PESTICIDE USE ANNUAL REPORT

2024 Data Summary

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Contents

Table of Contents

Year in Summary 2
Pesticide Use Measures 5
Data Summary 6
- Trends by Use Type 7
  - Insecticide (including miticide) 9
  - Fungicide 11
  - Fungicide/Insecticide 12
  - Herbicides 14
  - Fumigants 15
  - Other 17
- Pesticide Use by County 19
- Production Ag and Largest NonAg Uses 20
- Trends in Use for Select Pesticide Categories 22
  - Biopesticides 23
  - Oils 27
  - Carcinogens 29
  - Cholinesterase Inhibitors 33
  - Fumigants 37
  - Groundwater Contaminants 41
  - Reproductive Toxins 45
  - Toxic Air Contaminants 48
- Trends in Pesticide Use for Select Commodities 52
  - Alfalfa 57
  - Almond 58
  - Cotton 59
  - Orange 60
  - Pistachio 61
  - Processing Tomato 62
  - Rice 63
  - Strawberry 64
  - Table and Raisin Grape 65
  - Tangerine 66
  - Walnut 67
  - Wine Grape 68

Year in Summary

Overview:

Reported pesticide use for California in 2024 totaled 179 million pounds of applied active ingredients (AIs) and 102 million acres treated (See definition of cumulative acres treated). Twelve percent of the pounds applied and 29 percent of the acres treated were adjuvants[1]. Over the ten-year period from 2015 to 2024, total pounds applied decreased by 33 million pounds (16 percent decrease) while acres treated increased by five million acres (5 percent increase). From 2023 to 2024, pounds applied of AIs increased by three million pounds (2 percent increase), while the acres treated increased by three million acres (4 percent increase).

2024 TOP FIVE STATEWIDE

Top 5 AIs by Pounds Applied

1. Sulfur
2. Oils
3. Glyphosate
4. Chloropicrin
5. Metam-potassium

Top 5 AIs by Acres Treated

1. Glyphosate
2. Oils
3. Sulfur
4. Lambda-cyhalothrin
5. Glufosinate-ammonium

The AIs with the highest statewide total reported pounds applied in 2024 were sulfur (fungicide/insecticide), petroleum and mineral oils (fungicide/insecticide), glyphosate (herbicide), chloropicrin (fumigant), and potassium N-methyldithiocarbamate ("metam-potassium," fumigant). Fungicide/insecticide AIs have both fungicidal and insecticidal activity, although they may be used solely as fungicide or insecticide depending on the crop. The AIs with the highest reported acres treated in 2024 were glyphosate, petroleum and mineral oils, sulfur, lambda-cyhalothrin (insecticide), and glufosinate-ammonium (herbicide).

An increase or decrease in use, from one year to the next or in the span of a few years, may not necessarily indicate a general use trend, but rather may represent variations related to:

- New regulations (pesticides, water supply, etc.),
- Changes in planted acreage,
- Types of crops planted,
- Changes in pricing and supply,
- Changes in pest management practices,
- Pest pressures (including increased pressure from invasive species), and
- Weather conditions (droughts, heavy rains, flooding).

[1] An adjuvant is broadly defined as any non-pesticide material used with a pesticide product or pesticide spray mixture to improve the pesticide's performance or the physical properties of the spray mixture (Examples: spreader stickers, surfactants, oils, buffering agents, etc.) California law requires registration of adjuvants, which are not considered pesticides under federal law.

Changes in total use, measured as either pounds applied or acres treated, encompass AIs with varying levels of risk and do not account for mitigation measures designed to prevent off-site movement and potential exposure to pesticides. Changes in total use therefore do not necessarily correspond to changes in risk to human health or the environment. See the Evaluating Risk chapter of the Pesticide Use Annual Report History and Background document for more information on the relationship between use amounts and risk.

Trends by Pesticide Category:

Pesticide trends are reported by category based on the type of pesticide (e.g., biopesticide) and the health or environmental risks (e.g., carcinogen or groundwater contaminant). Definitions of each category can be found in the section Trends in Use for Select Pesticide Categories. Biopesticides and petroleum/mineral oils are considered to pose lower risks to human health and the environment, and some products within these categories are used by organic growers. Higher-risk pesticide categories include carcinogens, cholinesterase inhibitors, fumigants, groundwater contaminants, reproductive toxins, and toxic air contaminants.

Some AIs belong to more than one higher-risk category. For example, many fumigants are also classified as toxic air contaminants and are therefore included in the totals for both categories. The pesticides in these categories are monitored and regulated by the department to reduce potential exposure and potential risks to human health and the environment. This process of continuous evaluation is how DPR informs and prioritizes its work to mitigate pesticide-related risks. Pesticide use reporting allows DPR to determine how much of a pesticide is used, which is one information source for DPR's continuous evaluation of pesticides in California.

Table 1 shows the ten-year use trend from 2015 to 2024 and the single-year change from 2023 to 2024 measured by pounds of AIs applied for each pesticide category. Table 2 presents the same category use trends measured by acres treated. Evaluating pesticide use trends spanning multiple years provides a broader overview of changes and trends in pesticide use compared to annual changes, which can vary from one year to the next based on short-term conditions such as weather, water availability, changes in pricing and supply, and other factors.

From 2023 to 2024, pounds applied and acres treated of biopesticides increased by 5 percent and 6 percent, respectively. Pounds of oils applied increased by 8 percent, while acres treated decreased by 3 percent. For higher-risk categories, the single-year change ranged from a decrease of 5 percent to an increase of 3 percent for pounds applied, and a decrease of 4 percent to an increase of 39 percent for acres treated (Tables 1 and 2).

Over the ten-year period from 2015 to 2024, pounds of biopesticides applied increased by 36 percent, and acres treated increased by 39 percent. Pounds of oils applied decreased by 27 percent over the same period, while acres treated decreased by 1 percent. For higher-risk pesticide categories, the ten-year decrease in pounds applied ranged from 26 to 78 percent, while the decline in acres treated ranged from 21 to 53 percent (Tables 1 and 2).

Table 1. Ten-year (2015-2024) and one-year (2023-2024) changes in pesticide use by category, measured as difference and percentage change in pounds of AIs applied. The ten-year visual trend column shows a simple graphical trendline for the category.

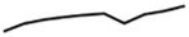
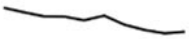
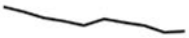
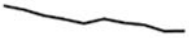
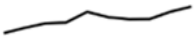
Category	Ten-Year Visual Trend	Ten-Year Pounds Change	Ten-Year Percent Change	One-Year Pounds Change	One-Year Percent Change
Biopesticides		2,499,987	36%	490,823	5%
Oils		-11,071,338	-27%	2,320,148	8%
Carcinogens		-13,109,295	-28%	862,305	3%
Cholinesterase Inhibitors		-1,902,197	-43%	-135,268	-5%
Fumigants		-11,712,647	-26%	579,798	2%
Groundwater Contaminants		-454,974	-78%	275	0.2%
Reproductive Toxins		-3,365,991	-38%	-6,455	-0.1%
Toxic Air Contaminants		-14,439,690	-29%	205,782	1%

Table 2. Ten-year (2015-2024) and one-year (2023-2024) changes in pesticide use by category, measured as difference and percent change in acres treated. The ten-year visual trend column shows a simple graphical trendline for the category.

Category	Ten-Year Visual Trend	Ten-Year Acres Change	Ten-Year Percent Change	One-Year Acres Change	One-Year Percent Change
Biopesticides		2,574,561	39%	495,752	6%
Oils		-61,524	-1%	-136,575	-3%
Carcinogens		-1,963,303	-21%	300,540	4%
Cholinesterase Inhibitors		-1,387,918	-39%	111,551	5%
Fumigants		-186,425	-53%	-6,609	-4%
Groundwater Contaminants		-177,970	-41%	72,376	39%
Reproductive Toxins		-1,484,583	-31%	80,917	2%
Toxic Air Contaminants		-1,594,591	-48%	52,550	3%

Pesticide Use Measures

This report focuses on two different measures of pesticide use: pounds of AI applied and acres treated. Pesticide use trends measured in pounds applied tend to be driven by pesticides with high application rates (e.g. pounds of AI per acre per application), such as sulfur, kaolin clay, oil, or fumigants. Trends reported in acres treated reflect how widely a pesticide is used and how often it is applied, without being influenced by the amount applied per acre. Considering the use factors and data trends for both measures together provides a more nuanced understanding of how pesticide use changes over time.

Pounds of AI applied: While most pesticides are applied at rates of one to two pounds per acre, some may be as low as a few ounces or as high as hundreds of pounds per acre. When comparing use among different AIs, the pounds-applied use measure will emphasize pesticides used at high application rates, such as sulfur, kaolin clay, oils, and fumigants, even if applied to a relatively limited area.

Acres treated: The acres-treated use measure is the cumulative sum of the acres treated with an AI. This measure is often greater than the total planted acreage due to multiple applications being made to the same area during a given year. For example, if a one-acre field is treated with an AI three times in a year, then the cumulative acres treated for the year with that AI is three acres, even though the field itself is only one acre.

As a pesticide use measure, acres treated reflects application frequency and geographic coverage and is not influenced by high application rates that drive rankings by pounds applied. It is limited as a use measure, however, in that it is only a partial representation of the total pesticide use reported: Only applications reported with units of acres or square feet are included in this use measure. Applications with volume or weight units cannot be converted to acres, so they are excluded. In addition, acres treated is not required for some non-agricultural (NonAg) pesticide use reports (PURs) such as structural and other types of urban uses, so these pesticide applications are not included in acres treated totals. For more information about agricultural and non-agricultural pesticide uses, see the "Agricultural (Ag) versus Nonagricultural (NonAg) Pesticide Uses" section of the Pesticide Use Annual Report Data Access, References, and Definitions Guide.

DID YOU KNOW?

Pesticide use trends can differ depending on how pesticide use is measured. Common pesticide use measures include ***pounds applied, acres treated, and application counts.***

Pounds applied measures the total weight of the pesticide used. This measure is strongly influenced by pesticides with high application rates, such as oil, sulfur, kaolin clay, and fumigants. As a result, these pesticides will top most pesticide use lists when pounds applied is the unit of measure.

Acres Treated and **Application Counts** measure how widely or how often pesticides are used. These metrics are not affected by high application rates but are not available for all types of applications. For some non-agricultural pesticide uses, reporting of acres treated or application counts is not legally required.

Analyzing trends using multiple pesticide use metrics can offer a more nuanced, complete understanding of pesticide use.

The number of applications can also be a useful measure of pesticide use; however, its utility is limited because of inconsistencies in reporting methodologies for NonAg use and because it is not required for structural use reporting. For Agricultural (Ag) use, each PUR represents a single application. Whereas for NonAg use, each PUR is a monthly summary of all the applications of a single product on a specific type of application site. Inconsistency in NonAg use reporting arises because there is not a standardized definition for what is to be considered as a single application, as opposed to the standard, quantified definitions that exist for a single acre or a single pound. The user-interpreted definition of a single application in NonAg use can therefore vary greatly among different pesticide applicators or businesses. For example, one business may treat an apartment building for termites and consider the building application as a whole to be a single application, while another business may treat a similar apartment building but consider each room in the building to be a single application. The differences in the user-interpreted definition of a single application result in large variation in the total number of applications for very similar pesticide applications of NonAg pesticide uses. As a result, NonAg application counts are not included in the annual report (Note that Ag application counts are included in some of the larger tables available on the Annual Report website but are rarely used in Annual Report graphs or discussion).

The trends in use for a single AI will usually follow similar patterns of increases or decreases for both pounds applied and acres treated. However, when pounds applied and acres treated move in different directions for one AI, it is often due to fluctuations in NonAg uses of the AI which do not legally have to report acreage. Differences between these use measures may also result from a change in use of products with a higher or lower percentage concentration of the AI.

For easier interpretation of the data and to reflect the AI names most familiar to users, the Appendix table groups certain AIs that have numerous salts, esters, subspecies, strains, or other closely related derivatives included under a single general name. These general AI names are used in subsequent tables where totals are reported. If needed, values for the individual AIs can be found in the downloadable supplemental tables on the annual report webpage.

Data Summary

This report is a snapshot summary based on 2024 PUR data submitted to DPR as of September 28, 2025. The PUR data is continually updated, so this snapshot summary may not fully correlate to later PUR data queries, including those from the California Pesticide Information Portal (CalPIP, an online query tool), that contain record corrections made after September 28, 2025.

Since 1990, the reported pounds applied of pesticides and acres treated have fluctuated from year to year. Regression analysis on pounds of AI since 1990 does not indicate a significant trend of either increase or decrease in total pesticide use. However, there can be significant changes in the types of pesticides that makeup the statewide total.

Trends by Use Type

Pesticide use can be classified into broad use types based on the overall generalized pest categories targeted by the pesticide. Examples of use types include herbicides (for treating various weeds); insecticides, including miticides (for treating many arthropod pests); fungicides (for treating assorted fungal diseases); and many more. The PUR data does not include information on the pest targeted by any individual pesticide application, which can make it difficult to determine the intended use type. Trends were analyzed for the most common use types: insecticides, fungicides, fungicide/insecticides, herbicides, and fumigants. Given the high reported use of sulfur, oils, and other similar AIs which have both fungicidal and insecticidal activity, the fungicide/insecticide category was created. "Fumigant" is technically an application method rather than a use type, often spanning multiple target pest categories, such as a soil fumigant that treats insect, fungal disease, nematodes, and weeds.

Figures 1 and 2 measure six pesticide use types:

- Fungicides,
- Insecticides (including miticides),
- Fungicide/Insecticides (pesticides with both fungicide and insecticide/miticide properties, such as sulfur and oils),
- Fumigants,
- Herbicides, and
- Other (all remaining pesticide types that did not have significant enough amounts used to warrant their own graph trend line).

Fumigants and fungicide/insecticides typically have high application rates and therefore ranked high in use at the top of the graph when measured by pounds applied (Figure 1) but ranked near the bottom of the graph when measured by acres treated (Figure 2) due to less widespread use compared to other types of pesticides and a lack of acre treated values when the fumigant is a NonAg pesticide use such as structural termite control or commodity fumigations.

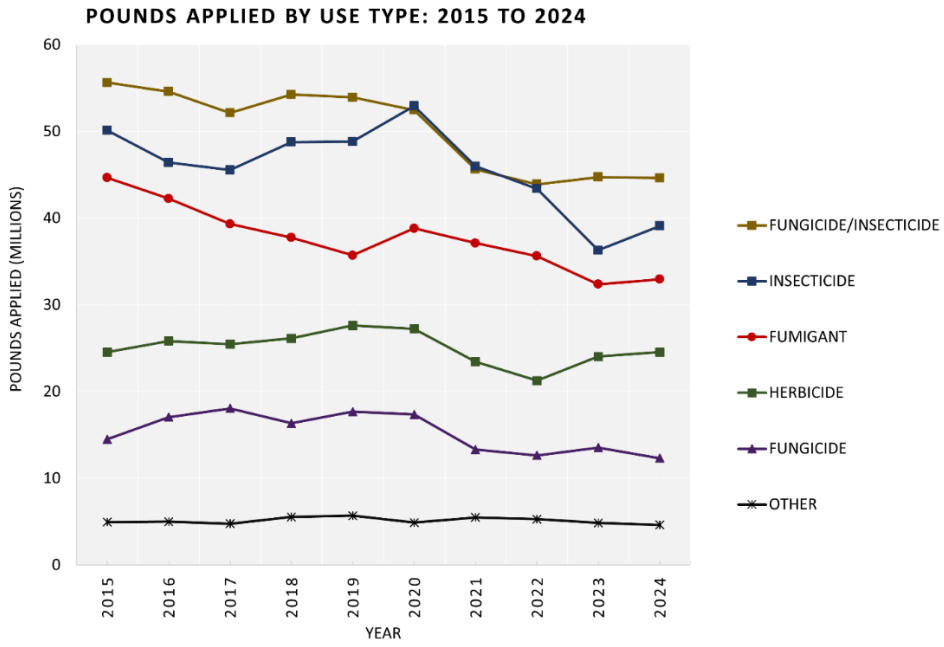


Figure 1. Pounds applied of all AIs in the major types of pesticides from 2015 to 2024, where "Other" includes pesticides such as plant growth regulators, bactericides, harvest aids, rodenticides, molluscicides, algaecides, repellents, antimicrobials, antifoulants, disinfectants, and biocides.

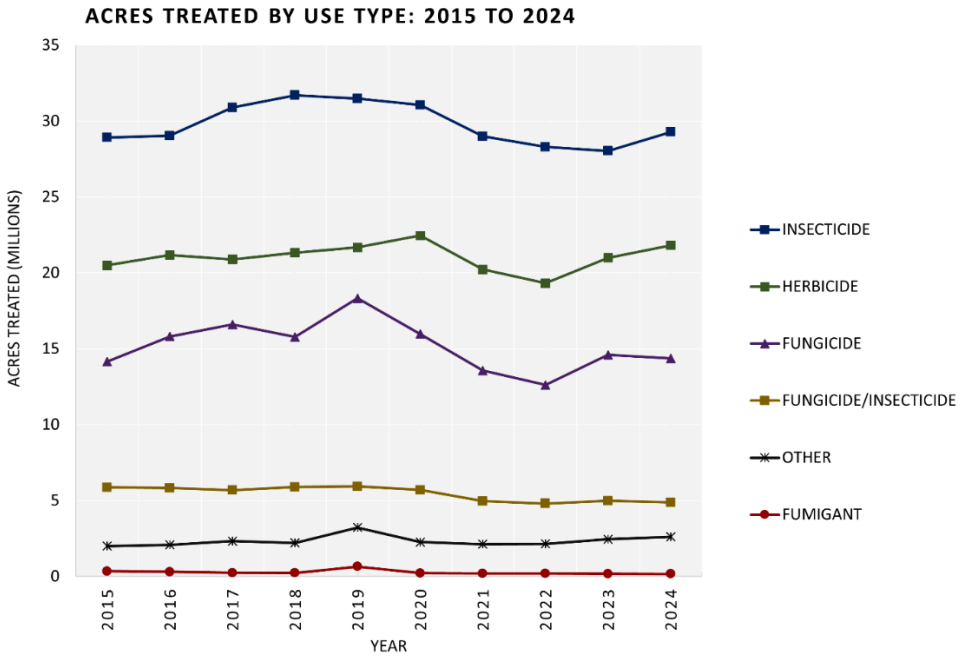


Figure 2. Acres treated by all AIs in the major types of pesticides from 2015 to 2024, where "Other" includes pesticides such as plant growth regulators, bactericides, harvest aids, rodenticides, molluscicides, algaecides, repellents, antimicrobials, antifoulants, disinfectants, and biocides.

The top five AIs for each use type by acres treated and pounds applied are detailed below.

Insecticide (including miticide)

Petroleum and mineral oils ("oil") used in insecticides ranked highest when measured by either acres treated or by pounds applied. The remaining four of the top five insecticide AIs, as measured by acres treated, included lambda-cyhalothrin (pyrethroid), chlorantraniliprole (anthranilic diamide), abamectin (botanical miticide/insecticide), and methoxyfenozide (diacylhydrazine insect growth regulator) (Table 3 and Figure 3). Boric acid (inorganic), methoxyfenozide, diatomaceous earth (inorganic), and *Bacillus thuringiensis* (microbial) made up the remainder of the top five insecticides measured by pounds applied (Table 4 and Figure 4).

Table 3. Top five insecticides in California by acres treated for 2024.

Top Five	Acres Treated
Oil	4,696,712
Lambda-Cyhalothrin	2,771,679
Chlorantraniliprole	2,189,323
Abamectin	2,146,698
Methoxyfenozide	2,052,578

Table 4. Top five insecticides in California by pounds applied for 2024.

Top Five	Pounds Applied
Oil	30,616,567
Boric Acid	1,102,727
Methoxyfenozide	623,817
Diatomaceous Earth	609,093
Bacillus thuringiensis	513,828

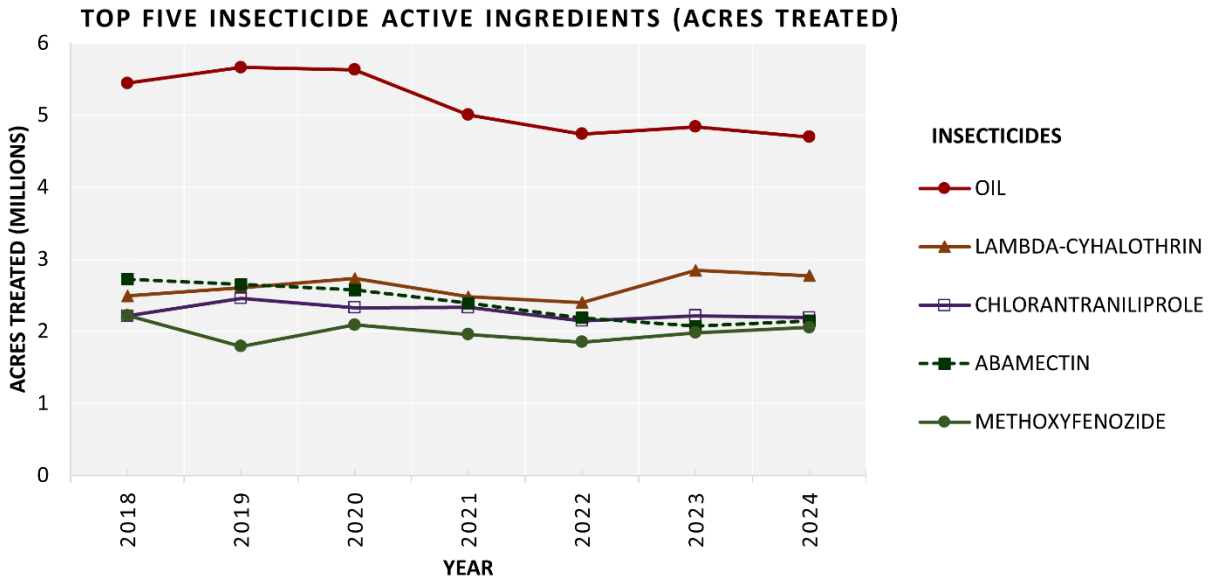


Figure 3. Acres treated by the top five insecticide AIs from 2018 to 2024.

