State’s Proposition 65 list of chemicals “known to cause reproductive toxicity.”

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
NABAM	55	20	<1	60	0		<1	<1	<1	2	1
NICOTINE	57	36	14	31	1	<1	2	3	<1	<1	<1
NITRAPYRIN	851	329	155	<1	169	258	42	143	0	35	0
OXADIAZON	1,983	3,408	2,660	2,637	1,838	1,904	3,120	2,209	2,144	2,991	2,746
OXYDEMETON-METHYL	186,964	253,281	225,990	200,171	193,453	189,015	206,751	173,480	164,094	161,756	140,661
OXYTHIOQUINOX	5,306	2,152	817	250	182	71	137	14	10	9	5
POTASSIUM DIMETHYL DITHIO CARBAMATE	<1	0	0	0	2	6	<1	0	0	0	0
PROPARGITE	756,098	795,410	704,529	606,737	524,439	558,056	543,728	519,412	287,261	261,953	183,428
RESMETHRIN	160	84,044	33	35	32	66	209	1	1	18	3
SODIUM DIMETHYL DITHIO CARBAMATE	253	20	<1	60	0		<1	<1	<1	2	1
SODIUM TETRATHIOCARBONATE	34,488	24,947	21,002	13,574	11,559	6,832	8,497	7,977	6,170	11,485	10,725
STREPTOMYCIN SULFATE	147,617	76,414	97,012	62,184	52,180	63,445	37,461	52,061	57,295	38,467	27,011
TAU-FLUVALINATE	14,075	17,343	10,107	10,893	9,046	7,939	7,313	5,879	5,438	4,777	5,708
THIOPHANATE-METHYL	64,098	81,428	68,986	53,990	64,340	121,339	112,501	135,296	108,408	100,014	71,387
TRIADIMEFON	79,968	25,719	12,131	9,501	6,747	7,625	6,752	8,585	2,949	1,806	2,041
TRIBUTYL TIN METHACRYLATE	1	1	1	<1	<1	0	0	0	0	0	0
TRIFORINE	6,352	1,279	751	244	203	196	61	181	102	373	11
VINCLOZOLIN	69,067	63,931	43,702	38,570	27,795	21,692	18,207	3,899	440	258	212
WARFARIN	310	129	556	101	449	632	1,504	430	473	3,165	1,114
TOTAL	4,410,790	3,918,052	4,137,967	2,820,291	2,515,189	2,510,977	2,340,408	2,252,242	1,892,619	1,772,536	1,590,066

Figure 1. Use trends of pesticides that are on the State’s Proposition 65 list of chemicals that are “known to cause reproductive toxicity.” Reported pounds of active ingredient (AI) applied include both agricultural and non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation’s Pesticide Use Reports.



USE TRENDS OF PESTICIDES LISTED BY U.S. EPA AS CARCINOGENS OR BY THE STATE AS “KNOWN TO CAUSE CANCER”

Table 5A. The reported pounds of pesticides used that are listed by U.S. EPA as B2 carcinogens or that are on the State’s Proposition 65 list of chemicals “known to cause cancer.” Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation’s Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,3-DICHLOROPROPENE	3,011,057	3,321,147	4,465,422	4,141,173	5,413,807	7,003,873	8,945,145	9,355,308	8,733,270	9,594,517	9,555,304
ACIFLUORFEN, SODIUM SALT	<1	10	<1	1	3	<1	18	<1	0	0	0
ALACHLOR	46,264	29,789	36,468	29,057	28,666	24,913	27,229	21,052	13,740	3,911	4,343
ARSENIC ACID	52,558	48,029	11,906	12,023	4,976	318	223	68	3	0	0
ARSENIC PENTOXIDE	50,899	245,238	91,267	259,400	194,650	129,889	12,705	180,505	474,517	7,805	7,433
ARSENIC TRIOXIDE	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CACODYLIC ACID	17,381	15,930	16,091	3,981	1,792	207	115	131	20	41	43
CAPTAN	1,542,556	966,020	644,221	399,146	395,575	498,445	370,418	468,413	508,939	449,328	354,645
CHLOROTHALONIL	1,182,963	755,314	745,717	521,581	601,060	713,226	571,622	765,150	824,391	734,647	558,315
CHROMIC ACID	71,109	343,543	128,642	363,225	272,300	182,022	17,753	252,176	662,927	10,904	10,384
CREOSOTE	1,752	4,873	9,879	4,700	9,018	3,385	1,048	<1	0	3	<1
DAMINOZIDE	10,406	9,411	9,088	11,309	10,077	10,111	9,586	8,793	7,805	7,096	6,993
DDVP	13,998	12,325	12,714	12,833	8,477	3,446	3,807	4,914	6,577	6,376	6,604
DIOCTYL PHTHALATE	318	1,076	595	640	604	521	397	583	1,016	484	340
DIPROPYL ISOCINCHOMERONATE	<1	0	<1	1	0	1	<1	<1	52	2	<1
DIURON	1,504,731	1,188,553	1,351,201	1,105,536	1,302,603	1,344,596	1,398,123	955,983	1,051,245	860,484	733,676
ETHOPROP	27,949	26,196	16,119	19,046	16,531	28,419	23,130	18,924	24,485	24,241	26,897
ETHYLENE OXIDE	31	2	6	3	0	0	0	0	0	2	3
FENOXYCARB	552	71	89	86	53	32	34	30	8	4	8
FOLPET	<1	<1	<1	0	2	<1	0	<1	<1	0	<1
FORMALDEHYDE	349,785	111,714	55,300	28,612	14,035	18,690	111,151	48,968	73,392	47,733	24,306
IPRODIONE	572,389	411,488	421,603	304,716	247,090	287,850	261,218	284,984	302,300	251,168	249,897
LINDANE	6,330	4,842	4,746	2,388	1,630	908	775	40	379	2	21
MANCOZEB	988,344	630,987	610,918	428,738	396,912	535,600	379,539	642,444	660,848	408,312	329,851
MANEB	1,596,466	1,045,567	1,202,515	816,548	851,819	1,026,804	954,085	1,122,684	1,175,939	1,055,347	833,006
METAM-SODIUM	14,120,788	17,273,325	13,143,954	12,562,799	15,116,768	14,822,689	14,698,228	12,991,279	11,422,382	9,903,649	9,219,288
METIRAM	<1	0	0	2	0	1	5	0	<1	0	0

Table 5A (cont.). The reported pounds of pesticides used that are listed by U.S. EPA as B2 carcinogens or that are on the State's Proposition 65 list of chemicals "known to cause cancer."

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
NITRAPYRIN	410	150	122	16	89	117	12	171	0	9	0
ORTHO-PHENYLPHENOL	11,248	8,600	8,516	4,016	15,129	4,936	21,740	9,454	2,083	5,128	4,389
ORTHO-PHENYLPHENOL, SODIUM SALT	32,972	29,019	31,677	27,071	25,029	20,536	5,898	4,979	6,948	2,266	3,211
ORYZALIN	814,717	712,809	457,625	110,122	155,909	429,224	574,783	703,007	787,725	656,453	595,918
OXADIAZON	22,389	19,253	18,280	15,905	16,692	12,566	12,979	13,762	11,714	12,512	9,331
OXYTHIOQUINOX	1,576	2,705	411	145	117	34	27	8	90	166	170
PARA-DICHLOROBENZENE	219	86	4	11	1	25	10	139	0	15	1
PENTACHLOROPHENOL	33	92	466	14	17	3	2	3	27	22	4
POTASSIUM DICHROMATE	103	319	554	1	<1	11	71	40	0	0	0
PROPARGITE	1,390,366	1,502,732	1,324,752	1,159,792	972,382	1,054,691	1,010,874	995,038	570,560	529,536	383,719
PROPOXUR	1,604	1,735	2,145	611	450	306	223	220	211	190	188
PROPYLENE OXIDE	198,595	172,556	118,381	99,727	99,674	99,396	151,484	147,324	133,028	109,936	104,192
PROPYZAMIDE	106,368	104,484	110,309	108,987	107,663	104,222	118,952	116,132	121,005	114,401	103,547
SODIUM DICHROMATE	122,647	32,699	122	329	633	0	0	0	0	0	0
TERRAZOLE	21	8	2	25	6	575	1,099	750	946	750	1,534
THIODICARB	114,785	60,453	36,724	9,042	5,195	8,392	2,249	1,872	894	686	362
VINCLOZOLIN	54,719	52,731	35,728	32,208	22,170	18,581	14,863	3,574	402	390	512
TOTAL	28,041,401	29,145,881	25,124,279	22,595,565	26,309,602	28,389,779	29,701,622	29,118,905	27,579,868	24,798,517	23,128,435

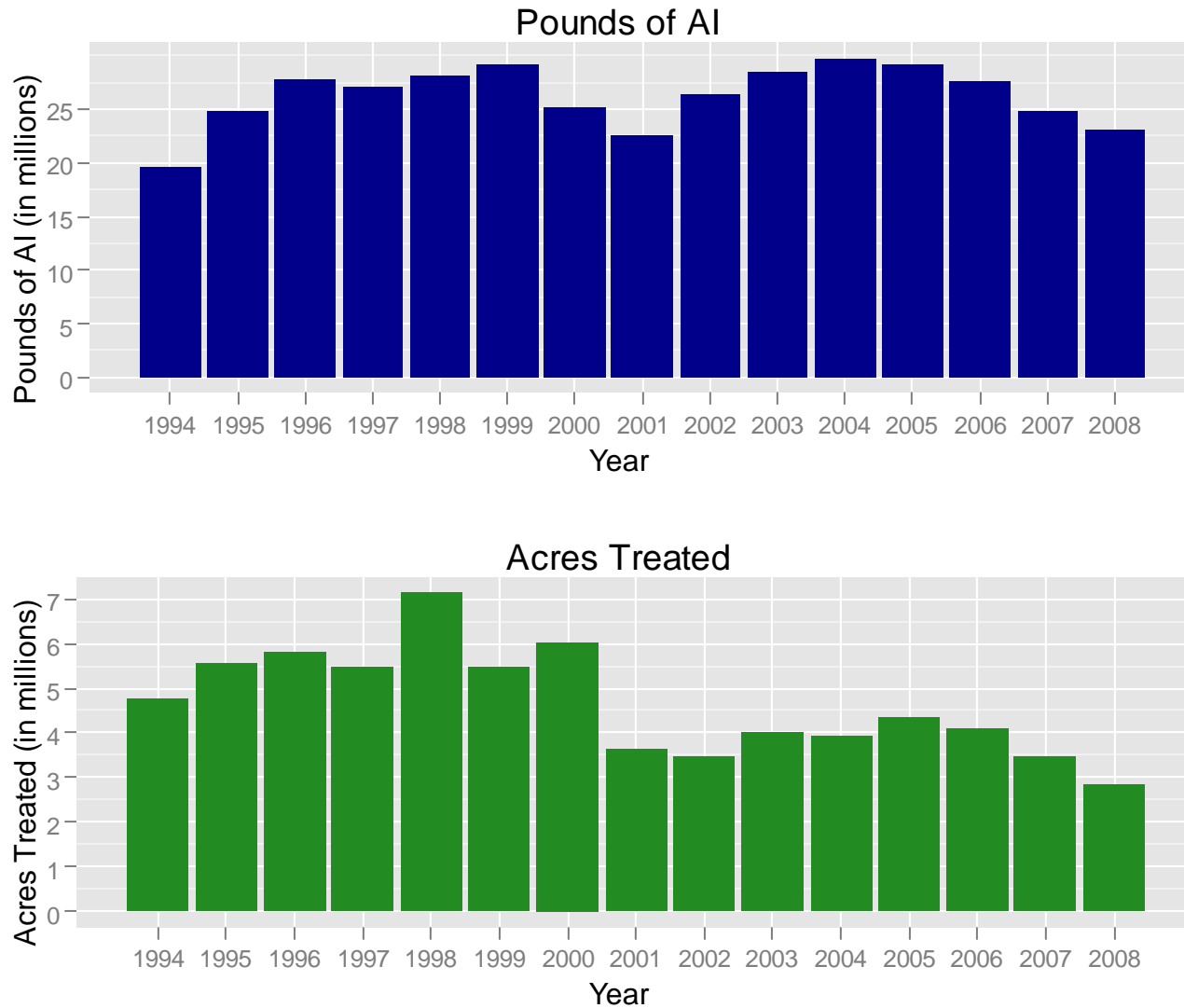
Table 5B. The reported cumulative acres treated with pesticides listed by U.S. EPA as B2 carcinogens or on the State's Proposition 65 list of chemicals "known to cause cancer." Use includes primarily agricultural applications. The grand total for acres treated is less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,3-DICHLOROPROPENE	27,059	29,430	33,244	30,817	42,172	48,944	56,618	51,486	49,885	53,937	56,491
ACIFLUORFEN, SODIUM SALT	<1	<1	<1	<1	11	<1	3	<1	0	0	0
ALACHLOR	16,430	11,008	13,302	11,453	14,467	10,004	9,888	7,935	5,192	1,500	1,635
ARSENIC ACID	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
ARSENIC PENTOXIDE	<1	<1	709,893	56	<1	<1	48	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	1	<1	<1	1	<1	<1	<1
CACODYLIC ACID	126,923	111,607	117,656	31,283	12,648	757	100	82	121	<1	<1
CAPTAN	602,684	404,731	309,989	215,969	215,412	271,140	211,028	252,040	262,936	215,787	195,548
CHLOROTHALONIL	796,672	456,007	430,128	312,726	347,736	361,203	331,710	418,600	438,373	389,495	288,964
CHROMIC ACID	<1	<1	709,893	56	<1	<1	<1	<1	<1	<1	<1
CREOSOTE	126	11	45	1	<1	<1	<1	<1	0	1	1
DAMINOZIDE	4,510	3,107	3,416	6,146	5,417	3,103	2,667	2,376	2,220	2,288	2,471
DDVP	3,692	2,180	2,336	3,954	4,327	2,576	1,637	7,445	1,526	2,733	2,231
DIOCTYL PHTHALATE	6,250	24,270	11,195	10,776	6,649	3,880	6,249	13,858	13,231	13,258	3,547
DIPROPYL ISOCINCHOMERONATE	<1	0	5	<1	0	<1	<1	1	18	<1	<1
DIURON	865,246	849,482	865,892	788,559	796,904	843,897	971,628	894,073	886,032	702,935	512,764
ETHOPROP	3,784	3,610	3,477	3,542	4,152	6,078	4,917	4,296	4,815	4,283	4,159
ETHYLENE OXIDE	194	31	41	<1	0	0	0	0	0	<1	2
FENOXYCARB	210	3,707	3,405	3,241	1,242	812	1,011	1,398	828	210	489
FOLPET	<1	<1	<1	0	<1	<1	0	<1	<1	0	<1
FORMALDEHYDE	126	123	47	53	33	18	23	2	265	57	67
IPRODIONE	1,348,382	933,982	1,194,618	501,033	364,809	445,511	409,250	450,354	468,465	412,687	433,119
LINDANE	32,650	20,930	14,640	13,832	8,010	8,828	9,437	557	9	1	37
MANCOZEB	683,756	387,300	363,306	228,275	197,196	276,093	194,219	370,266	348,360	212,354	169,102
MANEB	941,308	629,897	611,748	535,105	554,904	660,011	601,360	730,254	675,941	655,215	544,581
METAM-SODIUM	154,309	186,300	146,847	125,417	141,415	142,406	128,427	97,562	102,451	77,939	70,281
METIRAM	<1	0	0	7	0	<1	2	0	1	0	0

Table 5B (cont.). Reported cumulative acres treated with pesticides listed by U.S. EPA as B2 carcinogens or on the State's Proposition 65 list of chemicals "known to cause cancer."

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
NITRAPYRIN	851	329	155	<1	169	258	42	143	0	35	0
ORTHO-PHENYLPHENOL	645	583	321	59	82	726	272	429	65	149	22
ORTHO-PHENYLPHENOL, SODIUM SALT	20	6,234	18,564	60	40	9	<1	<1	<1	<1	<1
ORYZALIN	406,849	346,571	220,127	37,586	71,985	208,230	298,712	359,076	400,237	313,343	266,061
OXADIAZON	1,983	3,408	2,660	2,637	1,838	1,904	3,120	2,209	2,144	2,991	2,746
OXYTHIOQUINOX	5,306	2,152	817	250	182	71	137	14	10	9	5
PARA- DICHLOROBENZENE	10	<1	<1	<1	<1	<1	<1	<1	0	<1	1
PENTACHLOROPHENOL	190	<1	59	38	<1	<1	20	3	1	10	46
POTASSIUM DICHROMATE	40	71	40	<1	20	<1	<1	10	0	0	0
PROPARGITE	756,098	795,410	704,529	606,737	524,439	558,056	543,728	519,412	287,261	261,953	183,428
PROPOXUR	45	39	26	4	23	1	7	8	<1	<1	10
PROPYLENE OXIDE	<1	573	<1	<1	<1	<1	22	185	20	<1	12
PROPYZAMIDE	144,864	142,194	137,288	145,325	140,803	132,819	147,631	148,376	153,045	148,246	132,751
SODIUM DICHROMATE	<1	<1	<1	<1	<1	<1	0	0	0	0	0
TERRAZOLE	78	44	126	132	47	266	253	495	884	879	1,419
THIODICARB	155,440	83,796	50,611	13,382	8,258	12,113	3,684	2,965	1,293	1,196	609
VINCLOZOLIN	69,067	63,931	43,702	38,570	27,795	21,692	18,207	3,899	440	258	212
TOTAL	7,133,480	5,489,566	6,001,315	3,654,428	3,485,792	4,012,640	3,946,655	4,339,250	4,106,068	3,473,748	2,872,808

Figure 2. Use trends of pesticides that are listed by U.S. EPA as B2 carcinogens or that are on the State’s Proposition 65 list of chemicals “known to cause cancer.” Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation’s Pesticide Use Reports.



USE TRENDS OF CHOLINESTERASE-INHIBITING PESTICIDES

Table 6A. The reported pounds of cholinesterase-inhibiting pesticides used. These pesticides are organophosphate and carbamate active ingredients. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
3-iodo-2-propynyl butylcarbamate	1	<1	<1	<1	0	0	0	0	0	0	0
ACEPHATE	384,524	307,164	283,563	240,132	217,397	221,781	204,824	195,507	163,909	142,445	151,837
ALDICARB	534,665	280,585	329,553	297,244	244,786	262,103	231,012	230,409	176,624	115,088	75,058
AZINPHOS-METHYL	193,069	216,624	185,055	163,121	151,612	213,892	50,562	55,179	38,775	25,418	16,212
BENDIOCARB	125	108	593	62	32	23	9	6	2	8	2
BENSULIDE	192,500	242,460	216,442	186,908	192,220	228,739	237,290	246,396	284,533	258,164	231,843
BUTYLATE	69,805	71,071	32,658	27,640	19,412	26,826	20,323	9,923	2,671	945	27
CARBARYL	427,546	388,144	363,961	286,199	256,098	205,102	240,135	190,633	157,000	142,010	126,076
CARBOFURAN	161,588	138,665	132,427	95,863	81,486	49,276	30,354	28,093	25,790	24,306	15,866
CHLORPROPHAM	2,321	3,102	3,544	3,504	1,380	6,191	2,861	2,822	3,704	1,532	4,384
CHLORPYRIFOS	2,451,980	2,259,221	2,094,764	1,673,097	1,419,665	1,545,670	1,778,342	2,006,062	1,922,547	1,430,051	1,350,399
COUMAPHOS	0	15	152	97	62	64	63	1	3	<1	0
CYCLOATE	62,753	49,096	37,416	31,785	34,387	30,012	43,209	39,709	41,447	31,344	20,841
DDVP	13,998	12,325	12,714	12,833	8,477	3,446	3,807	4,914	6,577	6,376	6,604
DEMETON	3	5	2	3	42	<1	0	1	<1	1	0
DESMEDIPHAM	4,737	6,014	6,694	3,750	3,398	3,636	3,842	3,921	2,954	1,902	1,300
DIAZINON	901,388	983,628	1,058,923	999,578	690,375	523,957	492,148	398,620	385,923	350,640	256,218
DICROTOPHOS	11	122	0	2	27	0	0	2	6	0	0
DIMETHOATE	398,448	486,554	396,462	285,548	309,371	294,368	332,049	310,502	294,027	314,035	284,406
DISULFOTON	105,327	95,919	76,201	51,545	54,567	46,815	41,317	31,799	22,601	23,850	8,028
EPTC	393,031	448,883	323,613	276,724	253,634	141,552	182,532	181,825	108,209	152,707	125,116
ETHEPHON	762,217	734,263	734,838	620,075	538,403	574,377	637,205	642,137	584,613	427,247	295,631
ETHION	906	64	0	5	13	13	<1	261	13	0	2
ETHOPROP	27,949	26,196	16,119	19,046	16,531	28,419	23,130	18,924	24,485	24,241	26,897
FENAMIPHOS	125,459	107,745	104,537	66,330	70,939	59,421	58,691	46,336	33,511	39,677	17,453
FENTHION	29	22	33	61	79	3	36	15	2	4	4
FONOFOS	25,349	24,216	4,370	580	465	182	30	15	0	0	1

Table 6A (cont.). The reported pounds of cholinesterase-inhibiting pesticides used. These pesticides are organophosphate and carbamate active ingredients.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
FORMETANATE HYDROCHLORIDE	77,723	65,030	43,941	45,280	35,798	28,420	30,651	30,684	33,738	33,694	44,704
MALATHION	663,200	704,893	505,699	554,872	624,604	654,155	492,548	423,529	410,866	461,200	474,863
METHAMIDOPHOS	244,269	116,284	76,865	46,615	30,645	36,987	31,332	37,806	30,570	18,867	24,224
METHIDATHION	178,451	177,105	97,722	93,521	68,389	54,398	61,204	48,857	56,691	45,633	47,203
METHIOCARB	5,384	3,314	2,420	2,265	1,858	2,256	2,789	2,313	1,798	1,749	2,067
METHOMYL	666,694	551,115	555,444	378,131	295,237	359,050	262,195	347,010	317,302	305,018	243,064
METHYL PARATHION	158,248	157,439	75,075	59,620	53,955	73,365	71,525	78,821	84,785	75,368	34,110
MEVINPHOS	483	1,268	539	393	40	114	1	160	18	30	4
MEVINPHOS, OTHER RELATED	298	843	301	249	23	76	<1	107	12	20	3
MEXACARBATE	11	1	0	0	0	0	0	0	0	0	0
MOLINATE	1,006,025	911,376	1,025,786	733,534	877,572	539,871	367,155	171,362	141,421	75,241	18,828
NALED	260,291	302,708	246,572	276,651	177,102	185,611	152,479	223,725	185,444	132,050	170,279
O,O-DIMETHYL O-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE	0	0	0	0	0	0	0	0	<1	0	0
OXAMYL	161,042	128,662	137,597	76,971	80,315	93,781	112,603	153,167	116,639	44,843	99,850
OXYDEMETON-METHYL	90,790	122,912	110,754	99,756	96,363	93,774	102,563	121,910	119,717	121,936	110,786
PARATHION	5,762	4,041	3,360	2,589	3,205	611	240	855	1,542	479	33
PEBULATE	185,696	225,077	160,018	45,619	71,721	35,755	10,118	1,154	210	441	68
PHENMEDIPHAM	5,836	6,735	7,469	4,249	4,351	5,021	4,576	5,171	4,046	2,838	2,007
PHORATE	122,603	93,488	87,974	70,645	76,482	64,947	60,162	48,981	38,066	33,776	32,062
PHOSALONE	11	0	4	0	0	0	0	0	0	0	0
PHOSMET	645,380	638,704	580,552	482,481	405,236	341,541	658,087	547,813	628,892	421,109	339,696
POTASSIUM DIMETHYL DITHIO CARBAMATE	24,795	0	0	0	23	28	293	0	0	0	0
PROFENOFOS	40,433	49,575	43,879	22,011	24,452	12,871	15,620	23,924	20,885	3,638	215
PROPAMOCARB HYDROCHLORIDE	57,121	6,285	5,049	2,288	828	83	5	0	364	137,418	116,583
PROPETAMPHOS	9,970	6,074	4,583	3,991	2,464	721	315	148	207	136	116
PROPOXUR	1,604	1,735	2,145	611	450	306	223	220	211	190	188
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	438,038	345,842	396,827	257,062	190,149	233,640	179,690	100,210	78,084	45,757	11,931

Table 6A (cont.). The reported pounds of cholinesterase-inhibiting pesticides used. These pesticides are organophosphate and carbamate active ingredients.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
SODIUM DIMETHYL DITHIO CARBAMATE	8,279	355	1,315	173	0		10,693	30,440	23,414	9,073	9,800
SULFOTEP	213	246	215	267	77	8	29	17	1	7	4
SULPROFOS	84	0	0	<1	0	0	0	0	0	0	0
TEMEPHOS	6,428	7,934	130	0	0		356	1,102	803	1,173	684
TETRACHLORVINPHOS	5,831	3,975	4,833	4,746	3,285	1,262	722	788	1,203	667	1,012
THIOBENCARB	724,926	732,505	1,007,249	644,625	839,962	587,211	521,586	448,208	308,497	289,046	254,797
THIODICARB	114,785	60,453	36,724	9,042	5,195	8,392	2,249	1,872	894	686	362
TRICHLORFON	2,476	2,779	3,996	3,004	1,545	1,068	1,035	1,222	1,003	336	961
TOTAL	13,152,908	12,310,968	11,639,672	9,262,992	8,536,181	7,881,229	7,766,817	7,495,586	6,887,250	5,774,413	5,054,707

Table 6B. The reported cumulative acres treated with cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients. Use includes primarily agricultural applications. The grand total for acres treated is less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
3-iodo-2-propynyl butylcarbamate	150	<1	<1	40	0	0	0	0	0	0	0
ACEPHATE	403,545	370,111	295,614	266,278	232,949	223,408	211,892	198,982	172,119	148,866	147,311
ALDICARB	397,890	266,773	314,749	282,453	225,820	231,090	217,540	214,260	158,000	108,892	65,884
AZINPHOS-METHYL	134,334	140,226	118,805	117,544	94,035	117,060	38,622	37,622	25,534	16,636	9,888
BENDIOCARB	28	11	<1	2	<1	9	<1	1	<1	6	<1
BENSULIDE	61,984	80,873	73,088	62,859	60,883	66,376	70,367	70,625	82,280	76,748	71,905
BUTYLATE	14,259	14,959	7,235	6,270	4,598	5,450	3,940	1,954	610	236	7
CARBARYL	197,664	216,991	196,083	147,612	106,616	97,811	103,261	99,086	87,791	97,016	95,703
CARBOFURAN	303,957	272,441	258,441	246,149	182,567	91,801	50,138	55,488	43,417	39,795	23,712
CHLORPROPHAM	106	151	127	112	80	124	166	88	115	178	147
CHLORPYRIFOS	1,669,859	1,420,414	1,442,077	1,355,172	1,235,816	1,478,783	1,323,331	1,681,634	1,538,958	1,154,624	1,141,491
COUMAPHOS	0	<1	1,339	809	1,073	17	49	<1	3	<1	0
CYCLOATE	29,761	24,555	18,495	15,918	17,228	16,713	20,699	19,319	19,886	15,601	10,448
DDVP	3,692	2,180	2,336	3,954	4,327	2,576	1,637	7,445	1,526	2,733	2,231
DEMETON	18	66	<1	56	<1	0	0	35	<1	10	0
DESMEDIPHAM	56,272	71,977	60,916	34,738	32,344	35,435	37,152	35,795	30,883	24,780	13,287
DIAZINON	477,809	546,577	480,175	437,934	489,230	483,344	509,233	440,839	439,814	422,062	306,136
DICROTOPHOS	16	11	0	<1	<1	0	0	<1	110	0	0
DIMETHOATE	872,311	1,078,024	877,687	639,271	681,367	621,074	701,470	672,935	613,479	608,787	560,170
DISULFOTON	100,935	86,332	69,067	45,258	48,723	39,182	34,481	25,320	18,926	20,315	4,723
EPTC	141,511	148,685	107,744	99,953	94,240	56,639	64,194	64,263	38,871	51,706	43,727
ETHEPHON	653,817	720,773	697,340	631,330	550,256	601,503	660,356	679,253	640,720	490,355	362,793
ETHION	621	53	0	5	<1	1	<1	66	32	0	6
ETHOPROP	3,784	3,610	3,477	3,542	4,152	6,078	4,917	4,296	4,815	4,283	4,159
FENAMIPHOS	72,102	66,100	60,340	36,999	38,397	36,293	34,142	29,314	18,918	22,618	10,730
FENTHION	<1	<1	<1	<1	<1	<1	18	<1	<1	<1	<1
FONOFOS	16,926	14,146	2,325	497	234	116	20	15	0	0	<1

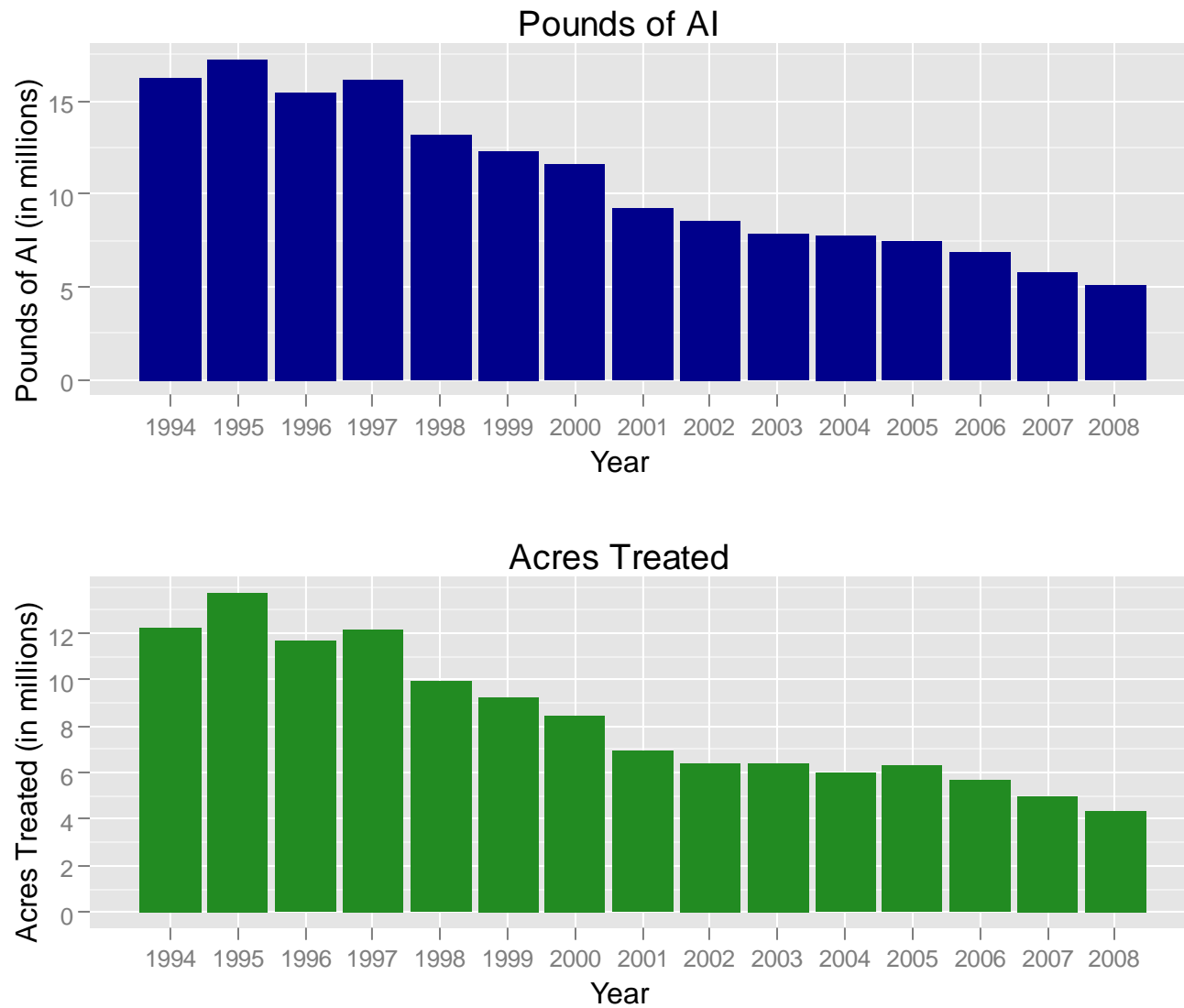
Table 6B (cont.). The reported cumulative acres treated with cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
FORMETANATE HYDROCHLORIDE	77,965	63,047	42,880	45,234	36,131	29,411	33,167	31,775	35,293	35,383	45,715
MALATHION	383,121	403,646	323,983	290,933	314,683	287,467	249,319	226,729	218,196	250,823	284,158
METHAMIDOPHOS	290,061	158,079	101,494	63,046	37,012	41,506	38,874	45,835	37,585	23,022	27,532
METHIDATHION	129,358	115,249	71,837	64,785	48,554	38,516	45,281	37,751	34,786	37,301	43,010
METHIOCARB	3,523	2,369	2,719	1,866	2,000	1,757	3,064	2,501	3,072	2,649	2,439
METHOMYL	1,118,188	880,910	893,585	627,264	510,006	615,669	437,673	612,989	529,347	502,325	395,943
METHYL PARATHION	128,675	119,315	43,773	39,449	37,514	51,252	48,640	49,771	51,184	45,173	21,574
MEVINPHOS	1,094	753	528	143	160	192	3	215	8	198	34
MEVINPHOS, OTHER RELATED	1,094	753	528	143	160	192	3	215	8	198	34
MEXACARBATE	15	1	0	0	0	0	0	0	0	0	0
MOLINATE	267,078	246,084	276,386	190,488	222,044	134,120	89,593	40,535	33,045	17,476	4,276
NALED	251,044	279,898	244,677	234,184	155,295	148,776	110,218	191,906	159,851	107,763	105,431
O,O-DIMETHYL O-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE	0	0	0	0	0	0	0	0	<1	0	0
OXAMYL	225,380	177,183	179,126	100,294	98,313	115,275	135,832	178,893	137,541	60,773	116,125
OXYDEMETON-METHYL	186,964	253,281	225,990	200,171	193,453	189,015	206,751	173,480	164,094	161,756	140,661
PARATHION	2,592	1,976	3,909	2,977	7,026	1,006	392	717	713	414	101
PEBULATE	64,501	74,697	51,243	15,122	21,491	10,680	4,319	297	35	163	151
PHENMEDIPHAM	58,649	73,905	62,643	35,477	34,452	38,265	38,964	38,675	33,208	26,762	14,698
PHORATE	109,759	81,724	71,406	63,160	58,391	50,290	47,488	35,938	27,676	23,557	10,686
PHOSALONE	5	0	10	0	0	0	0	0	0	0	0
PHOSMET	312,707	253,234	219,707	189,517	159,065	128,037	209,843	170,683	200,531	142,712	116,084
POTASSIUM DIMETHYL DITHIO CARBAMATE	<1	0	0	0	2	6	<1	0	0	0	0
PROFENOFOS	44,641	46,250	46,617	23,700	25,997	13,599	11,657	25,096	20,563	4,509	289
PROPAMOCARB HYDROCHLORIDE	81,050	6,851	17,696	2,625	1,041	22	10	0	187	144,949	123,597
PROPETAMPHOS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
PROPOXUR	45	39	26	4	23	1	7	8	<1	<1	10
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	305,306	245,470	282,844	187,153	129,570	158,604	133,535	74,538	52,330	31,408	10,778

Table 6B (cont.). The reported cumulative acres treated with cholinesterase-inhibiting pesticides. These pesticides are organophosphate and carbamate active ingredients.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
SODIUM DIMETHYL DITHIO CARBAMATE	253	20	<1	60	0		<1	<1	<1	2	1
SULFOTEP	241	224	168	314	57	3	8	9	<1	5	2
SULPROFOS	80	0	0	<1	0	0	0	0	0	0	0
TEMEPHOS	<1	<1	<1	0	0		<1	<1	<1	<1	<1
TETRACHLORVINPHOS	3,109	1,543	575	232	125	6	291	1,518	1	200	5
THIOBENCARB	187,295	186,341	252,506	169,056	222,606	154,952	136,132	118,786	79,109	74,271	65,305
THIODICARB	155,440	83,796	50,611	13,382	8,258	12,113	3,684	2,965	1,293	1,196	609
TRICHLORFON	1,071	97	70	51	19	8	<1	<1	<1	<1	<1
TOTAL	9,943,086	9,228,471	8,491,705	6,960,273	6,395,707	6,396,055	6,034,805	6,362,725	5,725,402	4,975,942	4,390,336

Figure 3. Use trends of cholinesterase-inhibiting pesticides, which includes pesticides with organophosphate and carbamate active ingredients. Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.



USE TRENDS OF PESTICIDES ON DPR'S GROUND WATER PROTECTION LIST

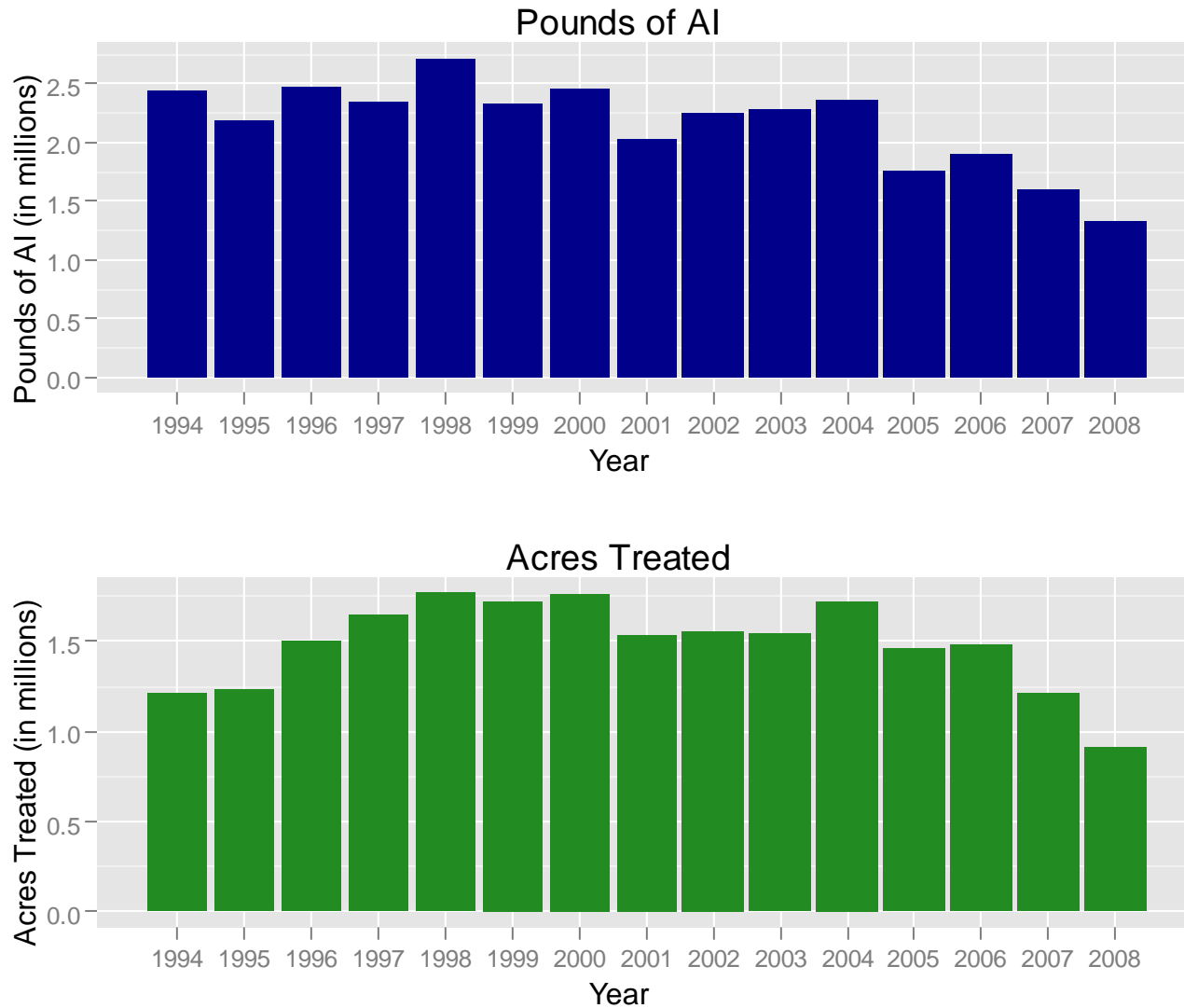
Table 7A. The reported pounds of pesticides on the "a" part of DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ATRAZINE	57,006	72,167	61,323	62,879	59,292	58,248	38,776	33,015	35,291	27,546	27,101
ATRAZINE, OTHER RELATED	1,289	1,509	1,282	1,314	1,237	1,213	812	695	732	571	571
BENTAZON, SODIUM SALT	1,757	1,876	1,210	393	1,045	1,216	1,370	2,272	2,633	4,858	8,069
BROMACIL	84,645	75,613	68,227	56,128	55,821	56,427	56,476	48,929	62,774	85,097	68,213
BROMACIL, LITHIUM SALT	4,686	4,162	4,478	3,217	4,016	3,025	1,801	1,059	2,529	1,172	1,851
DIURON	1,504,731	1,188,553	1,351,201	1,105,536	1,302,603	1,344,596	1,398,123	955,983	1,051,245	860,484	733,676
NORFLURAZON	265,886	286,214	259,328	208,667	187,927	146,408	139,960	94,037	107,763	77,615	56,958
PROMETON	22	4	28	2	21	2	20	3	8	3	3
SIMAZINE	795,103	696,768	713,729	585,400	632,901	670,916	729,850	623,806	635,486	538,627	432,429
TOTAL	2,715,125	2,326,865	2,460,806	2,023,534	2,244,862	2,282,050	2,367,187	1,759,800	1,898,460	1,595,973	1,328,871

Table 7B. The reported cumulative acres treated with pesticides on the "a" part of DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ATRAZINE	37,556	39,881	35,757	33,376	28,589	29,966	26,989	24,085	21,834	17,382	15,759
ATRAZINE, OTHER RELATED	37,529	39,876	35,757	33,376	28,589	29,966	26,989	24,085	21,834	17,382	15,759
BENTAZON, SODIUM SALT	1,904	1,968	1,502	432	1,094	987	1,279	2,218	2,217	4,215	6,628
BROMACIL	57,136	53,861	42,488	30,149	29,585	27,974	26,204	21,886	19,132	20,455	21,507
BROMACIL, LITHIUM SALT	40	40	30	<1	<1	<1	<1	<1	<1	<1	<1
DIURON	865,246	849,482	865,892	788,559	796,904	843,897	971,628	894,073	886,032	702,935	512,764
NORFLURAZON	214,144	217,178	230,848	192,305	161,746	125,619	125,802	81,589	91,035	74,085	57,799
PROMETON	85	18	51	<1	174	49	171	6	168	4	35
SIMAZINE	647,117	611,626	620,672	515,419	561,349	546,678	588,016	463,244	480,142	411,719	319,350
TOTAL	1,769,523	1,721,896	1,761,819	1,532,564	1,552,171	1,548,690	1,716,706	1,466,859	1,483,320	1,212,525	913,690

Figure 4. Use trends of pesticides on DPR's groundwater protection list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a). Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.



USE TRENDS OF PESTICIDES ON DPR'S TOXIC AIR CONTAMINANTS LIST

Table 8A. The reported pounds of pesticides on DPR's toxic air contaminants list applied in California. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,3-DICHLOROPROPENE	3,011,057	3,321,147	4,465,422	4,141,173	5,413,807	7,003,873	8,945,145	9,355,308	8,733,270	9,594,517	9,555,304
2,4-D	3,868	3,061	2,096	1,787	1,733	1,732	1,796	1,552	1,735	2,755	11,349
2,4-D, 2-ETHYLHEXYL ESTER	13,750	72,225	13,911	13,706	15,801	19,715	21,130	26,632	21,062	15,029	20,467
2,4-D, ALKANOLAMINE SALTS (ETHANOL AND ISOPROPANOL AMINES)	29,576	15,992	6,737	674	452	1,357	624	458	16	29	25
2,4-D, BUTOXYETHANOL ESTER	12,867	5,628	6,194	5,336	3,556	3,812	4,782	8,190	1,720	843	1,775
2,4-D, BUTOXYPROPYL ESTER	31	5	4	3	0	0	0	0	<1	0	13
2,4-D, BUTYL ESTER	2,180	8	<1	<1	593	0	0	10	15	9	0
2,4-D, DIETHANOLAMINE SALT	14,939	5,843	13,004	6,667	8,831	8,831	5,022	3,961	2,947	4,025	5,186
2,4-D, DIMETHYLAMINE SALT	422,824	356,770	426,911	395,537	425,706	511,519	470,871	454,762	438,864	395,887	440,251
2,4-D, DODECYLAMINE SALT	75	730	0	257	322	0	0	0	0	0	0
2,4-D, HEPTYLAMINE SALT	0	46	0	0	<1	0	0	0	0	0	0
2,4-D, ISOCTYL ESTER	47,016	17,387	8,505	15,828	12,380	12,366	10,039	10,314	10,627	11,572	9,603
2,4-D, ISOPROPYL ESTER	7,533	6,879	7,886	6,584	7,833	8,319	9,066	10,825	10,559	10,056	10,232
2,4-D, N-OLEYL-1,3-PROPYLENEDIAMINE SALT	3	7	11	0	0	0	0	0	0	0	0
2,4-D, OCTYL ESTER	0	0	0	0	0	0	0	0	0	0	0
2,4-D, PROPYL ESTER	999	1,822	783	391	634	326	472	382	398	212	141
2,4-D, TETRADECYLAMINE SALT	17	170	0	60	75	0	0	0	0	0	0

Table 8A (cont.). The reported pounds of pesticides on DPR's toxic air contaminants list applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2,4-D, TRIETHYLAMINE SALT	5,688	2,344	1,102	634	426	435	386	203	1,614	383	332
2,4-D, TRIISOPROPANOLAMINE SALT	0	0	0	0	565	550	742	672	1,133	985	1,140
2,4-D, TRIISOPROPYLAMINE SALT	5	6	0	5	9	0	0	0	458	636	472
ACROLEIN	264,207	328,238	290,180	233,928	282,590	272,733	211,014	257,189	246,659	201,112	215,822
ALUMINUM PHOSPHIDE	68,919	123,633	119,784	99,856	169,218	119,512	131,303	135,751	150,555	104,829	131,769
ARSENIC ACID	52,558	48,029	11,906	12,023	4,976	318	223	68	3	0	0
ARSENIC PENTOXIDE	50,899	245,238	91,267	259,400	194,650	129,889	12,705	180,505	474,517	7,805	7,433
ARSENIC TRIOXIDE	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CAPTAN	1,542,556	966,020	644,221	399,146	395,575	498,445	370,418	468,413	508,939	449,328	354,645
CAPTAN, OTHER RELATED	35,925	22,219	14,662	9,014	9,020	11,309	8,271	10,540	11,748	10,325	8,134
CARBARYL	427,546	388,144	363,961	286,199	256,098	205,102	240,135	190,633	157,000	142,010	126,076
CHLORINE	431,546	628,546	654,541	296,469	502,944	619,735	516,546	613,837	730,986	857,144	1,278,580
CHROMIC ACID	71,109	343,543	128,642	363,225	272,300	182,022	17,753	252,176	662,927	10,904	10,384
DAZOMET	15,246	12,409	10,981	44,299	45,020	34,848	58,492	48,263	34,310	37,537	40,272
DDVP	13,998	12,325	12,714	12,833	8,477	3,446	3,807	4,914	6,577	6,376	6,604
ETHYLENE OXIDE	31	2	6	3	0	0	0	0	0	2	3
FORMALDEHYDE	349,785	111,714	55,300	28,612	14,035	18,690	111,151	48,968	73,392	47,733	24,306
HYDROGEN CHLORIDE	762	11,067	3,316	4,276	4,256	3,222	2,529	14,755	2,464	1,470	32,924
LINDANE	6,330	4,842	4,746	2,388	1,630	908	775	40	379	2	21
MAGNESIUM PHOSPHIDE	4,132	3,540	3,550	2,492	4,824	2,844	2,621	3,156	3,931	4,984	10,315
MANCOZEB	988,344	630,987	610,918	428,738	396,912	535,600	379,539	642,444	660,848	408,312	329,851
MANEB	1,596,466	1,045,567	1,202,515	816,548	851,819	1,026,804	954,085	1,122,684	1,175,939	1,055,347	833,006
META-CRESOL	8	11	14	1	1	1	2	1	<1	<1	<1

Table 8A (cont.). The reported pounds of pesticides on DPR's toxic air contaminants list applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
METAM-SODIUM	14,120,788	17,273,325	13,143,954	12,562,799	15,116,768	14,822,689	14,698,228	12,991,279	11,422,382	9,903,649	9,219,288
METHANOL	0	3	<1	0	0	0	0	0	0	0	0
METHIDATHION	178,451	177,105	97,722	93,521	68,389	54,398	61,204	48,857	56,691	45,633	47,203
METHOXYCHLOR	566	16	26	41	144	3	1	13	130	6	0
METHOXYCHLOR, OTHER RELATED	11	<1	0	<1	0		<1	<1	0	0	0
METHYL BROMIDE	14,314,983	15,355,845	10,930,893	6,625,336	7,008,644	7,289,389	7,105,612	6,504,576	6,541,159	6,438,044	5,646,742
METHYL ISOTHIOCYANATE	220	616	3,323	2,871	3,512	547	1,357	1,549	1,073	388	0
METHYL PARATHION	158,248	157,439	75,075	59,620	53,955	73,365	71,525	78,821	84,785	75,368	34,110
NAPHTHALENE	333	<1	0	0	<1	0	0	<1	0	0	0
PARA-DICHLOROBENZENE	219	86	4	11	1	25	10	139	0	15	1
PARATHION	5,762	4,041	3,360	2,589	3,205	611	240	855	1,542	479	33
PCNB	88,036	67,424	62,809	50,937	43,450	38,989	34,176	37,942	32,786	30,663	29,044
PCP, OTHER RELATED	2	11	54	2	2	<1	<1	<1	3	2	1
PCP, SODIUM SALT	2	0	0	<1	0	0	0	0	0	<1	0
PCP, SODIUM SALT, OTHER RELATED	0	0	0	0	0	0	0	0	0	<1	0
PENTACHLOROPHENOL	33	92	466	14	17	3	2	3	27	22	4
PHENOL	44	12	20	30	0	<1	9	71	<1	0	0
PHOSPHINE	0	0	0	44	901	1,141	1,664	2,688	2,774	5,262	48,219
PHOSPHORUS	12	9	22	3	1	1	1	<1	2	<1	<1
POTASSIUM N-METHYLDITHIOCARBAMATE	9,143	0	105,364	464,882	1,175,168	1,911,698	851,181	1,994,072	3,202,884	3,785,436	5,482,586
POTASSIUM PERMANGANATE	243	0	0	0	0	0	0	0	0	0	0

Table 8A (cont.). The reported pounds of pesticides on DPR's toxic air contaminants list applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PROPOXUR	1,604	1,735	2,145	611	450	306	223	220	211	190	188
PROPYLENE OXIDE	198,595	172,556	118,381	99,727	99,674	99,396	151,484	147,324	133,028	109,936	104,192
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	438,038	345,842	396,827	257,062	190,149	233,640	179,690	100,210	78,084	45,757	11,931
SODIUM CYANIDE	3,263	1,098	2,178	2,437	2,542	2,808	2,865	3,086	2,853	2,670	3,406
SODIUM DICHROMATE	122,647	32,699	122	329	633	0	0	0	0	0	0
SODIUM TETRATHIOCARBONATE	900,991	688,701	596,028	375,487	352,342	212,308	259,542	330,886	171,194	386,876	354,294
SULFURYL FLUORIDE	2,173,338	2,790,343	2,428,345	2,585,680	3,047,882	3,138,687	3,270,698	3,394,126	2,880,853	2,152,451	2,120,533
TRIFLURALIN	1,220,106	1,261,482	1,162,159	934,018	1,091,597	1,061,631	1,023,142	1,027,804	1,041,805	899,604	648,895
XYLENE	5,362	4,847	4,292	9,544	2,680	4,349	2,109	1,598	1,418	1,173	574
ZINC PHOSPHIDE	1,200	5,447	1,609	1,116	981	1,253	1,924	2,371	3,794	3,215	1,296
TOTAL	43,435,036	47,076,920	38,310,968	32,016,805	37,569,402	40,185,748	40,208,334	40,536,097	39,785,069	37,268,996	37,218,975

Table 8B. The reported cumulative acres treated in California with pesticides on DPR's toxic air contaminants list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Use includes primarily agricultural applications. The grand total for acres treated is less than the sum of acres treated for all active ingredients because some products contain more than one active ingredient. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,3-DICHLOROPROPENE	27,059	29,430	33,244	30,817	42,172	48,944	56,618	51,486	49,885	53,937	56,491
2,4-D	11,649	7,791	5,134	3,952	2,304	2,562	3,377	1,466	2,824	7,405	32,607
2,4-D, 2-ETHYLHEXYL ESTER	6,867	7,624	8,460	6,919	10,260	22,426	20,642	21,360	15,303	8,362	15,047
2,4-D, ALKANOLAMINE SALTS (ETHANOL AND ISOPROPANOL AMINES)	22,117	11,843	5,711	359	264	630	1,475	403	6	23	55
2,4-D, BUTOXYETHANOL ESTER	13,810	7,198	7,158	5,633	2,655	2,539	3,835	2,951	1,600	1,297	3,648
2,4-D, BUTOXYPROPYL ESTER	93	37	5	9	0	0	0	0	<1	0	<1
2,4-D, BUTYL ESTER	307	37	24	1	101	<1	0	8	1	10	0
2,4-D, DIETHANOLAMINE SALT	58,239	23,884	49,377	27,705	36,290	39,046	22,729	18,739	13,826	13,339	18,417
2,4-D, DIMETHYLAMINE SALT	477,967	411,858	495,954	475,796	491,242	595,235	553,369	567,143	523,912	487,361	522,030
2,4-D, DODECYLAMINE SALT	82	1,481	0	262	276	0	0	0	0	0	0
2,4-D, HEPTYLAMINE SALT	0	29	0	0	<1	0	0	0	0	0	0
2,4-D, ISOCTYL ESTER	29,179	14,449	5,711	16,375	6,964	9,476	7,502	6,532	7,638	7,143	4,708
2,4-D, ISOPROPYL ESTER	101,141	100,837	103,938	88,849	108,908	116,840	117,870	144,377	146,090	137,043	135,758
2,4-D, N-OLEYL-1,3-PROPYLENEDIAMINE SALT	2	3	<1	0	0	0	0	0	0	0	0
2,4-D, OCTYL ESTER	0	0	0	0	0	0	0	0	0	0	0
2,4-D, PROPYL ESTER	14,356	15,542	11,278	5,200	7,468	5,509	8,680	5,261	5,660	3,348	1,955
2,4-D, TETRADECYLAMINE SALT	82	1,481	0	262	276	0	0	0	0	0	0
2,4-D, TRIETHYLAMINE SALT	7,381	2,638	1,391	1,257	688	1,035	677	243	815	473	679

Table 8B (cont.). The reported cumulative acres treated in California with pesticides on DPR's toxic air contaminants list.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
2,4-D, TRIIISOPROPANOLAMINE SALT	0	0	0	0	<1	5	209	396	393	108	952
2,4-D, TRIIISOPROPYLAMINE SALT	<1	<1	0	<1	<1	<1	0	0	<1	204	<1
ACROLEIN	292	3,981	873	1,409	2,206	642	575	73	18	141	1,027
ALUMINUM PHOSPHIDE	74,441	76,332	64,112	67,422	70,367	73,869	74,762	63,289	79,951	84,790	80,969
ARSENIC ACID	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
ARSENIC PENTOXIDE	<1	<1	709,893	56	<1	<1	48	<1	<1	<1	<1
ARSENIC TRIOXIDE	<1	<1	<1	<1	1	<1	<1	1	<1	<1	<1
CAPTAN	602,684	404,731	309,989	215,969	215,412	271,140	211,028	252,040	262,936	215,787	195,548
CAPTAN, OTHER RELATED	602,585	404,511	309,337	215,958	215,362	270,968	209,571	251,846	262,860	215,152	195,381
CARBARYL	197,664	216,991	196,083	147,612	106,616	97,811	103,261	99,086	87,791	97,016	95,703
CHLORINE	1,329	46,611	37,220	95	150	650	2,137	<1	431	1,201	14,414
CHROMIC ACID	<1	<1	709,893	56	<1	<1	<1	<1	<1	<1	<1
DAZOMET	3,589	243	223	224	136	326	298	113	124	700	183
DDVP	3,692	2,180	2,336	3,954	4,327	2,576	1,637	7,445	1,526	2,733	2,231
ETHYLENE OXIDE	194	31	41	<1	0	0	0	0	0	<1	2
FORMALDEHYDE	126	123	47	53	33	18	23	2	265	57	67
HYDROGEN CHLORIDE	16	<1	<1	27	590	273	1	17	18	4	1,865
LINDANE	32,650	20,930	14,640	13,832	8,010	8,828	9,437	557	9	1	37
MAGNESIUM PHOSPHIDE	184	17	46	373	7	167	1	23	29	6	143
MANCOZEB	683,756	387,300	363,306	228,275	197,196	276,093	194,219	370,266	348,360	212,354	169,102
MANEB	941,308	629,897	611,748	535,105	554,904	660,011	601,360	730,254	675,941	655,215	544,581
META-CRESOL	1,407	657	3,142	517	267	244	288	164	50	54	38
METAM-SODIUM	154,309	186,300	146,847	125,417	141,415	142,406	128,427	97,562	102,451	77,939	70,281
METHANOL	0	<1	14	0	0	0	0	0	0	0	0
METHIDATHION	129,358	115,249	71,837	64,785	48,554	38,516	45,281	37,751	34,786	37,301	43,010

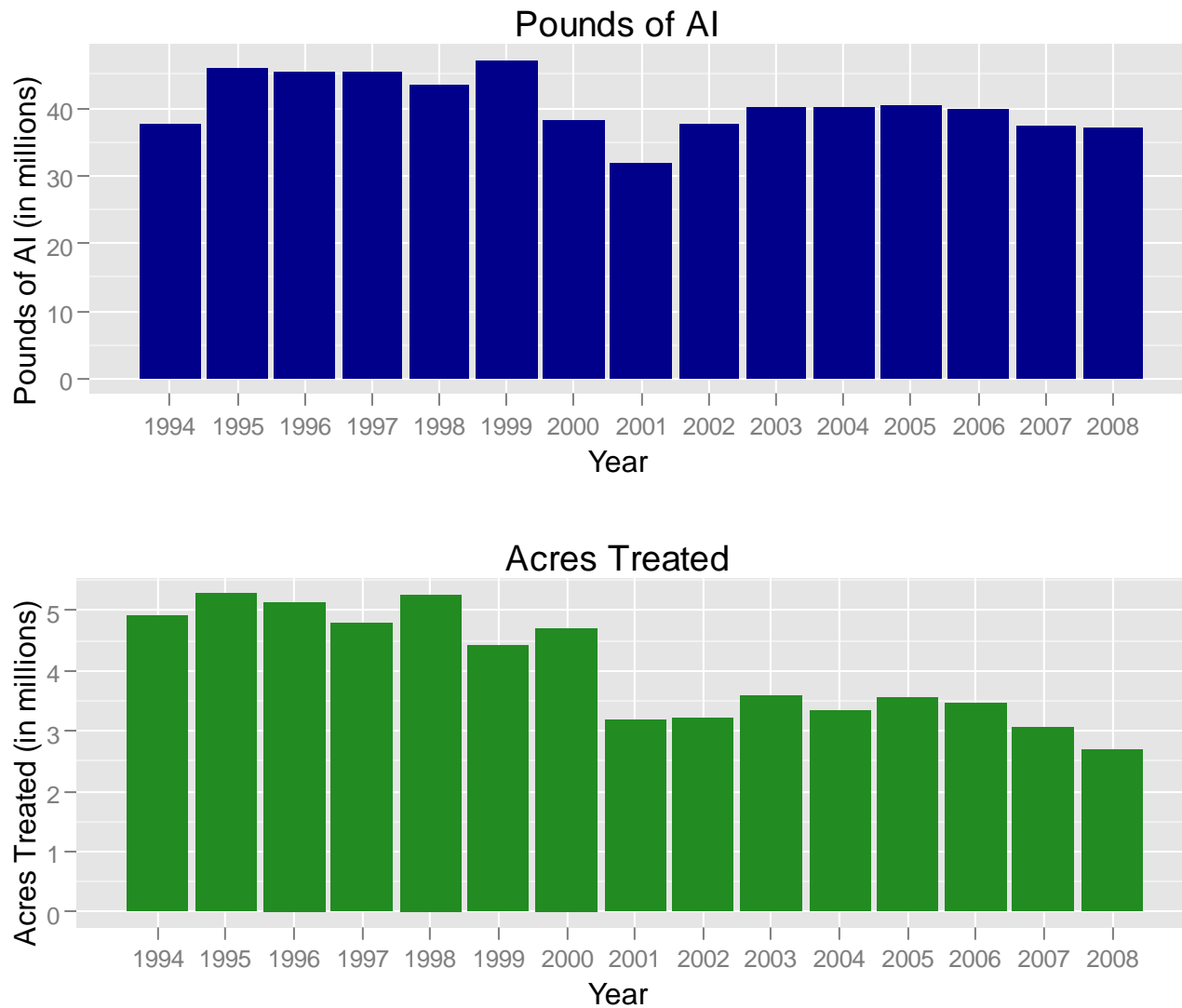
Table 8B (cont.). The reported cumulative acres treated in California with pesticides on DPR's toxic air contaminants list.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
METHOXYCHLOR	194	140	197	88	24	<1	44	26	395	43	0
METHOXYCHLOR, OTHER RELATED	5	<1	0	<1	0		<1	<1	0	0	0
METHYL BROMIDE	90,107	102,115	75,839	60,892	53,140	55,254	57,385	45,700	50,677	45,675	35,497
METHYL ISOTHIOCYANATE	47	100	<1	<1	<1	<1	<1	<1	<1	<1	0
METHYL PARATHION	128,675	119,315	43,773	39,449	37,514	51,252	48,640	49,771	51,184	45,173	21,574
NAPHTHALENE	<1	<1	0	<1	20	<1	0	2	0	0	0
PARA-DICHLOROBENZENE	10	<1	<1	<1	<1	<1	<1	<1	0	<1	1
PARATHION	2,592	1,976	3,909	2,977	7,026	1,006	392	717	713	414	101
PCNB	39,090	28,324	28,649	25,832	9,533	7,759	3,817	3,001	1,496	1,764	1,656
PCP, OTHER RELATED	15	<1	59	38	<1	<1	20	3	1	10	46
PCP, SODIUM SALT	20	0	0	<1	0	0	0	0	0	<1	0
PCP, SODIUM SALT, OTHER RELATED	0	0	0	0	0	0	0	0	0	<1	0
PENTACHLOROPHENOL	190	<1	59	38	<1	<1	20	3	1	10	46
PHENOL	275	459	5	501	0	25	310	239	<1	0	0
PHOSPHINE	0	0	0	<1	<1	<1	349	22	23	3	1,744
PHOSPHORUS	965	5,113	2,847	252	<1	<1	<1	23	<1	10	<1
POTASSIUM N-METHYLDITHIOCARBAMATE	50	0	534	2,321	9,073	12,887	10,229	19,670	27,299	42,988	55,868
POTASSIUM PERMANGANATE	20	0	0	0	0	0	0	0	0	0	0
PROPOXUR	45	39	26	4	23	1	7	8	<1	<1	10
PROPYLENE OXIDE	<1	573	<1	<1	<1	<1	22	185	20	<1	12
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	305,306	245,470	282,844	187,153	129,570	158,604	133,535	74,538	52,330	31,408	10,778

Table 8B (cont.). The reported cumulative acres treated in California with pesticides on DPR's toxic air contaminants list.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
SODIUM CYANIDE	53,285	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
SODIUM DICHROMATE	<1	<1	<1	<1	<1	<1	0	0	0	0	0
SODIUM TETRATHIOCARBONATE	34,488	24,947	21,002	13,574	11,559	6,832	8,497	7,977	6,170	11,485	10,725
SULFURYL FLUORIDE	<1	17	4	<1	<1	50	2	<1	78	9	57
TRIFLURALIN	1,083,219	1,159,648	1,039,430	800,893	944,407	903,654	920,545	886,258	901,629	772,753	546,789
XYLENE	11,327	3,325	6,208	9,665	4,533	7,502	3,375	2,722	1,824	2,021	1,418
ZINC PHOSPHIDE	18,833	38,101	16,349	11,069	7,234	8,387	14,150	9,038	15,284	9,301	11,478
TOTAL	5,271,989	4,410,435	4,710,647	3,176,025	3,226,193	3,579,708	3,336,277	3,557,634	3,454,674	3,053,275	2,685,630

Figure 5. Use trends of pesticides on DPR's toxic air contaminants list. These pesticides are the active ingredients listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6860. Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.