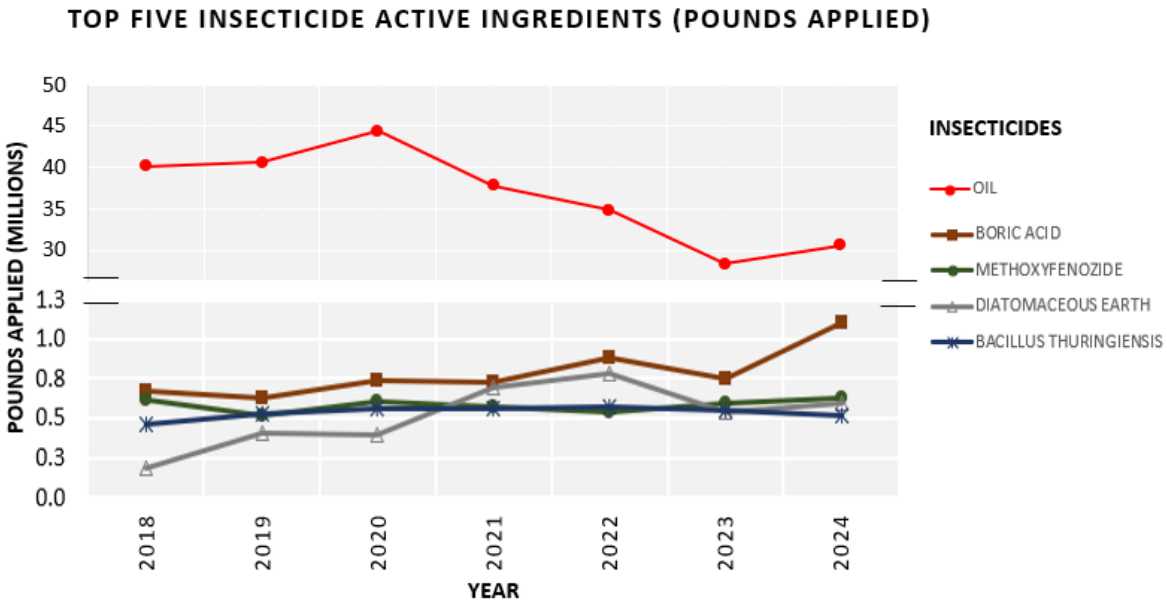


Figure 4. Pounds applied by the top five insecticide AIs from 2018 to 2024. Vertical axis is split to visually display AIs with substantially different ranges in use.

Fungicide

Azoxystrobin (strobilurin), copper (inorganic), pyraclostrobin (strobilurin), difenoconazole (azole), and fluxapyroxad (amide) comprised the top five fungicides by acres treated (Table 5 and Figure 5). Copper (inorganic), potassium phosphite (inorganic), chlorothalonil (substituted benzene), mancozeb (carbamate), and captan (thiophthalimide) made up the top five fungicides by pounds applied (Table 6 and Figure 6).

Table 5. Top five fungicides in California by acres treated for 2024.

Top Five	Acres Treated
Azoxystrobin	1,621,903
Copper	1,609,659
Pyraclostrobin	1,064,799
Difenoconazole	820,818
Fluxapyroxad	679,656

Table 6. Top five fungicides in California by pounds applied for 2024.

Top Five	Pounds Applied
Copper	5,977,262
Potassium Phosphite	1,243,143
Chlorothalonil	1,114,665
Mancozeb	960,577
Captan	374,304

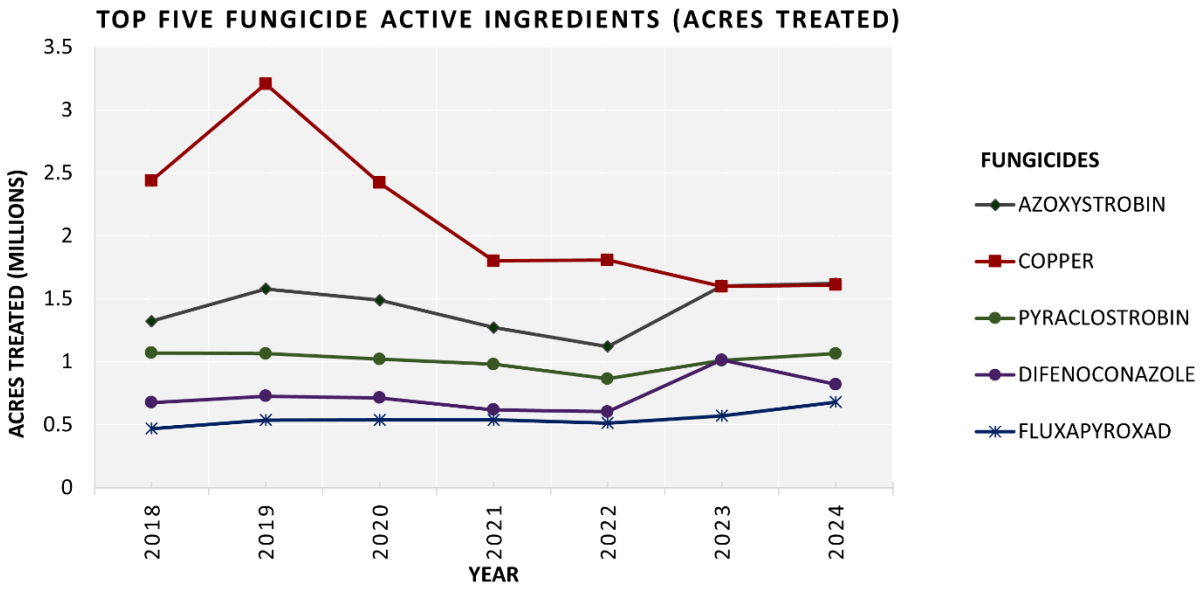


Figure 5. Acres treated by the top five fungicide AIs from 2018 to 2024.

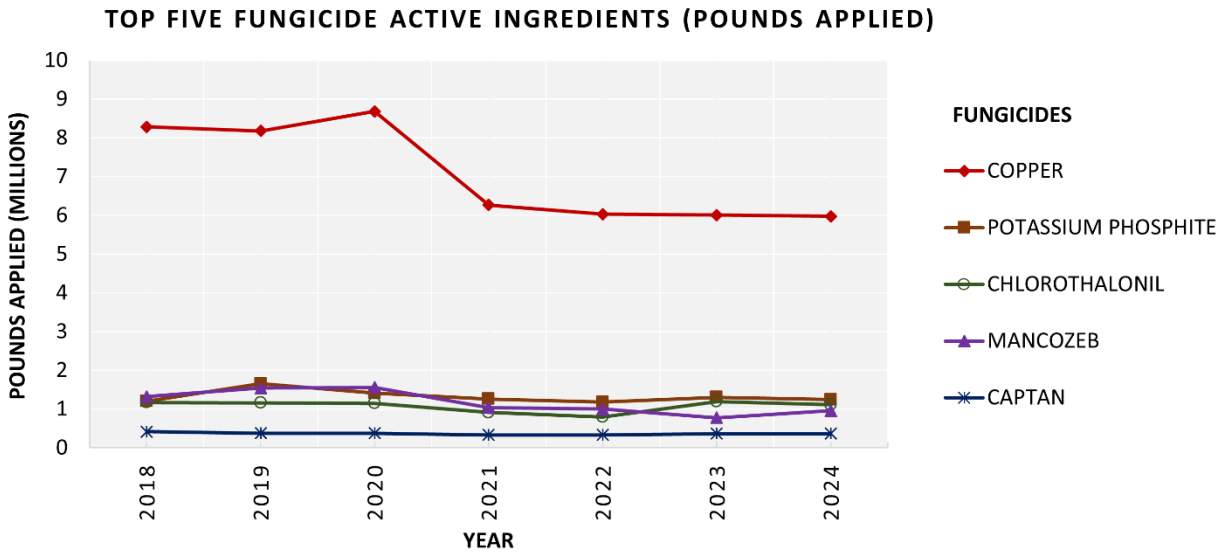


Figure 6. Pounds applied by the top five fungicide AIs from 2018 to 2024.

Fungicide/Insecticide

The category fungicide/insecticide includes a number of AIs which are used to control insects, mites, and fungal diseases. Sulfur represents most of the use in this category, with relatively minimal use of the remaining four of the top five AIs. Sulfur (inorganic), lime-sulfur (inorganic), the biopesticide kaolin clay ("kaolin," inorganic), and neem oil (botanical) ranked in the top five when measured by either acres treated or by pounds applied. Sodium tetraborate decahydrate (inorganic) made up the remaining AI in the top five when measured by acres treated (Table 7 and Figure 7). Disodium octaborate tetrahydrate (inorganic) was the remaining AI in the top five by pounds applied (Table 8 and Figure 8).

Table 7. Top five fungicide/insecticides in California by acres treated for 2024.

Top Five	Acres Treated
Sulfur	4,579,454
Lime-Sulfur	137,214
Neem Oil	97,309
Kaolin	96,546
Sodium Tetraborate Decahydrate	16,436

Table 8. Top five fungicide/insecticides in California by pounds applied for 2024.

Top Five	Pounds Applied
Sulfur	38,208,168
Kaolin	3,710,371
Lime-Sulfur	1,334,638
Disodium Octaborate Tetrahydrate	526,473
Neem Oil	190,574

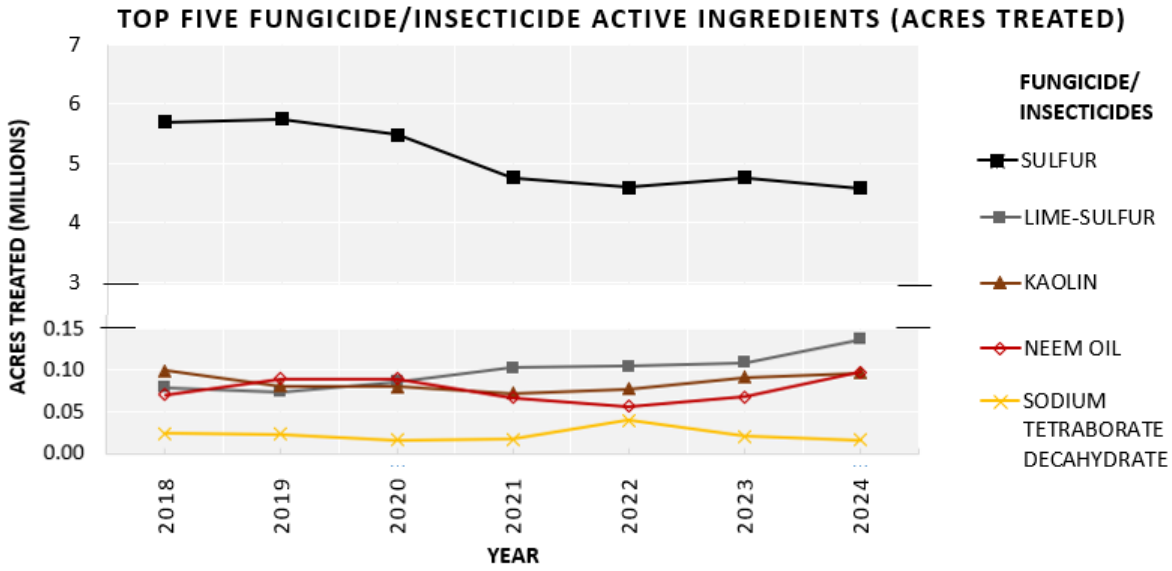


Figure 7. Acres treated by the top five fungicide/insecticide AIs from 2018 to 2024. Vertical axis is split to visually display AIs with substantially different ranges in use.

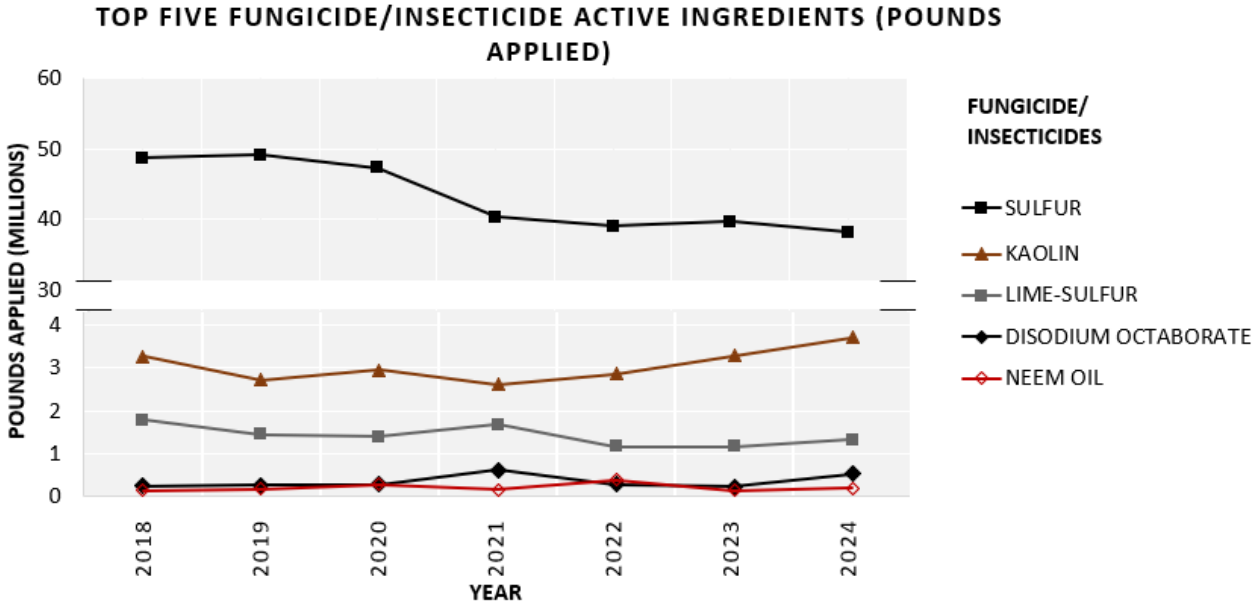


Figure 8. Pounds applied by the top five fungicide/insecticide AIs from 2018 to 2024. Vertical axis is split to visually display AIs with substantially different ranges in use.

Herbicides

The herbicides glyphosate (phosphonoglycine), glufosinate-ammonium (phosphonoglycine), oxyfluorfen (diphenyl ether), and pendimethalin (dinitroaniline) ranked in the top five herbicide AIs when measured by both acres treated and by pounds applied. Clethodim (cyclohexenone derivative) made up the remainder of AIs in the top five herbicides by acres treated (Table 9 and Figure 9), while propanil (amide) made up the remainder in the top five by pounds applied. (Table 10 and Figure 10).

Table 9. Top five herbicides in California by acres treated for 2024.

Top Five	Acres Treated
Glyphosate	5,132,497
Glufosinate-Ammonium	2,430,441
Oxyfluorfen	1,933,475
Clethodim	1,445,786
Pendimethalin	1,074,367

Table 10. Top five herbicides in California by pounds applied for 2024.

Top Five	Pounds Applied
Glyphosate	11,337,541
Glufosinate-Ammonium	2,398,177
Propanil	2,234,256
Pendimethalin	2,198,343
Oxyfluorfen	839,930

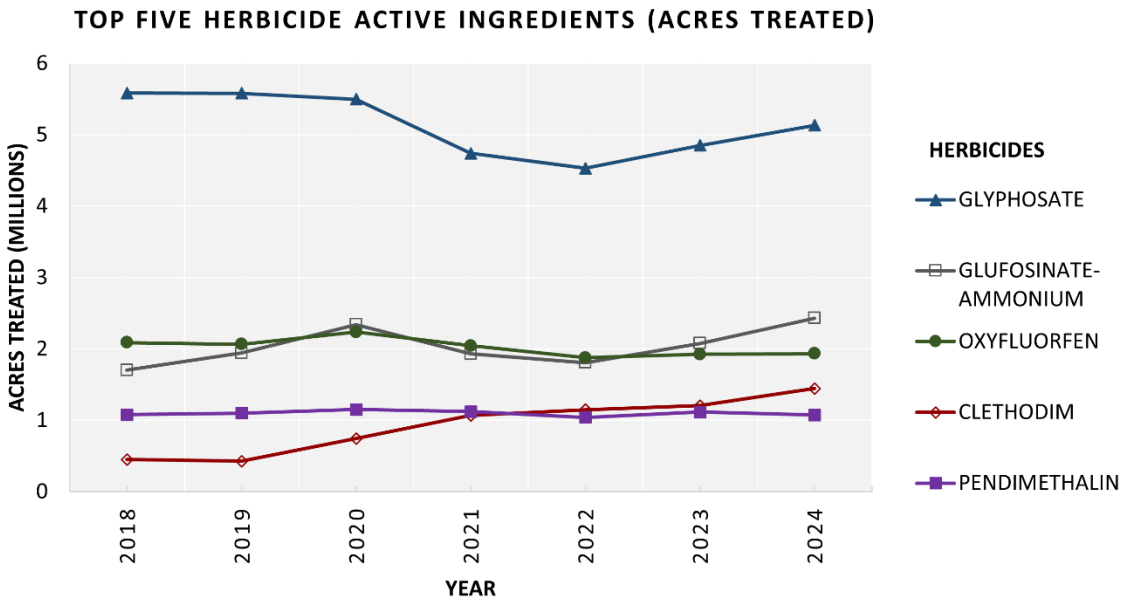


Figure 9. Acres treated by the top five herbicide AIs from 2018 to 2024.

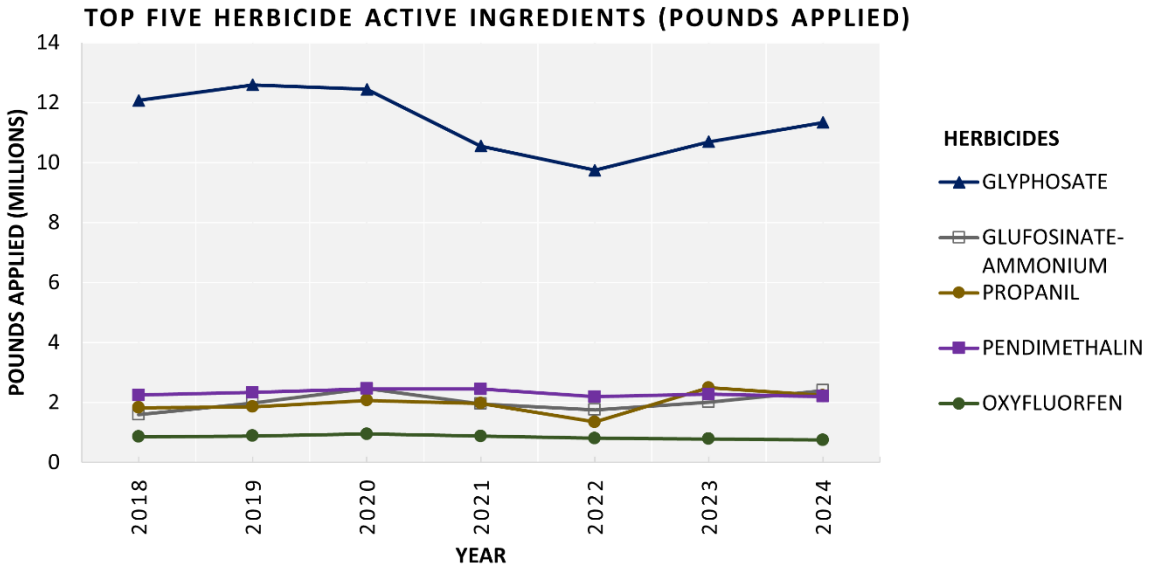


Figure 10. Pounds applied by the top five herbicide AIs from 2018 to 2024.

Fumigants

Potassium N-methyldithiocarbamate ("metam-potassium," carbamate), chloropicrin (inorganic), 1,3-dichloropropene (halogenated organic), and metam-sodium (carbamate) were in the top five fumigant AIs when ranked by either acres treated or pounds applied. Aluminum phosphide (inorganic) made up the remainder of the top five by acres treated (Table 11 and Figure 11), while sulfuryl fluoride (inorganic) was the remaining top five fumigant AI by pounds applied (Table 12 and Figure 12).

Table 11. Top five fumigants in California by acres treated for 2024.

Top Five	Acres Treated
Metam-Potassium	45,282
Chloropicrin	45,225
1,3-Dichloropropene	43,768
Aluminum Phosphide	30,410
Metam-Sodium	13,785

Table 12. Top five fumigants in California by pounds applied for 2024.

Top Five	Pounds Applied
Chloropicrin	9,128,132
Metam-Potassium	8,685,286
1,3-Dichloropropene	6,989,162
Metam-Sodium	2,833,708
Sulfuryl Fluoride	2,833,033

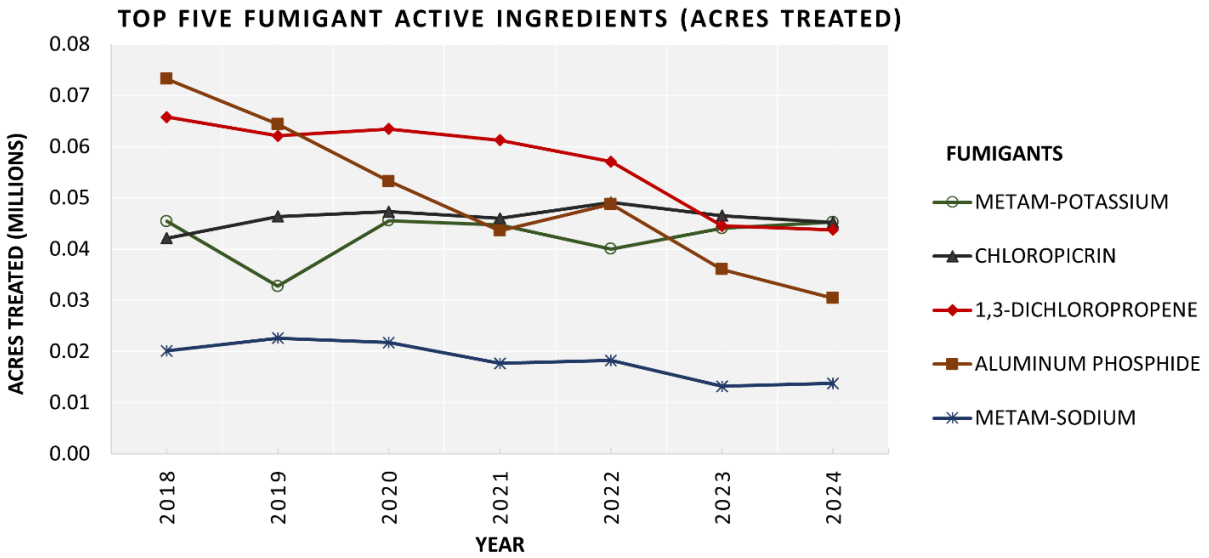


Figure 11. Acres treated by the top five fumigant AIs from 2018 to 2024.