USE TRENDS OF FUMIGANT PESTICIDES

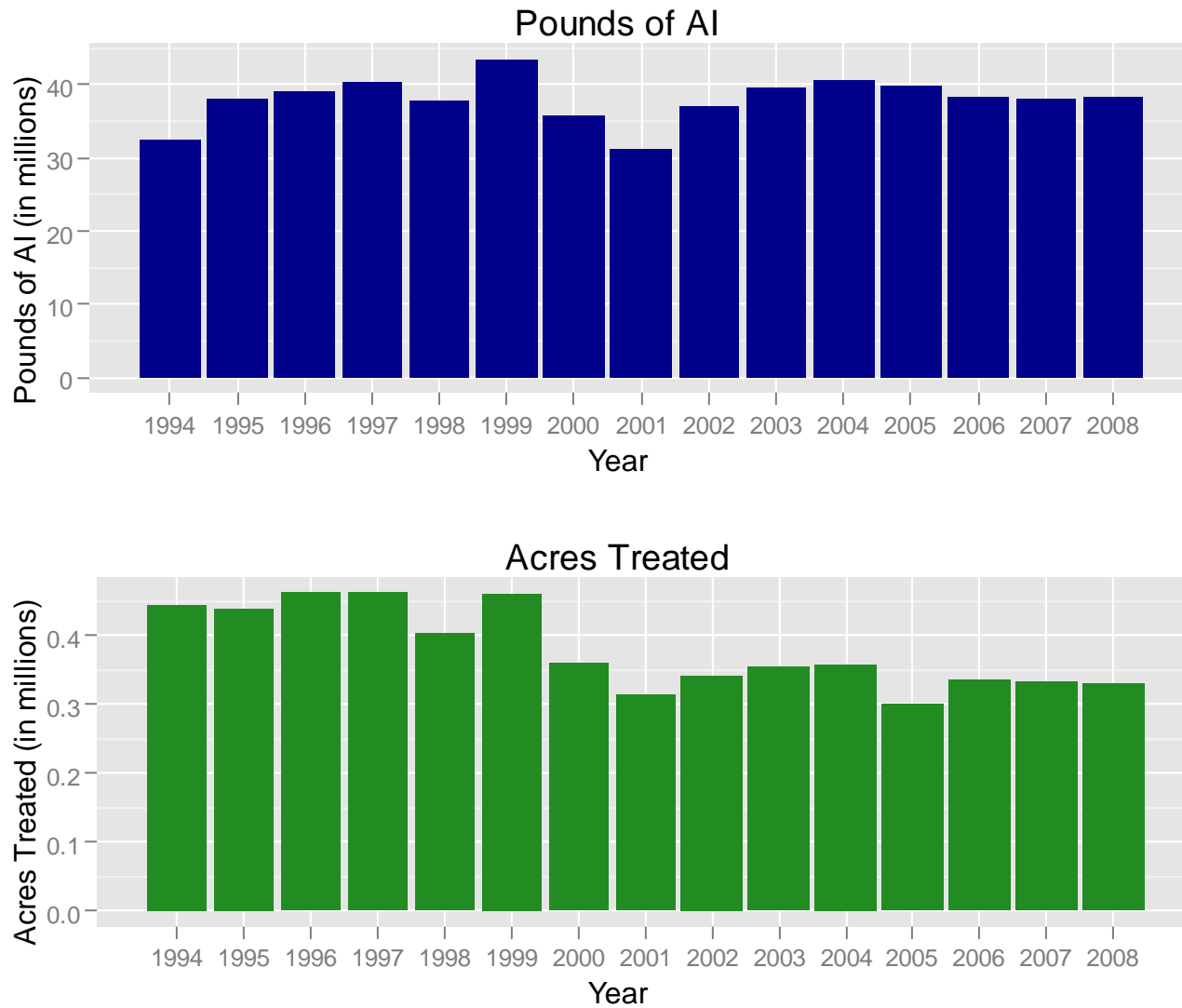
Table 9A. The reported pounds of fumigant pesticides used. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,2-DICHLOROPROPANE, 1,3-DICHLOROPROPENE AND RELATED C3 COMPOUNDS	243	927	87	110	331	393	22	0	182	10,532	0
1,3-DICHLOROPROPENE	3,011,057	3,321,147	4,465,422	4,141,173	5,413,807	7,003,873	8,945,145	9,355,308	8,733,270	9,594,517	9,555,304
ALUMINUM PHOSPHIDE	68,919	123,633	119,784	99,856	169,218	119,512	131,303	135,751	150,555	104,829	131,769
CARBON TETRACHLORIDE	38	<1	111	2	5	1	<1	0	0	180	1,980
CHLOROPICRIN	3,070,641	3,657,187	3,800,497	4,276,413	4,670,246	4,926,181	5,139,168	4,869,572	5,035,246	5,494,541	5,543,140
DAZOMET	15,246	12,409	10,981	44,299	45,020	34,848	58,492	48,263	34,310	37,537	40,272
ETHYLENE DIBROMIDE	5	<1	147	2,593	<1	<1	3	0	0	3	127
ETHYLENE DICHLORIDE	1	<1	3	4	11		1	0	0	0	<1
ETHYLENE OXIDE	31	2	6	3	0	0	0	0	0	2	3
MAGNESIUM PHOSPHIDE	4,132	3,540	3,550	2,492	4,824	2,844	2,621	3,156	3,931	4,984	10,315
METAM-SODIUM	14,120,788	17,273,325	13,143,954	12,562,799	15,116,768	14,822,689	14,698,228	12,991,279	11,422,382	9,903,649	9,219,288
METHYL BROMIDE	14,314,983	15,355,845	10,930,893	6,625,336	7,008,644	7,289,389	7,105,612	6,504,576	6,541,159	6,438,044	5,646,742
PHOSPHINE	0	0	0	44	901	1,141	1,664	2,688	2,774	5,262	48,219
POTASSIUM N- METHYLDITHIOCARBAMATE	9,143	0	105,364	464,882	1,175,168	1,911,698	851,181	1,994,072	3,202,884	3,785,436	5,482,586
PROPYLENE OXIDE	198,595	172,556	118,381	99,727	99,674	99,396	151,484	147,324	133,028	109,936	104,192
SODIUM TETRATHIOCARBONATE	900,991	688,701	596,028	375,487	352,342	212,308	259,542	330,886	171,194	386,876	354,294
SULFURYL FLUORIDE	2,173,338	2,790,343	2,428,345	2,585,680	3,047,882	3,138,687	3,270,698	3,394,126	2,880,853	2,152,451	2,120,533
ZINC PHOSPHIDE	1,200	5,447	1,609	1,116	981	1,253	1,924	2,371	3,794	3,215	1,296
TOTAL	37,889,350	43,405,063	35,725,162	31,282,017	37,105,823	39,564,213	40,617,089	39,779,372	38,315,562	38,031,993	38,260,062

Table 9B. The reported cumulative acres treated with fumigant pesticides. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1,2-DICHLOROPROPANE, 1,3-DICHLOROPROPENE AND RELATED C3 COMPOUNDS	70	207	136	370	44	45	9	0	32	108	0
1,3-DICHLOROPROPENE	27,059	29,430	33,244	30,817	42,172	48,944	56,618	51,486	49,885	53,937	56,491
ALUMINUM PHOSPHIDE	74,441	76,332	64,112	67,422	70,367	73,869	74,762	63,289	79,951	84,790	80,969
CARBON TETRACHLORIDE	23	<1	20	<1	<1	<1	<1	0	0	<1	161
CHLOROPICRIN	59,694	61,323	58,139	60,083	53,786	51,791	53,737	50,272	51,191	51,512	52,842
DAZOMET	3,589	243	223	224	136	326	298	113	124	700	183
ETHYLENE DIBROMIDE	20	<1	21	52	<1	<1	<1	0	0	<1	<1
ETHYLENE DICHLORIDE	<1	<1	<1	<1	<1	<1	<1	0	0	0	160
ETHYLENE OXIDE	194	31	41	<1	0	0	0	0	0	<1	2
MAGNESIUM PHOSPHIDE	184	17	46	373	7	167	1	23	29	6	143
METAM-SODIUM	154,309	186,300	146,847	125,417	141,415	142,406	128,427	97,562	102,451	77,939	70,281
METHYL BROMIDE	90,107	102,115	75,839	60,892	53,140	55,254	57,385	45,700	50,677	45,675	35,497
PHOSPHINE	0	0	0	<1	<1	<1	349	22	23	3	1,744
POTASSIUM N- METHYLDITHIOCARBAMATE	50	0	534	2,321	9,073	12,887	10,229	19,670	27,299	42,988	55,868
PROPYLENE OXIDE	<1	573	<1	<1	<1	<1	22	185	20	<1	12
SODIUM TETRATHIOCARBONATE	34,488	24,947	21,002	13,574	11,559	6,832	8,497	7,977	6,170	11,485	10,725
SULFURYL FLUORIDE	<1	17	4	<1	<1	50	2	<1	78	9	57
ZINC PHOSPHIDE	18,833	38,101	16,349	11,069	7,234	8,387	14,150	9,038	15,284	9,301	11,478
TOTAL	404,205	459,653	360,635	315,720	341,296	356,352	356,814	300,847	337,084	333,285	330,146

Figure 6. Use trends of fumigant pesticides. Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.



USE TRENDS OF OIL PESTICIDES

Table 10A. *The reported pounds of oil pesticides. As a broad group, oil pesticides and other petroleum distillates are on U.S. EPA's list of B2 carcinogens or the State's Proposition 65 list of chemicals "known to cause cancer." However, these classifications do not distinguish among oil pesticides that may not qualify as carcinogenic due to their degree of refinement. Many such oil pesticides also serve as alternatives to high-toxicity chemicals. For this reason, oil pesticide data was classified separately in this report. Use includes both agricultural and reportable non-agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.*

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
COAL TAR HYDROCARBONS	0	0	0	50	<1	0	0	0	0	0	0
HYDROTREATED PARAFFINIC SOLVENT	88,353	79,480	102,361	189,538	206,552	283,768	320,019	244,114	252,134	274,358	226,780
ISOPARAFFINIC HYDROCARBONS	81,780	75,575	65,032	45,763	22,479	23,707	30,125	31,183	18,997	16,859	11,109
KEROSENE	90,108	70,398	84,654	49,037	20,973	17,144	14,243	7,983	11,373	12,137	21,945
MINERAL OIL	6,920,065	6,015,658	5,866,245	5,405,244	7,341,195	9,250,426	9,939,325	10,613,463	12,385,824	12,841,837	12,212,908
MINERAL OIL, PETROLEUM DISTILLATES, SOLVENT REFINED LIGHT	0	0	0	0	0	0	0	0	169	139	173
NAPHTHA, HEAVY AROMATIC	0	0	0	29	0	2	53	0	0	0	0
PETROLEUM DERIVATIVE RESIN	6	1	3	1	<1	1	1	4	5	0	0
PETROLEUM DISTILLATES	1,625,537	2,421,987	2,289,550	1,730,640	1,120,617	828,663	714,744	609,729	297,049	342,435	488,457
PETROLEUM DISTILLATES, ALIPHATIC	0	0	<1	7	49,237	15,163	30,638	34,152	34,017	18,323	12,309
PETROLEUM DISTILLATES, AROMATIC	35,085	9,925	10,610	2,851	6,182	2,916	5,486	2,092	2,136	1,160	367
PETROLEUM DISTILLATES, REFINED	61,294	114,467	927,849	846,418	318,728	371,411	1,023,900	779,702	1,175,944	1,237,629	1,484,514

Table 10A (cont.). The reported pounds of oil pesticides. As a broad group, oil pesticides and other petroleum distillates are on U.S. EPA's list of B2 carcinogens or the State's Proposition 65 list of chemicals "known to cause cancer."

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PETROLEUM HYDROCARBONS	24,333	7,278	8,051	3,185	1,019	985	642	956	1,574	1,407	184
PETROLEUM NAPHTHENIC OILS	9	2	3	91	325	208	24	48	158	240	234
PETROLEUM OIL, PARAFFIN BASED	270,998	310,791	371,181	418,474	281,516	364,770	433,848	405,894	558,255	504,964	493,509
PETROLEUM OIL, UNCLASSIFIED	20,334,019	18,541,147	17,989,907	13,668,208	15,929,777	15,527,171	15,932,497	16,232,606	18,241,502	13,418,820	13,503,780
PETROLEUM SULFONATES	<1	<1	1	<1	<1	0	0	0	<1	<1	<1
TOTAL	29,531,588	27,646,708	27,715,447	22,359,538	25,298,602	26,686,335	28,445,546	28,961,925	32,979,137	28,670,308	28,456,269

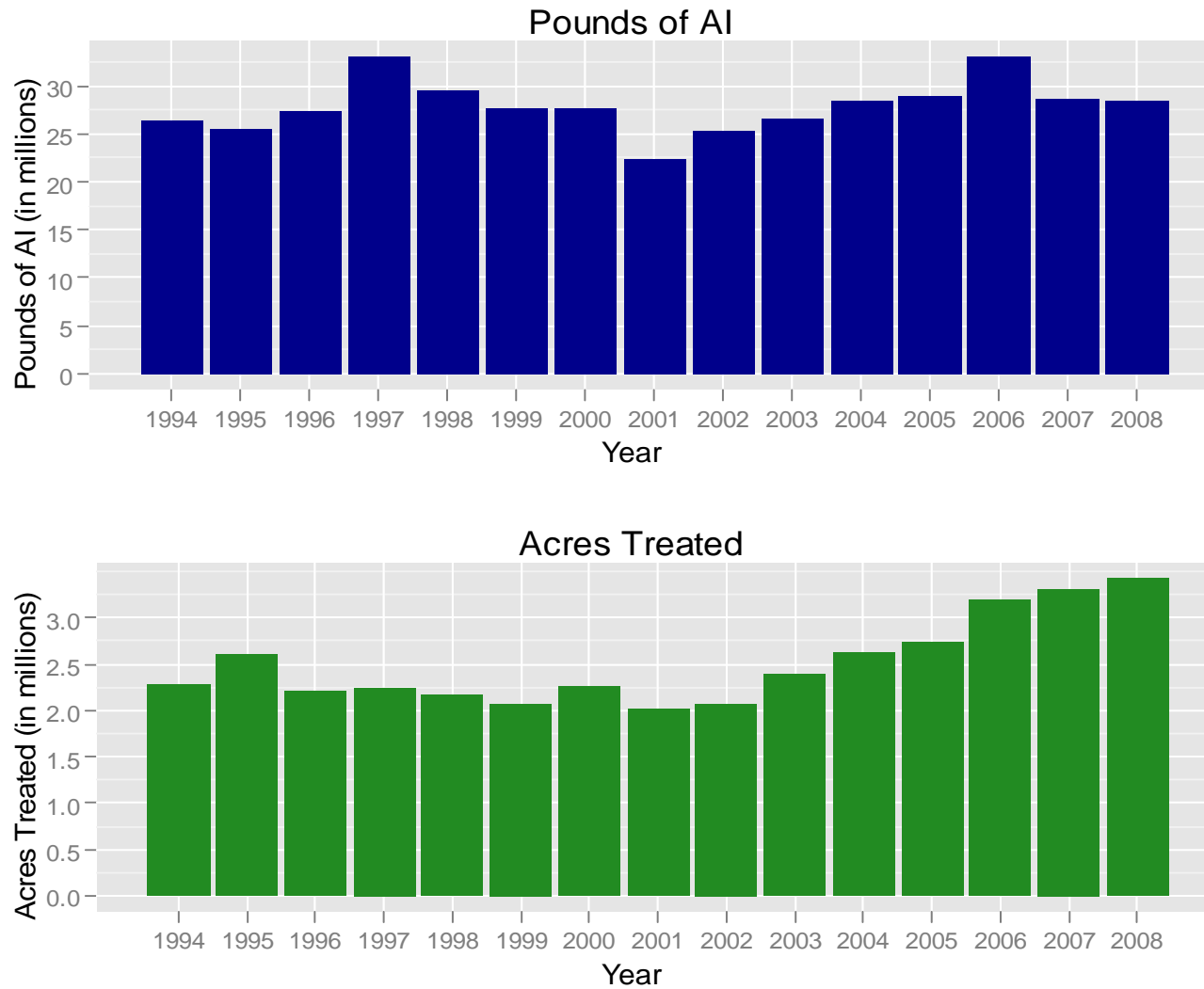
Table 10B. The reported cumulative acres treated in California with oil pesticides. (See qualifying comments on U.S. EPA B2 carcinogen and Proposition 65 listing with Table 9A.) Uses include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
COAL TAR HYDROCARBONS	0	0	0	<1	<1	0	0	0	0	0	0
HYDROTREATED PARAFFINIC SOLVENT	109,419	93,111	124,688	192,297	220,789	306,243	327,022	252,863	270,421	261,415	213,051
ISOPARAFFINIC HYDROCARBONS	164,561	139,939	134,149	92,768	53,847	56,120	67,795	55,920	39,757	27,903	18,629
KEROSENE	223,822	179,961	227,734	199,672	194,210	291,162	264,266	314,821	348,522	254,279	271,028
MINERAL OIL	226,710	204,895	204,621	226,195	246,310	337,986	407,046	478,445	596,338	816,118	847,115
MINERAL OIL, PETROLEUM DISTILLATES, SOLVENT REFINED LIGHT	0	0	0	0	0	0	0	0	959	522	760
NAPHTHA, HEAVY AROMATIC	0	0	0	11	0	<1	<1	0	0	0	0
PETROLEUM DERIVATIVE RESIN	13	1	<1	<1	<1	<1	<1	10	<1	0	0
PETROLEUM DISTILLATES	295,807	232,305	283,564	221,743	210,498	237,198	244,673	171,158	180,495	280,747	412,504
PETROLEUM DISTILLATES, ALIPHATIC	0	0	<1	5,104	44,494	26,131	25,904	22,723	34,136	31,441	27,852
PETROLEUM DISTILLATES, AROMATIC	2,153	7,088	6,299	1,900	3,935	1,808	519	385	658	383	107
PETROLEUM DISTILLATES, REFINED	6,162	12,495	42,145	48,446	35,413	39,830	79,589	117,570	200,933	231,859	288,355

Table 10B (cont.). *The reported cumulative acres treated in California with oil pesticides.*

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PETROLEUM HYDROCARBONS	2,970	3,993	2,777	4,029	3,269	2,869	108	430	260	546	334
PETROLEUM NAPHTHENIC OILS	50	37	<1	5,119	13,241	11,314	2,484	358	11,125	17,950	18,093
PETROLEUM OIL, PARAFFIN BASED	432,587	470,300	466,132	448,032	417,941	488,928	555,670	605,289	724,671	737,969	641,889
PETROLEUM OIL, UNCLASSIFIED	710,417	734,320	771,039	572,825	657,135	615,742	653,743	717,903	807,931	674,655	699,897
PETROLEUM SULFONATES	<1	<1	10	<1	<1	0	0	0	<1	<1	<1
TOTAL	2,174,621	2,078,349	2,263,136	2,007,065	2,080,932	2,395,024	2,621,876	2,734,754	3,202,318	3,315,786	3,419,349

Figure 7. Use trends of oil pesticides. As a broad group, oil pesticides and other petroleum distillates are on U.S. EPA’s list of B2 carcinogens or the State’s Proposition 65 list of chemicals “known to cause cancer.” However, these classifications do not distinguish among oil pesticides that may not qualify as carcinogenic due to their degree of refinement. Many such oil pesticides also serve as alternatives to high-toxicity chemicals. For this reason, oil pesticide data was classified separately in this report. Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation’s Pesticide Use Reports



USE TRENDS OF BIOPESTICIDES

Table 11A. The reported pounds of biopesticides applied in California. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Use includes both agricultural and non-agricultural applications. Zero values in early years likely indicate the pesticide was not yet registered for use. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
(3S, 6R)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	0	0	0	1	<1	<1	<1	0	0
(3S, 6S)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	0	0	0	<1	<1	<1	<1	0	0
(E)-4-TRIDECEN-1-YL-ACETATE	65	67	263	182	247	254	131	68	103	113	176
(E)-5-DECENOL	176	246	5	2	2	295	5	<1	4	2	2
(E)-5-DECENYL ACETATE	844	1,183	26	9	12	889	23	<1	17	7	8
(R,Z)-5-(1-DECENYL) DIHYDRO-2-(3H)-FURANONE	<1	0	<1	0	0		<1	<1	0	0	0
(S)-KINOPRENE	1,261	357	245	311	327	418	359	289	201	235	239
(Z)-11-HEXADECEN-1-YL ACETATE	0	0	0	0	35	10	10	5	6	2	0
(Z)-11-HEXADECENAL	0	0	0	0	35	10	10	5	6	2	0
(Z)-4-TRIDECEN-1-YL-ACETATE	2	2	9	6	8	8	4	2	3	4	6
(Z)-9-DODECENYL ACETATE	0	0	0	0	0	0	0	<1	<1	1	<1
(Z,E)-7,11-HEXADECADIEN-1-YL ACETATE	46	229	3	13	2	0	0	0	0	0	<1
(Z,Z)-11,13-HEXADECADIENAL	0	0	0	0	0	0	0	0	0	<1	<1
(Z,Z)-7,11-HEXADECADIEN-1-YL ACETATE	46	242	3	<1	3	0	0	0	0	0	0
1,7-DIOXASPIRO-(5,5)-UNDECANE	0	0	0	0	0	<1	0	<1	<1	<1	<1
1-DECANOL	<1	<1	<1	<1	0	0	0	0	0	0	0
1-METHYLCYCLOPROPENE	0	0	0	<1	<1	<1	<1	<1	<1	<1	<1
1-NAPHTHALENEACETAMIDE	283	333	217	213	88	119	113	55	30	49	55
3,13 OCTADECADIEN-1-YL ACETATE	0	0	0	0	0	0	0	0	0	0	44
3,7-DIMETHYL-6-OCTEN-1-OL	0	0	0	0	0	0	0	0	0	0	1
ACETIC ACID	2	3	1	<1	<1	<1	<1	<1	0	1	21
AGROBACTERIUM RADIOBACTER	432	225	179	114	144	211	183	27	291	371	23
AGROBACTERIUM RADIOBACTER, STRAIN K1026	0	0	<1	<1	1	<1	<1	<1	6	<1	<1

Table 11A (cont.). The reported pounds of biopesticides applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ALLYL ISOTHIOCYANATE	0	0	<1	<1	<1	<1	<1	<1	<1	0	0
AMINO ETHOXY VINYL GLYCINE HYDROCHLORIDE	8	1	<1	1	1	0	0	24	703	894	1,058
AMPELOMYCES QUISQUALIS	40	4	4	2	<1	<1	<1	<1	<1	<1	0
ASPERGILLUS FLAVUS STRAIN AF36	0	0	0	0	0	0	0	<1	0	0	0
AZADIRACTIN	654	16,770	1,215	1,523	1,474	1,366	2,915	1,340	2,407	2,221	2,191
BACILLUS PUMILUS, STRAIN QST 2808	0	0	0	0	0	<1	2	3,546	5,636	6,977	8,031
BACILLUS SPHAERICUS, SEROTYPE H-5A5B, STRAIN 2362	4,886	2,274	2,749	7,941	4,667	10,158	14,187	34,154	45,430	20,192	21,441
BACILLUS SUBTILIS GB03	<1	<1	<1	1	4	5	7	15	14	6	1
BACILLUS THURINGIENSIS (BERLINER)	751	24	76	115	16	11	12	16	35	27	16
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, GC-91 PROTEIN	4,282	3,017	4,419	3,953	3,980	5,024	4,088	11,255	9,377	20,474	20,464
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, SEROTYPE H-7	10,854	10,427	9,067	5,511	3,889	7,548	3,014	2,335	1,752	2,877	2,361
BACILLUS THURINGIENSIS (BERLINER), SUBSP. ISRAELENIS, SEROTYPE H-14	13,180	5,038	88,039	24,711	8,266	11,376	9,311	11,927	14,394	8,309	9,500
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI STRAIN SA-12	0	0	7,375	7,132	23,432	27,174	16,576	16,580	16,042	22,702	12,325
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	21,683	15,244	14,478	31,046	3,423	6,161	3,916	1,931	2,272	987	454
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG 2348	5,207	2,191	2,140	2,743	1,481	222	107	211	281	147	369
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG2371	1,633	213	139	58	19	39	2	5	1	0	0
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN SA-11	9,616	8,730	10,548	13,540	22,282	19,683	20,348	53,051	54,234	63,851	65,775

Table 11A (cont.). The reported pounds of biopesticides applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
BACILLUS THURINGIENSIS (BERLINER), SUBSP. SAN DIEGO	8	34	18	8	1	2	1	<1	2	2	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI STRAIN BMP 123	6	1	33	79	164	130	10	1	3	0	764
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7841 LEPIDOPTERAN ACTIVE TOXIN	12,522	12,831	16,773	8,739	681	1,503	344	338	3,872	632	277
BACILLUS THURINGIENSIS VAR. KURSTAKI STRAIN M-200	0	0	<1	<1	0	<1	0	0	0	<1	0
BACILLUS THURINGIENSIS VAR. KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7826	0	0	6,482	14,734	439	1,527	930	1,919	1,384	154	442
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN ABTS-1857	0	0	0	0	10,540	21,956	27,075	33,336	28,878	32,526	39,341
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN SD-1372, LEPIDOPTERAN ACTIVE TOXIN(S)	0	3	158	498	1,322	562	347	315	432	563	256
BACILLUS THURINGIENSIS, SUBSP. ISRAELENIS, STRAIN AM 65-52	0	0	0	271	9,485	29,326	23,001	41,734	59,018	40,376	52,969
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN ABTS-351, FERMENTATION SOLIDS AND SOLUBLES	0	0	0	3,021	15,491	38,034	46,754	57,985	53,346	70,048	77,760
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN HD-1	21,037	23,660	22,309	17,828	10,655	7,173	4,731	3,185	6,139	2,261	2,063
BACILLUS THURINGIENSIS, VAR. KURSTAKI DELTA ENDOTOXINS CRY 1A(C) AND CRY 1C (GENETICALLY ENGINEERED) ENCAPSULATED IN PSEUDOMONAS FLUORESCENS (KILLED)	12,634	8,055	7,166	2,211	258	54	5	3	<1	1	26
BEAUVERIA BASSIANA STRAIN GHA	1,250	923	915	678	1,041	715	863	824	570	704	568
CANDIDA OLEOPHILA ISOLATE I-182	216	55	0	0	0	0	0	0	0	0	0
CANOLA OIL	0	0	1	5	<1	1	4	1	4	29	24

Table 11A (cont.). The reported pounds of biopesticides applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CAPSICUM OLEORESIN	17	104	3	73	3	5	49	2	2	10	5
CASTOR OIL	174	24	557	297	504	1,281	363	79	37	4	4
CHITOSAN	0	0	0	0	0		<1	0	0	0	0
CINNAMALDEHYDE	<1	6,764	10,334	4,704	806	238	326	34	12	3	354
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	55,528	94,591	110,342	83,664	301,512	60,498	84,880	111,921	95,441	110,215	102,515
CODLING MOTH GRANULOSIS VIRUS	0	0	0	0	0	0	0	0	<1	<1	<1
CONIOTHYRIUM MINITANS STRAIN CON/M/91-08	0	0	0	0	103	171	198	6	11	6	0
CYTOKININ	<1	0	<1	<1	0	<1	0	0	0	0	0
DIHYDRO-5-HEPTYL-2(3H)-FURANONE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIHYDRO-5-PENTYL-2(3H)-FURANONE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
E,E-8,10-DODECADIEN-1-OL	849	21,029	7,091	6,390	5,107	1,802	1,113	2,193	2,126	2,203	1,786
E-11-TETRADECEN-1-YL ACETATE	163	548	397	65	122	132	91	79	99	2,397	746
E-8-DODECENYL ACETATE	57	66	170	73	61	113	122	110	225	229	243
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. KURSTAKI IN KILLED PSEUDOMONAS FLUORESCENS	35,129	28,435	17,792	6,442	2,948	445	114	7	6	32	18
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. SAN DIEGO IN KILLED PSEUDOMONAS FLUORESCENS	34	1	6	1	6		2	1	0	0	0
ESSENTIAL OILS	11	<1	<1	<1	<1	<1	1	<1	4	<1	0
ETHYLENE	1	5,073	6	6	3	24	32	0	0	0	0
EUCALYPTUS OIL	0	0	0	0	0	0	0	50	<1	0	0
EUGENOL	3	0	<1	0	0		3	<1	<1	0	0
FARNESOL	30	36	37	15	10	9	7	10	4	2	2
GAMMA AMINOBUTYRIC ACID	0	0	<1	23	3,102	6,077	8,402	8,081	4,201	1,739	944
GARLIC	10,203	7,113	897	1,490	667	295	174	203	89	142	212
GERANIOL	0	0	0	0	0	0	0	0	<1	0	1
GERMAN COCKROACH PHEROMONE	0	0	0	0	<1	<1	<1	<1	<1	<1	<1
GIBBERELLINS	23,085	19,775	21,009	19,435	24,946	20,415	20,372	23,443	22,916	22,694	21,597
GIBBERELLINS, POTASSIUM SALT	1	15	<1	1	<1	<1	1	<1	15	<1	<1

Table 11A (cont.). The reported pounds of biopesticides applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
GLIOCLADIUM VIRENS GL-21 (SPORES)	104	86	60	314	110	48	30	19	1	152	945
GLUTAMIC ACID	0	0	<1	23	3,102	6,077	8,402	8,081	4,201	1,739	944
HYDROGEN PEROXIDE	1	15	82	1,754	2,713	2,618	2,822	5,552	17,524	11,860	20,175
HYDROPRENE	1,486	1,609	1,703	1,380	1,656	1,043	1,309	2,910	11,970	2,282	2,380
IBA	43	9	34	18	16	13	19	11	31	20	11
LAGENIDIUM GIGANTEUM (CALIFORNIA STRAIN)	859	499	0	1	0		58	<1	0	<1	<1
LAURYL ALCOHOL	464	7,287	942	302	249	257	295	873	386	466	693
LINALOOL	631	229	197	173	274	280	174	176	170	113	63
METARHIZIUM ANISOPLIAE, VAR. ANISOPLIAE, STRAIN ESF1	37	15	18	15	22	<1	<1	<1	<1	<1	<1
METHOPRENE	3,030	10,285	14,312	2,483	5,117	7,875	8,874	9,900	6,941	3,357	2,620
METHYL ANTHRANILATE	49	57	50	37	85	34	534	151	449	152	118
METHYL SALICYLATE	0	0	0	<1	0	0	0	0	<1	<1	0
MUSCALURE	2	2	3	2	1	11	10	14	15	22	19
MYRISTYL ALCOHOL	94	1,502	192	62	51	52	60	177	79	95	141
MYROTHECIUM VERRUCARIA, DRIED FERMENTATION SOLIDS & SOLUBLES, STRAIN AARC-0255	8,496	18,824	20,869	45,917	36,104	47,037	39,789	27,977	25,039	29,951	23,867
NAA	240	14	35	10	6	5	9	13	9	4	31
NEROLIDOL	24	29	30	12	8	7	6	8	3	2	2
NITROGEN, LIQUIFIED	1,003,749	424,897	391,469	478,466	561,505	321,182	79,369	82,298	57,121	15,741	11,945
NONANOIC ACID	11,729	13,303	12,580	14,890	11,559	7,886	7,224	8,845	11,138	10,949	11,919
NONANOIC ACID, OTHER RELATED	617	700	662	784	608	415	380	466	586	576	627
NOSEMA LOCUSTAE SPORES	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
OIL OF ANISE	0	0	0	<1	<1	<1	<1	<1	<1	<1	<1
OIL OF BERGAMOT	0	0	0	0	0	0	0	0	<1	0	0
OIL OF CEDARWOOD	0	0	0	0	0	0	0	0	0	0	0
OIL OF CITRONELLA	5	11	1	33	0	0	0	<1	<1	<1	3
OIL OF LEMONGRASS	0	0	0	0	0	0	0	<1	<1	0	0
OIL OF MUSTARD	0	0	0	0	0	0	0	0	0	0	0
OXYPURINOL	0	0	<1	<1	0	0	0	<1	0	<1	0
PAECILOMYCES FUMOSOROSEUS APOPKA STRAIN 97	0	0	0	5	0	0	0	0	0	0	0
PERFUME	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 11A (cont.). The reported pounds of biopesticides applied in California.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
POLYHEDRAL OCCLUSION BODIES (OB'S) OF THE NUCLEAR POLYHEDROSIS VIRUS OF HELICOVERPA ZEA (CORN EARWORM)	0	0	0	0	0	1	1	0	0	0	<1
POTASSIUM BICARBONATE	65,909	92,785	130,446	121,796	180,072	283,920	159,772	388,854	162,836	114,150	109,060
PROPYLENE GLYCOL	68,506	54,833	63,611	56,899	60,567	50,356	44,235	47,765	42,348	28,168	23,537
PSEUDOMONAS FLUORESCENS, STRAIN A506	3,660	2,084	103	1,102	1,361	1,972	841	896	1,004	614	390
PSEUDOMONAS SYRINGAE STRAIN ESC-11	34	0	0	0	<1		20	<1	<1	0	0
PSEUDOMONAS SYRINGAE, STRAIN ESC-10	<1	0	0	0	0	0	0	0	<1	0	0
PUTRESCENT WHOLE EGG SOLIDS	19	136	112	140	184	186	110	60	69	20	1
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	0	0	882	7,201	18,957	17,323	16,619	14,039	17,135	16,976	16,579
S-METHOPRENE	2,652	409	371	366	867	762	530	1,138	1,391	1,726	3,530
SODIUM BICARBONATE	0	5	22	230	2,063		126	0	0	0	67
SODIUM LAURYL SULFATE	14	8	2	9	<1	<1	3	15	274	400	340
SOYBEAN OIL	18,578	59,695	40,963	27,651	31,726	33,006	50,301	20,587	70,398	14,747	12,005
STREPTOMYCES GRISEOVIRIDIS STRAIN K61	5	2	5	2	1	1	<1	<1	1	<1	<1
STREPTOMYCES LYDICUS WYEC 108	0	0	0	0	0	0	0	0	<1	<1	<1
SUCROSE OCTANOATE	0	0	0	0	0	0	0	0	2	0	1,685
THYME	0	0	0	0	0	0	0	0	171	485	579
TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2	60	121	125	116	55	43	37	16	24	38	20
XANTHINE	0	0	<1	<1	0	0	0	<1	0	<1	0
YUCCA SCHIDIGERA	0	0	0	0	0	0	0	0	0	0	5
Z,E-9,12-TETRADECADIEN-1-YL ACETATE	0	0	0	0	<1	0	0	0	0	1	0
Z-11-TETRADECEN-1-YL ACETATE	18	85	61	9	18	19	14	12	14	228	9
Z-8-DODECENOL	10	12	30	13	11	20	22	19	41	40	43
Z-8-DODECENYL ACETATE	888	1,009	2,645	1,127	935	1,738	1,875	1,693	3,398	3,542	3,720
Z-9-TETRADECEN-1-OL	0	0	0	0	<1	0	0	0	0	0	0
TOTAL	1,440,924	986,515	1,046,313	1,033,221	1,383,821	1,067,671	719,511	1,045,269	866,850	696,042	695,553

Table 11B. The reported cumulative acres treated in California with each biopesticide. Biopesticides includes microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Use includes primarily agricultural applications. The grand total for acres treated is less than the sum of acres for all active ingredients because some products contain more than one active ingredient. Zero values in early years likely indicate the pesticide was not yet registered for use. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
(3S, 6R)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	0	0	0	15	86	1,604	1,484	0	0
(3S, 6S)-3-METHYL-6-ISOPROPENYL-9-DECEN-1-YL ACETATE	0	0	0	0	0	15	86	1,604	1,484	0	0
(E)-4-TRIDECEN-1-YL-ACETATE	2,886	3,132	12,531	9,159	11,739	10,902	5,555	3,226	4,870	5,193	7,672
(E)-5-DECENOL	1,414	1,034	784	1,316	1,206	1,360	809	71	385	737	262
(E)-5-DECENYL ACETATE	1,414	1,034	784	1,316	1,206	1,360	809	71	385	737	262
(R,Z)-5-(1-DECENYL) DIHYDRO-2-(3H)-FURANONE	1	0	<1	0	0		15	<1	0	0	0
(S)-KINOPRENE	2,610	888	600	847	872	755	1,864	494	440	453	575
(Z)-11-HEXADECEN-1-YL ACETATE	0	0	0	0	1,053	476	365	164	183	116	0
(Z)-11-HEXADECENAL	0	0	0	0	1,053	476	365	164	423	72	0
(Z)-4-TRIDECEN-1-YL-ACETATE	2,886	3,132	12,531	9,159	11,739	10,902	5,555	3,226	4,870	5,193	7,672
(Z)-9-DODECENYL ACETATE	0	0	0	0	0	0	0	570	96	5,342	1,304
(Z,E)-7,11-HEXADECADIEN-1-YL ACETATE	82	148	171	128	87	0	0	0	0	0	1
(Z,Z)-11,13-HEXADECADIENAL	0	0	0	0	0	0	0	0	0	200	109
(Z,Z)-7,11-HEXADECADIEN-1-YL ACETATE	82	148	171	128	87	0	0	0	0	0	0
1,7-DIOXASPIRO-(5,5)-UNDECANE	0	0	0	0	0	0	0	49	4	55	<1
1-DECANOL	<1	<1	<1	<1	0	0	0	0	0	0	0
1-METHYLCYCLOPROPENE	0	0	0	3	<1	9	4	8	2	6	13
1-NAPHTHALENEACETAMIDE	5,211	5,418	4,135	3,690	1,705	2,355	2,201	1,100	666	927	870
3,13 OCTADECADIEN-1-YL ACETATE	0	0	0	0	0	0	0	0	0	0	85
3,7-DIMETHYL-6-OCTEN-1-OL	0	0	0	0	0	0	0	0	0	0	67
ACETIC ACID	9,038	13,693	3,618	1,182	1,146	734	290	60	0	10	2
AGROBACTERIUM RADIOBACTER	5,954	1,517	1,072	514	500	365	493	306	698	555	217
AGROBACTERIUM RADIOBACTER, STRAIN K1026	0	0	4	325	355	716	524	292	335	366	1,935
ALLYL ISOTHIOCYANATE	0	0	<1	1	<1	36	<1	20	<1	0	0
AMINO ETHOXY VINYL GLYCINE HYDROCHLORIDE	75	142	1	6	10	0	0	229	6,453	9,238	10,253
AMPELOMYCES QUISQUALIS	15,039	8,363	7,156	2,193	540	332	697	247	10	15	0

Table 11B (cont.). The reported cumulative acres treated in California with each biopesticide.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ASPERGILLUS FLAVUS STRAIN AF36	0	0	0	0	0	0	0	258	0	0	0
AZADIRACHTIN	64,239	103,078	71,394	73,876	92,145	79,581	64,488	55,657	68,244	91,275	85,545
BACILLUS PUMILUS, STRAIN QST 2808	0	0	0	0	0	1	4	34,748	64,333	79,765	90,586
BACILLUS SPHAERICUS, SEROTYPE H-5A5B, STRAIN 2362	84	39	<1	<1	<1	<1	<1	<1	<1	<1	<1
BACILLUS SUBTILIS GB03	<1	<1	<1	<1	<1	<1	379	23	3	2	5
BACILLUS THURINGIENSIS (BERLINER)	4,437	301	533	644	535	2	441	100	2,939	1,129	41
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, GC-91 PROTEIN	82,473	60,262	74,290	71,531	73,992	90,283	63,504	62,244	39,077	53,040	40,415
BACILLUS THURINGIENSIS (BERLINER), SUBSP. AIZAWAI, SEROTYPE H-7	86,430	85,564	65,943	41,378	31,487	54,037	24,160	19,190	15,784	24,379	20,390
BACILLUS THURINGIENSIS (BERLINER), SUBSP. ISRAELENSIS, SEROTYPE H-14	5,242	3,221	2,435	931	824	2,114	1,048	3,480	543	833	4,719
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI STRAIN SA-12	0	0	9,474	11,773	43,337	54,540	28,485	34,533	29,505	35,513	21,008
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, SEROTYPE 3A,3B	342,525	249,709	245,114	141,868	56,879	65,654	69,454	31,406	42,279	16,522	8,593
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG 2348	22,097	14,541	14,702	21,987	10,416	1,931	737	1,625	2,913	1,271	2,147
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN EG2371	11,015	1,684	849	439	134	338	19	54	7	0	0
BACILLUS THURINGIENSIS (BERLINER), SUBSP. KURSTAKI, STRAIN SA-11	161,858	152,834	143,664	168,496	180,621	158,448	123,796	156,026	125,390	119,045	95,496
BACILLUS THURINGIENSIS (BERLINER), SUBSP. SAN DIEGO	6	20	18	7	2	3	1	<1	<1	<1	0
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI STRAIN BMP 123	87	7	687	1,913	6,279	3,013	268	20	93	0	1,898

Table 11B (cont.). The reported cumulative acres treated in California with each biopesticide.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7841 LEPIDOPTERAN ACTIVE TOXIN	81,541	83,094	118,628	55,515	5,061	8,479	1,766	1,160	6,684	1,225	451
BACILLUS THURINGIENSIS VAR. KURSTAKI STRAIN M-200	0	0	2	<1	0	0	0	0	0	<1	0
BACILLUS THURINGIENSIS VAR. KURSTAKI, GENETICALLY ENGINEERED STRAIN EG7826	0	0	30,603	76,935	2,571	8,493	6,457	8,724	3,021	479	1,298
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN ABTS-1857	0	0	0	0	13,835	34,164	38,718	47,071	41,546	43,209	49,759
BACILLUS THURINGIENSIS, SUBSP. AIZAWAI, STRAIN SD-1372, LEPIDOPTERAN ACTIVE TOXIN(S)	0	32	1,561	4,718	10,897	4,989	3,465	3,025	4,235	4,766	2,343
BACILLUS THURINGIENSIS, SUBSP. ISRAELENIS, STRAIN AM 65-52	0	0	0	<1	5	1	3	313	4,809	25	2,497
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN ABTS-351, FERMENTATION SOLIDS AND SOLUBLES	0	0	0	6,938	33,146	75,373	94,559	109,681	100,697	133,269	133,594
BACILLUS THURINGIENSIS, SUBSP. KURSTAKI, STRAIN HD-1	202,653	217,136	199,385	170,574	110,540	62,367	44,536	29,129	23,346	20,045	15,146
BACILLUS THURINGIENSIS, VAR. KURSTAKI DELTA ENDOTOXINS CRY 1A(C) AND CRY 1C (GENETICALLY ENGINEERED) ENCAPSULATED IN PSEUDOMONAS FLUORESCENS (KILLED)	23,196	14,779	14,742	4,622	546	111	7	<1	<1	<1	25
BEAUVERIA BASSIANA STRAIN GHA	2,991	25,510	3,405	2,853	3,702	2,887	4,019	3,531	2,743	2,448	2,091
CANDIDA OLEOPHILA ISOLATE I-182	<1	<1	0	0	0	0	0	0	0	0	0
CANOLA OIL	0	<1	2	2	2	2	<1	2	5	33	1,266
CAPSICUM OLEORESIN	2,762	1,799	261	254	149	318	379	71	247	277	528
CASTOR OIL	<1	<1	1	<1	<1	<1	<1	<1	2	<1	4
CHITOSAN	0	0	0	0	0		<1	0	0	0	0
CINNAMALDEHYDE	<1	2,418	4,139	1,534	295	105	137	18	10	2	556
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	22,092	45,247	49,142	36,602	34,157	38,357	51,009	69,051	73,386	71,183	62,389

Table 11B (cont.). The reported cumulative acres treated in California with each biopesticide.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CODLING MOTH GRANULOSIS VIRUS	0	0	0	0	0	0	0	0	1,479	2,141	1,487
CONIOTHYRIUM MINITANS STRAIN CON/M/91-08	0	0	0	0	935	1,301	1,781	26	63	120	0
CYTOKININ	82	0	3	<1	0	<1	0	0	0	0	0
DIHYDRO-5-HEPTYL-2(3H)- FURANONE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
DIHYDRO-5-PENTYL-2(3H)- FURANONE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
E,E-8,10-DODECADIEN-1-OL	4,300	4,514	10,407	10,381	11,841	21,255	17,383	21,896	20,728	27,784	21,536
E-11-TETRADECEN-1-YL ACETATE	2,171	54,460	38,834	14,063	16,870	10,335	8,836	7,351	6,637	6,189	6,093
E-8-DODECENYL ACETATE	11,791	23,549	22,721	33,383	33,602	39,198	41,752	33,419	37,412	49,086	54,242
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. KURSTAKI IN KILLED PSEUDOMONAS FLUORESCENS	83,238	59,905	32,372	15,188	7,529	1,160	143	33	9	35	91
ENCAPSULATED DELTA ENDOTOXIN OF BACILLUS THURINGIENSIS VAR. SAN DIEGO IN KILLED PSEUDOMONAS FLUORESCENS	19	7	6	4	<1		1	1	0	0	0
ESSENTIAL OILS	<1	<1	6	268	<1	<1	1	<1	<1	1	0
ETHYLENE	<1	2	<1	<1	<1	<1	7	0	0	0	0
EUCALYPTUS OIL	0	0	0	0	0	0	0	150	<1	0	0
EUGENOL	1	0	<1	0	0		15	<1	<1	0	0
FARNESOL	12,543	43,212	25,673	8,495	6,584	5,451	4,294	4,369	1,246	652	422
GAMMA AMINOBUTYRIC ACID	0	0	1	320	43,682	87,153	117,477	114,189	58,586	24,697	12,834
GARLIC	12,403	7,376	4,690	2,407	2,756	828	259	513	363	346	288
GERANIOL	0	0	0	0	0	0	0	0	<1	0	67
GERMAN COCKROACH PHEROMONE	0	0	0	0	<1	<1	<1	6	<1	<1	<1
GIBBERELLINS	487,195	439,529	464,775	387,488	423,337	431,001	414,093	462,231	458,764	454,509	490,488
GIBBERELLINS, POTASSIUM SALT	70	1,429	8	188	22	59	170	65	348	32	9
GLIOCLADIUM VIRENS GL-21 (SPORES)	29	12	8	768	6	<1	<1	18	<1	5	1,090
GLUTAMIC ACID	0	0	1	320	43,682	87,153	117,477	114,189	58,586	24,697	12,834
HYDROGEN PEROXIDE	<1	5	21	485	636	802	1,057	985	9,952	7,744	9,144
HYDROPRENE	1	1	<1	1	<1	<1	<1	<1	7	2	200
IBA	1,319	1,236	271	124	244	252	1,566	79	27,670	44,093	3,858

Table 11B (cont.). The reported cumulative acres treated in California with each biopesticide.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
LAGENIDIUM GIGANTEUM (CALIFORNIA STRAIN)	<1	<1	0	<1	0		24	2	0	<1	<1
LAURYL ALCOHOL	2,886	2,666	8,038	6,429	4,635	4,791	6,009	6,719	5,488	9,358	7,782
LINALOOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	7
METARHIZIUM ANISOPLIAE, VAR. ANISOPLIAE, STRAIN ESF1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
METHOPRENE	23	58	38	50	<1	359	1	<1	157	51	42
METHYL ANTHRANILATE	<1	<1	<1	<1	81	56	1,458	448	1,557	298	219
METHYL SALICYLATE	0	0	0	<1	0	0	0	0	<1	1	0
MUSCALURE	979	292	473	189	121	2,283	307	2,715	476	1,179	<1
MYRISTYL ALCOHOL	2,886	2,666	8,038	6,429	4,635	4,791	6,009	6,719	5,488	9,358	7,782
MYROTHECIUM VERRUCARIA, DRIED FERMENTATION SOLIDS & SOLUBLES, STRAIN AARC-0255	1,514	3,348	3,173	4,392	3,926	4,390	8,348	4,680	4,478	5,097	5,257
NAA	542	788	177	102	72	75	1,096	49	26,799	43,507	3,327
NEROLIDOL	12,543	43,212	25,673	8,495	6,584	5,451	4,294	4,369	1,246	652	422
NITROGEN, LIQUIFIED	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
NONANOIC ACID	645	573	496	495	443	476	1,075	675	877	1,275	1,179
NONANOIC ACID, OTHER RELATED	645	573	496	495	443	476	1,075	675	877	1,275	1,179
NOSEMA LOCUSTAE SPORES	7	14	2	9	<1	35	37	1	<1	254	30
OIL OF ANISE	0	0	0	<1	<1	<1	<1	<1	<1	<1	<1
OIL OF BERGAMOT	0	0	0	0	0	0	0	0	<1	0	0
OIL OF CEDARWOOD	0	0	<1	0	0	0	0	0	0	0	0
OIL OF CITRONELLA	80	24	1	<1	0	<1	0	<1	<1	<1	2
OIL OF LEMONGRASS	0	0	0	0	0	0	0	20	<1	0	0
OIL OF MUSTARD	0	0	0	0	0	0	0	0	0	0	0
OXPURINOL	0	0	<1	<1	0	0	0	<1	0	1	0
PAECILOMYCES FUMOSOROSEUS AOPKA STRAIN 97	0	0	0	13	0	0	0	0	0	0	0
PERFUME	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
POLYHEDRAL OCCLUSION BODIES (OB'S) OF THE NUCLEAR POLYHEDROSIS VIRUS OF HELICOVERPA ZEA (CORN EARWORM)	0	0	0	0	0	293	742	0	0	0	98
POTASSIUM BICARBONATE	34,010	52,110	60,330	52,654	74,151	106,988	64,994	143,968	61,465	47,285	41,893
PROPYLENE GLYCOL	1,208,619	961,979	1,057,746	812,714	746,000	763,898	778,321	754,665	738,448	520,502	418,605

Table 11B (cont.). The reported cumulative acres treated in California with each biopesticide.

AI	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PSEUDOMONAS FLUORESCENS, STRAIN A506	29,656	15,760	1,443	11,668	13,126	16,945	6,559	7,176	11,929	4,801	1,943
PSEUDOMONAS SYRINGAE STRAIN ESC-11	17	0	0	0	<1		<1	<1	<1	0	0
PSEUDOMONAS SYRINGAE, STRAIN ESC-10	<1	0	0	0	0	0	0	0	<1	0	0
PUTRESCENT WHOLE EGG SOLIDS	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	0	0	2,154	15,205	40,786	54,547	58,871	56,342	64,606	67,563	75,593
S-METHOPRENE	505	<1	567	951	166	21	49	2,395	9,552	30,635	47,287
SODIUM BICARBONATE	0	8	<1	<1	<1		100	0	0	0	17
SODIUM LAURYL SULFATE	48	<1	16	<1	29	<1	<1	<1	<1	<1	14
SOYBEAN OIL	10,427	13,609	12,837	11,254	18,627	15,359	9,870	6,344	3,675	3,277	2,460
STREPTOMYCES GRISEOVIRIDIS STRAIN K61	34	27	83	50	17	14	5	20	29	12	<1
STREPTOMYCES LYDICUS WYEC 108	0	0	0	0	0	0	0	0	50	96	1,910
SUCROSE OCTANOATE	0	0	0	0	0	0	0	0	4	0	448
THYME	0	0	0	0	0	0	0	0	<1	<1	<1
TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2	369	456	885	1,048	293	466	833	406	286	311	201
XANTHINE	0	0	<1	<1	0	0	0	<1	0	1	0
YUCCA SCHIDIGERA	0	0	0	0	0	0	0	0	0	0	18
Z,E-9,12-TETRADECADIEN-1-YL ACETATE	0	0	0	0	13	0	0	0	0	44	0
Z-11-TETRADECEN-1-YL ACETATE	2,171	54,460	38,834	14,063	16,870	10,335	8,836	7,351	6,637	6,166	5,040
Z-8-DODECENOL	11,791	23,549	22,721	33,383	33,602	39,198	41,752	33,419	37,412	49,086	54,291
Z-8-DODECENYL ACETATE	11,791	23,549	22,721	33,383	33,602	39,198	41,752	33,419	37,412	49,086	54,291
Z-9-TETRADECEN-1-OL	0	0	0	0	13	0	0	0	0	0	0
TOTAL	3,060,138	2,779,079	2,821,087	2,298,987	2,176,590	2,328,885	2,175,148	2,304,744	2,188,554	2,022,135	1,864,664

Figure 8. Use trends of biopesticides. Biopesticides include microorganisms and naturally occurring compounds, or compounds essentially identical to naturally occurring compounds that are not toxic to the target pest (such as pheromones). Reported pounds of active ingredient (AI) applied include both agricultural and reportable non-agricultural applications. The reported cumulative acres treated include primarily agricultural applications. Data are from the Department of Pesticide Regulation's Pesticide Use Reports.



V. TRENDS IN PESTICIDE USE IN CERTAIN COMMODITIES

This summary describes possible reasons for changes in pesticide use from 2007 to 2008 for the following commodities: (1) almonds, (2) wine grapes, (3) table and raisin grapes, (4) alfalfa, (5) cotton, (6) processing tomatoes, (7) oranges, (8) rice, (9) head lettuce, (10) walnuts, (11) peaches and nectarines, (12) strawberries, and (13) carrots. These 13 commodities were chosen because each was treated with more than 3 million pounds of active ingredients (AIs) or cumulatively treated on more than 1.9 million acres. Collectively, this represents 70 percent of all reported pesticide pounds used (76 percent of all pounds used on agricultural fields) and 72 percent of the acres treated in 2008.

Information used to develop this section was drawn from several publications and phone interviews with pest control advisors, growers, University of California Cooperative Extension farm advisors and specialists, researchers, and commodity association representatives. DPR staff analyzed the information, using their knowledge of pesticides, California agriculture, pests, and pest management practices to draw conclusions about possible explanations for changes in pesticide use. However, it is important to note these explanations are based on anecdotal information, not rigorous statistical analyses.

Reported pesticide use in California in 2008 totaled 162 million pounds, a decrease of 10 million pounds from 2007 (6.0 percent). The AIs with the largest uses by pounds were sulfur, petroleum and mineral oils, 1,3-dichloropropene (1,3-D), metam-sodium, and glyphosate. Sulfur accounted for 25 percent of all reported pesticide use in 2008. Sulfur use decreased by 5.7 million pounds (12 percent) from 2007 to 2008, and accounted for most of the decrease in pounds of AI. Sulfur is a natural fungicide favored by both conventional and organic farmers and is used mostly to control powdery mildew on grapes and processing tomatoes. Other pesticides that declined in use include copper-based pesticides (1.2 million pound decrease, 17 percent), the fumigant methyl bromide (790,000 pound decrease, 12 percent), the fumigant metam-sodium (680,000 pound decrease, 7 percent), and the wood preservative othilinone (410,000 pound decrease, 92 percent). Oils are used mostly as insecticides and miticides in orchards. Copper-based pesticides are used mostly in rice, oranges, walnuts, almonds, and grapes; methyl bromide is used mostly for strawberries and nurseries; metam-sodium is used for carrots, potatoes, and processing tomatoes; and glyphosate, an herbicide, is used mostly on almonds, rights of way, wine grapes, and landscaping.

In contrast, use of some pesticides increased. Pesticides with the greatest increase in pounds applied were the fumigant potassium n-methyldithiocarbamate (also called metam-potassium) (1.7 million pound increase, 45 percent), the adjuvant calcium hydroxide (520,000 pound increase, 12 percent), the disinfectant chlorine (420,000 pounds increase, 49 percent), and the herbicide pendimethalin (320,000 pounds increase, 29 percent). Metam-potassium was used mostly for tomatoes and carrots and its use increased primarily as a replacement for other fumigants. The use of all fumigants was nearly the same in 2008 as in 2007. Pendimethalin was used mostly in alfalfa and almonds but the increase in use was in alfalfa.

Different pesticides are used at different rates. In California, most pesticides are applied at rates of around 1 to 2 pounds per acre. However, fumigants are usually applied at rates of hundreds of pounds per acre. Thus, comparing use by pounds will emphasize fumigants. Comparing use among different pesticides using acres treated gives a different picture.

Total acres treated with all pesticides in 2008 was 66 million, a decrease from 2007 of 2 million (3.3 percent). By acres treated, the non-adjuvant pesticides with the greatest use in 2008 were sulfur, glyphosate, oils, oxyfluorfen, and copper compounds. Most of the decrease in total acres treated was from decreases in sulfur and spinosad, with smaller decreases in paraquat dichloride, glyphosate, and trifluralin. AIs with the largest increase in acres treated were spinetoram and glufosinate-ammonium; smaller increases occurred with lambda-cyhalothrin, pendimethalin, and indoxacarb. Glyphosate, oxyfluorfen, paraquat dichloride, and trifluralin are all herbicides, mostly used on almonds, grapes, and alfalfa. Spinosad is an insecticide use mostly on lettuce, oranges, olives, and grapes. Spinetoram is a new insecticide, first used in California in 2007, mostly on lettuce and strawberries. Glufosinate-ammonium is an herbicide used mostly in almonds and grapes.

DPR data analyses have shown that pesticide use varies from year to year depending upon pest problems, weather, acreage and types of crops planted, economics, and other factors. The winter and spring of 2008 were relatively dry which probably resulted in less weed and disease pressure. Lygus bugs were a problem in some areas for cotton and strawberries because of changing cropping patterns. Also, mites were a problem for some crops because of the dry, hot summer. The reduction in spinosad use was due to increased use of spinetoram, a second-generation version of spinosad. Use of glufosinate-ammonium, a fairly recent herbicide, has probably increased as a replacement for some use of glyphosate, because of increased prevalence of glyphosate-resistant weeds.

In the following tables, use is given by pounds of AI applied and by acres treated. Acres treated means the cumulative number of acres treated; the acres treated in each application are summed even when the same field is sprayed more than once in a year. (For example, if the same acre is treated three times in a calendar year with an individual AI, it is counted as three acres treated).

Almonds

There are three distinct almond growing regions in California: the Sacramento Valley, Central San Joaquin Valley and Southern San Joaquin Valley. Weather conditions and pest pressure vary greatly from the northern region to the south. Almonds are California's largest tree nut crop in total dollar value and acreage and are the largest horticultural export from the United States. Total worldwide shipments increased 18 percent in fiscal year 2007/2008 reaching a total of 1.26 billion pounds.

Table 12A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for almonds each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, May 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	16,189,822	17,133,637	21,249,205	19,538,857	19,174,395
Acres Treated	7,316,210	8,898,957	11,226,899	10,464,255	10,035,599
Acres Planted	640,000	690,000	730,000	740,000	795,000
Price \$/lbs	\$2.21	\$2.81	\$2.06	\$1.75	\$1.40

Table 12B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for almonds each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	21	6	24	-8	-2
Acres Treated	15	22	26	-7	-4
Acres Planted	5	8	6	1	7
Price \$/lbs	41	27	-27	-15	-20

Figure 9. Acres of almonds treated by all AIs in the major types of pesticides from 1994 to 2008.