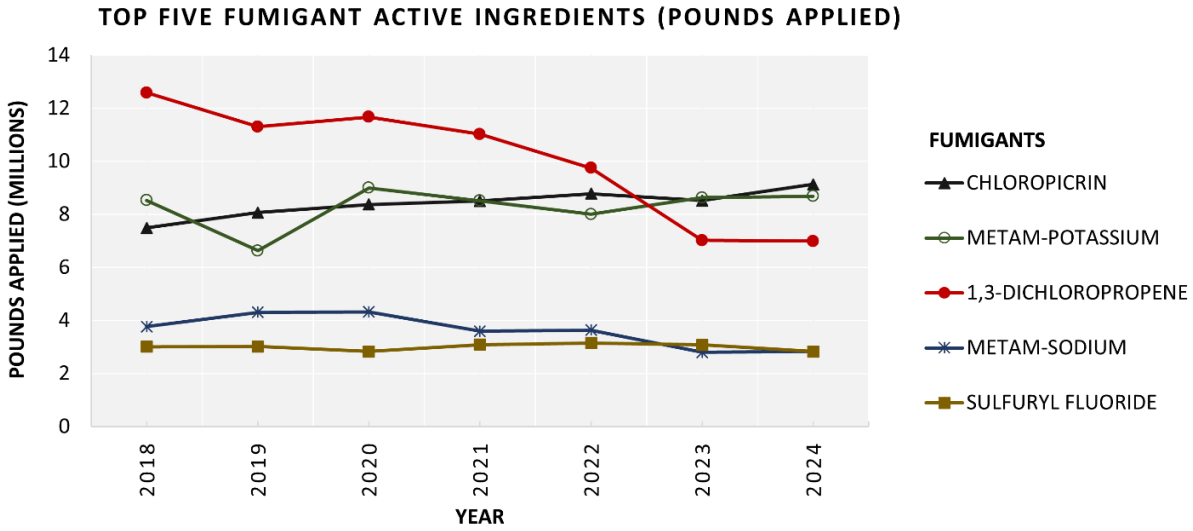


Figure 12. Pounds applied by the top five fumigant AIs from 2018 to 2024.

Other

The remaining "Other" category was largely comprised of plant growth regulators, bactericides, and algaecides. Ethephon (organophosphate growth regulator) and hydrogen peroxide (inorganic) ranked in the top five by both acres treated and pounds applied. Hydrogen peroxide is used as lower-risk bactericides/fungicides/algaecides in some crops. Gibberellins (botanical growth regulator), peroxyacetic acid (peroxide, used similarly to hydrogen peroxide), and *Aspergillus flavus* (microbial, used to reduce harmful aflatoxin contamination), made up the remainder of the top five by acres treated (Table 13 and Figure 13). By pounds applied, sodium hypochlorite (inorganic, used for post-harvest germicidal crop treatments), hydrogen cyanamide (inorganic, primarily used as a growth regulator), and sodium percarbonate (inorganic, used as an algaecide) completed the top five (Table 14 and Figure 14).

Table 13. Top five "Other" in California by acres treated for 2024.

Top Five	Acres Treated
Ethephon	436,681
Gibberellins	432,434
Hydrogen Peroxide	332,335
Peroxyacetic Acid	327,120
Aspergillus flavus	246,863

Table 14. Top five "Other" in California by pounds applied for 2024.

Top Five	Pounds Applied
Sodium Hypochlorite	886,570
Hydrogen Peroxide	653,335
Hydrogen Cyanamide	519,585
Sodium Percarbonate	387,249
Ethephon	382,851

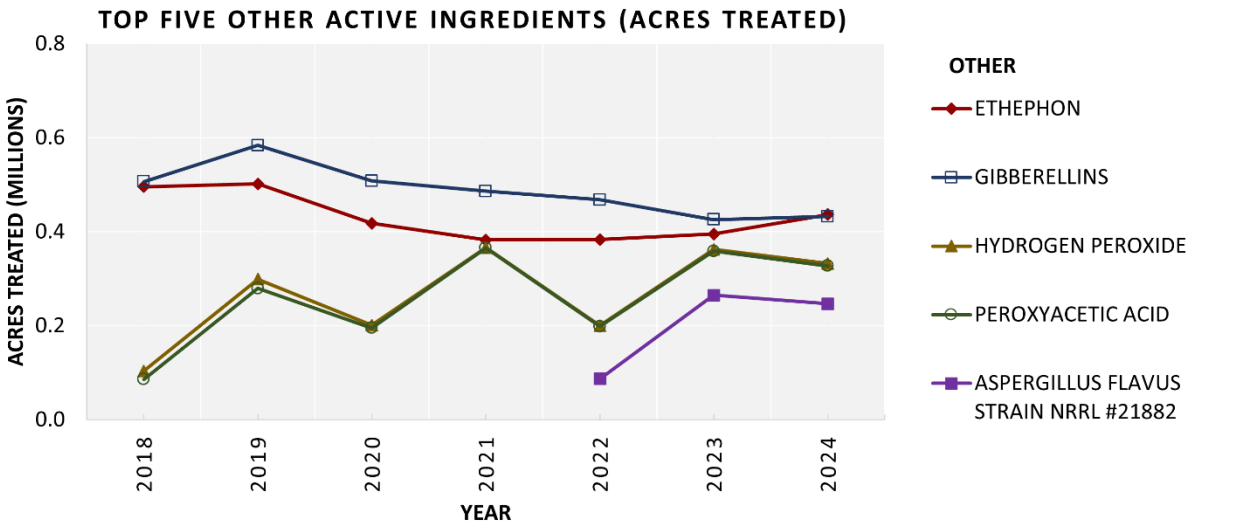


Figure 13. Acres treated by the top five "Other" AIs from 2018 to 2024 ("Other" includes pesticides such as plant growth regulators, bactericides, harvest aids, rodenticides, molluscicides, algaecides, repellents, antimicrobials, antifoulants, disinfectants, and biocides).

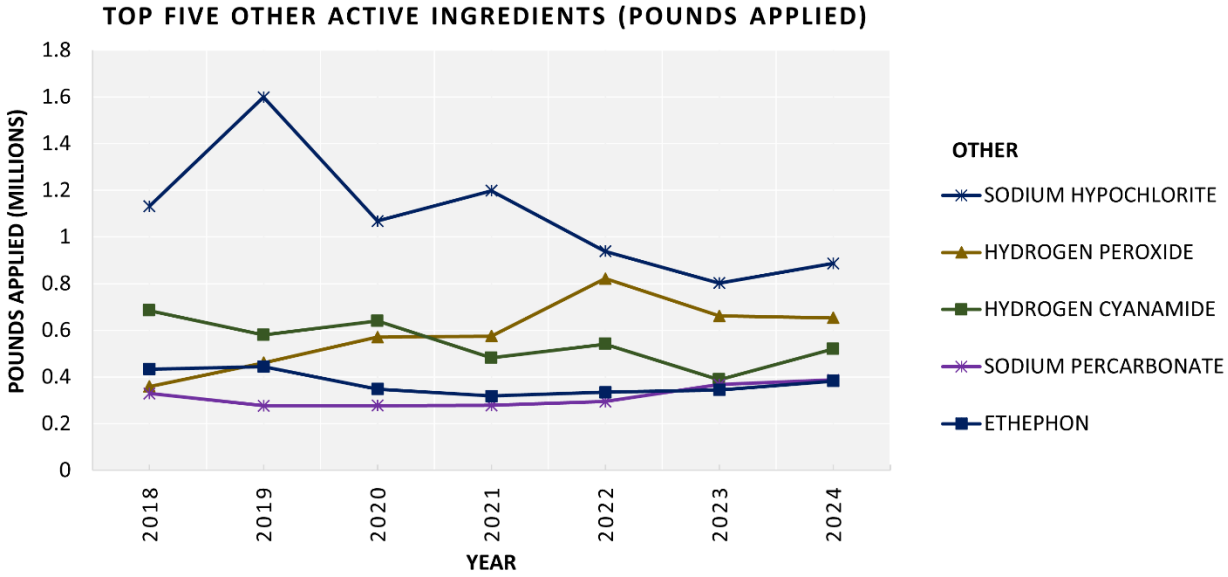


Figure 14. Pounds applied by the top five "Other" AIs from 2018 to 2024 ("Other" includes pesticides such as plant growth regulators, bactericides, harvest aids, rodenticides, molluscicides, algaecides, repellents, antimicrobials, antifoulants, disinfectants, and biocides).

Pesticide Use by County

In 2024, as in previous years, the region of highest pesticide use was California's San Joaquin Valley. The top five counties with the highest use were Fresno, Kern, Tulare, San Joaquin, and Monterey, accounting for 49 percent of the total pounds applied in California (Table 15). According to the California Department of Food and Agriculture (CDFA) 2023-2024 Agricultural Statistics Review report, these counties were also among the leading producers of agricultural commodities when ranked by agricultural production monetary value.

Table 15. Total pounds applied of AIs by county, rank, and the percent change from 2023 and 2024, ordered by 2024 rank, descending. Shaded rows show the counties where pounds applied decreased from 2023 to 2024. N/A stands for Not Applicable. Statewide totals may not exactly equal the sum of the columns due to rounding.

County	2023 Pounds Applied	2023 Rank	2024 Pounds Applied	2024 Rank	Percent Change
Fresno	26,338,105	1	25,760,691	1	-2
Kern	24,303,605	2	24,758,972	2	2
Tulare	16,817,146	3	17,280,942	3	3
San Joaquin	11,114,017	4	10,994,904	4	-1
Monterey	9,141,396	5	9,377,281	5	3
Merced	7,106,460	6	7,627,885	6	7
Kings	6,244,007	8	7,388,639	7	18
Madera	6,674,656	7	7,259,236	8	9
Ventura	6,105,658	9	6,464,051	9	6
Stanislaus	5,540,771	11	6,149,992	10	11
Santa Barbara	5,887,952	10	5,833,490	11	-1
Sacramento	4,858,148	12	4,420,574	12	-9
Imperial	4,388,435	13	4,165,207	13	-5
Yolo	3,784,034	14	3,558,650	14	-6
Riverside	2,820,235	16	2,996,320	15	6
San Luis Obispo	2,664,252	17	2,945,676	16	11
Sutter	2,659,374	18	2,543,945	17	-4
Colusa	2,483,273	19	2,413,611	18	-3
Glenn	2,208,539	22	2,375,117	19	8
Mendocino	2,149,694	23	2,370,639	20	10
Sonoma	2,461,272	21	2,336,922	21	-5
Butte	2,892,116	15	2,286,062	22	-21
Los Angeles	2,478,760	20	2,122,872	23	-14
Siskiyou	1,452,026	25	1,614,720	24	11
Santa Cruz	1,333,695	27	1,524,044	25	14
Napa	1,322,603	28	1,274,939	26	-4
San Diego	1,431,752	26	1,262,415	27	-12
Tehama	1,035,419	29	1,233,620	28	19
Solano	1,489,123	24	1,230,321	29	-17
Yuba	917,025	30	959,452	30	5
Orange	842,433	31	867,425	31	3
Santa Clara	751,073	32	785,387	32	5
San Bernardino	317,729	38	649,967	33	105

County	2023 Pounds Applied	2023 Rank	2024 Pounds Applied	2024 Rank	Percent Change
Contra Costa	576,450	34	586,273	34	2
Lake	562,494	35	584,624	35	4
San Benito	634,034	33	574,703	36	-9
Placer	381,814	36	344,366	37	-10
Alameda	329,194	37	325,483	38	-1
Shasta	262,027	39	278,672	39	6
Lassen	221,259	41	219,687	40	-1
Plumas	115,217	45	206,021	41	79
El Dorado	240,953	40	203,678	42	-15
San Mateo	202,293	42	190,343	43	-6
Del Norte	140,575	44	134,658	44	-4
Modoc	188,563	43	130,628	45	-31
Marin	88,885	47	83,459	46	-6
Amador	110,167	46	76,830	47	-30
Calaveras	53,206	49	69,340	48	30
Tuolumne	43,028	50	63,890	49	48
Trinity	27,724	53	43,975	50	59
Nevada	55,978	48	40,087	51	-28
Humboldt	30,249	51	33,611	52	11
San Francisco	27,772	52	32,249	53	16
Inyo	7,143	54	14,003	54	96
Sierra	2,437	57	9,347	55	284
Mono	3,331	56	7,278	56	119
Mariposa	5,703	55	7,211	57	26
Alpine	310	58	1,681	58	443
Total	175,325,587	N/A	179,096,065	N/A	2%

Production Ag and Largest NonAg Uses

Production agricultural pesticide use reports (Ag PURs) have always made up the majority of total reported pounds applied in California.[1] In 2024, Ag PURs made up 91 percent of the total pounds applied. Structural pest control and rights of way made up the largest segments of non-production agricultural pesticide uses (NonAg PURs), contributing 2.1 and 1.9 percent of total pesticide use, respectively. Landscape maintenance, post-harvest treatments, treated lumber, and industrial water were the next highest uses, representing 0.98, 0.97, 0.94, and 0.6 percent of all use in 2024, respectively. Post-harvest treatments are predominantly commodity fumigations but can also include pesticide treatments to irrigation ditches and other parts of fields that have not been planted with crops.

The remaining assortment of NonAg pesticide application types each made up less than 0.5 percent of all pesticide use and therefore were not given their own individual group heading. These uses were lumped together under an "All Other" group, including applications for research purposes, vector

[1] For more information about what pesticide uses are reported, see the Types of Pesticide Use Reported section in the Pesticide Use Annual Report Data Access, References, and Definitions Guide

control, and pest control through fumigation of non-food and non-feed materials. Together, the "All Other" category represented 1.8 percent of total pounds applied.

From 2023 to 2024, production agriculture increased in pounds applied by 1 percent, post-harvest treatments increased by 2 percent, structural pest control use increased by 7 percent, landscape maintenance increased by 13 percent, rights of way increased by 3 percent, treated lumber increased by 20 percent, industrial water decreased by 35 percent, and all other uses ("All Others") increased by 10 percent (Table 16).

Table 16. Pounds applied of pesticide AIs, from 2015 to 2024, by general use categories. Values in the Total Pounds Applied column may not exactly equal the sum of the columns due to rounding.

Year	Production Agriculture	Post-Harvest Treatment	Structural Pest Control	Landscape Maintenance	Rights of Way	Treated Lumber	Industrial Water	All Others	Total Pounds Applied
2015	195,265,544	1,450,925	4,216,124	1,689,364	3,554,008	446,665	1,976,586	3,389,880	211,989,097
2016	192,127,357	1,764,745	3,932,741	1,736,139	3,713,183	1,567,317	1,933,616	3,257,663	210,032,761
2017	188,815,839	1,635,327	3,643,811	1,581,020	3,699,445	1,625,937	1,499,130	3,605,436	206,105,944
2018	191,886,777	1,477,191	3,453,324	1,520,280	4,099,879	1,836,116	1,722,068	4,388,169	210,383,804
2019	190,943,150	1,571,103	3,368,852	2,291,094	5,117,847	1,395,035	2,062,345	4,056,042	210,805,468
2020	197,253,299	1,942,928	3,303,472	2,095,846	5,129,876	1,521,186	1,177,322	3,231,604	215,655,533
2021	173,812,590	1,622,188	3,923,017	1,566,322	3,689,616	1,542,994	2,164,637	3,014,928	191,336,292
2022	165,677,633	1,634,588	3,660,909	1,369,088	3,361,543	1,346,072	1,878,818	2,785,542	181,714,193
2023	160,176,686	1,708,787	3,582,888	1,567,525	3,269,930	1,400,903	1,697,013	2,921,855	176,325,587
2024	162,394,908	1,736,845	3,839,755	1,764,023	3,358,440	1,685,754	1,096,837	3,219,505	179,096,065

Trends in Use for Select Pesticide Categories

Pesticide use is summarized for the following eight categories that are based on either the type of pesticide (e.g., biopesticides) or a pesticide's potential to cause health or environmental impacts (e.g., carcinogens or groundwater contaminants):

- Biopesticides,
- Oils,
- Carcinogens,
- Cholinesterase inhibitors,
- Fumigants,
- Groundwater contaminants,
- Reproductive toxins, and
- Toxic air contaminants.

The summaries and the data are not intended to serve as indicators of actual pesticide impacts to the public or the environment as they do not account for label restrictions, mitigation methods, and other practices that may significantly reduce offsite movement of pesticides and potential for exposure. Rather, the data supports DPR regulatory functions to enhance public safety and environmental protection by increasing the understanding of the change in use of lower- and higher-risk AIs over time. Note that the pounds of AIs applied include both Ag and NonAg PURs, while the reported acres treated primarily reflects Ag PURs since this metric is not reported for most NonAg uses.

The following section discusses the one- and ten-year changes in pesticide use and presents graphs showing long-term use for each of the eight categories. Note that some AIs belong to more than one category. For example, many fumigants are also toxic air contaminants, so the total use of those AIs is included under both the fumigant and toxic air contaminant category totals. In addition, it is important to understand that the annual report addresses trends in pesticide AIs rather than pesticide products. Pesticide products may contain AIs from both lower and higher risk categories – for example, a product may contain two AIs – one that is a biopesticide and one that is a carcinogen. The risk level of the product would be defined by the highest-risk AI, so the product would be considered a carcinogen. An increase or decrease in ***biopesticide AIs*** therefore does not necessarily equate with a similar trend in use of ***biopesticide products.*** The biopesticide AI trend presented in this report should therefore be viewed as an increase or decrease in the incorporation of biopesticide AIs into pesticide products (including adjuvants). Tables reporting the amount of the individual chemicals used in each category over the last ten years can be downloaded under the Pesticide Category Lists section on the 2024 Summary Data website. Tables 17 and 18 show one-year and ten-year differences for each of the eight categories.

Table 17. The total pounds applied for eight different pesticide categories with the one-year percent change from 2023 to 2024 and the ten-year percent change from 2015 to 2024.

Category	2024 Pounds Applied	2023 Pounds Applied	One-Year %Change	2015 Pounds Applied	Ten-Year %Change
Biopesticides	9,435,206	8,944,384	5	6,935,219	36
Oils	30,650,689	28,330,542	8	41,722,028	-27
Carcinogens	33,368,241	32,505,936	3	46,477,535	-28
Cholinesterase inhibitors	2,563,040	2,698,308	-5	4,465,237	-43
Fumigants	32,947,303	32,367,505	2	44,659,950	-26
Ground water contaminants	131,280	131,005	0.2	586,254	-78
Reproductive toxins	5,594,913	5,601,369	-0.1	8,960,904	-38
Toxic air contaminants	34,690,125	34,484,343	1	49,129,814	-29

Table 18. The total acres treated for eight different pesticide categories with the one-year percent change from 2023 to 2024 and the ten-year percent change from 2015 to 2024.

Category	2024 Acres Treated	2023 Acres Treated	One-Year %Change	2015 Acres Treated	Ten-Year %Change
Biopesticides	9,092,847	8,597,095	6	6,518,287	39
Oils	4,842,512	4,979,087	-3	4,904,036	-1
Carcinogens	7,315,607	7,015,067	4	9,278,910	-21
Cholinesterase inhibitors	2,189,201	2,077,650	5	3,577,119	-39
Fumigants	162,087	168,696	-4	348,513	-53
Ground water contaminants	259,888	187,512	39	437,858	-41
Reproductive toxins	3,369,518	3,288,601	2	4,854,101	-31
Toxic air contaminants	1,737,550	1,684,999	3	3,332,141	-48

Biopesticides

Biopesticides include naturally occurring substances (biochemical pesticides) and microorganisms (microbial pesticides) that control pests or enhance the efficacy of other active ingredients. The definition may also include new technologies that do not easily fit into one of those two categories. Over 80 percent of the AIs identified as biopesticides by DPR come from the U.S. EPA Biopesticide Active Ingredient list, while the remaining AIs were determined to be biopesticides by DPR's Chemistry and Microbiology Program. As noted in the introduction to the Categories section, an increase or decrease in biopesticide AIs does not necessarily equate with a similar trend in use of biopesticide products since products containing biopesticide AIs may also contain more conventional or higher risk AIs as well. The biopesticide AI trend presented in this report should therefore be viewed as an increase or decrease in the incorporation of biopesticide AIs into pesticide products (including adjuvants).

Ten-year change (2015-2024)

Over the last ten years, annual biopesticide pounds applied increased from almost 7 million pounds to just over 9 million pounds, an increase of approximately 2 million pounds applied (36 percent increase). Acres treated with biopesticides increased from under 7 million acres to around 9 million acres, an increase of nearly 3 million acres treated (39 percent increase) (Figure 15).