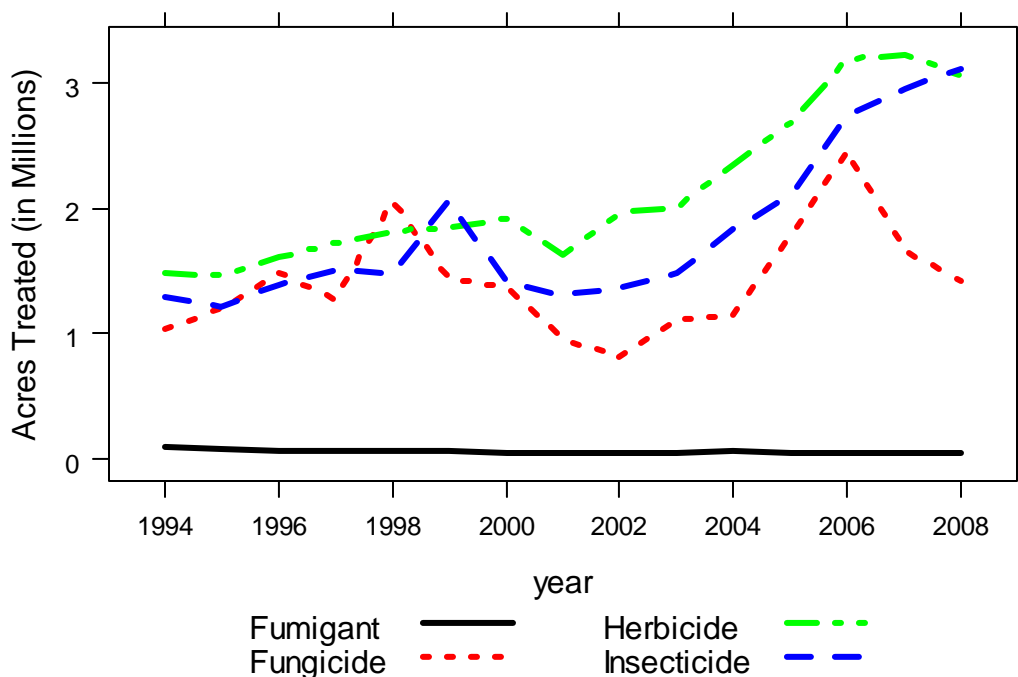


Table 12C. *The non-adjuvant pesticides with the largest change in acres treated of almonds from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.*

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
OIL	INSECTICIDE	483,367	544,607	680,308	730,564	822,304	91,741	13
PARAQUAT DICHLORIDE	HERBICIDE	242,179	286,201	349,596	335,509	256,183	-79,326	-24
GLYPHOSATE	HERBICIDE	1,034,569	1,223,314	1,343,037	1,316,550	1,242,707	-73,843	-6
GLUFOSINATE- AMMONIUM	HERBICIDE	7,986	30,358	62,777	129,008	201,060	72,052	56
CHLORPYRIFOS	INSECTICIDE	153,321	155,355	293,689	227,409	157,563	-69,846	-31
PYRIPROXYFEN	INSECTICIDE	76,974	91,566	101,867	1.00E+05	161,339	61,414	61
PROPICONAZOLE	FUNGICIDE	87	245	216	128	56,039	55,911	43,681
FLUMIOXAZIN	HERBICIDE		72,753	119,285	157,526	107,544	-49,981	-32
AZOXYSTROBIN	FUNGICIDE	100,953	255,380	219,046	79,259	39,527	-39,732	-50
CYPRODINIL	FUNGICIDE	266,986	268,997	234,041	151,630	114,081	-37,549	-25
ZIRAM	FUNGICIDE	61,926	104,207	155,830	90,259	53,534	-36,725	-41
MYCLOBUTANIL	FUNGICIDE	50,734	48,825	29,967	51,188	15,991	-35,196	-69
BOSCALID	FUNGICIDE	74,064	266,613	473,272	271,143	236,133	-35,010	-13
PYRACLOSTROBIN	FUNGICIDE	74,064	266,613	473,272	271,130	236,133	-34,997	-13
RIMSULFURON	HERBICIDE				2,554	35,188	32,635	1,278

Total pesticides applied in 2008, looking at acres treated and pounds AI applied were slightly lower compared to 2007. Weather in 2008 could be described as a “mixed bag.” Conditions were characterized by alternating periods of wet and dry, temperature swings from cool to hot including periods where hot dry winds increased moisture loss. Smoky conditions caused by numerous fires up and down the state were thought by some to have affected crop maturity. Dry conditions overall resulted in a reduction in the use of most fungicides. Exceptions were increased use of pyrimethanil, propiconazole, difenoconazole and fenbuconazole. Use of pyrimethanil increased to help manage strobilurin-resistant alternaria and almond scab. Propiconazole, difenoconazole and fenbuconazole are new materials that also fit well into a resistance management program.

Key arthropod pests in almonds are navel orangeworm (NOW), San Jose scale (SJS), peach twig borer (PTB), web-spinning mites, and ants. Data from 2008 show growers are shifting from broad-spectrum to reduced-risk insecticides. Winter sanitation to eliminate mummy nuts has become a standard practice to reduce over wintering NOW larva. Acres treated with oils alone in the dormant season increased 11 percent in 2008. Dormant sprays with oils alone were applied to control low to moderate populations of SJS. Other insecticides were added with the oil to control high populations of SJS and PTB. Compliance with European Union (EU) aflatoxin levels is an industry concern. Since insect damage to almond nuts can contribute to invasion by molds that produce aflatoxin, some growers changed their insecticide program specifically to protect the crop from insect damage that could compromise EU shipments.

In general, worms were not a big problem in 2008. In-season use of insecticides for worm control was slightly higher in 2008 compared to 2007. Notable increases in acres treated included methoxyfenozide, esfenvalerate, diflubenzuron, and bifenthrin. Acres treated with bifenthrin (Brigade) were up in 2008 to control navel orangeworm. Brigade is a new pyrethroid product that has been shown to be effective against NOW, and does not flare mites like

esfenvalerate and some of the older pyrethroids do. One Brigade treatment for NOW and a reduced-risk methoxyfenozide spray to control PTB, when necessary, are reportedly replacing conventional azinphos-methyl and phosmet treatments at hull split. Use of spinetoram, a new product that is effective in controlling NOW, showed a big increase in acres treated in 2008. Correspondingly, use of chlorpyrifos, permethrin, and phosmet were down, chlorpyrifos by as much as 30 percent.

Mites were a problem later in the 2008 season due to dry, hot weather. Acres treated with abamectin increased compared to 2007. Other increases included use of hexythiazox, etoxizole, fenproxiimate, bifentazate, spiromeclofen, and s-methoprene. As a result acres treated with propargite were down over 30 percent.

Growers reported treatment for ants in all growing regions using abamectin or pyriproxifen (Esteem). The use of abamectin for both mites and ants may have been a factor in the increased use.

The number of acres treated with herbicides in 2008 decreased slightly but overall was pretty close to that treated in 2007. The increased use of glufosinate-ammonium and rimsulfuron, used to control glyphosate-resistant weeds, were notable exceptions.

Total pounds applied and acres treated with 1,3-dichloropropene, methyl bromide, and sodium tetrathiocarbonate decreased in 2008 and use of chloropicrin increased. Chloropicrin was reportedly the material of choice in 2008 to control replant disease.

Wine Grapes

In 2008, roughly 62 percent of California vineyards produced wine grapes. There are four major wine grape production regions: 1) North Coast (Lake, Mendocino, Napa, Sonoma, and Solano counties); 2) Central Coast (Alameda, Monterey, San Luis Obispo, Santa Barbara, San Benito, Santa Cruz, and Santa Clara counties); 3) Northern San Joaquin Valley (San Joaquin, Calaveras, Amador, Sacramento, Merced, Stanislaus, and Yolo counties); and 4) Southern San Joaquin Valley (Fresno, Kings, Tulare, Kern, and Madera counties). The total pounds of pesticide active ingredients applied to wine grapes decreased by 13 percent in 2008 compared to 2007 and acres treated decreased by 9 percent. Factors that influence changes in pesticide use on wine grapes include weather, topography, pest pressures (which vary by region), competition from newer pesticide products, application restrictions, efforts by growers to reduce costs, and increasing emphasis on sustainable farming. The pooled figures in this report may not reflect differences in pesticide use patterns between production regions.

Table 13A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for wine grapes each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, March 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	27,644,413	33,749,192	23,993,654	24,331,410	21,193,224
Acres Treated	7,272,067	8,723,471	7,842,768	7,866,689	7,169,542
Acres Planted	513,000	522,000	527,000	523,000	526,000
Price \$/ton	\$570.00	\$582.00	\$582.00	\$564.00	\$609.00

Table 13B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for wine grapes each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-3	22	-29	1	-13
Acres Treated	-3	20	-10	0	-9
Acres Planted	-3	2	1	-1	1
Price \$/ton	8	2	0	-3	8

Figure 10. Acres of wine grapes treated by all AIs in the major types of pesticides from 1994 to 2008.

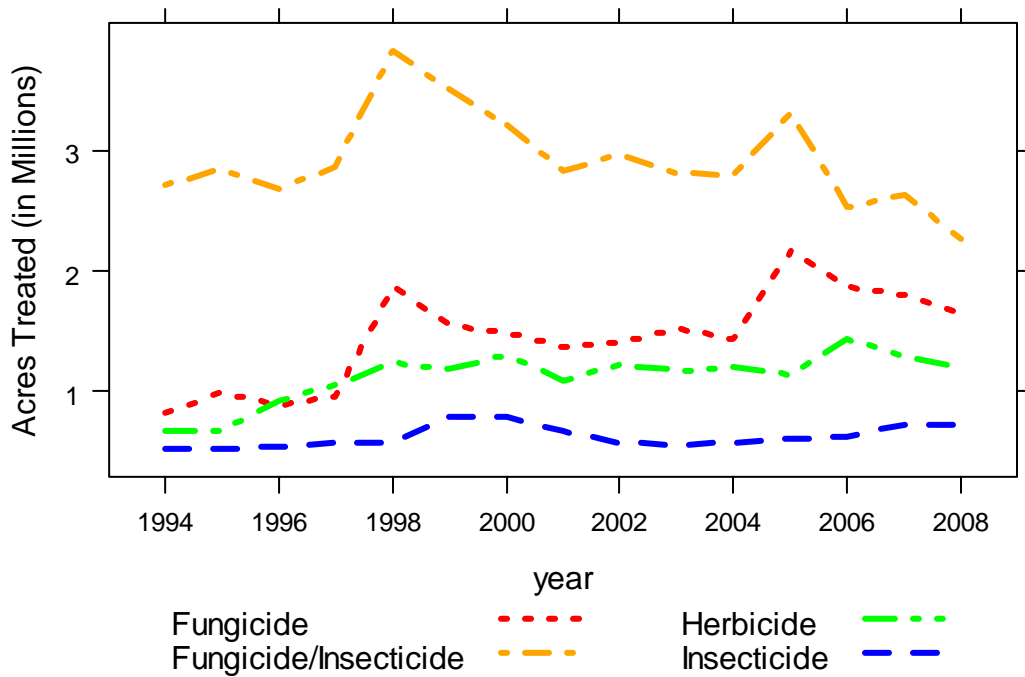


Table 13C. The non-adjuvant pesticides with the largest change in acres treated of wine grapes from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
SULFUR	FUNGICIDE/ INSECTICIDE	2,721,270	3,178,353	2,320,783	2,388,294	1,972,855	-415,439	-17
OIL	INSECTICIDE	89,318	134,231	232,686	292,795	380,824	88,029	30
GLUFOSINATE-AMMONIUM	HERBICIDE	18,891	19,883	90,345	92,699	180,094	87,395	94
GLYPHOSATE	HERBICIDE	464,787	475,458	473,164	471,086	410,108	-60,978	-13
PARAQUAT DICHLORIDE	HERBICIDE	155,644	146,912	177,339	128,737	78,714	-50,023	-39
MYCLOBUTANIL	FUNGICIDE	281,995	293,425	269,688	224,548	180,712	-43,836	-20
FLUMIOXAZIN	HERBICIDE		35,746	86,011	111,439	70,782	-40,657	-36
KRESOXIM-METHYL	FUNGICIDE	48,772	67,542	50,470	66,846	39,315	-27,532	-41
SIMAZINE	HERBICIDE	145,260	118,378	143,447	96,437	69,102	-27,335	-28
TEBUCONAZOLE	FUNGICIDE	130,382	177,130	103,719	137,225	116,670	-20,554	-15
BACILLUS PUMILUS, STRAIN QST 2808	FUNGICIDE	4	10,074	16,608	22,284	36,723	14,439	65
RIMSULFURON	HERBICIDE				147	14,258	14,111	9,590
FENHEXAMID	FUNGICIDE	30,663	48,182	33,957	33,173	19,162	-14,010	-42
FENPYROXIMATE	INSECTICIDE	3,982	25,342	23,433	19,509	33,473	13,963	72
THIOPHANATE-METHYL	FUNGICIDE	3,687	7,402	3,930	17,538	3,903	-13,635	-78

The acres treated with insecticides decreased marginally (by 1 percent) from 2007. The major insecticides applied in 2008 by acres treated were imidacloprid, oils, methoxyfenozide, chlorpyrifos, bifentazate, abamectin, etoxazole, and fenpyroximate. Chlorpyrifos is used before budbreak and after harvest to control mealybug infestations; imidacloprid is used during warmer weather between budbreak and harvest. Methoxyfenozide is used to control various moths, such as omnivorous leafroller (*Platynota stultana*). In 2008, acreage treated with oils increased by 30 percent. Oils have many attractive, broad-spectrum properties and are low-risk. Increasingly mixed with fungicides, oils can replace a surfactant and eradicate mildew growth, as well as suppress mites and insects such as grape leafhoppers. Bifentazate, fenpyroximate, and etoxazole are selective alternatives to older, higher-risk miticides, which have longer worker re-entry periods.

Acres treated with sulfur decreased by 17 percent, while acres treated with all other fungicides decreased by 8.1 percent. Sulfur, copper-based pesticides, pyraclostrobin, boscalid, myclobutanil, and trifloxystrobin were the most-used fungicides in terms of acres treated. Acres treated with lime sulfur in early 2008 against overwintering disease inoculum decreased by 36 percent. Dormant season disease pressure was low in 2008 due to low rainfall. Copper-based pesticides, used to treat downy mildew and botrytis bunch rot, was applied to 3 percent fewer acres in 2008 compared to 2007.

The acres treated with herbicides decreased by 7 percent in 2008 compared to 2007. In terms of acres treated, herbicides used most in wine grapes were glyphosate, oxyfluorfen, glufosinate-ammonium, paraquat, flumioxazin, and simazine. The acres treated with simazine, paraquat, and flumioxazin decreased dramatically, by 28, 39, and 36 percent respectively. In contrast,

glufosinate-ammonium-treated acreage doubled from 2007, while rimsulfuron-treated acreage increased 140 times. This is likely due to the increased prevalence of glyphosate-resistant weeds, such as marestail (*Conyza canadensis*) and fleabane (*Conyza bonariensis*), in vineyards. Both glufosinate-ammonium and rimsulfuron are used specifically to control these weed species.

Acres treated with Plant growth regulators (PGR) decreased by 18 percent in 2008 compared to 2007. The most common PGRs were gibberellins, which are applied in early spring in order to lengthen and loosen grape clusters. Less compact clusters may be less vulnerable to berry splitting and bunch rot.

Table and Raisin Grapes

Table and raisin grapes comprised approximately 38 percent of California's total grape crop in 2008, the rest being wine grapes. These categories shift depending on market conditions, since some grape varieties can be used for more than one purpose. Thompson Seedless is the leading raisin grape variety, while Flame Seedless is the leading table grape variety. California produced about 2.2 million tons of raisin grapes and 830,000 tons of table grapes in 2008. Statewide table grape and raisin tonnage increased by 5 percent and 3 percent, respectively, relative to 2007 production.

Table 14A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for table and raisin grapes each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, March 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	17,557,585	19,395,692	15,245,751	16,368,444	13,746,363
Acres Treated	4,984,244	5,927,808	5,731,725	5,522,212	5,529,126
Acres Planted	340,000	339,000	333,000	325,000	318,000
Price \$/ton	\$411.26	\$310.65	\$450.43	\$422.09	\$308.36

Table 14B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for table and raisin grapes each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	6	10	-21	7	-16
Acres Treated	-2	19	-3	-4	0
Acres Planted	-4	0	-2	-2	-2
Price \$/ton	45	-24	45	-6	-27

Figure 11. Acres of table and raisin grapes treated by all AIs in the major types of pesticides from 1994 to 2008.

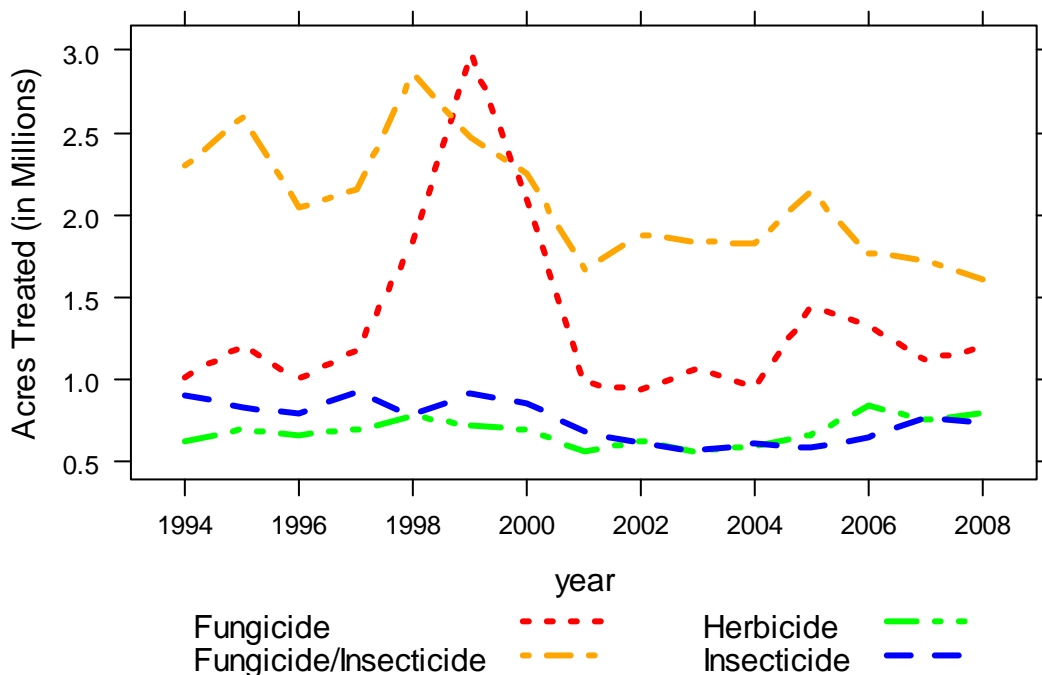


Table 14C. The non-adjuvant pesticides with the largest change in acres treated of table and raisin grapes from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
SULFUR	FUNGICIDE/ INSECTICIDE	1,820,909	2,120,638	1,742,570	1,714,758	1,593,236	-121,522	-7
GLUFOSINATE-AMMONIUM	HERBICIDE	8,644	15,447	46,364	63,141	130,798	67,657	107
GIBBERELLINS	PLANT GROWTH REGULATOR	311,804	345,991	341,024	339,481	382,892	43,411	13
PARAQUAT DICHLORIDE	HERBICIDE	106,879	128,530	156,655	119,499	89,866	-29,633	-25
TRIFLOXYSTROBIN	FUNGICIDE	71,116	117,568	106,542	101,991	128,330	26,339	26
OIL	INSECTICIDE	31,206	29,819	41,165	69,092	91,046	21,954	32
IMIDACLOPRID	INSECTICIDE	104,883	63,042	83,349	113,083	93,667	-19,415	-17
BUPROFEZIN	INSECTICIDE	14,281	22,888	25,899	43,536	62,662	19,126	44
SIMAZINE	HERBICIDE	98,273	76,110	95,866	75,931	56,876	-19,055	-25
MYCLOBUTANIL	FUNGICIDE	162,020	169,882	155,368	125,005	141,303	16,298	13
ZIRAM	FUNGICIDE	4,029	17,146	21,456	26,156	11,327	-14,829	-57
SPINOSAD	INSECTICIDE	4,670	55,405	52,703	63,840	49,953	-13,887	-22
QUINOXYFEN	FUNGICIDE	21,091	45,519	38,398	42,572	56,372	13,799	32
DINOTEFURAN	INSECTICIDE			3,787	17,459	4,458	-13,001	-74
BIFENAZATE	INSECTICIDE	34,176	43,682	30,152	29,563	18,154	-11,409	-39

The major insecticides applied in 2008 by acres treated were imidacloprid, oils, cryolite, methoxyfenozide, and buprofezin. The acres treated with insecticides decreased by 11 percent from 2007. Imidacloprid and buprofezin are used during warm weather between budbreak and harvest to control mealybug infestations. Cryolite is a stomach poison applied early in the season to control lepidopterous pests, such as omnivorous leafroller (*Platynota stultana*). Methoxyfenozide controls similar pests, but can be used later in the growing season than cryolite.

Acres treated with sulfur decreased by 7 percent, while acres treated with all other fungicides also increased by 7 percent. Sulfur, copper-based pesticides, myclobutanil, trifloxystrobin, boscalid, and pryaclostrobin were the most-used fungicides in terms of acres treated. Acres treated with lime sulfur in early 2008 against overwintering disease inoculum decreased by 17 percent. Dormant season disease pressure was low due to low rainfall. Copper-based pesticides, used to treat downy mildew and botrytis bunch rot, was applied to 4 percent fewer acres compared to 2007.

The acres treated with herbicides increased by 5 percent in 2008 compared to 2007. Herbicides used most in table and raisin grapes by acres treated were glyphosate products, glufosinate-ammonium, paraquat, oxyfluorfen, and flumioxazin. The acres treated with paraquat, oxyfluorfen, and glyphosate decreased by 25, 2, and 1 percent respectively. In contrast, glufosinate-ammonium-treated acreage doubled from 2007, while rimsulfuron saw its first year of use in the commodity. Increased use of the two new products is likely due to the increased prevalence of glyphosate-resistant weeds, such as marestail (*Conyza canadensis*) and fleabane (*Conyza bonariensis*), in vineyards. Both glufosinate-ammonium and rimsulfuron are used specifically to control these weed species.

Acres treated with plant growth regulators (PGRs) increased by 11 percent in 2008 compared to 2007. The most commonly used PGRs were gibberellins, which are applied in early spring to lengthen and loosen grape clusters. Less compact clusters may be less vulnerable to berry splitting and bunch rot. Gibberellin-treated acres increased by 13 percent in 2008.

Alfalfa

Alfalfa hay is produced for animal feed in California. The dairy industry remains the biggest market for alfalfa hay. Most counties produce some alfalfa hay, but more than half of the state's production comes from Fresno, Kern, Imperial, Merced, and Tulare counties. Harvested alfalfa acres decreased by 4 percent in 2008 compared to 2007, but the price per ton increased by 26 percent from 2007 to 2008. The increased price for hay was due to reduced production and the high costs of grain-based animal feeds, especially in the first half of the year when the number of alfalfa shipments from other western states into California were lower than usual. The total pounds of pesticide active ingredients applied to alfalfa increased by 7 percent in 2008 compared to 2007. The acres treated with pesticides increased by 15 percent in 2008 relative to 2007.

Table 15A. Total reported pounds of all active ingredients (AI), acres treated, acres harvested, and prices for alfalfa each year from 2004 to 2008. Harvested acres from 2003 to 2007 are from CDFR, 2008; harvested acres in 2008 are from NASS, June 2009; and marketing year average prices in 2003 and 2004 are from NASS July 2005a, prices in 2005 and 2006 are from NASS, July 2007a, and prices in 2007 and 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	2,673,263	2,862,543	3,021,455	2,909,823	3,102,080
Acres Treated	4,170,113	5,169,416	5,559,141	4,445,444	5,112,523
Acres Harvested	1,050,000	1,040,000	1,100,000	990,000	950,000
Price \$/ton	\$116.00	\$136.00	\$116.00	\$165.00	\$208.00

Table 15B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres harvested and prices for alfalfa each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-9	7	6	-4	7
Acres Treated	-14	24	8	-20	15
Acres Harvested	-4	-1	6	-10	-4
Price \$/ton	25	17	-15	42	26

Figure 12. Acres of alfalfa treated by all AIs in the major types of pesticides from 1994 to 2008.

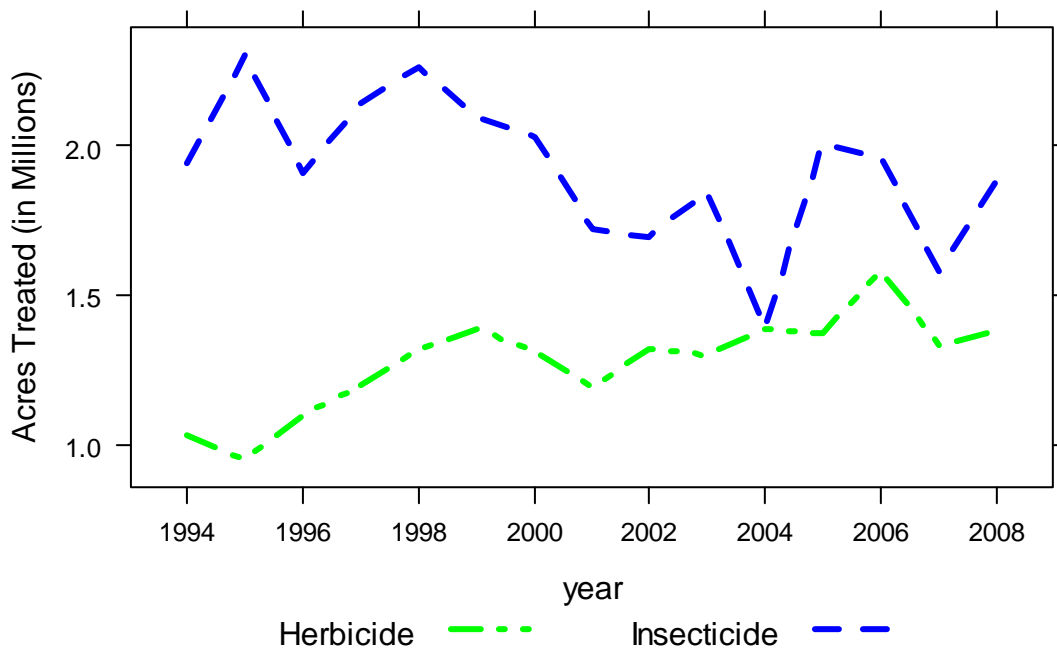


Table 15C. *The non-adjuvant pesticides with the largest change in acres treated of alfalfa from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.*

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
INDOXACARB	INSECTICIDE	122,368	337,267	481,660	246,318	386,411	140,094	57
PENDIMETHALIN	HERBICIDE	3,982	4,578	5,820	46,138	163,172	117,034	254
LAMBDA-CYHALOTHRIN	INSECTICIDE	215,929	230,868	247,127	255,170	358,530	103,360	41
TRIFLURALIN	HERBICIDE	282,948	303,796	317,191	276,815	202,758	-74,057	-27
METHOXYFENOZIDE	INSECTICIDE			5,725	330	64,337	64,008	19,426
DIURON	HERBICIDE	204,643	157,109	186,563	148,747	100,978	-47,769	-32
CYFLUTHRIN	INSECTICIDE	145,508	144,550	133,029	53,054	22,915	-30,139	-57
PARAQUAT DICHLORIDE 4-(2,4-DB), DIMETHYLAMINE SALT	HERBICIDE	258,297	216,114	251,477	196,254	225,894	29,640	15
IMAZETHAPYR, AMMONIUM SALT	HERBICIDE	50,436	64,028	85,443	52,879	71,085	18,206	34
IMAZAMOX, AMMONIUM SALT	HERBICIDE	9,947	54,651	99,473	68,426	86,572	18,146	27
CARBOFURAN	INSECTICIDE	71,896	98,113	120,149	80,894	98,659	17,764	22
GLYPHOSATE	HERBICIDE	46,532	53,049	37,565	37,150	20,693	-16,457	-44
BETA-CYFLUTHRIN	INSECTICIDE	17,292	19,930	52,114	84,867	68,594	-16,274	-19
HEXAZINONE	HERBICIDE			2,137	66,154	81,393	15,240	23
		159,010	133,672	159,994	124,286	109,768	-14,518	-12

Statewide, insecticide use on alfalfa increased by 12 percent in pounds of AI and by 20 percent in acres treated in 2008 compared to 2007. The increase in acres treated with insecticides were mainly from increased uses of indoxacarb (57 percent), lambda-cyhalothrin (41 percent), and especially methoxyfenozide (19,000 percent) in 2008 compared to 2007. In contrast, the acres treated with cyfluthrin and carbofuran decreased by 57 and 44 percent respectively in 2008. In 2008, growers switched to products like methoxyfenozide that are have less adverse environmental impacts.

Alfalfa production requires lots of water. The uncertainty surrounding water availability and drought in California had resulted in reduced acreage and changes in management practices. Some growers choose to take fewer hay harvests than normal, pulling out the plants or allow fields to seed in lieu of irrigation. The new management practices result in changes in both insect pests dynamics and insecticides use.

Insecticide use is a reflection of the intensity of pest pressure during the season and variations with the price of hay. The statewide increase for insecticide use in pounds and acres treated may be due to more insect pressure of western yellow striped armyworm, beet armyworm, alfalfa caterpillar, and Egyptian alfalfa weevil in 2008 relative to the preceding years. Also, as the price of hay increased in early 2008, growers let the hay grow longer and sprayed for insect pests to avoid damage and get greater tonnage in lieu of early harvest. Carbofuran registration is being lost, so growers are gradually replacing it with products like indoxacarb and lambda-cyhalothrin for alfalfa weevil. Methoxyfenozide has become popular with alfalfa hay growers for worm pest control because it is not as disruptive to beneficial insects as pyrethroids. The increase in indoxacarb and methoxyfenozide was mainly in the San Joaquin and Imperial valleys, while increased use of lambda-cyhalothrin use was mainly in the Sacramento, San Joaquin, and

Imperial Valleys. The decrease in cyfluthrin was predominantly in the Imperial Valley while carbofuran use decreased mainly in the San Joaquin and Imperial Valleys.

Statewide herbicide use in pounds and acres treated were relatively stable, marginally increasing by 3 and 4 percent respectively, in 2008 compared to 2007. Use of most of the 20 most highly used herbicides was stable or declined in 2008 compared to 2007, except for the use of pendimethalin, paraquat dichloride, and 2,4-DB, which increased. The increased use of paraquat dichloride may be because it is supplanting diquat dibromide, a desiccant used in seed production. The increased use of pendimethalin and 2,4-DB could be associated with the court injunction against the planting of Roundup Ready alfalfa.