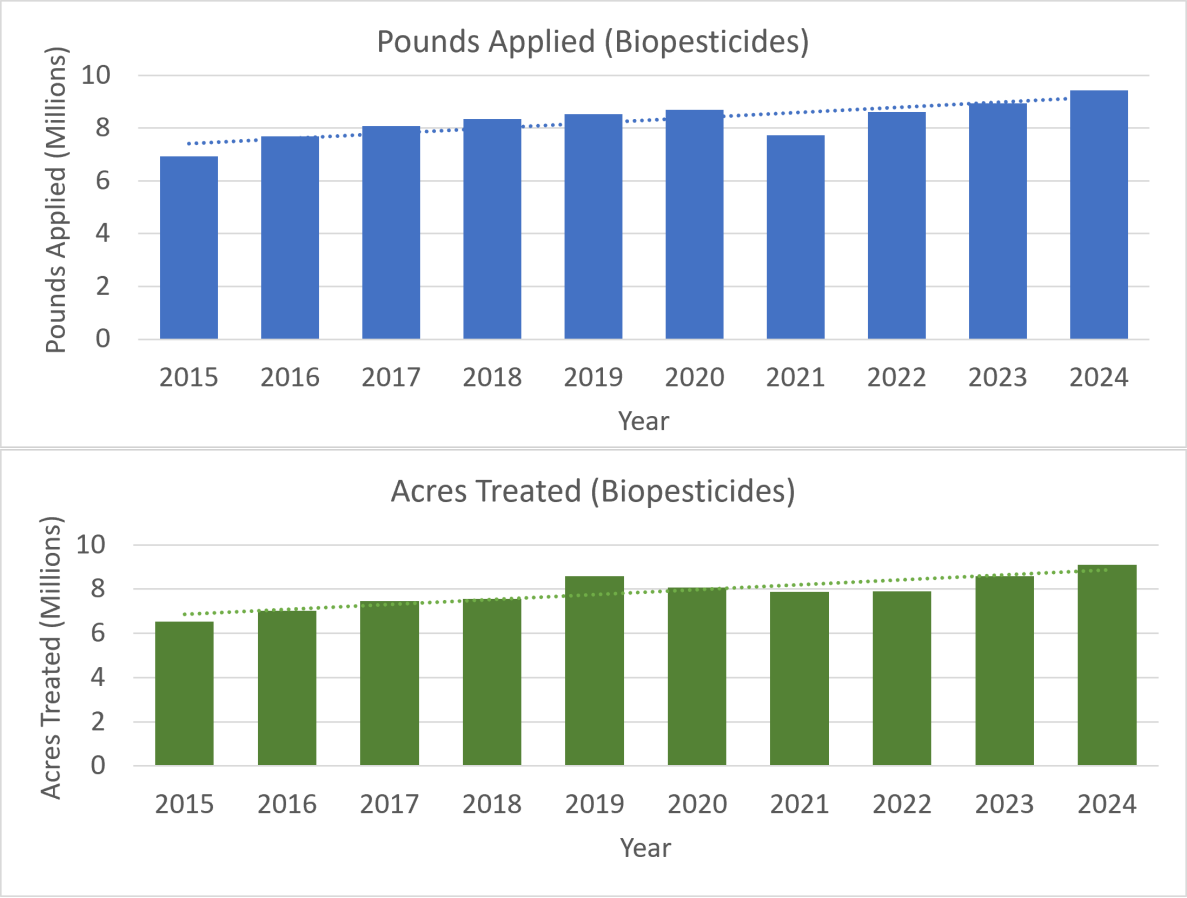


Figure 15. Use trends of pesticides that are biopesticides from 2015 to 2024.

Tables 19 and 20 show the top five AIs driving the ten-year increase in biopesticide pounds applied and acres treated, respectively. The microbiocide hydrogen peroxide and the fungicide potassium phosphite were the top contributors to the increase in pounds applied during this timeframe, increasing by 579 thousand pounds (778 percent increase) and 576 thousand pounds (86 percent increase), respectively. The adjuvant citric acid and the insecticide *Bacillus thuringiensis* were the largest contributors to the increase in acres treated, increasing by 1 million (55 percent increase) and 308 thousand pounds (79 percent increase), respectively.

Table 19. Ten-year change in AI pounds: Top five biopesticide AIs with largest increase in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	Hydrogen peroxide	653,335	74,428	578,906
2	Potassium phosphite	1,243,143	667,368	575,774
3	Burkholderia rinojensis	460,125	58,593	401,532
4	Kaolin	3,710,371	3,411,740	298,631
5	Vegetable oil	752,645	485,845	266,800

Table 20. Ten-year change in AI acres: Top five biopesticide AIs with largest increase in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Citric acid	2,979,060	1,923,716	1,055,344
2	*Bacillus thuringiensis*	695,816	388,281	307,536
3	Hydrogen peroxide	332,335	32,676	299,659
4	(Z,Z)-11,13-hexadecadienal	338,504	61,037	277,466
5	Potassium phosphite	449,373	199,792	249,581

One-year change (2023-2024)

From 2023 to 2024, annual biopesticide use increased from 8.9 million to 9.4 million pounds applied, an increase of 491 thousand pounds (5 percent increase). Acres treated with biopesticides increased from 8.6 million acres to 9.1 million acres, an increase of 496 thousand pounds (6 percent increase).

Tables 21 and 22 show the top five AIs and crops or sites driving the one-year increase in pounds applied. Most of the increase in pounds applied since the previous year was due to greater use of the fungicide/insecticide kaolin clay ("kaolin") and the adjuvant vegetable oil, which increased by 419 thousand pounds applied (13 percent increase) and 224 thousand pounds applied (42 percent increase), respectively (Table 22).

Orange and onion were the top crop contributors to the overall increase in biopesticide pounds applied (Table 23). Use on orange increased by 267 thousand pounds applied (86 percent increase), while use on onion increased by 135 thousand pounds applied (44 percent increase) over the previous year. These two crops had the largest increases in pounds of biopesticides, largely due to both crops increasing use of kaolin.

Table 21. One-year change in AI pounds: Top five biopesticide AIs with largest increase in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Kaolin	3,710,371	3,291,196	419,176
2	Vegetable oil	752,645	528,730	223,915
3	Soybean oil	154,984	90,154	64,830
4	Neem oil	194,672	150,181	44,491
5	Citric acid	230,171	193,224	36,947

Table 22. One-year change in crop or site pounds: Top five crops or sites with largest increase in biopesticide pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Orange	579,038	311,612	267,426
2	Onion, dry	440,071	304,878	135,193
3	Safflower	175,351	59,238	116,114
4	Lemon	400,875	293,525	107,350
5	Cotton	465,968	394,952	71,016

Tables 23 and 24 show the top five AIs and crops or sites driving the one-year increase by acres treated. The one-year increase in acres treated was largely due to 606 thousand more acres treated (26 percent increase) with the adjuvant citric acid and 206 thousand more acres treated (60 percent increase) with the adjuvant vegetable oil.

For crops, cotton and safflower accounted for the greatest increases in acres treated, with use of biopesticides on cotton increasing by 251 thousand acres treated (63 percent increase) and use on safflower increasing by 67 thousand acres treated (186 percent increase) (Table 24). According to the Quick Stats Database of the US Department of Agriculture, National Agricultural Statistics Service (USDA NASS), cotton production grew by 68,000 acres planted (69 percent increase) and safflower production by 17,000 acres planted (77 percent increase) from 2023 to 2024. According to a University of California Agriculture and Natural Resources (UC ANR) Cooperative Extension press release in 2023, the expansion of both cotton and safflower acreage in 2024 followed a year in which unusually wet conditions and flooding limited planting in portions of the San Joaquin Valley (UC ANR press release). The increases in statewide cotton and safflower acreage likely contributed to the overall rise in biopesticide use in these two crops.

Table 23. One-year change in AI acres: Top five biopesticide AIs with largest increase in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Citric acid	2,979,060	2,373,489	605,571
2	Vegetable oil	548,002	341,668	206,334
3	Soybean oil	130,827	43,530	87,298
4	Iron hedta	59,089	20,291	38,798
5	(Z)-11-hexadecen-1-yl acetate	43,469	16,829	26,640

Table 24. One-year change in crop acres: Top five crops or sites with largest increase in acres treated with biopesticides between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Cotton	645,991	395,463	250,527
2	Safflower	103,750	36,263	67,486
3	Corn*	185,220	127,491	57,729
4	Broccoli	147,521	94,796	52,725
5	Orange	248,141	211,639	36,502

*Corn for forage or fodder

Oils

The oils category includes pesticides with a petroleum-based oil AI (botanical oils are not included in these totals). Petroleum-based oils are often used as broad-spectrum insecticides or fungicides. As an insecticide, the oil kills insects by either physically blocking their ability to breathe or affecting how they eat. As a fungicide, the oil smothers the fungus pathogens and limits spore germination. Some refined petroleum-based oils are relatively lower risk than conventional pesticides and may be used in organic farming.

Ten-year change (2015-2024)

Over the last ten years, annual pounds applied of oil pesticides decreased from 42 million to 31 million, a decrease of 11 million pounds applied (27 percent decrease). Acres treated with oils decreased from 4.9 million to 4.8 million, a decrease of 62 thousand acres (1 percent decrease) (Figure 16).

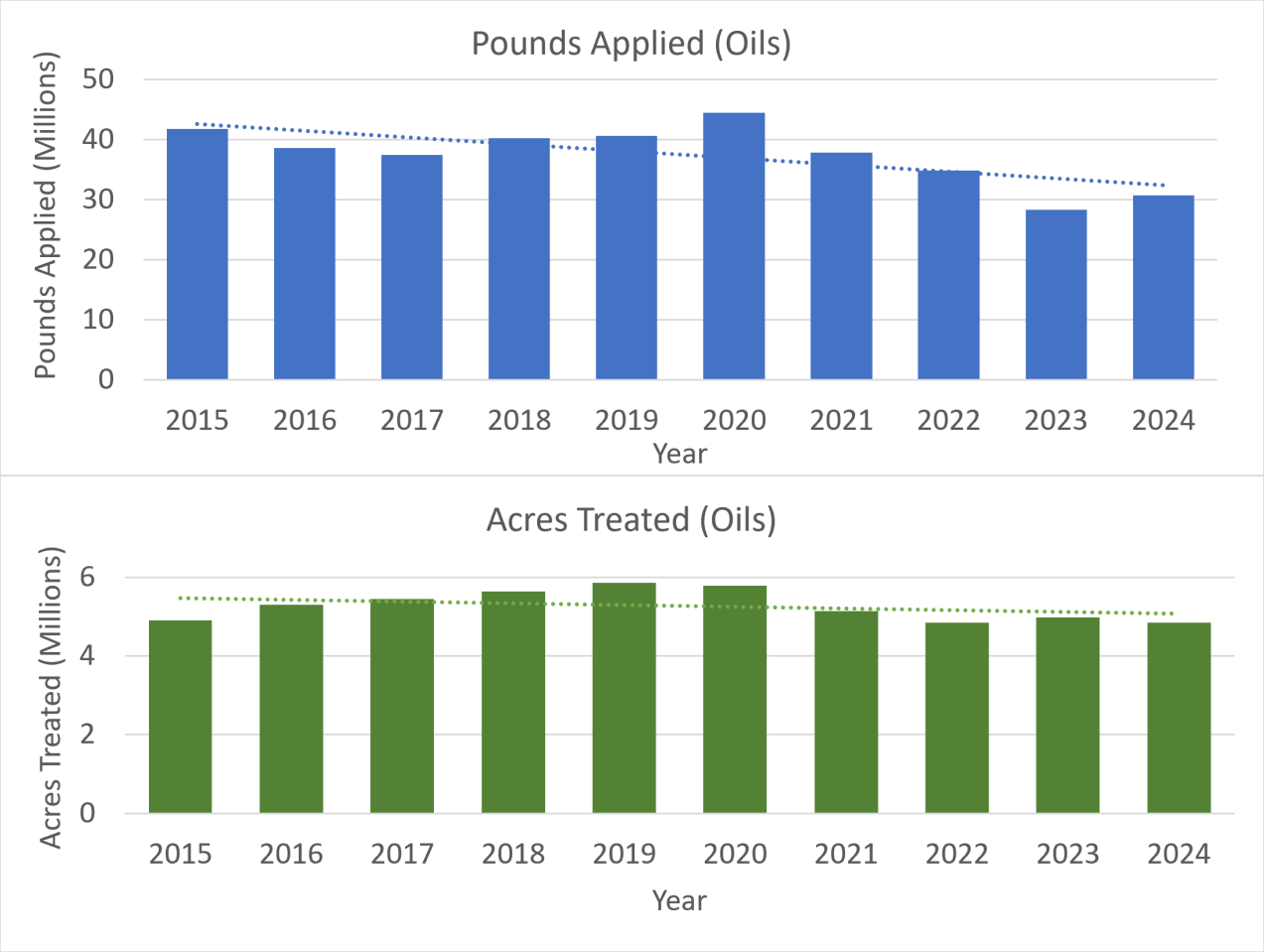


Figure 16. Use trends of pesticides that are oils from 2015 to 2024.

One-year change (2023-2024)

Tables 25 and 26 show the top five crops or sites driving the one-year changes by pounds applied and acres treated, respectively. From 2023 to 2024, use of oils increased by 2 million pounds (8 percent increase) and decreased by 137 thousand acres treated (3 percent decrease). Almond, tangerine, and orange were the top crop contributors to the increase in pounds applied (Table 25). Use on almond increased by 1.6 million pounds applied (19 percent increase), while use on tangerine and orange increased by 761 thousand pounds applied (36 percent increase) and 676 thousand pounds applied (15 percent increase), respectively. The decrease in acres treated was largely due to 89 thousand fewer acres treated in rice (28 percent decrease) and 56 thousand fewer acres treated in wine grapes (11 percent decrease) (Table 26).

Table 25. One-year change in crop or site pounds: Top five crops or sites with largest increase in oil pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Almond	10,260,443	8,614,857	1,645,586
2	Tangerine	2,874,773	2,113,586	761,186
3	Orange	5,202,808	4,526,975	675,833
4	Lemon	2,332,309	2,128,575	203,734
5	Peach	1,304,248	1,208,656	95,593

Table 26. One-year change in crop or site acres: Top five crops or sites with largest decrease in acres treated with oils between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Rice	225,926	314,488	-88,563
2	Grape, wine	469,596	525,971	-56,376
3	Alfalfa	180,899	212,638	-31,739
4	Nectarine	55,139	76,946	-21,807
5	Lettuce, leaf	10,997	30,787	-19,790

Carcinogens

The carcinogens category includes all AIs listed on the State's Proposition 65 list of chemicals known to cause cancer as well as the AIs receiving a "carcinogen," "probable carcinogen," or "possible carcinogen" rating from the U.S. EPA's Chronic Dose-Response Assessment Table (Dose-Response Assessment for Assessing Health Risks Associated with Exposure to Hazardous Air Pollutants). This category reflects hazard classifications identified by external authoritative bodies and is not a determination of risk associated with specific pesticide uses or exposure scenarios.

Ten-year change (2015-2024)

Over the ten-year period, annual carcinogen pounds applied decreased from 46 million to 33 million, a decrease of 13 million pounds (28 percent decrease). Acres treated decreased from 9 million to 7 million acres, representing a decrease of approximately 2 million acres treated (21 percent decrease) (Figure 17).

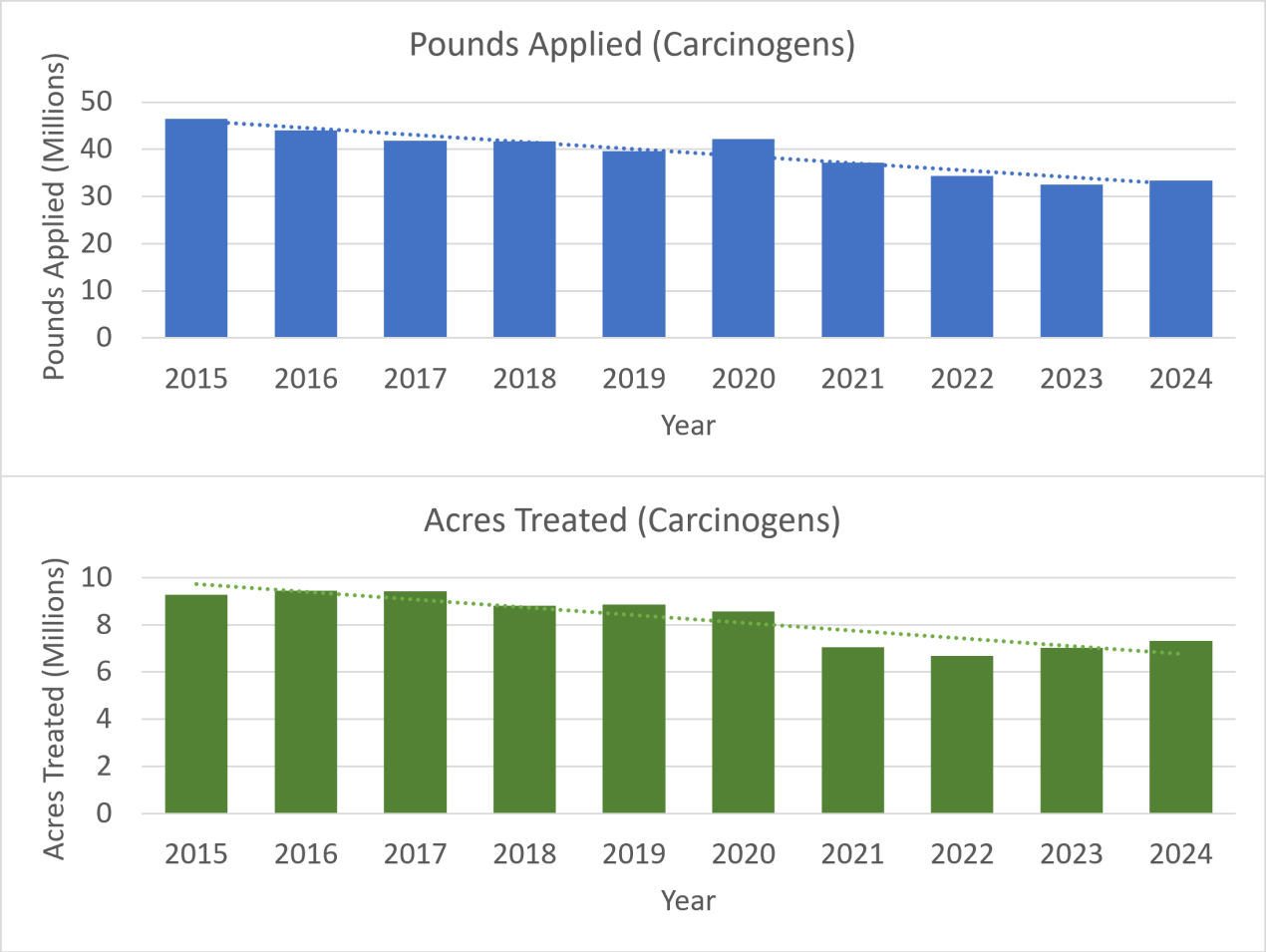


Figure 17. Use trends of pesticides identified as potentially carcinogenic by the U.S. EPA or the State's Proposition 65 list from 2015 to 2024.

Tables 27 and 28 show the top five AIs driving the ten-year decrease in carcinogen pounds applied and acres treated, respectively. The fumigants 1,3-dichloropropene and potassium N-methyldithiocarbamate ("metam-potassium") were the top contributors to the decrease in pounds applied during this timeframe, with 1,3-dichloropropene decreasing by just under 9 million pounds (55 percent decrease) and metam-potassium decreasing by under 2 million pounds (15 percent decrease). Less use of the herbicide glyphosate and the fungicide iprodione were largely responsible for the decrease in acres treated, with glyphosate decreasing by 525 thousand acres treated (9 percent decrease) and iprodione decreasing by 347 thousand acres treated (85 percent decrease).

Table 27. Ten-year change in AI pounds: Top five carcinogen AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	1,3-dichloropropene	6,989,162	15,693,070	-8,703,909
2	Metam-potassium	8,685,286	10,256,414	-1,571,128
3	Metam-sodium	2,833,708	3,606,650	-772,941
4	Oryzalin	2,626	510,680	-508,054
5	Mancozeb	960,577	1,273,730	-313,152

Table 28. Ten-year change in AI acres: Top five carcinogen AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Glyphosate	5,132,497	5,657,078	-524,581
2	Iprodione	59,655	407,078	-347,423
3	Mancozeb	482,675	740,616	-257,941
4	Oryzalin	1,158	162,536	-161,378
5	Coconut diethanolamide	118,387	266,085	-147,699

One-year change (2023-2024)

From 2023 to 2024, use of carcinogens increased from 32.5 million pounds to 33.4 million pounds, an increase of 862 thousand pounds (3 percent increase). Acres treated increased from 7 million to 7.3 million acres, an increase of 301 thousand acres treated (4 percent increase).

Tables 29 and 30 show the top five AIs and crops or sites driving the one-year increase in pounds applied. Most of the increase in pounds applied since the previous year was due to greater use of the herbicide glyphosate and the fungicide mancozeb, which increased by 640 thousand pounds applied (6 percent increase) and 187 thousand pounds applied (24 percent increase), respectively (Table 29).

Use on the crops almond and cotton were the top contributors to the overall increase in carcinogenic pounds applied (Table 30). Almond use increased by 871 thousand pounds applied (19 percent increase), mostly due to an increase in pounds applied of the fumigant 1,3-dichloropropene. Cotton use increased by 350 thousand pounds applied (88 percent increase) over the previous year, largely due to increased use of glyphosate. The increase in cotton pounds applied coincided with a substantial increase in cotton planted acreage, which grew from approximately 98 thousand acres planted in 2023 to 166 thousand acres planted in 2024 (69 percent increase), according to USDA NASS. The expansion of cotton acreage in 2024 followed a year in which unusually wet conditions and flooding limited planting in portions of the San Joaquin Valley, according to a UC ANR press release.

Table 29. One-year change in AI pounds: Top five carcinogen AIs with largest increase in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Glyphosate	11,337,541	10,697,642	639,900
2	Mancozeb	960,577	773,716	186,861
3	Metam potassium	8,685,286	8,633,739	51,547
4	Malathion	318,349	272,942	45,406
5	Propargite	176,160	140,595	35,564

*Potassium N-methyldithiocarbamate

Table 30. One-year change in crop or site pounds: Top five crops or sites with largest increase in carcinogen pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Almond	5,350,982	4,479,795	871,187
2	Cotton	746,294	396,637	349,657
3	Watermelon	317,746	108,519	209,226
4	Onion, dry	725,031	544,051	180,979
5	Strawberry	4,457,186	4,294,381	162,805

Tables 31 and 32 show the top five AIs and crops or sites driving the one-year increase by acres treated. The increase in acres treated from 2023 to 2024 was largely due to 281 thousand more acres treated (6 percent increase) with the herbicide glyphosate and 82 thousand more acres treated (58 percent increase) with the herbicide diuron (Table 31).