The increased herbicide use in 2008 occurred mainly in the Sacramento and San Joaquin valleys whereas most of the decreased use occurred in the Imperial Valley. Although the reasons for selecting certain herbicides over others were unclear, efforts to use materials that are less likely to contaminate groundwater may have played a role in the general pattern in herbicide use.

Fungicide use in alfalfa was minimal in 2008.

Cotton

Cotton is grown for fiber, oil, and animal feed. Once one of the most widely grown crops in California, cotton acres has decreased dramatically in the last few years. Total cotton acreage decreased by 40 percent from 2007 to 2008. Two main kinds of cotton are grown: upland and Pima. Some upland cotton has also been genetically modified to be tolerant to the herbicide glyphosate (Roundup). Most cotton is grown in the southern San Joaquin Valley, but a small percentage is grown in Imperial and Riverside counties. Even less is grown in a few counties in the Sacramento Valley.

Table 16A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for cotton each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, June 2009; Roundup Ready acres are from NASS, June 2009; and marketing year average prices from 2003 and 2004 are from NASS, July 2005a, prices from 2005 and 2006 are from NASS, July 2007a, and prices from 2007 and 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	7,175,673	7,010,023	5,581,509	3,459,174	2,401,597
Acres Treated	10,422,661	11,416,289	9,767,050	6,306,290	4,907,648
Acres Planted Upland Cotton	560,000	430,000	285,000	195,000	120,000
Acres Planted Pima Cotton	215,000	230,000	275,000	260,000	155,000
Acres Planted Roundup-Ready	148,500	218,400	172,000	114,000	99,450
Acres Planted Total	775,000	660,000	560,000	455,000	275,000
Price Upland \$/lbs	\$0.56	\$0.60	\$0.57	\$0.72	\$0.56
Price Pima \$/lbs	\$1.01	\$1.26	\$1.04	\$0.99	\$1.14
Price All	\$0.68	\$0.83	\$0.80	\$0.88	\$0.89

Table 16B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for cotton each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-2	-2	-20	-38	-31
Acres Treated	-1	10	-14	-35	-22
Acres Planted Upland Cotton	2	-23	-34	-32	-38
Acres Planted Pima Cotton	43	7	20	-5	-40
Acres Planted Roundup-Ready	0	47	-21	-34	-13
Acres Planted Total	11	-15	-15	-19	-40
Price Upland \$/lbs	-26	9	-5	26	-22
Price Pima \$/lbs	-18	25	-17	-5	15
Price All	-20	22	-4	9	1

Figure 13. Acres of cotton treated by all AIs in the major types of pesticides from 1994 to 2008.

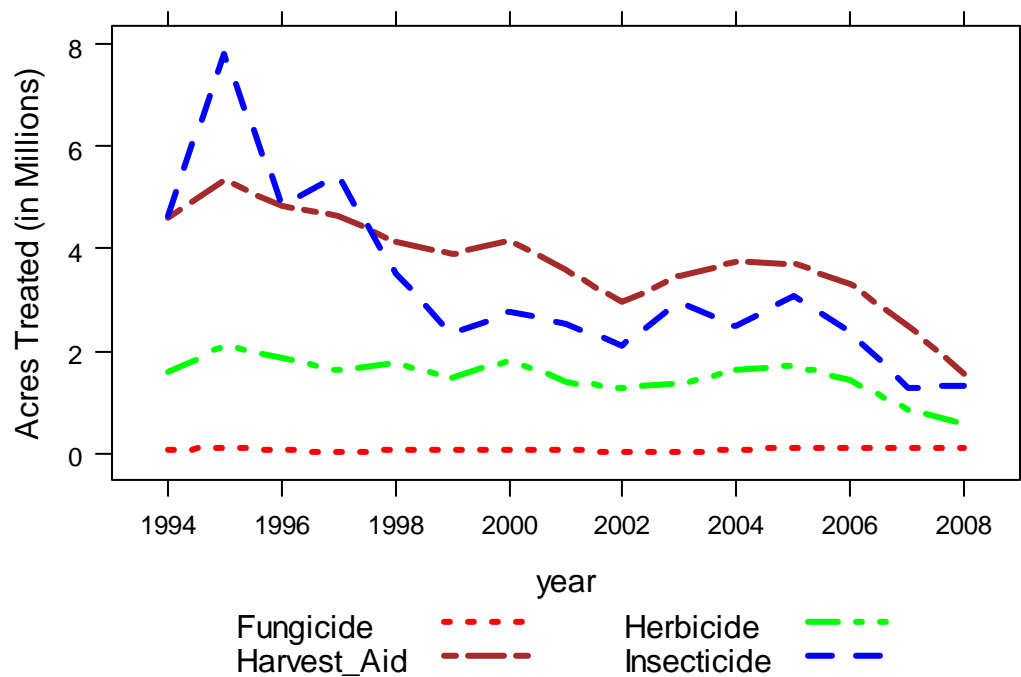


Table 16C. *The non-adjuvant pesticides with the largest change in acres treated of cotton from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.*

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
ETHEPHON	HARVEST_AID	572,142	563,771	487,576	385,164	243,830	-141,334	-37
DIURON	HARVEST_AID	524,547	511,547	477,647	373,162	232,917	-140,245	-38
THIDIAZURON	HARVEST_AID	526,341	503,099	465,903	370,921	238,120	-132,801	-36
MEPIQUAT CHLORIDE	HARVEST_AID	553,951	653,612	583,147	338,816	208,544	-130,272	-38
UREA DIHYDROGEN SULFATE	HARVEST_AID	343,362	366,171	317,537	266,547	154,890	-111,657	-42
ABAMECTIN	INSECTICIDE	337,191	320,683	250,327	211,551	121,723	-89,828	-42
PARAQUAT DICHLORIDE	HARVEST_AID	434,773	381,290	424,408	264,366	182,197	-82,169	-31
PYRAFLUFEN-ETHYL	HARVEST_AID	129,032	332,511	362,964	292,443	212,506	-79,938	-27
PYRITHIOBAC- SODIUM	HERBICIDE	140,874	154,014	148,330	109,630	46,157	-63,474	-58
SODIUM CHLORATE	HARVEST_AID	341,291	243,709	187,968	109,314	46,968	-62,346	-57
GLYPHOSATE	HERBICIDE	583,138	613,245	431,057	263,930	205,698	-58,232	-22
BIFENTHRIN	INSECTICIDE	35,247	63,719	45,893	28,333	84,270	55,936	197
TRIFLURALIN	HERBICIDE	231,240	200,558	159,848	96,623	43,071	-53,552	-55
OXAMYL	INSECTICIDE	93,895	138,340	92,916	17,904	69,043	51,139	286
IPRODIONE	FUNGICIDE		1,924	2,405	84	43,657	43,573	51,872

Total pesticide use on cotton decreased from 2007 to 2008, but use per acre planted increased. The increase was due to use in Kings County, where total pounds AI used, mostly insecticides, increased 8 percent. In all other major counties, pounds of AI decreased between 35 to 90 percent. The use of insecticides increased by 4 percent (acres treated) and 13 percent (pounds AI); herbicide use decreased by 34 percent (acres treated) and 31 percent (pounds AI); harvest aids, which are chemicals used to defoliate or desiccate cotton plants before harvest, decreased by 38 percent (acres treated) and 46 percent (pounds AI). Although acres treated with fungicides remained nearly the same in 2008 as in 2007, the pounds AI of fungicides decreased 17 percent.

In 2008, the insecticide applied to the greatest acreages was flonicamid, followed by abamectin, imidacloprid, indoxacarb, and bifenthrin. Use of most of the major insecticides increased above use in 2007, especially (s)-cypermethrin, lambda-cyhalothrin, and dinotefuran, all of which increased more than 600 percent. Significantly, use of cyfluthrin in Kings County increased more than 5,000 percent. However, use of many insecticides decreased, as was the case with flonicamid, abamectin, acetamiprid, aldicarb, etoxazole, thiamethoxam, oils, and methoxyfenozide. Use of flonicamid decreased only slightly (1 percent by acres treated and 3 percent by pounds of AI). Use of all miticides decreased.

Most insect and mite populations were fairly low, similar to those in 2007. Lygus bug populations, however, were major problems in some areas. Flonicamid, bifenthrin, oxamyl, cyfluthrin, (s)-cypermethrin, and lambda-cyhalothrin applications targeted lygus bugs for the most part and were all applied from mid-June through August. Lygus was a problem because safflower acreage increased and its growing season was more asynchronous and extended than usual. As the safflower matured, lygus migrated into nearby cotton fields. Alfalfa is another

good host of lygus bugs, but when alfalfa is water-stressed, lygus often emigrate. Such was the case in 2008 in the water-short Lake Bottom and Corcoran areas of Kings County.

The herbicides applied to the greatest acreage of cotton in 2008 were glyphosate, pendimethalin, oxyfluorfen, pyriothiazol-sodium, and trifluralin. The only herbicide with increased use was paraquat dichloride, which was applied to 14,000 more acres than in 2007, a 100 percent increase. Again all of this increase occurred in Kings County. The largest decreases among the main herbicide by acres were pyriothiazol-sodium, trifluralin, glyphosate, flumioxazin, and oxyfluorfen. Some AIs, such as paraquat dichloride, are used both as harvest aids and herbicides. Here it is assumed if use occurred in August through November it was used as a harvest aid, otherwise as an herbicide. The decrease in herbicide use was due mostly to the decrease in acres planted.

The harvest aids that were applied to the greatest acreage were ethephon, thidiazuron, diuron, mepiquat chloride, and pyraflufen-ethyl. Although mepiquat chloride is usually included among the harvest aids, it is actually a growth regulator and is typically used mid-season. The top four harvest aids were applied to 36 percent fewer acres. Pyraflufen-ethyl had the smallest decrease in acres treated (29 percent) of nearly all harvest aids. The harvest aids with the greatest decrease were S,S,S-tributyl phosphorotrithioate (67 percent), endothall (61 percent), and sodium chlorate (57 percent). These harvest aids have been in use for many years and are being replaced somewhat by newer chemicals, such as pyraflufen-ethyl and cyclanilide, which have more predictable performance.

Fungicides are not widely used in cotton, but their use per acre planted has been trending upward because of increased problems with seedling diseases, mostly *Rhizoctonia*. The most commonly used fungicide both by pounds and acres treated is azoxystrobin; however, its use from 2007 to 2008 decreased by 29 percent in pounds AI and 42 percent in acres treated. The only other fungicide with any significant number of acres treated was iprodione, and its use increased dramatically from 84 acres in 2007 to 44,000 acres in 2008, nearly all of which occurred in Kings County. Azoxystrobin and iprodione are applied to cotton fields at planting to control seedling diseases. Their combined use has been high in recent years because cool spring weather was conducive to seedling diseases and because re-planting fields was nearly cost-prohibitive.

Nearly all other fungicides are used as seed treatments and are not applied to the field, so their use is reported only in pounds. Use of these seed treatments decreased except for myclobutanil, which increased by 24 percent. Nearly all myclobutanil use in 2008 occurred in Kings County.

Processing Tomatoes

Processing tomato growers planted 281,000 acres in 2008, a 7 percent decrease from 2007. The highest concentration of processing tomatoes continues to be located in the southern San Joaquin Valley. Fresno County leads the state in production, with 36 percent (102,000 acres) of the statewide acres followed by Yolo County (39,000 acres), San Joaquin County (32,000 acres), and Kings County (27,000 acres).

Table 17A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for processing tomatoes each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, January 2009; and marketing year average prices from 2003 to 2005 are from NASS, January 2006 and prices from 2006 to 2008 are from NASS, January 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	11,531,086	11,296,815	12,269,869	10,677,234	11,586,769
Acres Treated	2,504,906	2,777,366	2,962,484	2,683,605	2,665,731
Acres Planted	301,000	267,000	283,000	301,000	281,000
Price \$/ton	\$57.40	\$59.60	\$65.40	\$70.30	\$75.90

Table 17B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for processing tomatoes each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	5	-2	9	-13	9
Acres Treated	-6	11	7	-9	-1
Acres Planted	4	-11	6	6	-7
Price \$/ton	0	4	10	7	8

Figure 14. Acres of processing tomatoes treated by all AIs in the major types of pesticides from 1994 to 2008.

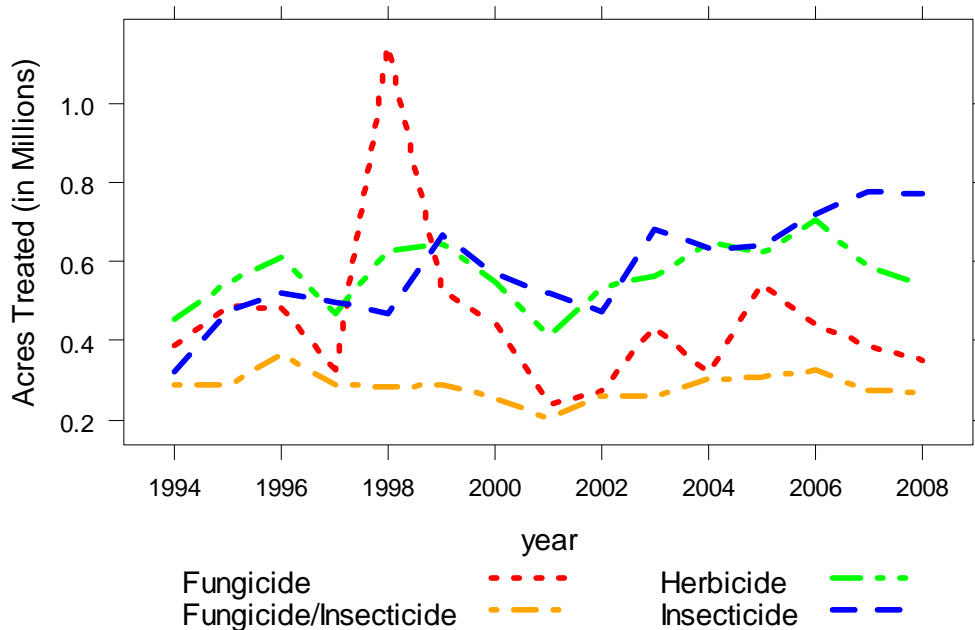


Table 17C. The non-adjuvant pesticides with the largest change in acres treated of processing tomatoes from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
CHLOROTHALONIL	FUNGICIDE	94,490	101,997	114,304	140,933	78,676	-62,257	-44
TRIFLURALIN	HERBICIDE	196,807	182,284	202,205	198,929	141,364	-57,565	-29
MYCLOBUTANIL	FUNGICIDE	19,310	19,042	31,505	37,307	68,747	31,439	84
PYRACLOSTROBIN	FUNGICIDE	58,385	54,581	53,634	66,297	95,629	29,332	44
DIMETHOATE	INSECTICIDE	87,967	91,100	92,309	121,219	95,731	-25,488	-21
METHOXYFENOZIDE	INSECTICIDE	33,893	71,046	93,152	106,233	81,312	-24,921	-23
S-METOLACHLOR	HERBICIDE	142,195	145,364	168,950	155,503	133,106	-22,396	-14
BIFENTHRIN	INSECTICIDE	-	-	38	7,144	29,281	22,137	310
PERMETHRIN	INSECTICIDE	17,566	16,100	24,356	22,133	7,198	-14,935	-67
RIMSULFURON	HERBICIDE	146,534	122,692	113,644	96,173	81,457	-14,716	-15
POTASSIUM N-METHYLDITHIOCARBAMATE	FUMIGANT	1,668	1,862	10,532	21,954	34,594	12,641	58
COPPER BACILLUS THURINGIENSIS	FUNGICIDE	21,096	136,762	74,214	26,846	14,931	-11,915	-44
MEFENOXAM	INSECTICIDE	53,599	60,234	32,294	27,053	15,428	-11,625	-43
MANCOZEB	FUNGICIDE	39,177	22,617	32,327	31,769	20,289	-11,480	-36
	FUNGICIDE	9,433	63,256	48,129	21,975	11,006	-10,970	-50

Total tons of processing tomato production in 2008 decreased by 2 percent from 2007 while pesticide use in terms of pounds of active ingredients (AI), increased by 9 percent, from 11 million pounds in 2007 to 12 million pounds in 2008. This increase in pesticide use was attributable to the onset of severe tomato powdery mildew. Similar to 2007, sulfur, metam-sodium, and metam-potassium accounted for 85 percent of the total pounds of pesticide AI applied to processing tomatoes in 2008.

In 2008, 770,000 acres were treated with insecticides which is similar to the use in 2007. Insecticide treatments were primarily in response to pressure from aphids, lepidopterous pests (tomato pinworm and armyworms), and concerns about tomato spotted wilt virus, which is vectored by western flower thrips. Dimethoate, an inexpensive insecticide that works well for aphid control, remained the most used insecticide in pounds AI in 2008, even though use decreased by 20 percent from 2007 to 2008. Malathion had the largest percentage increase in use, increasing from only 24 pounds on 10 acres in 2007 to 3,208 pounds on 6,443 acres in 2008. This increase in use occurred because malathion became an approved insecticide for shipment of tomatoes in Mediterranean fruit fly quarantine areas of the state. Registered on tomatoes in 2007, bifenthrin is used to control mites and stinkbugs, and manage virus diseases, spotted wilt particularly. Bifenthrin use increased from 4,140 pounds on 7,144 acres in 2007 to 14,374 pounds on 29,281 acres in 2008. In contrast, the use of methoxyfenozide, permethrin, and *Bacillus thuringiensis* (Bt) decreased in pounds applied and acres treated. As was the case in 2007, carbaryl use increased in 2008 by 23 percent. The increased use of carbaryl is due to the appearance of ground beetles during transplanting and seedling emergence.

Acres treated with herbicides decreased by 8 percent in 2008 compared to the preceding year. Likewise, total pounds of herbicides used also decreased (7 percent). The decreases were due to a dry winter and spring that allowed cultivation. Pounds of s-metolachlor, the fifth most heavily used pesticide AI, decreased 13 percent. However, total pounds of potassium N-methyldithiocarbamate increased by 88 percent and for the first time surpassed metam-sodium

(down 23 percent) as the most heavily used fumigant. Growers now prefer to add potassium rather than sodium to the soil when using this type of fumigant. The most used herbicides in 2008, both in pounds of active ingredients and acres treated include, s-metolachlor, glyphosate, trifluralin and pendimethalin. For the first time since 2002, pendimethalin use was reported because an existing pendimethalin pre-emergent residual herbicide product was approved for use on tomato in California. The availability of pendimethalin resulted in a decrease (26 percent) in trifluralin use.

One of the major issues for tomato growers in 2008 was the onset of severe tomato powdery mildew. Use of sulfur, used for russet mite and powdery mildew during May through August, increased 172,000 pounds (2 percent) in 2008 compared to 2007. However, acres treated with sulfur decreased slightly (1 percent), from 267,000 acres in 2007 to 265,000 acres in 2008. Acres treated with chlorothalonil decreased, down 62,000 acres (44 percent) from 2007 and pounds of AI applied also decreased—from 255,000 pounds in 2007 to 145,000 pounds in 2008, a 43 percent decrease. Chlorothalonil, used to control black mold primarily, but also to limit defoliation and resulting sunburn, was the most commonly used non-sulfur fungicide in 2008. Mancozeb was the next most commonly used fungicide. Even though chlorothalonil was the most used non-sulfur fungicide in 2008, its use decreased by 43 percent because other broad spectrum products were used for powdery mildew. For example, pyraclostrobin use increased by 29,332 pounds (55 percent) over use in 2007. Use of copper-based pesticides and mancozeb decreased mainly because spring weather did not favor the development of bacterial spot and bacterial speck.

Oranges

California oranges account for 27 percent of the oranges produced in the United States (US), second to Florida as the top US producing state of oranges. California's orange production was 40 percent higher in 2008 than in 2007, but the price decreased by 19 percent due to the boost in production. Most of California oranges are grown in the San Joaquin Valley (Fresno, Kern and Tulare counties) with over half of the total in Tulare County alone. The rest are grown in the interior region (Riverside and San Bernardino counties) and on the south coast (mostly in Ventura and San Diego counties). The navel oranges were of good color, maturity, and sugar content, attributes helpful to drive consumer demand.

Table 18A. Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for oranges each year from 2004 to 2008. Bearing acres from 2003 to 2007 are from CDFA, 2008; bearing acres in 2008 are from NASS, September 2008; and marketing year average prices from 2003 to 2005 are from NASS, July 2006 and prices from 2006 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	9,612,556	12,341,386	12,215,178	10,221,547	9,381,501
Acres Treated	2,249,087	2,627,278	2,520,099	2,396,445	2,322,494
Acres Bearing	184,000	182,000	181,000	179,000	180,000
Price \$/box*	\$10.72	\$9.36	\$10.38	\$11.98	\$9.68

* A box is approximately 75 oranges.

Table 18B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres bearing and prices for oranges each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	33	28	-1	-16	-8
Acres Treated	9	17	-4	-5	-3
Acres Bearing	-3	-1	-1	-1	1
Price \$/box	43	-13	11	15	-19

Figure 15. Acres of oranges treated by all AIs in the major types of pesticides from 1994 to 2008.

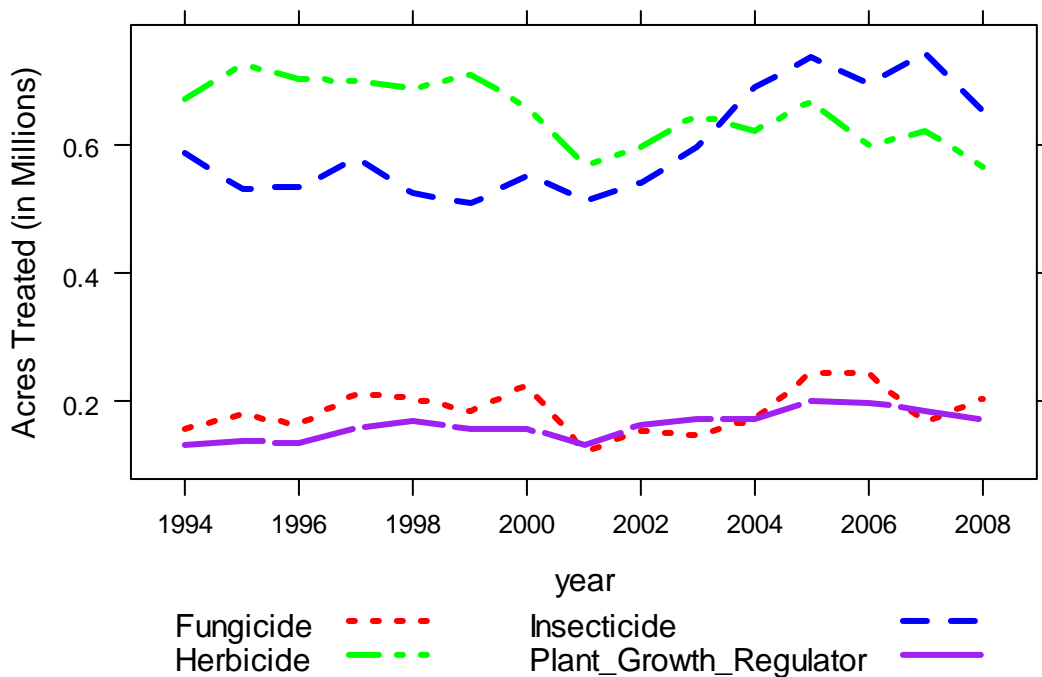


Table 18C. *The non-adjuvant pesticides with the largest change in acres treated of oranges from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.*

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
OIL	INSECTICIDE	202,753	205,507	196,535	200,604	146,666	-53,938	-27
SPINOSAD	INSECTICIDE	95,971	106,022	102,534	119,426	67,634	-51,792	-43
GLYPHOSATE	HERBICIDE	366,938	398,359	351,848	364,382	316,969	-47,413	-13
COPPER	FUNGICIDE	163,517	234,484	240,070	163,984	199,255	35,271	22
ABAMECTIN	INSECTICIDE	25,305	26,364	27,075	22,410	46,465	24,055	107
IMIDACLOPRID	INSECTICIDE	12,689	4,209	13,502	11,105	33,741	22,636	204
PYRIPROXYFEN	INSECTICIDE	44,364	41,263	43,323	57,139	40,268	-16,871	-30
ACETAMIPRID	INSECTICIDE	8,881	5,938	3,767	23,303	12,399	-10,904	-47
RIMSULFURON	HERBICIDE				154	10,399	10,245	6,653
LIMONENE	INSECTICIDE	4,005	27,698	37,067	35,583	25,921	-9,662	-27
SIMAZINE	HERBICIDE	93,651	101,451	81,151	74,535	65,252	-9,283	-12
	PLANT GROWTH							
2,4-D	REGULATOR	124,778	149,359	147,396	141,839	132,620	-9,219	-6
BETA-CYFLUTHRIN	INSECTICIDE				41,872	50,527	8,655	21
DIMETHOATE	INSECTICIDE	21,497	22,008	25,209	34,785	27,212	-7,574	-22
BACILLUS THURINGIENSIS	INSECTICIDE	31,601	42,872	27,834	44,851	37,909	-6,943	-15

Total pounds of pesticides used decreased 8 percent from 2007 to 2008 and acres treated decreased by 3 percent. The price set per box of oranges decreased by 19 percent. The most significant decreases were in the amounts of insecticides and fungicides used. The number of bearing acres rose slightly (1 percent) which ended a downward trend that started in 2001.

The year 2008 did not have a hard freeze like the one that occurred in January 2007 that wiped out approximately 40 percent of the citrus crops. January through February 2008 was mild and warmer than usual, creating near perfect growing conditions for oranges. The summer saw high temperatures and low humidity in the citrus-growing regions. December 2008 brought low temperatures and a series of storms that negatively impacted some orange crops, but no unusual freeze events occurred.

Overall, pounds of insecticides used decreased by 33 percent from 2007 to 2008. The majority of this came from decreases in the use of horticulture oils, cryolite and malathion. Dimethoate and spinosad also had significant reduction in pounds used from 2007 to 2008. The decrease in the use of these products is most likely due to a variety of factors, such as cost, availability, exporting requirements, and pest pressures. Thrip populations were much lower in the San Joaquin Valley area during 2008 compared to previous years. Two notable pests were the Asian citrus psyllid, which arrived in California but did not have a big affect on commercial citrus in 2008, and the citrus leafminer which expanded its range north towards the San Francisco Bay Area.

Oils, spinosad, beta-cyfluthrin, abamectin, and chlorpyrifos were the insecticides used on the most acres. During 2008, oils were used to treat 146,247 acres, chlorpyrifos 43,758 acres, and spinosad, beta-cyfluthrin, and abamectin between 45,000 to 70,000 acres each. The use of oils and spinosad decreased by 27 and 43 percent respectively in 2008 compared to 2007. All five of

these broad range insecticides can be used to control a variety of insects which most likely explains the large amount of acres treated with these insecticides.

Oils, chlorpyrifos, dimethoate, cryolite, and carbaryl were the most used insecticides based on pounds used. horticulture oil use decreased by 36 percent. Oils are a broad spectrum pesticide that kills soft-bodied insects such as aphids, immature whiteflies, immature scales, psyllids, immature true bugs, thrips, and some insect eggs as well as mites. Oils also control powdery mildew and other fungi. Oils can also be used as an adjuvant in pesticide treatments.

Chlorpyrifos, a broad spectrum insecticide, is commonly used to control citricola scale on citrus, especially oranges. Chlorpyrifos use increased by 13 percent from 2007 to 2008. However, chlorpyrifos was used to treat 5 percent fewer acres, meaning that it was used at a higher rate of use. The rate of use may have increased due to pest resistance issues.

Dimethoate use in pounds decreased 14 percent and 22 percent in acres treated. Dimethoate is used to control a wide range of insects, including aphids, mites, thrips, plant hoppers, and white flies systemically and on contact. The decrease in dimethoate use is most likely because it is an older organophosphate pesticide product that has shown some pest resistance issues.

Pounds of cryolite used decreased by 43 percent and acres treated decreased by 40 percent. Cryolite is used on citrus crops to protect against leaf eating pests and katydids, which feeds on young fruit. The significant decrease is most likely due to the lack of availability of the insecticide and because there are more effective treatments to control target pests.

Carbaryl use decreased by 19 percent in terms of pounds applied and acres treated

Imidacloprid-treated acres increased 200 percent and pounds applied increased by 185 percent. Imidacloprid is a systemic insecticide mostly used to control the sucking insects and leafminers on oranges. It is also used for area-wide treatment programs to reduce vectors of plant diseases, such as glassywinged sharpshooter, cotton aphid, and Asian citrus psyllid. Imidacloprid application amounts can rise and fall dramatically with these programs.

Abamectin use in terms of acres treated and pounds applied doubled from 2007 to 2008. Abamectin is primarily used as a miticide but is also effective against leafminers and leaf beetles.

Acres treated with fungicides increased by 28 percent between 2007 and 2008. That increase was primarily due to increased use of copper-based pesticides. Pounds of copper and imazalil applied during 2008 increased by 19 and 81 percent, respectively. Copper-based pesticides are the most widely used fungicides on oranges. They are used to prevent Phytophthora gummosis, Phytophthora root rot, and fruit diseases such as brown rot and Septoria spot. These diseases are exacerbated by wet weather. The increase in copper use may be related to the program to export navel oranges to Korea; the program may require one to two additional copper applications.

Acres treated with herbicides decreased by 10 percent between 2007 and 2008. Glyphosate was used the most, followed by diuron and simazine. The herbicide glyphosate is used to control weeds post-emergence. Diuron and simazine are used for pre-emergent weed control. Pounds of glyphosate and simazine applied in 2008 decreased by 10 and 11 percent, respectively; diuron use increased 5 percent. The use of the herbicide oryzalin, although used at lower amounts than glyphosate, diuron, and simazine, increased 100 percent. Paraquat dichloride use decreased by

almost 44 percent. The herbicide rimsulfuron had a 6,700 percent increase in acres treated from 2007 to 2008. This large increase in acres treated is most likely due to growers trying out the new product in lieu of some of the older herbicides. Decreased use of herbicides is partially due to ground water regulations. Simazine and diuron have been identified as groundwater contaminants and human health toxins, while paraquat dichloride is associated with acute inhalation toxicity and worker safety concerns. In addition, lower-than-average rainfall in 2008 caused reduced weed pressure resulting in relatively low herbicide use.

Rice

California's Sacramento Valley contains more than 95 percent of the state's rice acreage. The remainder is in north to central San Joaquin Valley. The leading rice-producing counties are Colusa, Sutter, Butte, Glenn, and Yolo. Approximately 500,000 acres in the Sacramento Valley are of a soil type restricting the crops to rice or pasture. The remainder of the acreage has greater crop flexibility.

Table 19A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for rice each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, June 2009; and marketing year average prices in 2003 and 2004 are from NASS, July 2005a, prices in 2005 and 2006 are from NASS, July 2007a, and prices in 2007 and 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	6,632,313	5,135,455	5,459,723	4,838,755	4,229,298
Acres Treated	2,756,203	1,996,823	2,100,371	2,292,628	2,223,562
Acres Planted	595,000	528,000	526,000	534,000	519,000
Price \$/cwt	\$6.95	\$10.10	\$11.60	\$16.20	\$19.30

Table 19B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for rice each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	2	-23	6	-11	-13
Acres Treated	24	-28	5	9	-3
Acres Planted	17	-11	0	2	-3
Price \$/cwt	-33	45	15	40	19

Figure 16. Acres of rice treated by all AIs in the major types of pesticides from 1994 to 2008.