Cotton and almond accounted for the greatest increases in acres treated with carcinogen AIs, with cotton increasing by 250 thousand acres treated (67 percent increase) and almond increasing by 102 thousand acres treated (6 percent increase) (Table 32). Glyphosate was the AI with the highest increase in acres treated for both crops. As noted previously, the increase in cotton acres treated coincided with a substantial increase in cotton planted acreage, which grew from approximately 98 thousand acres planted in 2023 to 166 thousand acres planted in 2024, per USDA NASS.

Table 31. One-year change in AI acres: Top five carcinogen AIs with largest increase in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Glyphosate	5,132,497	4,851,294	281,203
2	Diuron	223,330	141,132	82,198
3	Mancozeb	482,675	436,536	46,140
4	Propargite	79,322	63,884	15,438
5	Malathion	181,425	172,350	9,075

Table 32. One-year change in crop or site acres: Top five crops or sites with largest increase in acres treated with carcinogens between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Cotton	619,653	370,117	249,536
2	Almond	1,876,236	1,773,806	102,431
3	Uncultivated ag	314,716	254,616	60,100
4	Onion, dry	133,189	92,531	40,659
5	Forest, timberland	133,192	102,191	31,000

Cholinesterase Inhibitors

Cholinesterase-inhibiting pesticides block the enzyme cholinesterase (ChE) that breaks down acetylcholine, which can result in overstimulation of the nervous system. Organophosphates and carbamates are the two primary chemical classes of ChE-inhibiting pesticides, although not all pesticides in these two classes exhibit ChE inhibition.

Ten-year change (2015-2024)

Over the last ten years, annual pounds applied of cholinesterase inhibitors decreased from over 4 million to just under 3 million pounds, a decrease of nearly 2 million pounds applied (43 percent decrease). Acres treated decreased from almost 4 million to just over 2 million acres, a decrease of more than 1 million acres treated (39 percent decrease) (Figure 18).

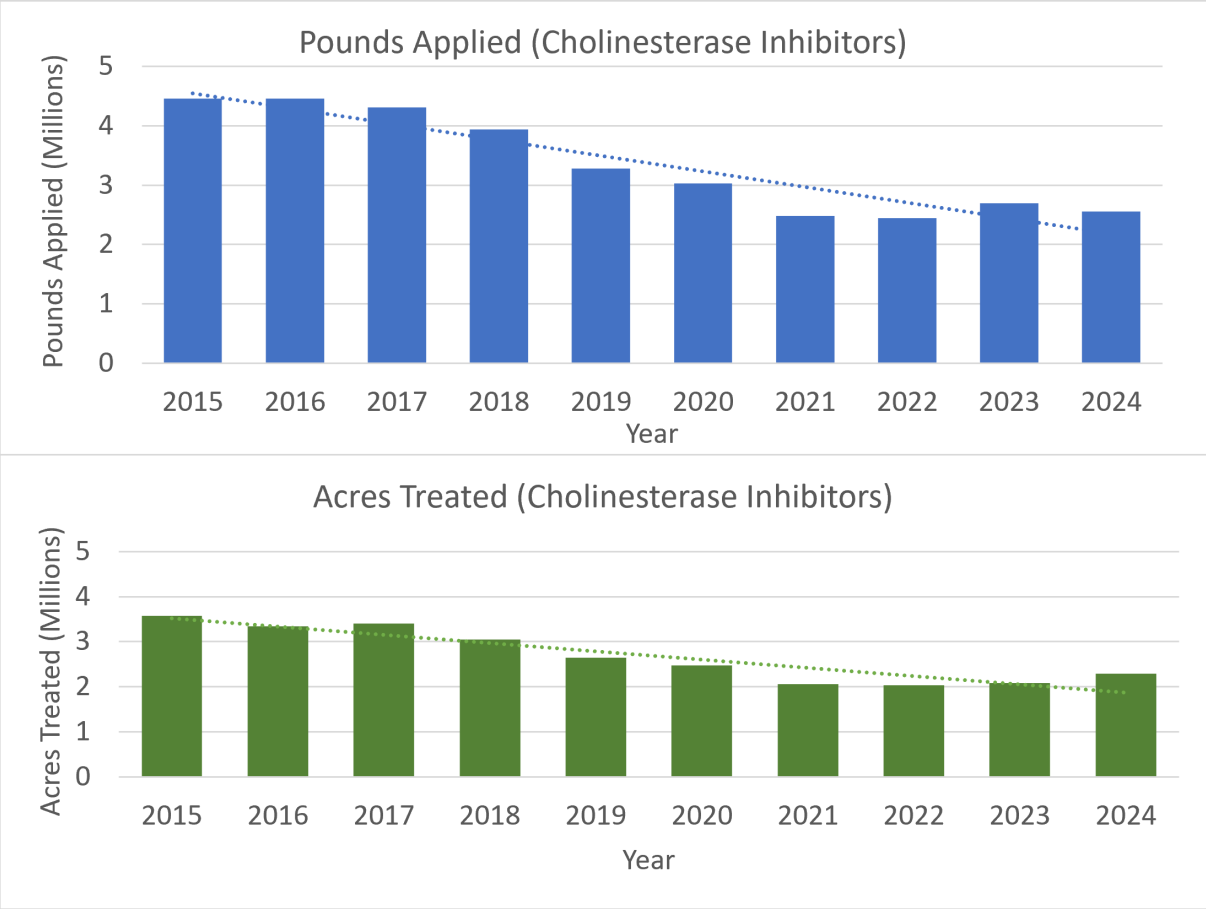


Figure 18. Use trends of pesticides that are organophosphorus or carbamate cholinesterase-inhibiting pesticides from 2015 to 2024.

Tables 33 and 34 show the top five AIs driving the ten-year decrease in cholinesterase inhibitors pounds applied and acres treated, respectively. The insecticide chlorpyrifos and the herbicide thiobencarb were the top contributors to the decrease in pounds applied during this timeframe, with chlorpyrifos decreasing by one million pounds (just under 100 percent decrease) and thiobencarb decreasing by 279 thousand pounds (53 percent decrease). Use of the insecticides chlorpyrifos and dimethoate were largely responsible for the decrease in acres treated, with chlorpyrifos decreasing by 829 thousand acres (just under 100 percent decrease) and dimethoate decreasing by 324 thousand acres (52 percent decrease). The large decrease in chlorpyrifos was due to DPR actions in 2019 prohibiting virtually all chlorpyrifos applications in California.

Table 33. Ten-year change in AI pounds: Top five cholinesterase inhibitor AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	Chlorpyrifos	2,445	1,107,435	-1,104,990
2	Thiobencarb	244,602	523,582	-278,980
3	Dimethoate	94,635	288,977	-194,342
4	Malathion	318,349	443,262	-124,913
5	Methomyl	203,349	282,520	-79,171

Table 34. Ten-year change in AI acres: Top five cholinesterase inhibitor AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Chlorpyrifos	259	829,326	-829,067
2	Dimethoate	303,405	627,043	-323,638
3	Methomyl	327,260	453,848	-126,588
4	Malathion	181,425	266,899	-85,474
5	Thiobencarb	75,935	148,349	-72,414

One-year change (2023-2024)

From 2023 to 2024, use of cholinesterase inhibitors decreased from 2.7 million pounds to 2.6 million pounds, a decrease of 135 thousand pounds applied (5 percent decrease). Acres treated with cholinesterase inhibitors increased from 2.1 million acres to 2.2 million acres, an increase of 112 thousand acres treated (5 percent increase).

Tables 35 and 36 show the top five AIs and crops or sites driving the one-year decrease in pounds applied. Most of the decrease in pounds applied since the previous year was due to less use of the herbicide thiobencarb, which decreased by 221 thousand pounds applied (47 percent decrease) (Table 35).

Rice and public health were the two biggest crops or sites contributing to the overall decrease in cholinesterase inhibitor pounds applied (Table 36). Public health is a site name that mostly consists of PURs from vector control districts for control of mosquitoes and other pests that vector diseases. Use on rice decreased by 220 thousand pounds applied (47 percent decrease) due mainly to less use of thiobencarb, while use under the public health site decreased by 73 thousand pounds applied (65 percent decrease) due primarily to less use of the insecticide naled over the previous year. According to USDA NASS, statewide rice planted acreage decreased by 49,000 acres planted (9 percent decrease) from 2023 to 2024. This decline may have been one contributing factor to the observed reduction in cholinesterase inhibitor use.

Table 35. One-year change in AI pounds: Top five cholinesterase inhibitor AIs with largest decrease in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Thiobencarb	244,602	465,525	-220,923
2	Formetanate hydrochloride	30,196	69,797	-39,602
3	Diazinon	16,302	39,932	-23,630
4	Dimethoate	94,635	111,215	-16,580
5	Bensulide	360,699	373,170	-12,471

Table 36. One-year change in crop or site pounds: Top five crops or sites with largest decrease in cholinesterase inhibitor pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Rice	244,631	464,633	-220,002
2	Public health	39,664	112,879	-73,215
3	Tomato, processing	99,416	152,664	-53,248
4	Orange	39,648	67,968	-28,320
5	Lettuce, leaf	239,225	249,217	-9,992

Tables 37 and 38 show the top five AIs and crops or sites driving the one-year increase by acres treated, respectively. The increase in acres treated from 2023 to 2024 was largely due to 55 thousand more acres treated (48 percent increase) with the insecticide naled, 41 thousand more acres treated (10 percent increase) with the plant growth regulator ethephon, and 28 thousand more acres treated (10 percent increase) with the insecticide dimethoate (Table 37).

Use on the crops cotton and safflower accounted for the greatest increases in acres treated. Use on cotton increased by 145 thousand acres (37 percent increase) due to more acres treated with ethephon, malathion, and naled, while use on safflower increased by 60 thousand acres (139 percent increase) due largely to increases in the insecticides dimethoate and naled (Table 38). According to USDA NASS, cotton production grew by 68,000 acres planted (69 percent increase) and safflower production by 17,000 acres planted (77 percent increase) from 2023 to 2024. These expansions in statewide acreage likely contributed to the overall rise in acres treated with these cholinesterase inhibitors.

Table 37. One-year change in AI acres: Top five cholinesterase inhibitor AIs with largest increase in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Naled	168,828	114,295	54,533
2	Ethephon	436,681	395,343	41,338
3	Dimethoate	303,405	275,158	28,247
4	Propamocarb hydrochloride	89,756	65,136	24,620
5	Acephate	161,042	136,924	24,118

Table 38. One-year change in crop or site acres: Top five crops or sites with largest increase in acres treated with cholinesterase inhibitors between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Cotton	540,005	394,708	145,297
2	Safflower	103,587	43,368	60,219
3	Corn*	99,013	81,382	17,631
4	Bean, dried	30,926	13,666	17,260
5	Broccoli	53,304	41,028	12,276

* Corn for human consumption

Fumigants

The fumigant category includes all higher-risk AIs applied as fumigants. Fumigants are volatile gas pesticides that can penetrate into soil, stored products (such as food, seeds, fibers), structures, and other sites to kill pests.

Ten-year change (2015-2024)

Over the last ten years, pounds of fumigant pesticides applied have decreased from 45 million pounds to 33 million pounds, a decrease of about 12 millions pounds applied (26 percent decrease). Acres treated have decreased from 349 thousand acres to 162 thousand acres, a decrease of around 186 thousand acres treated (53 percent decrease) (Figure 19).

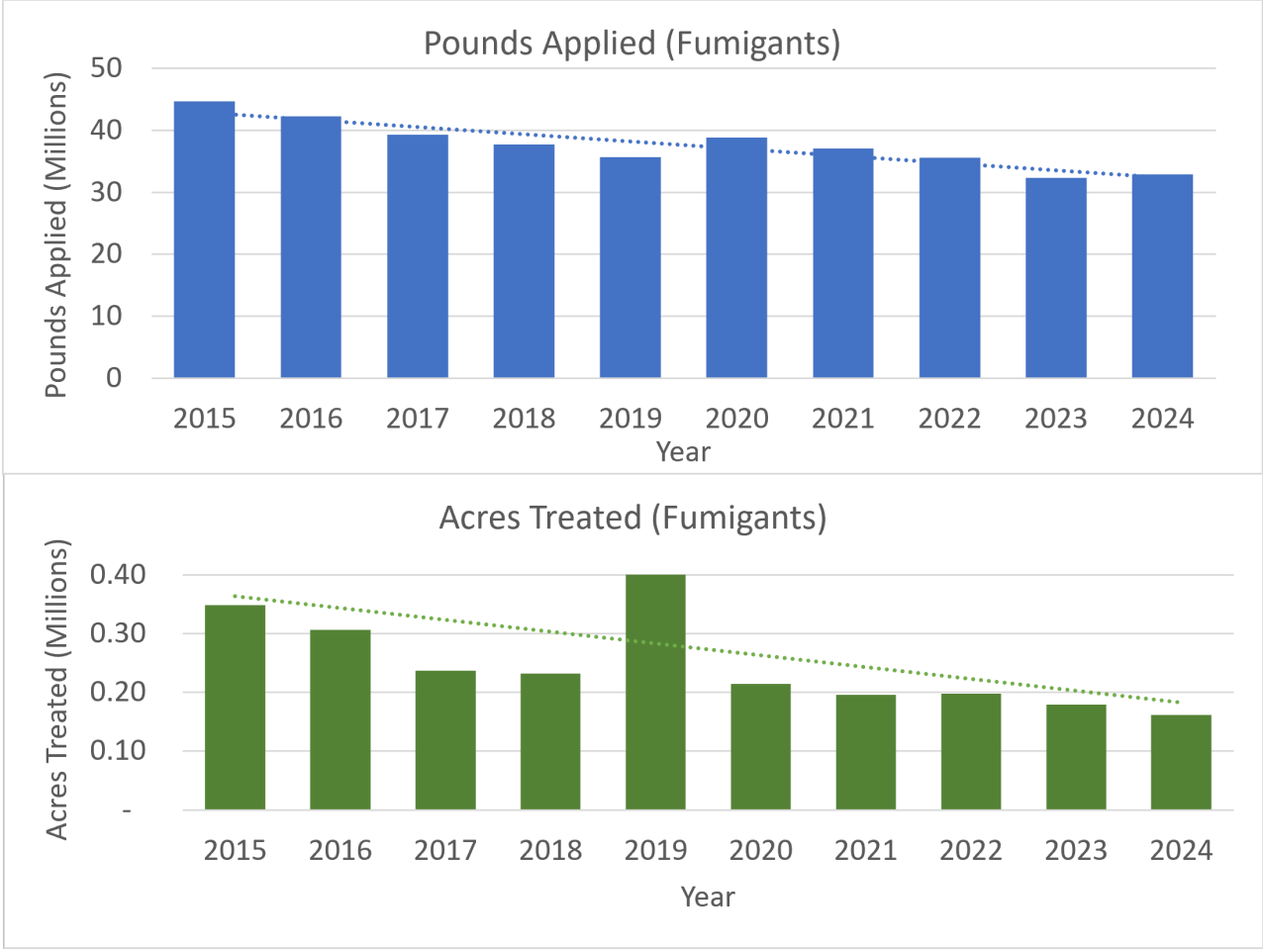


Figure 19. Use trends of pesticides that are fumigants from 2015 to 2024.

Tables 39 and 40 show the top five AIs driving the ten-year decrease in fumigant pounds applied and acres treated, respectively. The fumigants 1,3-dichloropropene and potassium N-methyldithiocarbamate ("metam-potassium") were the top contributors to the decrease in pounds applied during this timeframe, with 1,3-dichloropropene decreasing by just under 9 million pounds (55 percent decrease) and metam-potassium decreasing by under 2 million pounds (15 percent decrease). Use of the fumigants aluminum phosphide and 1,3-dichloropropene were the largest contributors to the decrease in acres treated. The acres treated with aluminum phosphide decreased by 129 thousand pounds (81 percent decrease) and the acres treated with 1,3-dichloropropene decreased by just under 35 thousand pounds (44 percent decrease).

Table 39. Ten-year change in AI pounds: Top five fumigant AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	1,3-dichloropropene	6,989,162	15,693,070	-8,703,909
2	Metam-potassium	8,685,286	10,256,414	-1,571,128
3	Methyl bromide	1,603,994	2,655,364	-1,051,370
4	Metam-sodium	2,833,708	3,606,650	-772,941
5	Propylene oxide	134,498	396,191	-261,693

Table 40. Ten-year change in AI acres: Top five fumigant AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Aluminum phosphide	30,410	159,056	-128,647
2	1,3-dichloropropene	43,768	78,360	-34,592
3	Metam-sodium	13,785	24,254	-10,470
4	Chloropicrin	45,225	53,794	-8,568
5	Methyl bromide	6,045	12,796	-6,750

One-year change (2023-2024)

From 2023 to 2024, use of fumigants increased from 32.4 million pounds to 32.9 million pounds, a 580 thousand increase in pounds applied (2 percent increase). Acres treated with fumigants decreased from just under 169 thousand acres to around 162 thousand acres, a decrease by 7 thousand acres treated (4 percent decrease).

Tables 41 and 42 show the top five AIs and crops or sites driving the one-year increase in pounds applied. Most of the increase in pounds applied since the previous year was due to greater use of the fumigants chloropicrin and carbon dioxide, which increased by 612 thousand pounds applied (7 percent increase) and 177 thousand pounds applied (153 percent increase), respectively (Table 41).

Use on the crops strawberry and almond were the top contributors to the overall increase in fumigant pounds applied (Table 42). Use on strawberry increased by 705 thousand pounds applied (6 percent increase), while use on almond increased by 442 thousand pounds applied (29 percent increase) over the previous year. According to USDA NASS, strawberry production grew by 2,200 acres planted (5 percent increase) during this time period. This increase in statewide strawberry acreage likely in part contributed to the overall rise in chloropicrin pounds applied.

Table 41. One-year change in AI pounds: Top five fumigant AIs with largest increase in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Chloropicrin	9,128,132	8,515,832	612,300
2	Carbon dioxide	292,724	115,574	177,150
3	Phosphine	89,426	15,383	74,043
4	Metam-potassium	8,685,286	8,633,739	51,547
5	Metam-sodium	2,833,708	2,800,594	33,115

Table 42. One-year change in crop or site pounds: Top five crops or sites with largest increase in fumigant pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Strawberry	11,564,448	10,859,785	704,662
2	Almond	1,967,535	1,525,494	442,041
3	Tomato, processing	2,489,537	2,259,504	230,033
4	Watermelon	294,133	89,159	204,974
5	Onion, dry	520,060	402,172	117,888

Tables 43 and 44 show the top five AIs and crops or sites driving the one-year decrease by acres treated, respectively. The one-year decrease in acres treated was largely due to 5,618 fewer acres treated (16 percent decrease) with the fumigant aluminum phosphide and 1,307 fewer acres treated (3 percent decrease) with the fumigant chloropicrin (Table 43).

Soil fumigation/preplant and pastureland were the top contributors to the decrease in acres treated with fumigants, decreasing by 4,482 acres (34 percent decrease) and 3,408 acres (96 percent decrease), respectively. Soil fumigation/preplant is a general site name used most often when the crop to be planted is unknown (Table 44).

Table 43. One-year change in AI acres: Top five fumigant AIs with largest decrease in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Aluminum phosphide	30,410	36,028	-5,618
2	Chloropicrin	45,225	46,532	-1,307
3	Sulfuryl fluoride	1,180	2,024	-844
4	1,3-dichloropropene	43,768	44,554	-786
5	Methyl bromide	6,045	6,288	-242

Table 44. One-year change in crop or site acres: Top five crops or sites with largest decrease in acres treated with fumigants between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Soil fumigation/preplant	8,607	13,089	-4,482
2	Pastureland	147	3,555	-3,408
3	Grape, wine	611	2,664	-2,053
4	Pistachio	130	2,158	-2,028
5	Melon	1,424	2,444	-1,020

Groundwater Contaminants

Groundwater contaminants are defined as pesticides that have the potential to pollute groundwater based on their chemical properties and labeled use. The groundwater contaminant category included all AIs listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 1, Article 1, Section 6800(a).

Ten-year change (2015-2024)

Over the last ten years, annual pounds applied of pesticides that are groundwater contaminants decreased from just over 586 thousand pounds to just over 131 thousand pounds, a reduction of 455 thousand pounds (78 percent decrease). Acres treated decreased from around 438 thousand acres to 260 thousand acres, a decrease of 178 thousand acres treated (41 percent decrease) (Figure 20).

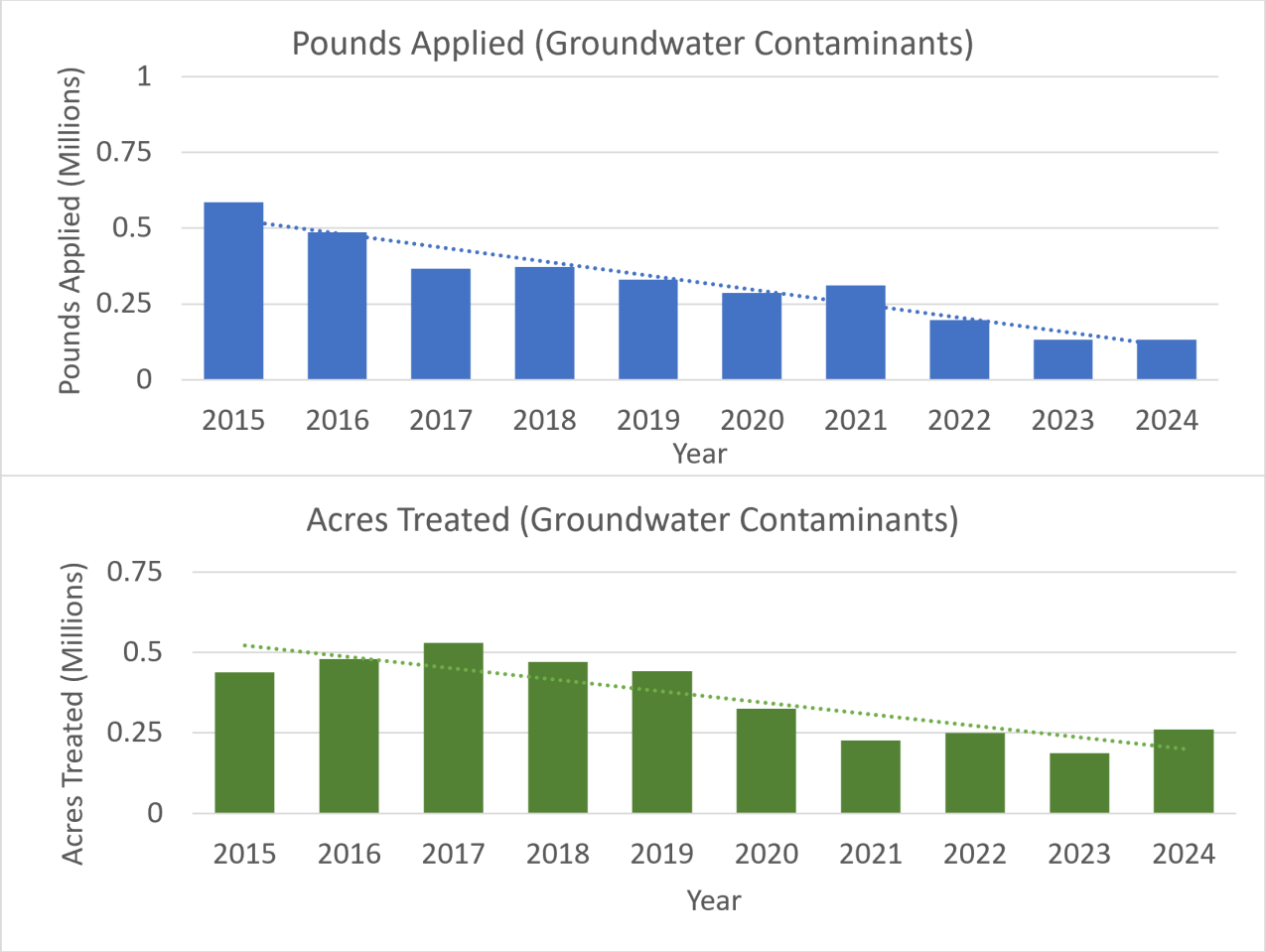


Figure 20. Use trends of pesticides that are groundwater contaminants from 2015 to 2024.

Tables 45 and 46 show the top five AIs driving the ten-year decrease in groundwater contaminant pounds applied and acres treated, respectively. The herbicides diuron and simazine were the top contributors to the decrease in both pounds applied and acres treated during this timeframe. Diruon decreased by 243 thousand pounds (77 percent decrease) and 56 thousand acres treated (20 percent decrease), while simazine decreased by 147 thousand pounds (82 percent decrease) and 97 thousand acres treated (20 percent decrease).

Table 45. Ten-year change in AI pounds: Top five groundwater contaminant AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	Diuron	74,136	317,328	-243,192
2	Simazine	32,448	179,321	-146,873
3	Bromacil	3,460	37,484	-34,024
4	Norflurazon	810	22,562	-21,751
5	Atrazine	13,985	18,287	-4,302

Table 46. Ten-year change in AI acres: Top five groundwater contaminant AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Simazine	21,394	118,823	-97,429
2	Diuron	223,330	279,721	-56,391
3	Norflurazon	664	17,343	-16,679
4	Atrazine	17,451	29,074	-11,622
5	Bromacil	565	5,942	5,377

One-year change (2023-2024)

From 2023 to 2024, use of groundwater contaminants increased from 131 thousand pounds to 131.3 thousand pounds, a small increase of 275 pounds (0.2 percent increase). Acres treated increased from 188 thousand acres to 260 thousand acres, an increase of 72 thousand acres treated (39 percent increase).

Tables 47 and 48 show the top five AIs and crops or sites driving the small one-year increase in pounds applied, respectively. Most of the increase in pounds applied since the previous year was due to greater use of the herbicide diuron, which increased by around 14 thousand pounds applied (23 percent increase) (Table 47).

Rights of way was the top contributor to the overall increase in groundwater contaminant pounds applied (Table 48). Use on rights of way increased by just under 11 thousand pounds applied (30 percent increase) over the previous year. Diuron was the AI with the largest increase in pounds applied for rights of way.

Table 47. One-year change in AI pounds: Top five groundwater contaminant AIs with largest increase in pounds applied between 2023 and 2024. (Only four groundwater AIs increased during this time).

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Diuron	74,136	60,490	13,646
2	Bromacil	3,460	2,199	1,260
3	Bromacil, lithium salt	497	55	442
4	Prometon	11	0	11

Table 48. One-year change in crop or site pounds: Top five crops or sites with largest increase in groundwater contaminant pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Rights of way	45,315	34,741	10,574
2	Uncultivated non-ag	2,445	747	1,698
3	Cotton	5,101	3,498	1,603
4	Corn*	11,231	9,994	1,237
5	Pecan	1,320	438	882

* Corn for human consumption

Tables 49 and 50 show the top five AIs and crops or sites driving the one-year increase by acres treated, respectively. Similar to pounds applied, the one-year increase in acres treated was largely due to 82 thousand more acres treated (58 percent increase) with the herbicide diuron (Table 49). However, for acres treated, cotton was the crop or site with the largest increase of diuron. As a result, cotton accounted for the greatest increase in acres treated with groundwater contaminants, increasing by just under 80 thousand acres (62 percent increase), largely due to increased use of diuron (Table 50). During this period, cotton production increased by 68 thousand acres planted (69 percent increase), according to USDA NASS. This expansion in statewide cotton acreage likely contributed to the overall rise in acres treated with groundwater contaminants.

Table 49. One-year change in AI acres: Top five groundwater contaminant AIs with largest increase in acres treated between 2023 and 2024. (Only two groundwater AIs increased during this time).

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Diuron	223,330	141,132	82,198
2	Prometon	115	0	115

Table 50. One-year change in crop or site acres: Top five crops or sites with largest increase in acres treated with groundwater contaminants between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Cotton	207,765	127,897	79,868
2	Citrus*	2,398	18	2,380
3	Avocado	3,762	2,962	799
4	Corn**	7,046	6,439	606
5	Rights of way	1,802	1,261	541

* Citrus is a general site name for growers with fields containing a mix of multiple types of citrus crops receiving the same pesticide application.
* *Corn for human consumption

Reproductive Toxins

The reproductive toxins category includes all AIs listed on the State's Proposition 65 list of chemicals known to cause reproductive toxicity in the form of birth defects or reproductive harm.

Ten-year change (2015-2024)

Over the last ten years, pounds applied of reproductive toxins decreased from 9 million pounds to just under 6 million pounds, a reduction of around 3 million pounds applied (38 percent decrease). Acres treated decreased from around 5 million acres to just over 3 million acres, a decrease of about 2 million acres (31 percent decrease) (Figure 21).

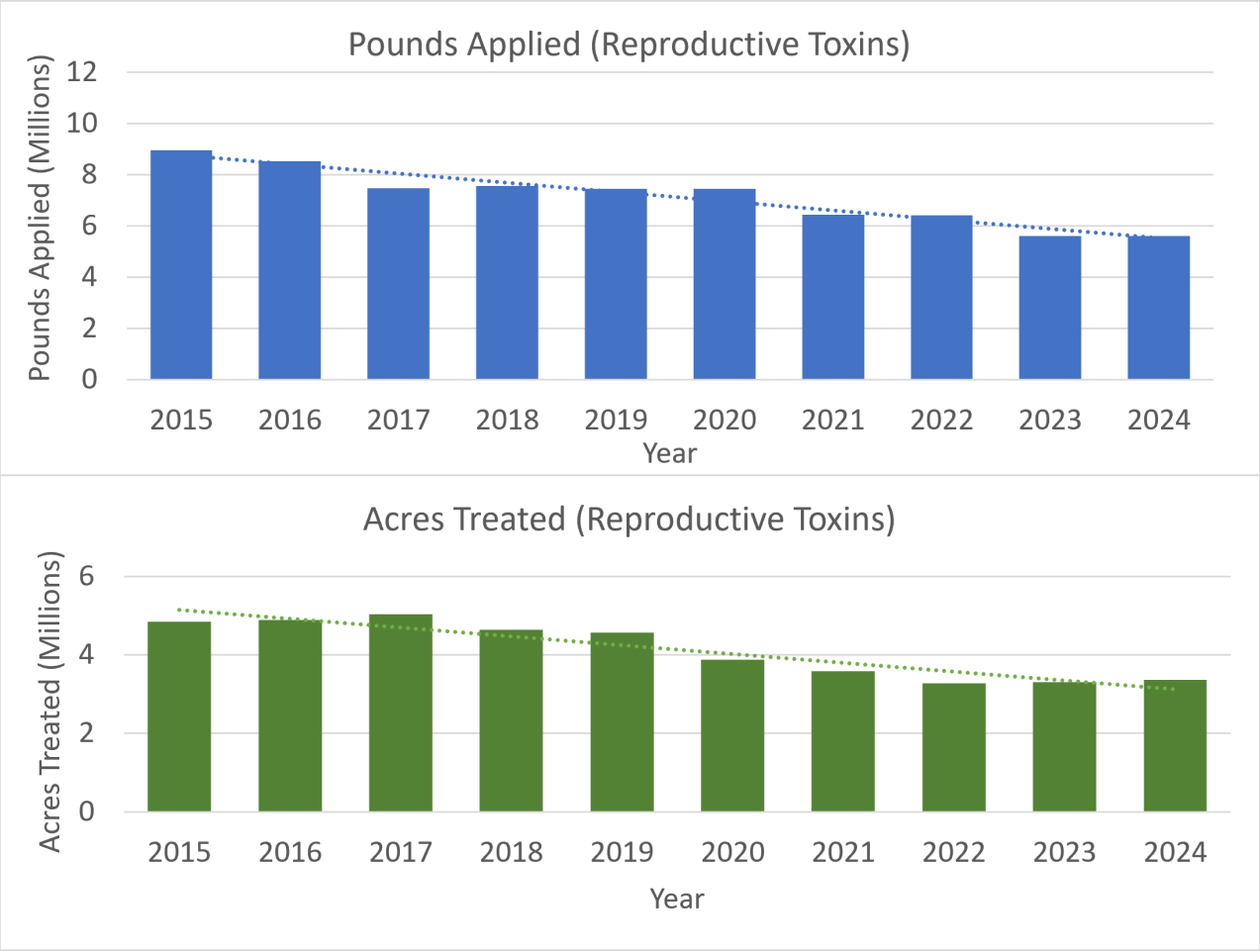


Figure 21. Use trends of pesticides that are on the State's Proposition 65 list of chemicals that are "known to cause reproductive toxicity" from 2015 to 2024.

Tables 51 and 52 show the top five AIs driving the ten-year decrease in reproductive toxin pounds applied and acres treated, respectively. The insecticide chlorpyrifos and the fumigant methyl bromide were the top contributors to the decrease in pounds applied during this timeframe, with chlorpyrifos decreasing by around 1 million pounds (just under 100 percent decrease) and methyl bromide decreasing by about 1 million pounds (40 percent decrease). Less use of chlorpyrifos and the fungicide myclobutanil were largely responsible for the reduction in acres treated, with

chlorpyrifos decreasing by 829 thousand acres (just under 100 percent decrease) and myclobutanil decreasing by about 296 thousand acres (54 percent decrease).

Table 51. Ten-year change in AI pounds: Top five reproductive toxin AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	Chlorpyrifos	2,445	1,107,435	-1,104,990
2	Methyl bromide	1,603,994	2,655,364	-1,051,370
3	Metam-sodium	2,833,708	3,606,650	-772,941
4	Simazine	32,448	179,321	-146,873
5	Eptc	160,440	238,017	-77,577

Table 52. Ten-year change in AI acres: Top five reproductive toxin AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Chlorpyrifos	259	829,326	-829,067
2	Myclobutanil	249,102	545,288	-296,186
3	Abamectin	2,146,698	2,340,385	-193,688
4	Simazine	21,394	118,823	-97,429
5	Ethylene glycol	164,922	202,923	-38,001

One-year change (2023-2024)

From 2023 to 2024, use of reproductive toxins decreased slightly from 5.6 million pounds to 5.59 million pound, a six thousand pound decrease (0.1 percent decrease). Acres treated increased from 3.3 million acres to 3.4 million acres, an increase of 81 thousand acres treated (2 percent increase).

Tables 53 and 54 show the top five AIs and crops or sites driving the one-year decrease in pounds applied, respectively. Most of the decrease in pounds applied since last year was due to less use of the fumigants methyl bromide and sulfur dioxide, which decreased by 73 thousand pounds applied (4 percent decrease) and 39 thousand pounds applied (17 percent decrease), respectively (Table 53). Turf/sod and soil fumigation/preplant were the sites with the largest decrease in pounds of methyl bromide, while the site fumigation/other had the largest decrease in sulfur dioxide. Soil fumigation/preplant is a general site name used most often when the crop to be planted is unknown, while fumigation/other is a general site name for fumigation of non-commodity sites, such as transport vehicles, cold storage rooms, etc.

The top crop or site contributors to the overall decrease in reproductive toxin pounds applied were potato and fruiting pepper (Table 54). Potato use decreased by 98 thousand pounds applied (17 percent decrease), while fruiting pepper decreased by 61 thousand pounds applied (21 percent decrease) over the previous year. The reduction in pounds applied by both crops was largely due to less use of the fumigant metam-sodium.

Table 53. One-year change in AI pounds: Top five reproductive toxin AIs with largest decrease in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Methyl bromide	1,603,994	1,676,651	-72,657
2	Sulfur dioxide	187,531	227,031	-39,499
3	Ethylene glycol	42,270	53,572	-11,302
4	Simazine	32,448	40,362	-7,914
5	Myclobutanil	29,530	33,038	-3,508

Table 54. One-year change in crop or site pounds: Top five crops or sites with largest decrease in reproductive toxins pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Potato	474,984	572,674	-97,690
2	Pepper, fruiting	236,549	297,695	-61,146
3	N-outdr flower*	11,400	72,544	-61,144
4	Turf/sod	676	60,324	-59,647
5	Lemon	3,917	50,698	-46,782

*Nursery-Outdoor grown cut flowers or greens

Tables 55 and 56 show the top five AIs and crops or sites driving the one-year increase by acres treated. The one-year increase in acres treated with reproductive toxins was largely due to 76 thousand more acres treated (4 percent increase) with the insecticide/miticide abamectin (Table 55).

For crops, use on cotton and almond accounted for the greatest increases in acres treated, with use on cotton increasing by 79 thousand acres treated (84 percent increase) and use on almond increasing by 63 thousand acres treated (5 percent increase) (Table 56). According to USDA NASS, cotton production grew by 68,000 acres planted (69 percent increase) from 2023 to 2024. This expansion in statewide acreage likely contributed to the small increase in acres treated with reproductive toxins.

Table 55. One-year change in AI acres: Top five reproductive toxin AIs with largest increase in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Abamectin	2,146,698	2,070,516	76,182
2	Thiophanate-methyl	219,945	194,929	25,016
3	Propargite	79,322	63,884	15,438
4	Eptc	57,905	49,228	8,677
5	Oxytetracycline hydrochloride	26,106	18,439	7,667

Table 56. One-year change in crop or site acres: Top five crops or sites with largest increase in acres treated with reproductive toxin AIs between 2023 and 2024.

Rank	Crop or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Cotton	173,433	94,353	79,080
2	Almond	1,241,855	1,178,809	63,046
3	Walnut	100,499	85,829	14,670
4	Pear	69,921	55,453	14,468
5	Rice	14,269	2,172	12,097

Toxic Air Contaminants

Toxic air contaminants are defined as air pollutants that may cause or contribute to increases in serious illness or death or may pose a present or potential hazard to human health, including pesticides identified as hazardous air pollutants per Section 7412 of Title 42 of the United States Code and in consultation with the Office of Environmental Health Hazard Assessment. The toxic air contaminants category included all AIs listed in the California Code of Regulations, Title 3, Division 6, Chapter 4, Subchapter 2, Article 1, Section 6860.

Ten-year change (2015-2024)

Over the last ten years, pounds applied of pesticides that are toxic air contaminants have decreased from around 49 million pounds to just under 35 million pounds, a decrease of 14 million pounds (29 percent decrease). Acres treated have decreased from just over 3 million acres to under 2 million acres (48 percent decrease) (Figure 22).

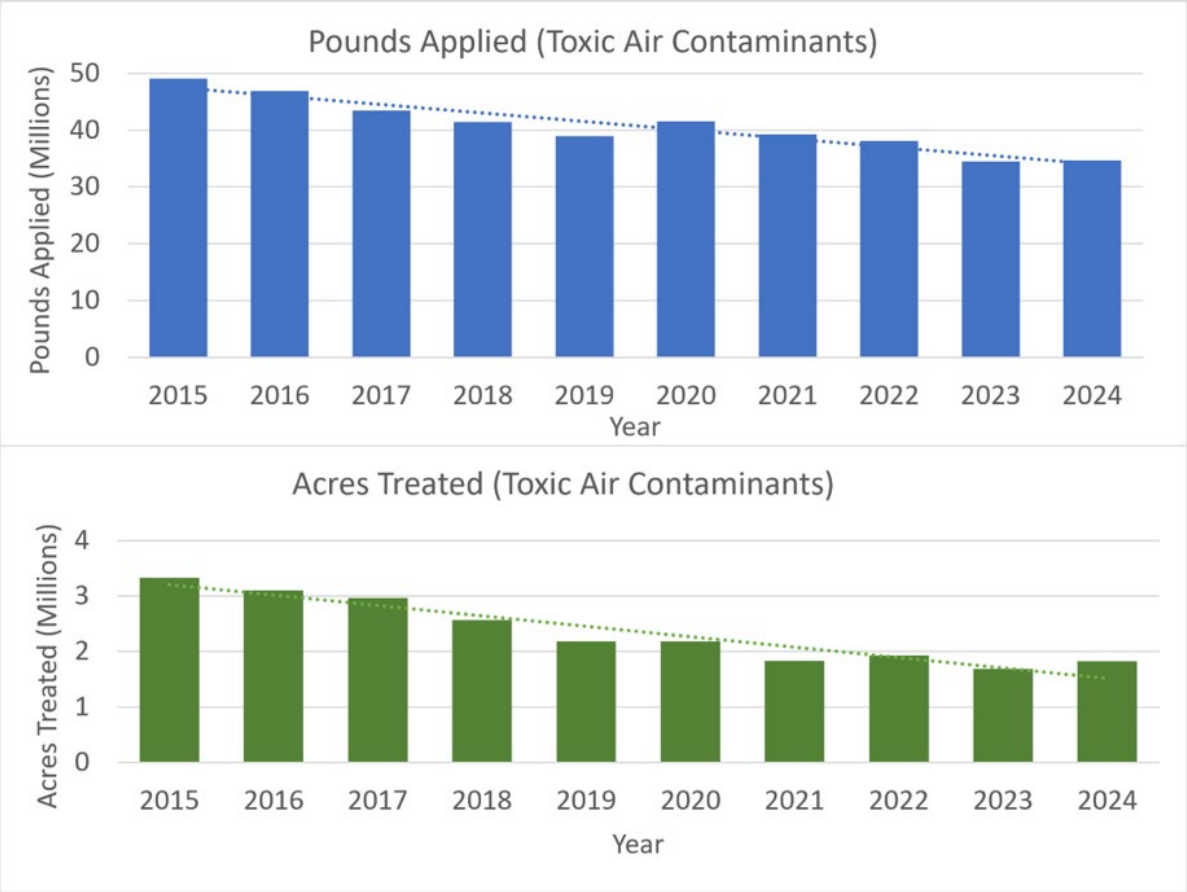


Figure 22. Use trends of pesticides that are toxic air contaminants from 2015 to 2024.

Tables 57 and 58 show the top five AIs driving the ten-year decrease in toxic air contaminant pounds applied and acres treated, respectively. 1,3-dichloropropene and potassium N-methyldithiocarbamate ("metam-potassium") were the top contributors to the decrease in pounds applied during this timeframe, with 1,3-dichloropropene decreasing by just under 9 million pounds (55 percent decrease) and metam-potassium decreasing by under 2 million pounds (15 percent decrease). The insecticide chlorpyrifos and fungicide mancozeb were the largest contributors to the decrease in acres treated, with chlorpyrifos decreasing by 829 thousand acres treated (just under 100 percent decrease) and mancozeb decreasing by 258 thousand acres treated (35 percent decrease). The large decrease in chlorpyrifos use was the result of DPR actions in 2019 prohibiting virtually all chlorpyrifos applications in California.

Table 57. Ten-year change in AI pounds: Top five toxic air contaminant AIs with largest decrease in pounds applied between 2015 and 2024.

Rank	AI	2024 Pounds	2015 Pounds	Pounds Difference
1	1,3-dichloropropene	6,989,162	15,693,070	-8,703,909
2	Metam-potassium	8,685,286	10,256,414	-1,571,128
3	Chlorpyrifos	2,445	1,107,435	-1,104,990
4	Methyl bromide	1,603,994	2,655,364	-1,051,370
5	Metam-sodium	2,833,708	3,606,650	-772,941

Table 58. Ten-year change in AI acres: Top five toxic air contaminant AIs with largest decrease in acres treated between 2015 and 2024.

Rank	AI	2024 Acres Treated	2015 Acres Treated	Acres Treated Difference
1	Chlorpyrifos	259	829,326	-829,067
2	Mancozeb	482,675	740,616	-257,941
3	Trifluralin	253,062	480,763	-227,701
4	Aluminum phosphide	30,410	159,056	-128,647
5	2,4-D	416,301	510,635	-94,333

One-year change (2023-2024)

From 2023 to 2024, use of toxic air contaminants increased slightly from 34.5 million pounds to 34.7 million pounds, an increase of 206 thousand pounds (less than 1 percent increase). Acres treated increased from 1.68 million acres to 1.74 million acres, an increase of 53 thousand acres treated (3 percent increase).

Tables 59 and 60 show the top five AIs and crops or sites driving the one-year increase in pounds applied. Most of the increase in pounds applied since the previous year was due to greater use of the fumigant chloropicrin, which increased by 612 thousand pounds applied (7 percent increase) (Table 59).