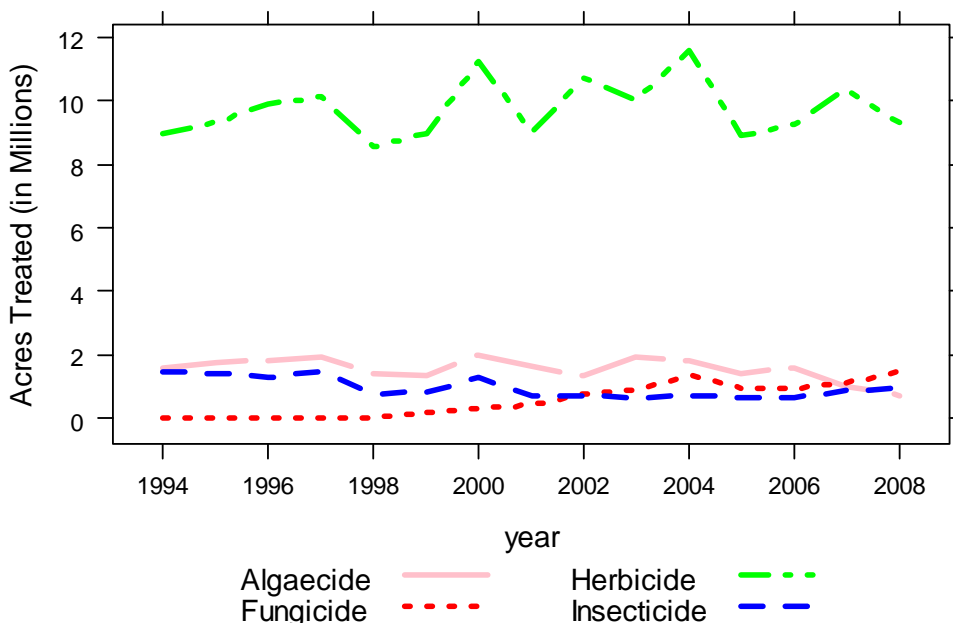


Table 19C. The non-adjuvant pesticides with the largest change in acres treated of rice from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
COPPER	ALGAECIDE	227,340	179,268	200,000	127,024	91,395	-35,629	-28
AZOXYSTROBIN	FUNGICIDE	167,917	108,844	105,448	139,787	172,030	32,243	23
CYHALOFOP BUTYL	HERBICIDE	201,215	78,238	107,917	119,979	89,348	-30,631	-26
PROPANIL	HERBICIDE	376,499	307,673	317,521	377,903	348,102	-29,801	-8
LAMBDA-CYHALOTHRIN	INSECTICIDE	49,901	54,627	39,618	59,505	79,988	20,483	34
(S)-CYPERMETHRIN	INSECTICIDE	30,535	21,814	38,257	48,412	30,986	-17,426	-36
FENOXAPROP-P-ETHYL	HERBICIDE	3,989	22,572	28,253	28,099	13,887	-14,212	-51
MOLINATE	HERBICIDE	89,593	40,535	33,044	17,471	4,276	-13,195	-76
TRICLOPYR, TRIETHYLAMINE SALT	HERBICIDE	309,007	236,598	245,837	295,644	282,892	-12,752	-4
CLOMAZONE	HERBICIDE	85,850	71,315	119,166	159,161	171,900	12,739	8
PENOXSULAM	HERBICIDE		73,058	77,151	82,492	72,744	-9,748	-12
2,4-D	HERBICIDE	20,960	17,914	12,893	19,946	10,356	-9,591	-48
THIOBENCARB	HERBICIDE	136,132	118,786	79,109	74,251	65,305	-8,945	-12
MCPA, DIMETHYLAMINE SALT	HERBICIDE	13,598	7,303	10,053	7,577	2,632	-4,945	-65
GLYPHOSATE	HERBICIDE	26,961	17,271	11,070	6,135	1,976	-4,160	-68

Pesticide use decreased both in pounds of active ingredients applied and acres treated by 3 percent and 13 percent respectively from 2007 to 2008. Planted acres decreased by almost 3

percent. There were no major shifts in pest pressures in 2008. Herbicides were the most used pesticides accounting for 75 percent of non-adjuvant pesticide acres treated. Herbicide use decreased by 10 percent from 2007 to 2008 while insecticide and fungicide uses increased. The total acres treated with insecticides increased 14 percent and fungicides increased 10 percent in 2008 compared to 2007. Major pesticides with the largest percent increases in acres treated include lambda-cyhalothrin, azoxystrobin, and clomazone. Pesticides with the largest percentage decreases in acres treated include molinate, glyphosate, MCPA (dimethylamine salt), fenoxyprop-P-ethyl, and 2,4-D.

Lambda-cyhalothrin is the most widely used insecticide by acres treated and its use increased 34 percent in 2008 compared to 2007, at least, partly because of its low price. The price of lambda-cyhalothrin is low because it is now off patent. The price of s-cypermethrin was correspondingly dropped to compete with lambda-cyhalothrin. Both insecticides are used primarily for rice water weevil control, and secondarily for armyworm and tadpole shrimp. Insect pressure is low for California rice and these insecticides are used on only about 10 percent of planted fields. Copper sulfate is also used to control tadpole shrimp, however, it is more expensive and the primary use is for algae control in rice fields. Copper sulfate also binds to organic matter such as straw residue making it less effective. Growers often rely on pyrethroids to control tadpole shrimp and rice water weevil soon after flooding. The rice water weevil is the number one rice insect pest in California rice.

Copper sulfate is the only algacide registered for rice, and one of the few products acceptable for organic rice production. The product doubles as a control for tadpole shrimp, which is very important to organic rice growers. Copper sulfate is used in the early season when algae mats may cover fields before seedling rice breaks the water surface. Pounds of copper sulfate decreased by 25 percent because of less algal pressure at planting and a higher price of copper sulfate.

Azoxystrobin is a reduced-risk foliar fungicide. Although disease pressure is low in 2008, some growers used the product as a preventative for disease control, which increases yield.

The major herbicides in rice in 2008 in terms of acres treated were propanil, triclopyr, clomazone, cyhalofop-butyl, penoxsulam, thiobencarb, and bispyribac-sodium. Use of all of them decreased from 2007 to 2008, except for clomazone. Control of ricefield bulrush with carfentrazone has had difficulties and penoxsulam has emerged as a good control for this weed. Resistance to molinate, carfentrazone, and thiobencarb help account for the increased use of clomazone and the continued popularity of propanil. With the declining use of water-applied molinate and thiobencarb, use of foliar herbicides (cyhalofop, propanil, bispyribac-sodium, and the liquid formulation of penoxsulam) increased. Use of these herbicides require growers to lower field water levels, which in turn increases sprangletop incidence and growers' use of cyhalofop-butyl. Glyphosate is used as a preplant herbicide in rice. The 68 percent decrease in glyphosate use probably reflects more normal weather during the planting season allowing normal spring tillage operations. However, glyphosate use can be expected to increase in the future as stale-seedbed systems (early spring seedbed preparation with no soil disturbance) become adopted for herbicide resistance management.

Head Lettuce

Head lettuce is grown in four regions in the state: the central coastal area (Monterey, San Benito, Santa Cruz, and Santa Clara counties); the southern coastal area (Santa Barbara and San Luis Obispo counties); the San Joaquin Valley (Fresno, Kings, and Kern counties); and the southern deserts (Imperial and Riverside counties). In 2004, 59 percent of all California head lettuce was planted in the central coastal area, 17 percent in the southern coastal area, 12 percent in the San Joaquin Valley, and 11 percent in the southern deserts. California produces about 72 percent of the head lettuce grown in the United States annually. In this analysis, the central and southern coastal areas are combined unless noted.

Table 20A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for head lettuce each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFR, 2008; planted acres in 2008 are from NASS, January 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	1,619,139	1,826,746	1,882,444	1,713,064	1,463,664
Acres Treated	2,227,663	2,361,120	2,314,357	2,189,716	1,960,116
Acres Planted	131,000	130,000	131,000	138,000	118,000
Price \$/cwt	\$15.10	\$15.80	\$17.80	\$22.00	\$21.20

Table 20B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for head lettuce each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-6	13	3	-9	-15
Acres Treated	9	6	-2	-5	-10
Acres Planted	-1	-1	1	5	-14
Price \$/cwt	-28	5	13	24	-4

Figure 17. Acres of head lettuce treated by all AIs in the major types of pesticides from 1994 to 2008.

from 1994 to 2008.

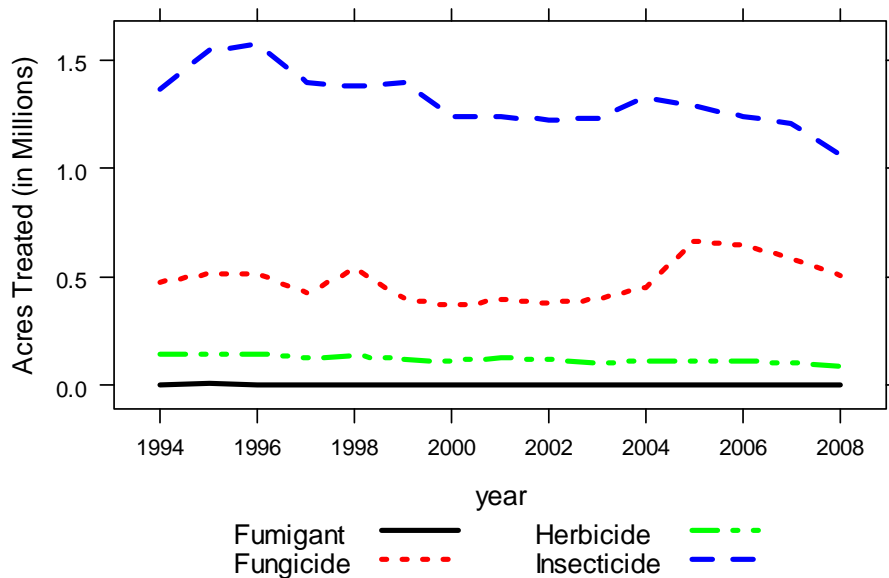


Table 20C. The non-adjuvant pesticides with the largest change in acres treated of head lettuce from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
SPINOSAD	INSECTICIDE	125,190	128,716	124,997	107,120	43,989	-63,132	-59
SPINETORAM	INSECTICIDE				3,543	54,740	51,198	1,445
DIAZINON	INSECTICIDE	148,995	129,042	130,840	128,790	89,714	-39,075	-30
PERMETHRIN	INSECTICIDE	123,483	130,178	119,665	103,428	72,369	-31,059	-30
DIMETHOMORPH	FUNGICIDE	64,832	98,433	94,852	67,596	44,292	-23,304	-34
FOSETYL-AL	FUNGICIDE	32,107	52,593	47,078	36,477	18,349	-18,128	-50
(S)-CYPERMETHRIN	INSECTICIDE	92,837	107,410	114,210	104,169	87,222	-16,948	-16
METHOMYL	INSECTICIDE	43,002	63,823	76,500	77,103	63,764	-13,340	-17
ESFENVALERATE	INSECTICIDE	32,367	34,763	24,222	14,246	25,661	11,415	80
ACETAMIPRID	INSECTICIDE	33,428	29,910	35,889	48,838	37,609	-11,229	-23
PROPAMOCARB HYDROCHLORIDE	FUNGICIDE			28	74,240	63,497	-10,743	-14
PROPYZAMIDE	HERBICIDE	76,874	76,392	79,071	72,433	61,736	-10,697	-15
FLONICAMID	INSECTICIDE				2,250	12,640	10,390	462
METHOXYFENOZIDE	INSECTICIDE	35,613	57,931	51,333	59,822	49,631	-10,191	-17
INDOXACARB	INSECTICIDE	36,789	31,967	24,432	27,605	17,515	-10,090	-37

Pesticide use on head lettuce fluctuated from 2004 through 2008. Use of all classes of pesticide declined from 2007 to 2008. There was a 14 percent decrease from 2007 to 2008 in acres of head lettuce planted, and 2 percent decrease in acres of head lettuce harvested. Yield per acre remained the same from 2007 to 2008, but overall production decreased by 3 percent.

The major pesticides with the largest increase in acres treated were two new reduced-risk insecticides, spinetoram and flonicamid, and the pyrethroid esfenvalerate. Major pesticides with the largest decrease were spinosad, fosetyl-al, indoxacarb, dimethomorph, diazinon, permethrin, acetamiprid, methomyl, methoxyfenozide, (s)-cypermethrin, propyzamide, and propamocarb

hydrochloride. During 2008, the top insecticides used (by acres treated) were imidacloprid, diazinon, (S)-cypermethrin, lambda cyhalothrin, and permethrin. The main fungicides used were maneb, propamocarb hydrochloride, dimethomorph, boscalid, and fosetyl-al. Three herbicides dominated—propryzamide (pronamide), bensulide, and benefin. Metam-potassium (potassium n-methyldithiocarbamate) was the main fumigant used, followed by metam sodium. A total of 2 acres, which is less than 0.002 percent of total acres of lettuce planted, were treated with methyl bromide.

Insecticide use fell from 2004 to 2008. Use from 2007 to 2008, as measured by acres treated, averaged a 10 percent decline in all areas. Insecticide-treated acres decreased mostly in the inland areas—the southern deserts and San Joaquin Valley—and less so in the coastal areas. In each area, reduced-risk insecticides contributed to the total amount of insecticides used. Use of high-risk insecticides decreased overall by 15 percent:

The neonicotinoid insecticide imidacloprid is used mostly to suppress lettuce and foxglove aphids. Use of imidacloprid in the coastal area increased by 12 percent, peaking in April and August. Throughout California from 2007 to 2008, use of acephate, the popular systemic for aphids, declined in all regions.

The insecticides (S)-cypermethrin and spinosad are used to manage larvae of beet armyworm and cabbage looper, primarily pests in the southern deserts. Use of (S)-cypermethrin and spinosad, as measured by acres treated, decreased by 38 percent and 91 percent, respectively. The reduction in spinosad use was due to increased use of spinetoram, a second-generation version of spinosad. Spinetoram was used on more acres of desert lettuce than any other insecticide (over 19 thousand acres treated; spinosad was used on 3 thousand acres). In the coastal areas, use of esfenvalerate and methomyl for caterpillars increased, but decreased in the inland areas. Use of permethrin, which is primarily used for controlling seedling pests in the southern deserts such as crickets, earwigs, cutworms, and sowbugs, increased in that area by 9 percent, although seedling pest pressure was average. Permethrin use decreased in the mid-coastal area and the San Joaquin Valley, where it is used for loopers and other lepidopterous pests. Diazinon use also decreased by 61 percent in the southern deserts, where it is often used for seedling pests. Use of lambda-cyhalothrin in the central coast increased by 46 percent, probably due to high numbers of symphylans. Use of this insecticide decreased in other lettuce-growing areas.

Diazinon is a preplant treatment applied for soil pests, and until 2005 was recommended for symphylans, which show up in some coastal fields. The pyrethroids lambda-cyhalothrin and (S)-cypermethrin supposedly give better control. Use of diazinon decreased throughout the State, but increased by over 50 percent in the south coastal area. Use of S-cypermethrin decreased in all lettuce-growing areas. Insecticides such as abamectin have replaced permethrin to manage leafminers. Abamectin use in 2008 increased in the San Joaquin Valley and south coastal area due to mounting leafminer pressure.

Two new reduced-risk insecticides appeared in 2007 and became more prominent in 2008. Spinetoram, mentioned above, is effective against caterpillars, leafminers, and thrips. In 2008, its use was 55,000 acres treated. Flonicamid is a systemic that suppresses feeding by thrips and aphids, and in 2008, 10,000 acres were treated. Another reduced-risk insecticide, spirotetramat, was registered in July 2008. A systemic for aphids, its use was 16,000 acres treated. Also newly

registered in May 2008 was the insecticide chlorantraniliprole, along with an insecticide that shares its diamide structure, flubendiamide.

Fungicide use by acres treated decreased by 14 percent from 2007 to 2008. Several active ingredients—both old chemistry and reduced risk, are rotated for downy mildew, a disease that has many pathogens. Maneb, used primarily to control downy mildew and prevent anthracnose, was again the dominant fungicide, as it has been every year since the early 1990s. Use of maneb declined from 2007 to 2008, as did that of dimethomorph and fosetyl-al. (See Sulfur below for powdery mildew.) Propamocarb hydrochloride, a new systemic introduced for downy mildew in 2006, is primarily used in the central coast. In 2008, its use in the coastal areas and San Joaquin Valley was second only to maneb's. A new product containing mandipropamid was registered in June 2008, and was the fourth most-used fungicide by acres in the coastal areas to manage downy mildew.

Lettuce drop (*Sclerotinia drop*) is another fungal disease with a shift in popular active ingredients. Use of iprodione fell in all areas from 2007 to 2008, but rose by 3 percent in the southern deserts. Use of boscalid, a reduced-risk material, continued to rise in all lettuce-growing regions except the southern deserts. Dicloran use fell overall because of a large drop in the coastal areas; otherwise, its use increased in the inland areas. (See also chloropicrin below.) Sulfur is applied as a foliar treatment for powdery mildew. Its use decreased by 45 percent from 2007 to 2008.

Herbicide use by acres treated decreased by 14 percent from 2007 to 2008. Use of propyzamide (pronamide), applied as a postplant–preemergence herbicide, decreased statewide by 15 percent from 2007 to 2008. As consistent with its use for the past ten years, propyzamide was applied to many more acres than the preemergent, bensulide, which targets small-seeded annual grasses and is not as effective as propyzamide in the coastal areas. Use of benefin, a pre-plant herbicide popular in the San Joaquin Valley, increased from 2007 to 2008 in the middle coastal area and desert.

Nematodes are not economic pests of head lettuce, so soil is primarily fumigated to control soil-borne diseases and suppress weeds. In 2008, fumigants, mostly metam-potassium, were used on less than 3 percent of all planted lettuce acreage. Metam-potassium, like its cousin metam-sodium, is a broad-spectrum contact soil sterilant used on a handful of crops. Use of both metam-sodium and metam-potassium dropped by almost a third from 2007 to 2008. The fumigant, 1,3-dichloropropene, was used only in the San Joaquin Valley, possibly for nutsedge. Use of methyl bromide, used entirely in the coastal area, decreased by 75 percent. Chloropicrin is used to reduce soil populations of *Verticillium* wilt and lettuce drop alone or when combined with methyl bromide or 1,3-dichloropropene. In 2008, no chloropicrin was used on head lettuce.

Walnuts

California produces 99 percent of the walnuts grown in the United States and 66 percent of the world's production. Just over half of the walnuts produced in California are exported. In 2008, the total bearing acreage increased marginally (2 percent) from that of 2007 while the acres treated with pesticides decreased by 17 percent. The 2008 market price per ton exhibited a sharp decline of nearly 50 percent compared with that of 2007, likely due to the record large walnut

harvest in 2008 (33 percent increase from 2007), combined with the global economic crisis substantially slowing demand.

Table 21A. Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for walnuts each year from 2004 to 2008. Bearing acres from 2003 to 2005 are from NASS, July 2006; bearing acres from 2006 to 2008 are from NASS, July 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	2,551,681	3,812,159	3,548,919	3,984,782	3,231,532
Acres Treated	1,550,512	2,000,806	1,950,913	2,084,581	1,731,390
Acres Bearing	214,000	215,000	216,000	218,000	223,000
Price \$/tons	\$1,390.00	\$1,570.00	\$1,630.00	\$2,290.00	\$1,210.00

Table 21B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres bearing, and prices for walnuts each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-11	49	-7	12	-19
Acres Treated	-6	29	-2	7	-17
Acres Bearing	0	0	0	1	2
Price \$/tons	20	13	4	40	-47

Figure 18. Acres of walnuts treated by all AIs in the major types of pesticides from 1994 to 2008.

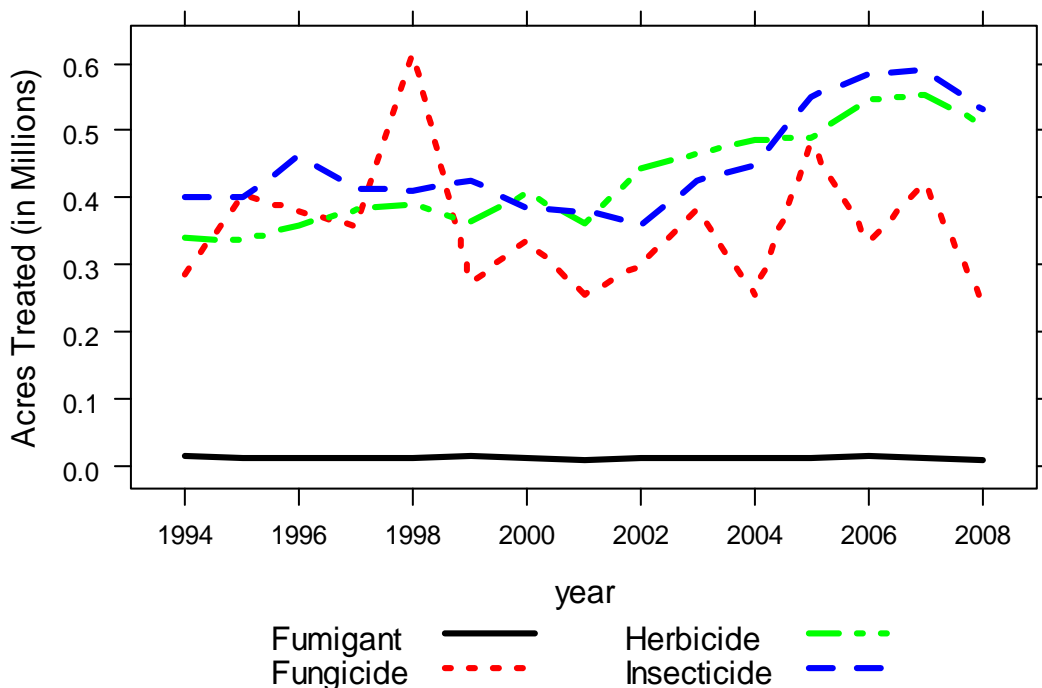


Table 21C. The non-adjuvant pesticides with the largest change in acres treated of walnuts from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
COPPER	FUNGICIDE	144,502	283,356	187,113	234,595	135,266	-99,329	-42
MANEB	FUNGICIDE	108,974	195,554	144,629	184,317	109,287	-75,030	-41
METHYL PARATHION	INSECTICIDE	40,427	46,380	49,269	43,742	18,564	-25,179	-58
GLYPHOSATE	HERBICIDE	204,592	211,224	226,920	231,481	207,015	-24,466	-11
PROPARGITE	INSECTICIDE	56,745	67,590	64,765	50,909	29,918	-20,992	-41
GLUFOSINATE- AMMONIUM	HERBICIDE	1,140	4,574	8,116	13,544	31,185	17,641	130
PARAQUAT DICHLORIDE	HERBICIDE	39,710	41,007	48,507	48,551	34,883	-13,667	-28
	INSECTICIDE	20,526	18,292	25,784	46,867	58,097	11,230	24
CHLORPYRIFOS	INSECTICIDE	102,775	121,904	117,602	108,538	98,689	-9,850	-9
OXYFLUORFEN	HERBICIDE	111,154	115,038	118,722	116,304	108,594	-7,709	-7
ABAMECTIN	INSECTICIDE	14,812	14,336	26,065	31,778	39,388	7,610	24
LAMBDA- CYHALOTHRIN	INSECTICIDE	8,096	20,460	18,744	13,827	20,355	6,528	47
SIMAZINE	HERBICIDE	41,283	34,280	34,839	29,029	22,731	-6,298	-22
DIURON	HERBICIDE	30,943	29,249	30,767	22,016	16,172	-5,845	-27
SPIRODICLOFEN	INSECTICIDE				6,326	11,894	5,568	88

In 2007, the most recent year of available acreage data, approximately 94 percent of walnut acreage was located in the Sacramento and San Joaquin valleys, with the remaining acreage primarily in the coastal and north eastern regions of California. In 2008, San Joaquin Valley walnuts had the highest pesticide use with a total of 1.7 million pounds of pesticide AIs used and 880,000 acres treated (includes multiple applications on the same acreage). Sacramento Valley walnuts had the next highest use, with 1.5 millions pounds AIs and 820,000 acres treated. Finally, north east and coastal region walnuts used approximately 33,000 pounds of active ingredients, with 27,000 acres treated.

The total acres treated and pounds of pesticide active ingredients decreased by 17 and 19 percent respectively in 2008 relative to the preceding year. This trend is thought to be a reflection of the reduced returns to growers caused by the low market price. In addition, continued drought reduced the need for fungicides and fumigants, as dry weather lessened the pressure of important pests such as walnut blight. Thus, acreage treated with fungicides such as copper-based pesticides and maneb and fumigants such as methyl bromide decreased by 30 to 40 percent in 2008 compared to 2007. These reductions can be environmentally significant, particularly for maneb, which has been shown to be a reproductive toxin and a carcinogen, and methyl bromide, which is associated with depletion of the stratospheric ozone layer, as well as being acutely toxic and exhibiting reproductive and developmental toxicity.

Similar to fungicides and fumigants, herbicide use also decreased in 2008 compared to that of 2007. The largest reductions were seen in the use of simazine, diuron, paraquat dichloride, glyphosate, and oxyfluorfen. Simazine and diuron are groundwater contaminants and developmental/reproductive toxins, while paraquat dichloride is associated with acute inhalation toxicity and worker safety issues. These health issues are thought to have motivated many growers to reduce use of these products. In addition, an increasing presence of glyphosate-resistant weeds may account for an 11 percent decrease in acres treated with glyphosate, as well

as a 7 percent reduction in acres treated with oxyfluorfen, which is often used in conjunction with glyphosate. In contrast, glufosinate-ammonium, a newer herbicide said to be effective in controlling glyphosate-resistant weeds, showed a use increase of 128 percent in 2008 compared to 2007. Overall, growers used slightly lower amounts of products reported to be of higher risk in 2008, with little to no change in use of lower risk herbicides.

Use of insecticides also decreased in 2008, with a general shift toward use of lower risk products. Important walnut arthropod pests include codling moth, walnut husk fly, navel orangeworm, and to a lesser degree, mites and aphids. With the exception of mites, most of these pests have been traditionally controlled with organophosphates. However, accounts of negative environmental and health impacts have resulted in increasing regulations and restrictions of organophosphate use. In addition, certain pests have developed resistance to commonly used organophosphate products. Thus, increasing regulation combined with increased resistance in target pests have prompted growers to seek alternative pest control means, which is reflected in substantial decreases in the use of many organophosphates in 2008, including chlorpyrifos, methyl parathion, phosmet, naled, malathion, diazinon, and azinphos-methyl. In contrast, the acres treated with lambda-cyhalothrin, a pyrethroid, rose by 47 percent, reflecting a move toward replacing organophosphates with pyrethroid products.

In addition to increased use of some pyrethroids, there was also expanded use of lower risk alternative products in 2008, such as kaolin clay, the insect growth regulator methoxyfenozide, oils, and the botanical insecticide, neem. While spinosad, a popular alternative spinosyn, decreased in use, a new spinosyn active ingredient, spinotorem, showed a strong increase. Pheromone mating disruption exhibited a slight decrease in use from 2007, but has shown a strong upward trend since 2000.

Finally, for mite control, there has been a substantial shift away from propargite, which use is highly regulated and has a long re-entry interval due to its carcinogenicity and its acute and developmental/reproductive toxicity. A newer miticide, spiroticlofen, is thought to be effective for growers experiencing resistance issues with mites, possibly explaining the 88 percent increase in use from 2007. Reduced risk miticides, such as etoxazole, bifenazate, and oils also showed increased use in 2008, following the general trend among walnut growers toward use of lower risk pest controls.

Peaches and Nectarines

California ranks first in the United States in peach and nectarine production. In 2008 the state grew 77 percent of all peaches (including 63 percent of fresh market peaches and all of the processed peaches) and 92 percent of nectarines. Most freestone peaches and nectarines are produced in the central San Joaquin Valley, and are sold on the fresh market. Clingstone peaches, largely grown in the Sacramento Valley, are used exclusively for processing into canned and frozen products including baby food and juice. Nectarine and freestone peach acreage remained unchanged in 2008 at 31,000 acres each, while clingstone peach acreage declined from 26,500 to 25,000 acres. Peaches and nectarines are discussed together because pest management issues for the two crops are similar.

Table 22A. Total reported pounds of all active ingredients (AI), acres treated, acres bearing, and prices for peaches and nectarines each year from 2004 to 2008. Bearing acres in 2003 are from NASS, July 2005b; bearing acres from 2004 to 2005 are from NASS, July 2007b; bearing acres from 2006 to 2008 are from NASS, July 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	6,439,437	6,514,894	6,793,883	5,153,494	5,356,344
Acres Treated	1,519,265	1,581,849	1,697,962	1,407,695	1,438,923
Acres Bearing	105,500	101,900	92,000	88,500	87,000
Price \$/tons	\$341.35	\$528.50	\$569.97	\$440.77	\$385.02

Table 22B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres bearing and prices for peaches and nectarines each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-1	1	4	-24	4
Acres Treated	0	4	7	-17	2
Acres Bearing	1	-3	-10	-4	-2
Price \$/tons	-18	55	8	-23	-13

Figure 19. Acres of peaches and nectarines treated by all AIs in the major types of pesticides from 1994 to 2008.