The crops strawberry and almond were the top contributors to the overall increase in toxic air contaminants applied (Table 60). Strawberry use increased by 706 thousand pounds applied (6 percent increase), while almond use increased by 592 thousand pounds applied (35 percent increase) over the previous year. The increase in pounds applied by both crops was largely due to increased fumigant use – chloropicrin in strawberry and 1,3-dichloropropene in almond. According to USDA NASS, strawberry production grew by 2,200 acres planted (5 percent increase) during this time period. This increase in statewide strawberry acreage likely contributed in part to the small rise in pounds of toxic air contaminants applied.

Table 59. One-year change in AI pounds: Top five toxic air contaminant AIs with largest increase in pounds applied between 2023 and 2024.

Rank	AI	2024 Pounds	2023 Pounds	Pounds Difference
1	Chloropicrin	9,128,132	8,515,832	612,300
2	Mancozeb	960,577	773,716	186,861
3	Phosphine	89,426	15,383	74,043
4	Metam-potassium	8,685,286	8,633,739	51,547
5	Metam-sodium	2,833,708	2,800,594	33,115

Table 60. One-year change in crop or site pounds: Top five crops or sites with largest increase in toxic air contaminant pounds applied between 2023 and 2024.

Rank	Crop or Site	2024 Pounds	2023 Pounds	Pounds Difference
1	Strawberry	11,913,166	11,207,359	705,807
2	Almond	2,261,058	1,668,685	592,373
3	Tomato, processing	2,628,400	2,404,388	224,012
4	Watermelon	295,486	90,760	204,725
5	Onion, dry	620,930	475,006	145,924

Tables 61 and 62 show the top five AIs and crops or sites driving the one-year increase by acres treated. The one-year increase in acres treated was largely due to 46 thousand more acres treated (11 percent increase) with the fungicide mancozeb and 40 thousand more acres treated (13 percent increase) with the fungicide captan (Table 61).

For crops, almond and walnut accounted for the greatest increases in acres treated, with almond increasing by 43 thousand acres (30 percent increase) and walnut increasing by 20 thousand acres (13 percent increase) (Table 62). An increase in almond acres treated with the rodenticide zinc phosphide and an increase in walnut acres treated with the fumigant aluminum phosphide were the greatest contributors for each of these two crops. These two AIs are used for rodent control, potentially reflecting the severe rat infestations in the western Central Valley in the fall of 2024, as reported by CDFA (CDFA Memo: Rat Damage in Almond Orchards).

Table 61. One-year change in AI acres: Top five toxic air contaminant AIs with largest increase in acres treated between 2023 and 2024.

Rank	AI	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Mancozeb	482,675	436,536	46,140
2	Captan	357,472	317,741	39,730
3	Zinc phosphide	58,153	40,290	17,863
4	Chlorine	3,834	767	3,067
5	Carbaryl	109,693	107,895	1,798

Table 62. One-year change in crop or site acres: Top five crops or sites with largest increase in acres treated with toxic air contaminant AIs between 2023 and 2024.

Rank	Crop Or Site	2024 Acres Treated	2023 Acres Treated	Acres Treated Difference
1	Almond	188,202	145,214	42,988
2	Walnut	174,816	154,746	20,070
3	Onion, dry	54,820	39,302	15,518
4	Tangerine	39,115	31,224	7,891
5	Cotton	19,851	12,979	6,872

Trends in Pesticide Use for Select Commodities

A grower's or applicator's decision to apply pesticides may depend on several factors, such as:

- Potential pesticide risk to farm workers, local communities, endangered species, wildlife, and the environment
- The presence of biological control agents (e.g., predatory insects and other natural enemies)
- Other available management practices
- Pest pressure
- Cost of pesticides and labor
- Value of the crop
- Pesticide resistance and effectiveness

Pest population and the resulting pest pressure are determined by complex ecological and management interactions. For example, weather is a critically important ecological factor that affects pest species in different ways: higher temperatures may speed up developmental rates of various pests, increasing the number of generations and thus can increase pest pressure and pesticide use. Rainy weather can increase damage from pests that need cool, damp conditions, such as slugs and snails. In addition, various pesticides may cause secondary pest outbreaks if the pesticide harms beneficial insects controlling other pests. Plant nutrition can contribute to outbreaks if deficiencies weaken plant defenses, or alternatively, if nutrient excesses attract pests to plants. However, sometimes the causes of pest outbreaks are unknown.

Crops treated with the highest total pounds applied of pesticides in 2024 were:

1. Almond
2. Wine grape
3. Strawberry
4. Table and raisin grape
5. Orange

Besides total pounds applied, the magnitudes of changes in use can be of interest in understanding pesticide use trends. Table 63 shows the five crops or sites with the greatest *increases* in pounds applied, while table 64 shows the five crops or sites with the greatest *decreases* in pounds applied over the last year. The reasons for changes in use can be due to many different variables, but sometimes the increase or decrease in use may occur at least in part because the total crop acreage increased or decreased. Therefore, in addition to the change in pounds applied of AIs since last year, the table also includes the change in acres planted, bearing, or harvested, as measured by the Quick Stats Database USDA NASS. In certain cases, the NASS acreage measure may not correlate well with specific types of pesticide use: for example, preplant soil fumigation for new orchards may not correlate with a change in NASS bearing acres of the orchard crop, but bearing acres may better correlated with changes in post-harvest fumigations.

Table 63. The total, change, and percent change in pounds of AI applied and NASS acreage (planted, bearing, or harvested) from 2023 to 2024 for the crops or sites with the greatest increase. Acres unit (planted, bearing, or harvested) dependent on the NASS surveys available for the crop. Pounds is short for pounds applied.

Sites	2024 Pounds	2023 Pounds	Change in Pounds	% Change Pounds	2024 Nass Acres	2023 Nass Acres	Change in Nass Acres	% Change Nass Acres
Almond	26,295,905	23,935,647	2,360,258	10	1,380,000	1,380,000	0	0
Cotton	2,742,274	1,799,529	942,745	52	166,000	98,000	68,000	69
Strawberry	13,987,196	13,082,466	904,730	7	45,300	43,100	2,200	5
Tangerine	5,440,540	4,605,563	834,977	18	68,000	67,000	1,000	1
Walnut	3,831,291	3,472,925	358,366	10	370,000	385,000	-15,000	-4

Table 64. The total, change, and percent change in pounds of AI applied and NASS acres (planted, bearing, or harvested) from 2023 to 2024 for the crops or sites with the greatest decrease in pounds applied. N/A means not available. Acre values sourced from the USDA NASS Quick Stats database. Acres unit (planted, bearing, or harvested) dependent on the NASS surveys available for the crop. Pounds is short for pounds applied.

Sites	2024 Pounds	2023 Pounds	Change in Pounds	% Change Pounds	2024 Nass Acres	2023 Nass Acres	Change in Nass Acres	% Change Nass Acres
Wine Grape	24,947,376	26,328,505	-1,381,130	-5	550,000	570,000	-20,000	-4
Soil Fum. Preplant*	2,419,776	3,436,187	-1,016,412	-30	N/A	N/A	N/A	N/A
Processing Tomato	9,468,627	10,416,563	-947,936	-9	228,000	269,000	-41,000	-15
Rice	5,177,578	5,994,927	-817,349	-14	467,000	516,000	-49,000	-9
Water (Industrial)	1,096,837	1,697,013	-600,176	-35	N/A	N/A	N/A	N/A

*Fum. stands for fumigation

Crops or sites with the greatest *increase* in the amount applied from 2023 to 2024 included almond, cotton, strawberry, tangerine, and walnut. The increase in pounds applied to cotton, strawberry, and tangerine may be due in part to the increase in planted (cotton and strawberry) or bearing (tangerine) acreage. Pounds applied to almond increased despite no reported change in bearing acres, while pounds applied to walnuts increased despite a decrease in bearing acres (Table 63).

Crops or sites with the greatest *decrease* in the amount applied from 2023 to 2024 included wine grape, soil fumigation/preplant (seedbeds, etc.), processing tomato, rice, and industrial water. The decrease in pounds applied to wine grape, processing tomato, and rice may be due in part to less planted acreage (Table 64).

Top Agricultural Crops by Pesticide Use:

Top crops by pesticide use were defined as the commodities that were treated with more than four million pounds of AIs applied or had more than three million acres treated in 2024. Twelve commodities were chosen based on these criteria, listed here in descending order by pounds applied:

1. Almond
2. Wine Grape
3. Strawberry
4. Table and Raisin Grape
5. Orange
6. Processing Tomato
7. Pistachio
8. Tangerine
9. Rice
10. Walnut
11. Cotton
12. Alfalfa

Collectively, the pesticides used on these commodities represent 68 percent of the total amount used (pounds applied) and 73 percent of the acres treated in 2024 (Table 65).

Table 65. Pounds applied and acres treated of the top 12 crops, sorted by descending pounds applied, for 2024.

Crop	Pounds Applied	Acres Treated
Almond	26,295,905	24,925,332
Wine Grape	24,985,748	9,021,651
Strawberry	13,987,196	2,919,854
Table And Raisin Grape	11,210,858	4,515,720
Orange	9,883,345	2,583,960
Processing Tomato	9,468,627	3,126,966
Pistachio	7,246,016	8,583,738
Tangerine	5,440,540	1,397,338
Rice	5,177,578	3,678,405
Walnut	3,831,291	3,465,446
Cotton	2,742,274	5,777,495
Alfalfa	2,342,899	4,249,051

Note that inclusion on this list does not necessarily indicate that the highest pounds of AI per acre are applied to these commodities. Changes in total pesticide use as commodity acreage is added or removed from production is one of many factors that may influence pesticide use trends. As a result, a commodity with relatively low pesticide use per acre may still account for high total

pesticide use if it is grown on a large number of acres. Using total acreage[1] values from the Quick Stats Database of USDA NASS, Figure 23 shows that the decrease in pounds of AIs applied for wine grape, table and raisin grape, processing tomato, and rice is likely due, at least in part, to decreases in total acreage from 2023 to 2024. Similarly, the increase in pounds applied for cotton, tangerine, and strawberry may be due in part to increased total acreage in production in 2024 compared to 2023. The pounds applied to pistachio decreased despite an increase in total acreage, while the pounds applied to walnut, orange, almond, and alfalfa increased despite a decrease or no change in total acreage (Figure 23).

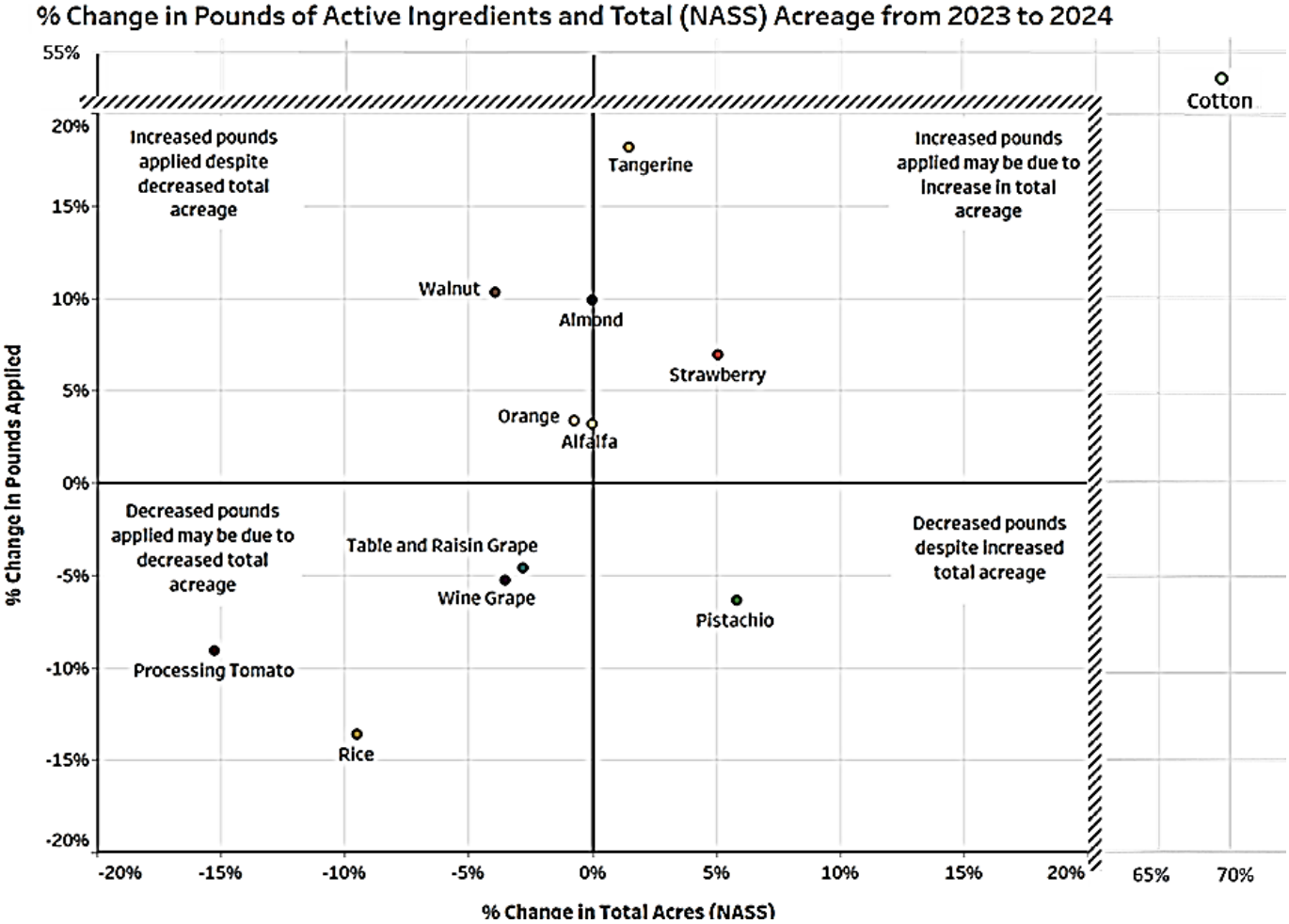


Figure 23. Graph showing percentage change in pounds of AIs applied from 2023 to 2024 against the change in the total acreage of the crop. Pounds applied is determined from the PUR data while the total acreage comes from the Quick Stats database, USDA NASS[1]. (Scale breaks were inserted into each axis of the graph as gray hashmarks to preserve optimal visualization of data points while accommodating the much larger percent increase in cotton).

[1] Total acreage may be acres planted, harvested, or bearing depending on the unit reported for the commodity in USDA NASS

Pesticide Use by Crop

The remainder of this report summarizes the changes in pesticide use and top five pesticides by pounds applied and acres treated for the 12 top crops, as defined at the beginning of this section. A use type (insecticide, fungicide, herbicide, etc.) is included for each AI. Note that use types may vary depending on the product that contains the AI, and there may be more than one use type for each AI. In cases where an AI is associated with more than one use type, the use type listed in the table is the one *most often* associated with the AI. Oil is listed as "many types" due to the many different types of pesticides that contain oil as an AI: the majority are insecticides, fungicides, and adjuvants. Most oil pesticides used in California serve as alternatives to more toxic pesticides. For each of the 12 crops, tables containing the top five AIs by acres treated and pounds applied are provided.

Alfalfa

Harvested alfalfa acreage[1] did not change from 2023 to 2024, remaining at 480 thousand acres (Figure 23). In 2024, there were 2.34 million pounds of AI applied to alfalfa compared to 2.27 million pounds applied in 2023 (3 percent increase). In contrast, the acres treated decreased, going from 4.4 million acres treated in 2023 to 4.2 million in 2024 (4 percent decrease).

The top five AIs used in alfalfa were mostly herbicides. Glyphosate and pendimethalin were in the top five when ranked by pounds applied and by acres treated. The insecticides lambda-cyhalothrin and indoxacarb, and the herbicide clethodim made up the remainder of the top five by acres treated, while the fungicide/insecticide sulfur and the herbicides trifluralin and EPTC comprised the remaining top five when measured by pounds applied (Tables 66, 67).

Table 66. The 2024 top five AIs by acres treated on alfalfa.

Top Five	Type	Acres Treated
Lambda-cyhalothrin	Insecticide	307,587
Clethodim	Herbicide	273,101
Pendimethalin	Herbicide	237,967
Glyphosate	Herbicide	222,145
Indoxacarb	Insecticide	187,056

Table 67. The 2024 top five AIs by pounds applied to alfalfa. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Pendimethalin	Herbicide	476,738
Glyphosate	Herbicide	367,448
Sulfur	Fung/Insect	325,357
Trifluralin	Herbicide	79,262
EPTC	Herbicide	74,099

ALFALFA



Alfalfa in bloom. DPR staff photo.



Common groundsel (Senecio vulgaris), a weed in alfalfa dangerous to livestock. Photo by Steve Dewey, Utah State University, Bugwood.org



Alfalfa caterpillar (Colias eurytheme), a pest on alfalfa. Photo by John Capinera, University of Florida, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Almond

Statewide bearing almond acreage[1] remained the same at 1.38 million acres in 2023 and 2024 (0 percent change) (Figure 23). The pounds of AI applied to almonds increased from 24 million pounds in 2023 to 26 million pounds in 2024 (10 percent increase). Almond acres treated with AIs increased from 23 million acres treated to 25 million acres treated (7 percent increase).

The herbicides glyphosate and glufosinate-ammonium made the top five AIs when ranked by both pounds applied and acres treated. The remaining top three AIs by acres treated included the insecticides chlorantraniliprole, methoxyfenozide, and abamectin. The remaining top five AIs by pounds applied included oil AIs, the fumigant 1,3-dichloropropene, and the fungicide-insecticide sulfur (Tables 68, 69).

Table 68. The 2024 top five AIs by acres treated on almond.

Top Five	Type	Acres Treated
Glyphosate	Herbicide	1,630,649
Chlorantraniliprole	Insecticide	1,099,663
Methoxyfenozide	Insecticide	1,059,759
Abamectin	Insecticide	1,053,029
Glufosinate-ammonium	Herbicide	975,074

Table 69. The 2024 top five AIs by pounds applied to almond. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Oil	Many	9,915,548
Glyphosate	Herbicide	3,215,264
1,3-Dichloropropene	Fumigant	1,381,277
Glufosinate-ammonium	Herbicide	986,167
Sulfur	Fung/Insect	667,651

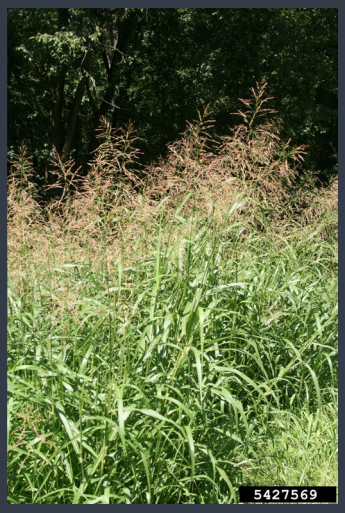
ALMOND



Almond branch heavy with nuts. DPR staff photo.



Navel orangeworm (*Amyelois transitella*), an almond pest. Photo by Mark Dreiling, Bugwood.org



Johnsongrass (*Sorghum halepense*), a weed in almonds. Photo by Chris Evans, University of Illinois, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Cotton

The total acres planted[1] of cotton increased from 98 thousand acres in 2023 to 166 thousand acres in 2024 (69 percent increase) (Figure 23). The pounds of AI applied increased from 2 million pounds applied in 2023 to 3 million pounds applied in 2024 (52 percent increase). The acres treated increased from 4 million acres treated in 2023 to 6 million acres treated applied in 2024 (59 percent increase).

The herbicide glyphosate and the plant growth regulator ethephon made the top five lists by both acres treated and pounds applied. The insecticide flonicamid, the defoliant thidiazuron, and the herbicide diuron made up the remaining top five AIs by acres treated, while the herbicide/defoliant urea dihydrogen sulfate and the insecticides malathion and naled were the remaining three top five AIs by pounds applied (Tables 70, 71).

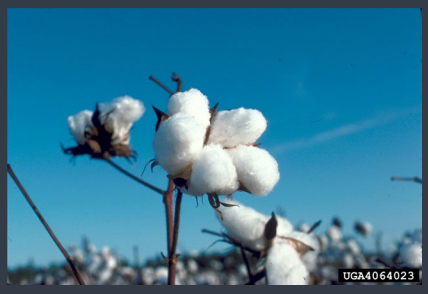
Table 70. The 2024 top five AIs by acres treated on cotton. PGR = Plant Growth Regulator.

Top Five	Type	Acres Treated
Glyphosate	Herbicide	337,914
Flonicamid	Insecticide	276,389
Thidiazuron	Defoliant	211,368
Ethephon	PGR	208,242
Diuron	Herbicide	207,765

Table 71. The 2024 top five AIs by pounds applied to cotton. Herb/Def = Herbicide/Defoliant. PGR = Plant Growth Regulator.

Top Five	Type	Pounds Applied
Glyphosate	Herbicide	542,394
Urea Dihydrogen Sulfate	Herb/Def	272,436
Ethephon	PGR	198,188
Malathion	Insecticide	119,170
Naled	Insecticide	79,214

COTTON



Cotton boll. Photo by Johnny Crawford, University of Georgia, Bugwood.org



Field bindweed (*Convolvulus arvensis*), a weed in cotton. Photo by Howard F. Schwartz, Colorado State University, Bugwood.org



Cotton bollworm (*Helicoverpa zea*), a pest on cotton. Photo by Russ Ottens, University of Georgia, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Orange

Total statewide bearing acreage[1] for orange decreased from 137 thousand acres in 2023 to 136 thousand acres in 2024 (1 percent decrease) (Figure 23). Pounds of AI applied increased from 9.6 million pounds applied in 2023 to 9.9 million pounds applied in 2024 (3 percent increase). In contrast, the acres treated decreased from 2.7 million acres in 2023 to 2.6 million acres treated in 2024 (6 percent decrease).

Oil was the most used AI by both pounds applied and acres treated. The fungicide copper and the herbicide glyphosate were also ranked in the top five AIs when measured by either pounds applied or acres treated. The insecticide/miticide abamectin and the insecticide cyantraniliprole rounded out the top five AIs by acres treated, while the biopesticide fungicide-insecticide kaolin clay ("kaolin") and the biocide sodium hypochlorite, used as a crop sanitizer, completed the top five list by pounds applied (Tables 72, 73).

Table 72. The 2024 top five AIs by acres treated on orange.

Top Five	Type	Acres Treated
Oil	Many	312,490
Copper	Fungicide	114,876
Abamectin	Insecticide	111,877
Cyantraniliprole	Insecticide	105,759
Glyphosate	Herbicide	102,072

Table 73. The 2024 top five AIs by pounds applied to orange. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Oil	Many	5,179,827
Copper	Fungicide	476,044
Kaolin	Fung/Insect	447,012
Glyphosate	Herbicide	148,637
Sodium Hypochlorite	Biocide	61,027

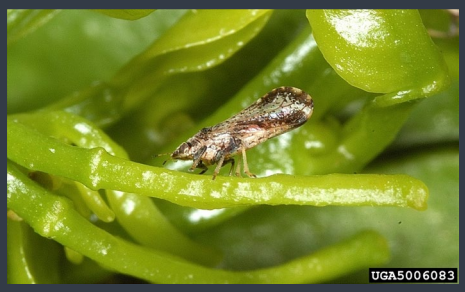
ORANGE



Orange tortrix (Argyrotaenia franciscana), a pest on citrus. Photo by Mark Dreiling, Bugwood.org



Citrus rust mite (Phyllocoptruta Olivera), a pest on citrus. Photo by Don Ferrin, Louisiana State University Agricultural Center, Bugwood.org



Asian citrus psyllid (*Diaphorina citri*), a pest that vectors the citrus greening disease (*Candidatus Liberibacter asiaticus*). Photo by David Hall, USDA Agricultural Research Service, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Pistachio

The total bearing acreage[1] of pistachio increased from 462 thousand acres in 2023 to 489 thousand acres in 2024 (6 percent increase) (Figure 23). Despite the increased bearing acreage, pesticide use decreased: Pounds of AI applied to pistachio decreased from 8 million pounds applied in 2023 to 7 million pounds applied in 2024 (6 percent decrease). Acres treated decreased from 8.7 million acres treated in 2023 to 8.6 million acres treated in 2024 (1 percent decrease).

The herbicides glyphosate and glufosinate-ammonium made the top five AIs when ranked by both pounds applied and by acres treated. The insecticides lambda-cyhalothrin and bifenthrin, and the fungicide *Aspergillus flavus* completed the top five when measured by acres treated, while the fungicide/insecticide sulfur, oil AIs, and the herbicide pendimethalin made up the rest of the top five when measured by pounds applied (Tables 74, 75).

Table 74. The 2024 top five AIs by acres treated on pistachio.

Top Five	Type	Acres Treated
Lambda-cyhalothrin	Insecticide	561,912
Glyphosate	Herbicide	532,391
Bifenthrin	Insecticide	436,346
Glufosinate-ammonium	Herbicide	367,918
Aspergillus flavus	Fungicide	345,396

Table 75. The 2024 top five AIs by pounds applied to pistachio. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Sulfur	Fung/Insect	1,182,284
Glyphosate	Herbicide	1,031,541
Oil	Many	834,195
Glufosinate-ammonium	Herbicide	369,641
Pendimethalin	Herbicide	257,338

PISTACHIO



Pistachio branch. Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org



Darkling beetle (*Blapstinus histricus*), a pest on pistachio. Photo by Lindsey Seastone, USDA APHIS PPQ, Bugwood.org



European fruit lecanium (*Parthenolecanium corni*), a pest on pistachio. Photo by Raymond Gill, CDFA, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Processing Tomato

The statewide planted acreage[1] of processing tomatoes decreased from 269 thousand acres in 2023 to 228 thousand acres in 2024 (15 percent decrease) (Figure 23). Pounds of AI applied decreased from 10 million pounds applied in 2023 to 9 million pounds applied in 2024 (9 percent decrease). The acres treated decreased from 4 million acres treated in 2023 to 3 million acres treated in 2024 (18 percent decrease).

The fungicide/insecticide sulfur and the fungicide chlorothalonil made the top five list by both pounds applied and acres treated. The insecticides bifenthrin, lambda-cyhalothrin, and chlorantraniliprole made up the remaining three of the top five AIs by acres treated. The fumigant potassium N-methyldithiocarbamate ("metam-potassium"), the biopesticide kaolin clay ("kaolin"), and the herbicide glyphosate ranked in the top five by pounds applied (Tables 76, 77).

Table 76. The 2024 top five AIs by acres treated on processing tomato. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Acres Treated
Sulfur	Fung/Insect	217,083
Bifenthrin	Insecticide	131,127
Chlorothalonil	Fungicide	125,398
Lambda-Cyhalothrin	Insecticide	123,103
Chlorantraniliprole	Insecticide	116,457

Table 77. The 2024 top five AIs by pounds applied to processing tomato. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Sulfur	Fung/Insect	5,164,840
Metam-potassium	Fumigant	2,297,298
Kaolin	Fung/Insect	384,383
Chlorothalonil	Fungicide	241,538
Glyphosate	Herbicide	216,174

PROCESSING TOMATO



Tomatoes on the vine. DPR staff photo.



Potato/tomato psyllid (*Bactericera cockerelli*), a pest on tomato. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org



Bacterial speck (*Pseudomonas syringae*), a disease on tomato Photo by Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Rice

The statewide planted acreage[1] of rice decreased from 516 thousand acres in 2023 to 467 thousand acres in 2024 (9 percent decrease) (Figure 23). This decrease may explain in part the decrease in the pounds of AI applied to rice in 2024, going from 6 million pounds applied in 2023 to 5 million pounds applied in 2024 (14 percent decrease). The acres treated with AIs decreased from 3.8 million acres treated in 2023 to 3.7 million acres treated in 2024 (4 percent decrease).

The herbicide propanil ranked in the top five AIs by both acres treated and pounds applied. The herbicide triclopyr (triethylamine salt), the herbicide benzobicyclon, the fungicide azoxystrobin, and the herbicide halosulfuron-methyl made up the remaining four of the top five AIs by acres treated, while the fungicide copper, the algaecide sodium percarbonate, the herbicide thiobencarb, and the herbicide/defoliant sodium chlorate ranked in the top five by pounds applied (Tables 78, 79).

Table 78. The 2024 top five AIs by acres treated in rice.

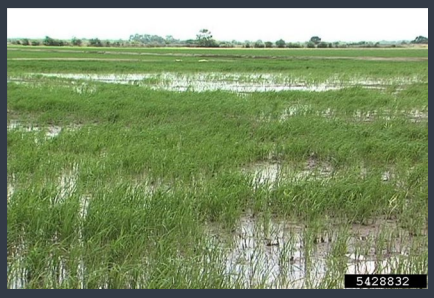
Top Five	Type	Acres Treated
Propanil	Herbicide	523,150
Triclopyr, Triethylamine Salt	Herbicide	307,158
Benzobicyclon	Herbicide	306,802
Azoxystrobin	Fungicide	291,270
Halosulfuron-Methyl	Herbicide	199,311

Table 79. The 2024 top five AIs by pounds applied to rice. Herb/Def = Herbicide/Defoliant.

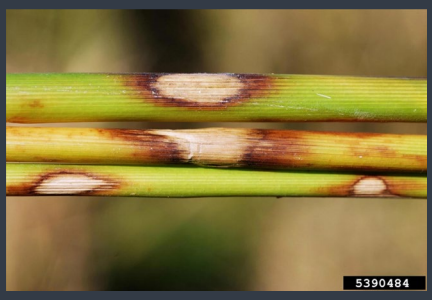
Top Five	Type	Pounds Applied
Propanil	Herbicide	2,226,200
Copper	Fungicide	752,255
Sodium Percarbonate	Algaecide	282,717
Thiobencarb	Herbicide	244,602
Sodium Chlorate	Herb/Def	70,056

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistic

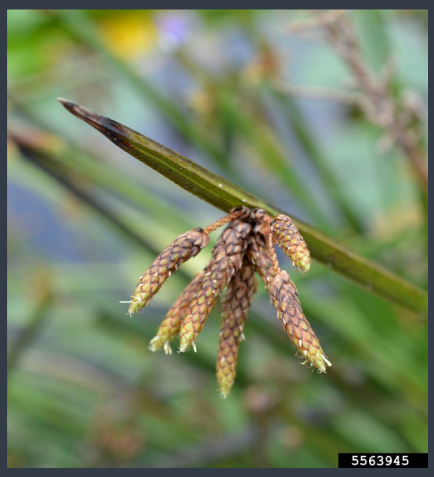
RICE



Rice field. Natalie Hummel, Louisiana State University Ag Center, Bugwood.org



Sheath spot (*Rhizoctonia oryzae*), a disease on rice. Photo by Donald Groth, Louisiana State University AgCenter, Bugwood.org



Ricefield bulrush (*Schoenoplectiella mucronata*), a weed in rice fields. Photo by Shaun Winterton, Aquarium and Pond Plants of the World, Edition 3, USDA APHIS PPQ, Bugwood.org

Strawberry

The total planted acreage[1] of strawberry in California increased from 43 thousand acres in 2023 to 45 thousand acres in 2024 (5 percent increase) (Figure 23). The pounds applied increased from 13 million pounds applied in 2023 to 14 million pounds applied in 2024 (7 percent increase). The acres treated increased from 2.7 million acres treated in 2023 to 2.9 million acres treated in 2024 (7 percent increase).

Sulfur, a fungicide/insecticide, ranked in the top five by both pounds applied and acres treated. The fungicide captan, the insecticide *Bacillus thuringiensis*, the fungicide fludioxonil, and the fungicide thiram rounded out the top five by acres treated. The fumigants chloropicrin, 1,3-dichloropropene, potassium N-methyldithiocarbamate ("metam-potassium"), and metam sodium made up the remaining four of the top five AIs by pounds applied (Tables 80, 81).

Table 80. The 2024 top five AIs by acres treated on strawberry. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Acres Treated
Captan	Fungicide	342,867
Sulfur	Fung/Insect	144,263
Bacillus thuringiensis	Insecticide	82,986
Fludioxonil	Fungicide	78,170
Thiram	Fungicide	76,650

Table 81. The 2024 top five AIs by pounds applied to strawberry. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Chloropicrin	Fumigant	7,481,599
1,3-Dichloropropene	Fumigant	1,789,060
Metam-Potassium	Fumigant	1,760,495
Sulfur	Fung/Insect	546,928
Metam-Sodium	Fumigant	483,721

STRAWBERRY



Strawberry on vine. DPR staff photo.



Yellow nutsedge, a weed in strawberry. Photo by Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org



Stunted roots caused by red stele root rot (Phytophthora fragariae var. fragariae), a disease on strawberry. Photo by SCRI-Dundee , Scottish Crop Research Institute, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Table and Raisin Grape

Total bearing acreage[1] of table and raisin grape decreased from 250 thousand acres in 2023 to 243 thousand acres in 2024 (3 percent decrease) (Figure 23). The pounds of AI applied decreased from 12 million pounds applied in 2023 to 11 million pounds applied in 2024 (5 percent decrease). The acres treated declined from 4.6 million acres treated in 2023 to 4.5 million acres treated in 2024 (2 percent decrease).

The fungicide/insecticide sulfur and the fungicide copper made the top five AIs by acres treated and pounds applied. The plant growth regulator gibberellins, the herbicide glufosinate-ammonium, and the insecticide spirotetramat comprised the remaining three top five AIs by acres treated, while the fungicide/insecticide lime-sulfur, the fumigant 1,3-dichloropropene, and the plant growth regulator hydrogen cyanamide completed the top five AIs by pounds applied (Tables 82, 83).

Table 82. The 2024 top five AIs by acres treated on table and raisin grape. Fung/Insect = Fungicide/Insecticide. PGR = Plant Growth Regulator.

Top Five	Type	Acres Treated
Sulfur	Fung/Insect	1,329,523
Copper	Fungicide	257,640
Gibberellins	PGR	237,238
Glufosinate-ammonium	Herbicide	100,175
Spirotetramat	Insecticide	93,429

Table 83. The 2024 top five AIs by pounds applied to table and raisin grape. Fung/Insect = Fungicide/Insecticide. PGR = Plant Growth Regulator.

Top Five	Type	Pounds Applied
Sulfur	Fung/Insect	8,076,095
Lime-Sulfur	Fung/Insect	601,307
1,3-Dichloropropene	Fumigant	291,940
Copper	Fungicide	272,447
Hydrogen Cyanamide	PGR	218,132

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

TABLE AND RAISIN GRAPE



Phomopsis cane and leaf spot (*Phomopsis viticola*), a disease on grape. Photo by Plant Pathology , University of Georgia, Bugwood.org



Grape leaffolder (*Desmia funeralis*), a pest on grape. Photo by Ansel Oommen, Bugwood.org



Panicle willowherb (*Epilobium brachycarpum*), a weed in vineyards. Photo by Joseph M. DiTomaso, University of California - Davis, Bugwood.org

Tangerine

Total statewide bearing acreage[1] for tangerine increased from 67 thousand acres in 2023 to 68 thousand acres in 2024 (1 percent increase) (Figure 23). Pounds of AI applied increased from 4.6 million pounds applied in 2023 to 5.4 million in 2024 (18 percent increase). Acres treated increased from 1.390 million acres treated in 2023 to 1.397 million acres treated in 2024 (1 percent increase).

Oils, the herbicide glyphosate, and the fungicide copper were ranked in the top five AIs when measured by either pounds applied or acres treated. The insecticide/miticide abamectin, and the plant growth regulator gibberellins rounded out the top five AIs by acres treated, while the biopesticide kaolin clay ("kaolin") and the fumigant 1,3-dichloropropene completed the top five list by pounds applied (Tables 84, 85).

Table 84. The 2024 top five AIs by acres treated on tangerine. PGR = Plant Growth Regulator.

Top Five	Type	Acres Treated
Oil	Many	172,532
Glyphosate	Herbicide	69,663
Abamectin	Insecticide	49,436
Gibberellins	PGR	49,285
Copper	Fungicide	48,549

Table 85. The 2024 top five AIs by pounds applied to tangerine. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Oil	Many	2,859,758
Kaolin	Fung/Insect	951,820
Copper	Fungicide	178,530
Glyphosate	Herbicide	118,763
1,3-Dichloropropene	Fumigant	97,709

TANGERINE



Tangerines. Photo by Forest and Kim Starr, Starr Environmental, Bugwood.org



California red scale (*Aonidiella aurantia*), a pest on citrus. Photo by Dennis Navea, ControlBest, Bugwood.org



Anthracnose (*Colletotrichum spp.*), a disease on citrus. Photo by Cesar Calderon, USDA APHIS PPQ, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Walnut

Total bearing acreage[1] of walnuts decreased from 385 thousand acres in 2023 to 370 thousand acres in 2024 (4 percent decrease) (Figure 23). The pounds applied increased from 3 million pounds applied in 2023 to 4 million pounds applied in 2024 (10 percent increase). Acres treated increased from 3.1 million in 2023 to 3.5 million acres treated in 2024 (11 percent increase).

The top five AIs used in walnut included the herbicide glyphosate and the fungicides copper and mancozeb for both pounds applied and acres treated. The remaining two AIs by acres treated were the plant growth regulator ethephon and the herbicide glufosinate-ammonium, while the biopesticide kaolin clay ("kaolin") and the fumigant 1,3-dichloropropene made up the remaining two top five AIs when measured by pounds applied (Tables 86, 87).

Table 86. The 2024 top five AIs by acres treated on walnut. PGR = Plant Growth Regulator.

Top Five	Type	Acres Treated
Glyphosate	Herbicide	257,819
Copper	Fungicide	176,942
Mancozeb	Fungicide	155,873
Ethephon	PGR	153,428
Glufosinate-ammonium	Herbicide	145,040

Table 87. The 2024 top five AIs by pounds applied to walnut. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Copper	Fungicide	620,861
Glyphosate	Herbicide	495,551
Kaolin	Fung/Insect	310,500
Mancozeb	Fungicide	273,329
1,3-Dichloropropene	Fumigant	272,853

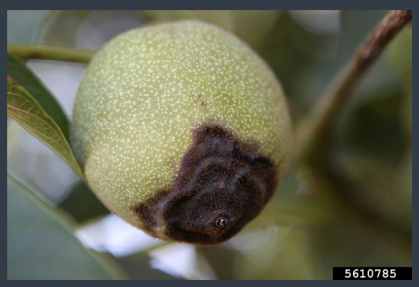
WALNUT



Walnut on branch. DPR staff photo.



Red-humped caterpillar (*Schizura concinna*), a pest on walnut. Photo by Howard Ensign Evans, Colorado State University, Bugwood.org



Walnut blight (*Xanthomonas arboricola pv. juglandis*), a disease on walnut. Photo by Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Wine Grape

The bearing acreage[1] of wine grapes in California decreased from 570 thousand acres in 2023 to 550 thousand acres in 2024 (4 percent decrease) (Figure 23). Pounds of AI applied decreased from 26 million pounds applied in 2023 to 25 million pounds applied in 2024 (5 percent decrease). The acres treated decreased from 10 million acres treated in 2023 to 9 million acres treated in 2024 (9 percent decrease).

The fungicide/insecticide sulfur, oil, and the herbicides glufosinate-ammonium and glyphosate made up the top five AIs when ranked by either acres treated or pounds applied. The fungicide copper rounded out the top five AIs by acres treated, while the fungicide/insecticide lime sulfur was the remaining AI of the top five by pounds applied (Tables 88, 89).

Table 88. The 2024 top five AIs by acres treated on wine grape. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Acres Treated
Sulfur	Fung/Insect	2,258,984
Copper	Fungicide	325,341
Glufosinate-ammonium	Herbicide	322,136
Oil	Many	300,756
Glyphosate	Herbicide	238,747

Table 89. The 2024 top five AIs by pounds applied to wine grape. Fung/Insect = Fungicide/Insecticide.

Top Five	Type	Pounds Applied
Sulfur	Fung/Insect	19,424,341
Oil	Many	1,889,766
Glyphosate	Herbicide	440,733
Lime-Sulfur	Fung/Insect	397,402
Glufosinate-ammonium	Herbicide	278,518

WINE GRAPE



Wine grape bunches. William M. Brown Jr., Bugwood.org



Powdery mildew (*Erysiphe necator*), a disease on grape. Photo by Yuan-Min Shen, National Taiwan University, Bugwood.org



Western grape leafhopper nymphs (*Erythroneura elegantula*), a pest on grape. Photo by Eugene E. Nelson, Bugwood.org

[1] Quick Stats Database of US Department of Agriculture, National Agricultural Statistics Service

Appendix. List of general AI names used throughout report and the individual AIs that the name represents. AIs with "other related" following their name are the naturally occurring impurities, or impurities formed during the synthesis of the chemical compound.

General AI name	Individual AIs
Abamectin	Abamectin
Abamectin	Abamectin, other related
Aspergillus flavus	*Aspergillus flavus strain: af-36*
Aspergillus flavus	*Aspergillus flavus strain nrrl #21882*
Atrazine	Atrazine
Atrazine	Atrazine, other related
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Kurstaki strain: sa-12*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Kurstaki strain: evb-113-19*
Bacillus thuringiensis	*Bacillus thuringiensis, subsp. Kurstaki, strain hd-1*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Kurstaki strain: eg7841 , genetically engineered*
Bacillus thuringiensis	*Bacillus thuringiensis (berliner)*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Aizawai strain: abts-1857*
Bacillus thuringiensis	*Bacillus thuringiensis subspecies Israelensis strain bmp 144*
Bacillus thuringiensis	*Bacillus thuringiensis (berliner), subsp. Kurstaki, strain sa-11*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Israelensis strain: am 65-52*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Israelensis strain: sum-6218*
Bacillus thuringiensis	*Bacillus thuringiensis (berliner), subsp. Aizawai, serotype h-7*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Aizawai strain: gc-91*
Bacillus thuringiensis	*Bacillus thuringiensis subsp. Kurstaki strain: abts-351*
Bacillus thuringiensis	*Bacillus thuringiensis (berliner), subsp. Kurstaki, serotype 3a,3b*
Bacillus velezensis	*Bacillus velezensis strain: mbi 600*
Bacillus velezensis	*Bacillus velezensis strain: d747*
Captan	Captan, other related
Captan	Captan
Copper	Copper triethanolamine complex
Copper	Copper octanoate
Copper	Copper oxide (ic)
Copper	Cuprous oxide
Copper	Copper ammonium complex
Copper	Copper sulfate (pentahydrate)
Copper	Copper salts of fatty and rosin acids
Copper	Copper ethanolamine complexes, mixed
Copper	Copper hydroxide
Copper	Copper 8-quinolinoleate
Copper	Copper ammonium carbonate
Copper	Copper carbonate, basic
Copper	Copper naphthenate

General AI name	Individual AIs
Copper	Copper ethylenediamine complex
Copper	Copper sulfate (basic)
Copper	Copper oxychloride
Copper	Copper
Diatomaceous earth	Diatomaceous earth, other related
Diatomaceous earth	Diatomaceous earth
Glyphosate	Glyphosate, diammonium salt
Glyphosate	Glyphosate, potassium salt
Glyphosate	Glyphosate
Glyphosate	Glyphosate, dimethylamine salt
Glyphosate	Glyphosate, monoammonium salt
Glyphosate	Glyphosate, isopropylamine salt
Neem oil	Clarified hydrophobic extract of neem oil
Neem oil	Azadirachtin
Neem oil	Margosa oil
Oil	Petroleum distillates
Oil	Kerosene
Oil	Low molecular weight paraffinic oil
Oil	Paraffinic hydrocarbons
Oil	Petroleum oil, sulfurized
Oil	Petroleum distillates, aromatic
Oil	Mineral oil
Oil	Naphtha, heavy aromatic
Oxytetracycline hydrochloride	Oxytetracycline hydrochloride, other related
Oxytetracycline hydrochloride	Oxytetracycline hydrochloride
Triclopyr	Triclopyr, butoxyethyl ester
Triclopyr	Triclopyr, triethylamine salt
Triclopyr	Triclopyr choline

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2024 Data Summary
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