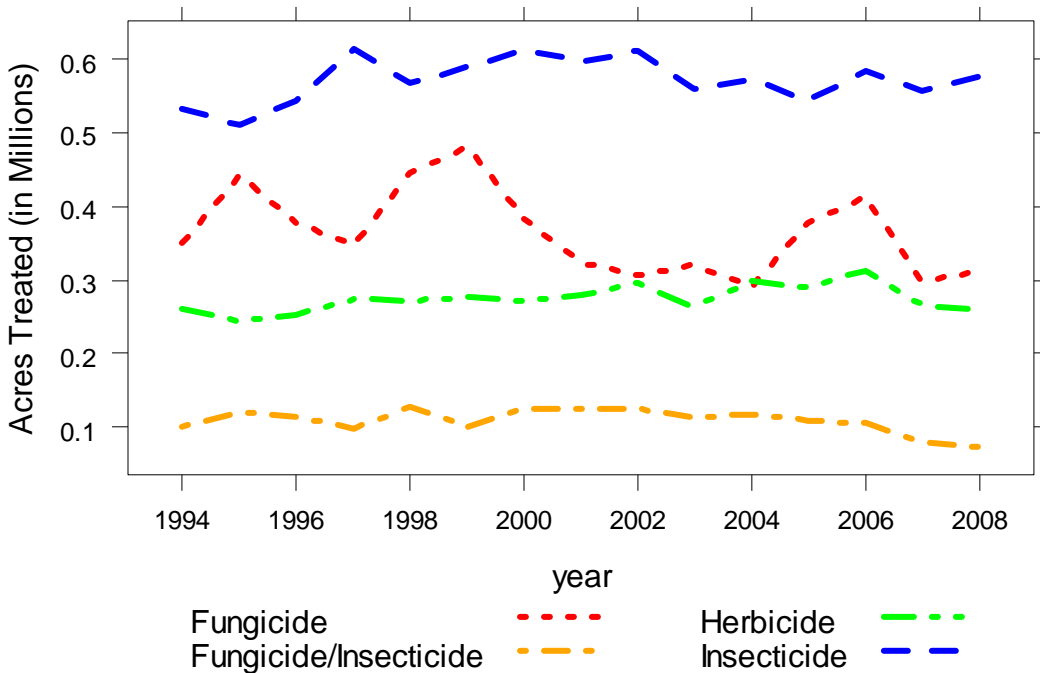


Table 22C. *The non-adjuvant pesticides with the largest change in acres treated of peaches and nectarines from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.*

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
OIL	INSECTICIDE	106,449	110,464	116,893	99,352	113,790	14,438	15
ESFENVALERATE	INSECTICIDE	98,028	95,817	101,673	80,572	92,197	11,624	14
GLYPHOSATE	HERBICIDE	141,044	143,569	152,461	126,486	116,495	-9,990	-8
SIMAZINE	HERBICIDE	33,116	17,554	18,012	11,382	4,291	-7,091	-62
CHLORPYRIFOS	INSECTICIDE	28,305	24,351	24,551	16,839	10,276	-6,564	-39
RIMSULFURON	HERBICIDE				2	6,159	6,157	310,961
PHOSMET	INSECTICIDE	48,084	32,253	41,204	37,782	32,179	-5,603	-15
SULFUR	FUNGICIDE/ INSECTICIDE	105,605	104,838	102,168	76,428	70,892	-5,537	-7
CYPRODINIL	FUNGICIDE	26,944	32,409	30,766	21,195	15,771	-5,424	-26
ORYZALIN	HERBICIDE	11,673	13,816	16,511	12,107	6,793	-5,314	-44
FORMETANATE HYDROCHLORIDE	INSECTICIDE	17,048	15,386	14,639	11,216	16,431	5,215	46
SPIRODICLOFEN	INSECTICIDE				12,066	16,916	4,850	40
MYCLOBUTANIL	FUNGICIDE	9,376	19,126	12,440	8,771	13,450	4,679	53
ZIRAM	FUNGICIDE	35,472	39,451	57,398	54,144	58,629	4,485	8
FLUMIOXAZIN	HERBICIDE		348	296	3,945	8,426	4,481	114

Peach and nectarine acreage treated with the major categories of pesticides has fluctuated from year to year since 1994 without substantial increasing or decreasing trends. In 2008, total acres treated with pesticides and total pounds of pesticide AI applied increased from 2007 levels by 2 percent and 3 percent respectively, even though there were 2 percent fewer bearing acres in 2008. Insect and mite outbreaks, problems with certain fungus diseases, and required treatments of large quantities of exported fruit resulted in increased applications of insecticides, miticides, fungicides, and in post-harvest fumigation. Herbicide use, however, declined. Cost-cutting and decreased weed growth due to drought may have contributed to that reduction.

Plenty of wintertime chill hours left trees “well rested” before spring bloom. Fruit set was good except in orchards damaged by a late April frost. Clingstone peaches in Yuba and Sutter counties suffered the greatest yield loss. Fruit sized normally, however, and orchards that escaped the frost produced a good crop. Average clingstone peach yield per acre declined about 10 percent compared to 2007, and the price per ton increased by 12 percent. In contrast, 2008 saw the second bumper crop of freestone peaches and nectarines in a row. Record tonnage was packed for fresh market sale, continuing a situation of oversupply and falling prices. Financial hardship forced some growers and packers of nectarines and freestone peaches out of business. Overall, peach and nectarine prices decreased 13 percent in 2008. Growers were strongly motivated to cut production costs.

Total peach and nectarine acres treated with insecticides and miticides increased by about 5 percent in 2008. The warm, dry spring brought on thrips at bloom in some areas, and continuing drought favored mite infestations. The most-used active ingredients in peaches and nectarines were oils; esfenvalerate; the Oriental fruit moth (OFM) mating disruption pheromones E-8-dodecenyl acetate, Z-8-dodecenyl acetate, and Z-8-dodecenol; spinosad; and phosmet. Oils are applied during the dormant season to forestall outbreaks of scales, mites, and moth pests. Esfenvalerate is a broad-spectrum chemical that may be used in dormant applications or during the growing season, including as an alternative to OFM pheromones. Significant increases in the

use of oils and esfenvalerate may be due in part to their relatively low cost. Spinosad and phosmet control moths and katydid, and spinosad is also effective against thrips. Acres treated with formetanate hydrochloride, an older, competitively priced broad-spectrum insecticide that controls thrips but triggers mite problems, and with spiroticlofen, a contact miticide, increased sharply. The jump in use of formetanate hydrochloride may be due partly to lack of a maximum residue limit (a fruit export requirement) for spinetoram, currently the main alternative for thrips control. A continuing decline in acres treated with the organophosphate insecticides chlorpyrifos and phosmet and increases in acres treated with oils and OFM pheromones suggest a trend toward reduced-risk insecticides. Reduced-risk insecticides are not more expensive than organophosphates and have shorter re-entry periods and less potential for leaving residues on fruit. Some reduced-risk insecticides that are widely used on peaches and nectarines are approved for organic production systems as well as conventional ones. Moreover, growers are being encouraged to protect water and air quality by using alternatives to conventional formulations of chlorpyrifos. Other possible reasons for the trend include residue issues with phosmet, its declining effectiveness for moth control, and a reduction in the cost of mating disruption for OFM management because longer-lasting pheromone dispensers have become available.

In 2008, peach and nectarine acres treated with fungicides increased by about 4 percent, at least in part because late May storms and cool temperatures promoted fungus growth. Problems with shot hole disease and brown rot were reported. The most-used fungicides by acres treated were sulfur, propiconazole, ziram, copper-based pesticides, iprodione, and pyraclostrobin/boscalid. Sulfur is the standard treatment for powdery mildew. Propiconazole is a low-dose chemical applied against fungi and powdery mildew. Ziram and copper-based pesticides are effective for leaf curl and shot hole disease, and ziram also controls scab. Pyraclostrobin and boscalid are reduced risk alternatives for mildew and fungus control. Acres treated with sulfur decreased significantly in 2008. Powdery mildew was not severe, and the price of sulfur went up. Applications of cyprodinil, used for brown rot, also decreased. Producers may have perceived alternatives to both sulfur and cyprodinil as being more cost-effective. Treatments with myclobutanil, a competitively priced systemic AI that controls brown rot, and with ziram, which is cheaper than copper-based pesticides for use against shot hole disease, both increased.

There was a 3 percent decrease in total peach and nectarine acres treated with herbicide in 2008. A second drought year limited weed growth and lower fruit prices motivated growers to cut costs where possible. Most-used herbicides by acres treated were glyphosate, oxyfluorfen, 2,4-D, pendimethalin, and paraquat. The use of glyphosate, simazine, and oryzalin decreased significantly. Glyphosate is becoming more costly and weed resistance to both glyphosate and paraquat is increasing, leading to greater reliance on alternatives. Simazine is a restricted-use chemical in areas prone to ground water contamination. Oryzalin is effective but expensive. In contrast, acres treated with pendimethalin continued to increase in 2008. Pendimethalin is a cheaper alternative to oryzalin. It is an effective grass herbicide with good residual control, and grass weeds can be more important during a dry spring. Use of the relatively new herbicide flumioxazin jumped, and the newly-registered AI rimsulfuron made a strong debut. Both are being promoted to growers strongly and are effective against many weeds, including some resistant species.

A reduction in total pounds of fumigant applied per acre, notable in 2007, recurred in 2008: total acres treated with fumigants increased slightly, while total pounds applied fell by about 22 percent. Growers appear to be using lower rates of most soil fumigants and/or moving from

broadcast application to spot or row treatments. Those changes save money, and also respond to regulatory encouragement to reduce emissions of volatile organic compounds (VOCs), which are precursors to ground level ozone formation. The preplant fumigants 1,3-D, chloropicrin, and methyl bromide and the post-plant fumigant sodium tetrathiocarbonate accounted for 63, 18, 15, and 4 percent of peach and nectarine acres treated with soil fumigants, respectively. Acreage treated with chloropicrin went up, perhaps because it is effective in suppressing “replant disease” after orchard replacement, stimulating first-year tree growth. Sodium tetrathiocarbonate treatments bounced back after dwindling almost to zero since 2004, and it was the only soil fumigant applied at a higher per acre rate during 2008. That increase may have reflected applications to control ring nematode in response to bacterial canker problems. Proposed methyl bromide applications are increasingly scrutinized because methyl bromide depletes stratospheric ozone, and it has become relatively expensive. Changing relationships between nematode infestations, rootstock choices, and application patterns also affect fumigant use and selection from year to year.

Methyl bromide is currently the only fumigant used to treat fresh peaches and nectarines in storage and for export. Post-harvest fumigant use jumped 74 percent, partly because a record crop inundated packing houses. In addition, low prices meant an exceptional amount of fresh fruit was shipped to Mexico, much of which was fumigated. Fumigation requirements may also increase if pests are detected in exported fruit upon its arrival in other countries.

Strawberries

California produces 89 percent of the total U.S. production of 2.84 billion pounds of strawberries. California produced 2.54 billion pounds valued at more than \$1.54 billion. Strawberries are grown mostly for fresh market (\$1.4 billion). Market prices determine the amount processed. California strawberry production occurs primarily along the central and southern coast, with smaller but significant production occurring in the Central Valley.

Table 23A. Total reported pounds of all active ingredients (AI), acres treated, acres harvested, and prices for strawberries each year from 2004 to 2008. Harvested acres from 2003 to 2007 are from CDFA, 2008; harvested acres in 2008 are from NASS, July 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	9,565,451	9,227,498	9,380,340	9,641,506	9,903,124
Acres Treated	1,241,172	1,279,092	1,291,122	1,357,345	1,513,534
Acres Harvested	33,200	34,300	35,800	35,500	37,600
Price \$/cwt	\$62.20	\$62.60	\$65.10	\$75.70	\$75.50

Table 23B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres harvested and prices for strawberries each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	4	-4	2	3	3
Acres Treated	-2	3	1	5	12
Acres Harvested	12	3	4	-1	6
Price \$/cwt	-15	1	4	16	0

Figure 20. Acres of strawberries treated by all AIs in the major types of pesticides from 1994 to 2008.

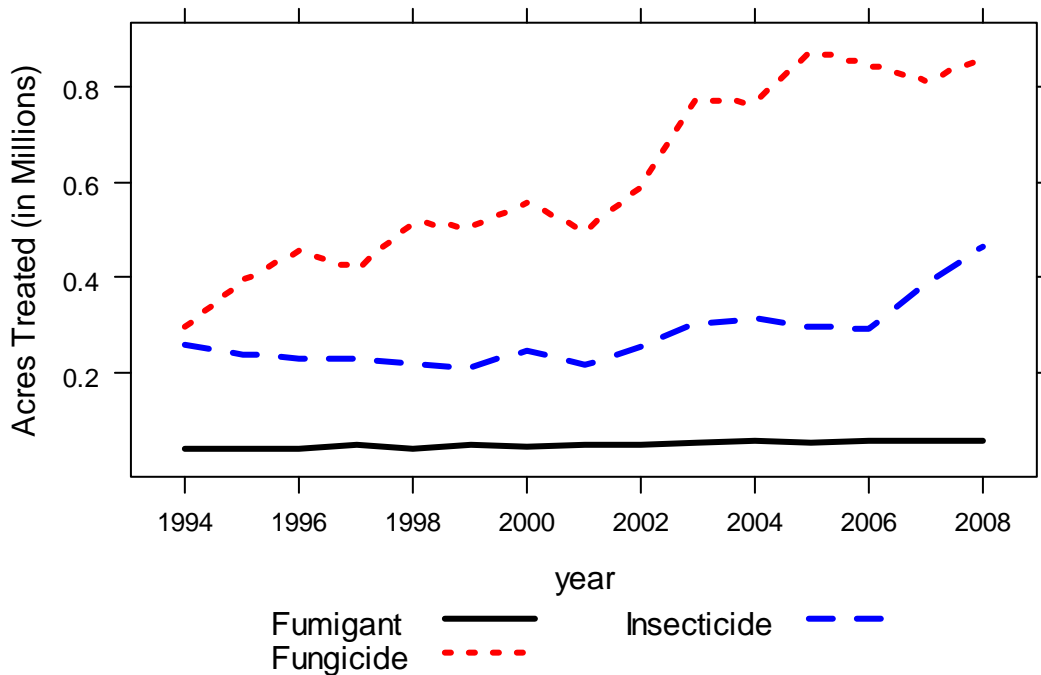


Table 23C. The non-adjuvant pesticides with the largest change in acres treated of strawberries from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
SPINETORAM	INSECTICIDE				246	32,332	32,087	13,070
SPINOSAD	INSECTICIDE	48,590	46,420	46,855	49,814	22,804	-27,010	-54
MALATHION	INSECTICIDE	48,708	37,523	28,460	34,528	51,217	16,689	48
BIFENTHRIN	INSECTICIDE	13,469	14,428	19,184	25,163	41,019	15,856	63
ACETAMIPRID	INSECTICIDE					14,033	14,033	
OIL	INSECTICIDE	1,378	289	477	6,431	19,009	12,577	196
MYCLOBUTANIL	FUNGICIDE	41,156	42,506	43,221	51,487	39,516	-11,971	-23
NALED	INSECTICIDE	22,209	20,666	18,681	23,819	33,852	10,034	42
ABAMECTIN	INSECTICIDE	13,753	13,871	13,024	16,962	26,103	9,141	54
CAPTAN	FUNGICIDE	149,227	174,707	151,742	127,029	135,748	8,719	7
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	FUNGICIDE		379	2,485	4,861	13,441	8,580	177
FENHEXAMID	FUNGICIDE	51,805	56,844	54,234	40,011	46,971	6,960	17
BACILLUS THURINGIENSIS	INSECTICIDE	46,042	49,546	33,783	57,842	51,176	-6,666	-12
BOSCALID	FUNGICIDE	28,072	52,115	56,822	55,747	62,268	6,521	12
BIFENAZATE	INSECTICIDE	21,270	18,346	21,184	25,423	31,735	6,312	25
PYRIMETHANIL	FUNGICIDE			30,419	16,080	22,270	6,190	38

The number of strawberry acres treated with pesticides increased 12 percent from 2007 to 2008, while acres harvested increased by 6 percent. This can in part be explained by a 4 percent increase in acres planted during this same period. Young plants were treated with pesticides but were not mature enough to be harvested until the following year. Pounds of pesticide applied increased 3 percent from 2007 to 2008 and pounds of pesticide per acre treated decreased 8 percent. Fungicides, followed by insecticides, account for the largest proportion of pesticides applied by acres treated. By acres treated, use of fungicides increased 6 percent, while insecticides increased 13 percent, while use of herbicides decreased 2 percent. The major pesticides with greatest increase in acres treated were spinetoram, malathion, bifenthrin, acetamiprid, and oils. The major pesticides with decreased use by acres treated were spinosad, myclobutanil, *Bacillus thuringiensis* (Bt), methomyl, and hexythiazox.

Fungicides continue to be the most used pesticides, as measured by acres treated. The most important fungal diseases of strawberries are Botrytis and powdery mildew. The major fungicides by acres treated in 2008 were captan, sulfur, pyraclostrobin, boscalid, fenhexamid, myclobutanil, cyprodinil, fludioxonil, pyrimethanil, propiconazole, and triflumizole. In general, the use of fungicides effective against Botrytis fruit rot and those effective against powdery mildew increased in 2008. The long-registered fungicides, captan, thiram, and thiophanate-methyl, fenhexamid, and boscalid, and the recently registered QST 713 strain *Bacillus subtilis*, and pyrimethanil are generally used to control Botrytis fruit rot. Acres treated with all of these products increased in 2008 primarily due to cool wet spring weather. Use of the biological pesticide *B. subtilis* continues the upward trend that began with its initial registration in 2005.

High humidity in the absence of free moisture on leaves favored development of powdery mildew in 2008. Conventional strawberry growers primarily used sulfur, myclobutanil, boscalid, pyraclostrobin, propiconazole, and quinoxifen for its control. Sulfur is relatively inexpensive and is also used by organic growers. Sulfur, myclobutanil, potassium bicarbonate, mephanoxam,

triflumizol, and azoxystrobin use decreased in 2008, while use of boscalid (up 12 percent), pyraclostrobin (up 6 percent), quinoxyfen (up 28 percent), and the newly registered propiconazole increased. The newer products are used in alternation with older fungicides to counter development of resistance and are increasingly used on summer-planted berries, which are particularly susceptible to powdery mildew. Pyraclostrobin is frequently used in combination with boscalid. Both acres treated and pounds of active ingredient applied increased with these two products in 2008. Propiconazole, registered for use on strawberries in 2008, is a fungistatic demethylation inhibitor like myclobutanil. Use of mefenoxam, effective against *Phytophthora fragariae* (red stele) and *P. cactorum* (leather rot and crown rot), decreased 33 percent in 2008. Some of the increased use of captan may have been due to its effectiveness on plant collapse pathogens, *Macrophomina phaseolina* and *Fusarium oxysporum*.

The major insect pests of strawberries are lygus bugs and worms (various moth and beetle larvae), especially in the Middle and South Coast growing areas. Until recently, lygus bugs were not considered a problem in the South Coast, but lygus has become a serious threat probably due to warmer and dryer winters and increased diversity in the regional crop complex that support this pest. The major insecticides used in 2008 by acres treated were spinetoram, malathion, Bt, bifenthrin, naled, bifenazate, methomyl, abamectin, fenpropathrin, spinosad, oils, spiromesifen and acetamiprid. Acres treated with all of these major insecticides increased except for those treated with methomyl (30 percent decrease), Bt (12 percent decrease) and spinosad (54 percent decrease). Methomyl use decreased due to the withdrawal of strawberries from the Lannate registration. Although Bt and spinosad use decreased in both the South Coast and in the Middle Coast regions they continued in 2008 to be the primary pesticides used to control worms. Bt, spinosad, and the newly registered spinetoram are biological pesticides primarily used against lepidopteran larvae. Spinosad and spinetoram are also effective against thrips. Spinosad and spinetoram have longer residual action and are generally more effective so do not need to be applied as frequently as Bt. Spinetoram, with the same mechanism of action as spinosad, appears to have partially replaced spinosad and Bt.

Increases in lygus bug populations in the South Coast growing area and wide-spread resistance to pyrethroid pesticides led to increased use of AIs with other modes of action that are different than those of pyrethroids. These include malathion (up 48 percent), naled (up 42 percent), thiamethoxam (up 38 percent), and the newly registered acetamiprid. Products that are effective against whiteflies also increased, in particular those that contain fenpropathrin (up 21 percent), malathion, spiromesifen (up 14 percent), and bifenthrin (up 63 percent). Bt and spinosad, as well as pyrethrins (down 35 percent), are available for use by organic growers. Like Bt, pyrethrins have short residual activity and so may require multiple sprays. After increased use in 2007, both imidacloprid and pyriproxyfen use declined in 2008 by 27 percent and 45 percent respectively. Pyriproxyfen is an insect growth regulator registered in 2002.

Increased pressure from two-spotted spider mite and red spider mite pressure resulted in a 25 percent increase in the use of bifenazate, which is effective against phytophagous mites and has low toxicity to predatory mites. Bifenazate has been used by conventional strawberry growers since its introduction in 2003. In terms of acres treated, the use of other miticides increased as well: spiromesifen (20 percent), etoxazole (18 percent), acequinocyl (67 percent), and abamectin (54 percent). Acequinocyl is effective against cyclamen mite, which is not controlled by bifenazate. Hexythiazox use decreased by 16 percent. Increased mite problems may be due to a relatively warm and dry winter in 2007-2008, but may also be due to carryover of mite populations from susceptible summer-planted berries to winter-planted.

Most strawberry production relies on several fumigants. Acres treated with fumigants in 2008 remained about the same as in 2007: chloropicrin use increased 3 percent, methyl bromide use increased 5 percent, while 1,3-dichloropropene (1,3-D) use decreased 7 percent, and metam-sodium use decreased 28 percent. Chloropicrin and 1,3-D are often used together. The increase in chloropicrin use and decline in 1,3-D use is probably due to reduced availability of 1,3-D and greater efficacy of formulations with a higher ratio of chloropicrin to 1,3-D against soil borne pathogens, particularly *Macrophomina* and *Fusarium*. In Ventura county the new VOC regulations reduced the amount fumigant available to growers and township caps on 1,3-D also favored the use of higher chloropicrin formulations. Metam-sodium is generally more effective in controlling weeds, but less effective than 1,3-D or 1,3-D plus chloropicrin against soil-borne diseases and nematodes. Methyl bromide use increased in both the North East and South Coast growing areas probably because of temporarily greater availability. It was used to control pathogens and nut sedge.

Fumigants accounted for about 85 percent by weight of all pesticide AIs applied in strawberries in 2008. Fumigants are applied at high rates, in part, because they treat a volume of space rather than a surface area, such as leaves and stems of plants. Thus, the pounds applied are large relative to other pesticide types even though the number of applications or number of acres treated may be relatively small.

Carrots

California is the largest producer of fresh market carrots in the United States accounting for about 85 percent of the U.S. production of 2.5 billion pounds with a total value of \$600 million in 2008. California has four main production regions for carrots: the San Joaquin Valley (Kern County); the central coast in San Luis Obispo and Santa Barbara counties (Cuyama Valley) and Monterey County; the low desert (Imperial and Riverside counties); and the high desert (Los Angeles County). The San Joaquin Valley accounts for more than half the state's acreage.

Table 24A. Total reported pounds of all active ingredients (AI), acres treated, acres planted, and prices for carrots each year from 2004 to 2008. Planted acres from 2003 to 2007 are from CDFA, 2008; planted acres in 2008 are from NASS, January 2009; and marketing year average prices from 2003 to 2008 are from NASS, August 2009. Acres treated means cumulative acres treated (see explanation p. 11).

	2004	2005	2006	2007	2008
Lbs AI	8,076,983	9,029,203	7,835,999	7,941,697	8,989,735
Acres Treated	503,062	535,967	453,099	523,431	590,437
Acres Planted	70,800	71,600	72,300	73,400	65,000
Price \$/cwt	\$21.50	\$21.70	\$21.10	\$22.40	\$25.10

Table 24B. Percent difference from previous year for reported pounds of all AIs, acres treated, acres planted and prices for carrots each year from 2004 to 2008.

	2004	2005	2006	2007	2008
Lbs AI	-6	12	-13	1	13
Acres Treated	13	7	-15	16	13
Acres Planted	-1	1	1	2	-11
Price \$/cwt	5	1	-3	6	12

Figure 21. Acres of carrots treated by all AIs in the major types of pesticides from 1994 to 2008.

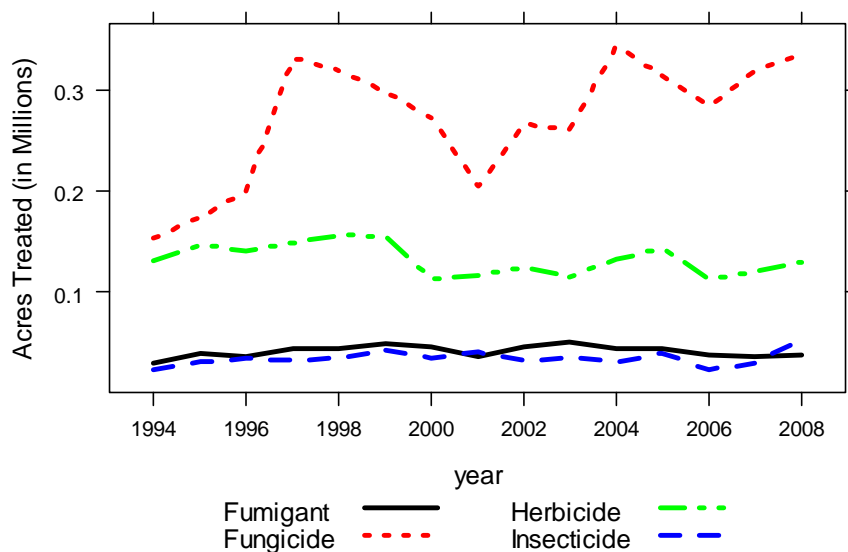


Table 24C. The non-adjuvant pesticides with the largest change in acres treated of carrots from 2007 to 2008. This table shows acres treated with each AI in each year from 2004 to 2008, the change in acres treated and percent change from 2007 to 2008.

AI	AI Type	2004	2005	2006	2007	2008	Change	Pct Change
ESFENVALERATE	INSECTICIDE	6,421	14,202	10,102	12,130	25,083	12,953	107
MEFENOXAM	FUNGICIDE	102,374	97,866	82,459	77,159	87,496	10,337	13
FENAMIDONE	FUNGICIDE			2,758	11,872	19,762	7,891	66
PENDIMETHALIN	HERBICIDE	5		75	17,574	24,807	7,233	41
PYRACLOSTROBIN	FUNGICIDE	24,732	21,765	23,938	23,844	27,393	3,549	15
IPRODIONE	FUNGICIDE	30,054	34,159	29,414	33,657	30,364	-3,293	-10
OIL	INSECTICIDE	2,292	6,642	1,069	1,646	4,777	3,131	190
SPINOSAD	INSECTICIDE	3,202	2,869	1,008	1,108	4,032	2,924	264
SULFUR	FUNGICIDE	28,092	46,235	32,527	78,574	81,404	2,830	4
CLETHODIM	HERBICIDE	967	2,039	1,016	1,288	4,052	2,764	215
CHLOROTHALONIL	FUNGICIDE	18,948	20,793	18,319	20,181	17,588	-2,593	-13
QST 713 STRAIN OF DRIED BACILLUS SUBTILIS	FUNGICIDE	187	35	490	1,111	3,594	2,484	224
PYRETHRINS	INSECTICIDE		142	90	2,544	205	-2,339	-92
BACILLUS THURINGIENSIS	INSECTICIDE	3,020	1,253	837	334	2,371	2,037	609
POTASSIUM N-METHYLDITHIOCARBAMATE	FUMIGANT	558	822	2,857	1,470	3,434	1,965	134

Total acres of carrots planted decreased by 11 percent while pesticide used (as acres treated) in carrots increased by 13 percent in 2008 compared to 2007. Pounds of pesticide active ingredients (AI) applied increased by 13 percent from 2007 to 2008. Reported use of all major pesticide types increased in terms of acres treated. Pesticides used most (as measured by acres treated) were mefenoxam, sulfur, iprodione, pyraclostrobin, esfenvalerate, pendimethalin, fenamidone, chlorothalonil, and oils. The major pesticides with increased acres treated were sulfur, pendimethalin, fenamidone, esfenvalerate, spinosad, *Bacillus thuringiensis* (Bt), potassium n-methyldithiocarbamate, clethodim, QST 713 strain of dried *Bacillus subtilis*, and oils. The major pesticides with decreased acres treated were pyrethrins, chlorothalonil, and iprodione.

Cumulatively, the most used pesticide category for carrots, as measured by acres treated, was fungicides, followed by herbicides and insecticides. From 2007 to 2008 acres treated with fungicides increased by 5 percent while pounds AI increased by 16 percent, and acres treated with herbicides increased 9 percent while pounds AI increased by 3 percent. The acres treated with insecticides increased 76 percent while pounds of AI increased by 119 percent.

The most applied fungicides in 2008 by acres treated were sulfur, mefenoxam, iprodione, pyraclostrobin, and chlorothalonil. Alternaria leaf blight, a foliar disease, is generally controlled by iprodione, chlorothalonil, pyraclostrobin, or azoxystrobin; the later two are strobilurins with the same mode of action. In terms of acres treated, iprodione use decreased 10 percent and chlorothalonil 13 percent while sulfur use increased 4 percent, pyraclostrobin increased 15 percent, mefenoxam 13 percent, and fenamidone 66 percent in 2008. Fenamidone was a new product. The organic carrot industry experienced leaf blight issues in 2008, which could explain the increased use of *B. subtilis* and sulfur. Carrot varieties resistant to fungal diseases are currently available which may explain the reduction of iprodione use in 2008. Cavity spot is a major, troublesome soilborne fungal disease that is commonly controlled by applying mefenoxam or metam sodium (a soil fumigant). Powdery mildew is primarily controlled by

sulfur, which is inexpensive and especially popular with organic growers. Sulfur use increased in 2008 because weather conditions favored powdery mildew infection.

In terms of acres treated, the main herbicides used in carrot production were linuron, pendimethalin, trifluralin, fluazifop-p-butyl, and clethodim. The use of linuron, a postemergence herbicide that provides good control of broadleaf weeds and small grasses, increased 2 percent. Trifluralin, a preemergence herbicide, complements linuron for weed management; its use increased by 4 percent. Pendimethalin use increased by 41 percent, possibly because it inhibits carrot root development less than other herbicides. In addition, fluazifop-p-butyl, a selective postemergence phenoxy herbicide used for control of annual and perennial grasses, decreased by 5 percent.

Most carrot production relies on the fumigants metam sodium, 1,3-D, potassium n-methyldithiocarbamate (metam-potassium), and to a lesser extent, chloropicrin. These fumigants are used to manage nematodes and may provide other benefits such as weed and soil borne disease control. In 2008, fumigants accounted for about 74 percent of the total pounds of pesticide AIs applied to carrots. This is a 13 percent increase from 2007. Also, acres treated with fumigants increased by 8 percent. The number of acres treated with metam sodium, metam potassium, and chloropicrin increased (8, 134, and 81 percent acres treated, respectively), while those treated with 1,3-D decreased by 14 percent. At low to moderate levels of nematode infestation, metam sodium or metam-potassium is usually used. If nematode levels are high, 1,3-D is preferred. 1,3-D usage decreased (14 percent) in 2008 compared to 2007, probably because of regional demand based on nematode populations and the effects of local use limits established to mitigate air quality concerns.

Insects are not generally major problems in carrot production, except for whiteflies, which are controlled with esfenvalerate and methomyl. The major insecticides used in 2008 in terms of acres treated were esfenvalerate, oils, spinosad, diazinon, cyfluthrin, and methomyl. Acres treated with esfenvalerate increased by 107 percent in 2008 compared to 2007. Major infestations of crown root aphid in 2008 could explain the increased use of esfenvalerate and spinosad. Although generally used against whitefly, they are also used to control flea beetle, leafhoppers and cutworms. Acres treated with methomyl decreased in 2008. This carbamate pesticide is effective against cutworms and leafhoppers as well as whiteflies. Diazinon use against cutworms and wireworms also decreased. The use of oils, used as an insecticide, increased by 190 percent. Cyfluthrin, a pyrethroid used to control cutworm and crown root aphids, increased by 175 percent while pyrethrins, used against a wide range of pests, decreased 92 percent in 2008.

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Private Consultants

University of California Cooperative Extension Area IPM Advisors

UC Cooperative Extension Farm Advisors

UC Cooperative Extension Specialists

UC Researchers

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