

CDFA Annual PUR Pesticide Category Analysis (2022-2023)

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Executive Summary

The Pesticide Use Reporting (PUR) Database maintained by the California Department of Pesticide Regulation (DPR) can provide valuable insights into the drivers of changing pesticide use. CDFA's Office of Pesticide Consultation and Analysis (OPCA) has expanded upon DPR's annual PUR data summaries to highlight potential crop- and active ingredient-specific drivers of change.

We find that in several cases, the annual changes in the use of notable pesticide categories (e.g. biopesticides, carcinogens, toxic air contaminants) likely results from changing crop acreage rather than any changes in management practices. This means that data on the annual use of pesticides in these categories, which are used by public and private groups in developing health, environmental, and agricultural policies, may be more reflective of what crops growers decide to plant that year rather than meaningful changes in how and when pesticides are used.

In many cases, use of specific pesticide ingredients increases in one crop while decreasing in another, revealing the complexity behind total annual changes in pesticide use categories. Overall, we show the need to examine how individual crop systems change and how specific pesticide products are used in order to accurately interpret how pesticide use data reflects in-field conditions and to evaluate how state policies and programs are effectuating changes in pest management practices.

Background

In September 2025, the California Department of Pesticide Regulation (DPR) released its Annual Report summarizing 2023 pesticide use reporting data. This report includes 1-year and 10-year trends in certain categories of pesticide use both statewide and for some specific high pesticide-using crops. These categories include lists of active ingredients (“AIs”), which are the chemical compounds with pesticidal activity used in pesticide products. Figure 1 below is taken from DPR’s report, showing annual pesticide use changes across categories.

Figure 1: Table from DPR’s 2023 Annual Pesticide Use Report: Annual change in pounds applied and acres treated of pesticides characterized as biopesticides, oils, carcinogens, cholinesterase inhibitors, groundwater contaminants, fumigants, reproductive toxins, and toxic air contaminants from 2022 to 2023.

| Category | Change in Pounds Applied | Percent Change Pounds | Change in Acres Treated | Percent Change Acres |
|---------------------------|--------------------------|-----------------------|-------------------------|----------------------|
| Biopesticides | ↑ 338,442 | 4 | ↑ 473,032 | 6 |
| Oils | ↓ -6,559,051 | -19 | ↑ 132,346 | 3 |
| Carcinogens | ↓ -2,033,643 | -6 | ↑ 396,746 | 6 |
| Cholinesterase Inhibitors | ↑ 132,662 | 5 | ↑ 51,639 | 3 |
| Fumigants | ↓ -3,278,535 | -9 | ↓ -13,951 | -7 |
| Groundwater Contaminants | ↓ -66,553 | -34 | ↓ -62,679 | -25 |
| Reproductive Toxins | ↓ -824,999 | -13 | ↑ 7,541 | 0.2 |
| Toxic Air Contaminants | ↓ -3,606,968 | -9 | ↓ -241,599 | -13 |

Here California Department of Food and Agriculture’s Office of Pesticide Consultation and Analysis is further examining several of the reported metrics, with the goal of identifying some drivers behind the changes described in the Annual Report. DPR’s reports recognize that many factors contribute to observed changes, but do not make efforts to examine them. While there is some value to reporting statewide top-line changes in pesticide use, identifying the annual and long-term factors driving changes in pesticide use produces more actionable insights and allows for policies and programs to prioritize reduction strategies and recognize possible roadblocks to progress.

Pesticide Category Analysis

DPR has established pesticide categories of interest, for both higher- and lower-risk categories. AIs can belong in multiple categories, and their classification can change based on updates from DPR.

We seek to examine the AIs in each category to identify which AIs are driving the biggest changes, what commodities they are most used in, and if we can find any possible external factors that might explain changes in use. For the crop-specific uses, we also calculate the total statewide acreage of key crops to show how planted acreage changes could affect other use trends. In commodities where pesticide use changed but total commodity acreage did not, this signals a change in either pest pressures or management decisions by growers. However, if pesticide use and total commodity acreage both change in the same direction and in the same magnitude, this suggests no change in pest pressure or management practices, only the total acreage being managed. This distinction is critical to policies and programs aimed at reducing per-acre reliance on pesticide use while supporting land dedicated to production.

Methods

We queried the PUR database for all agricultural pesticide use data from 2022 and 2023, then created datasets that include all applications of the AIs within DPR's categories of interest. We calculated the annual total lbs of AIs applied and the annual total acreage treated with AIs, then determined the percentage change of each from 2022 to 2023. Acreage treated reflects the area onto which a pesticide is applied and multiple applications to the same field are summed; for example, if a 10 acre field is treated with a pesticide twice, that would result in 20 "acres treated". This is calculated separately for each active ingredient even if the application contained multiple AIs. For example, if a sprayer applies a mixture of azadirachtin and hydrogen peroxide to a 10 acre field, that would result in 10 acres treated of azadirachtin and 10 acres treated of hydrogen peroxide.

For each pesticide category, we then identified the top three AIs whose use changed the most between 2022 and 2023 for both lbs applied and acres treated. In some cases, the same AI had the largest changes in both acreage and lbs applied. Definitions for each category below come from DPR's Annual Report. Tables show AIs that increased in acres treated or pounds applied in green rows, and those that decreased in red rows. In some figures, longer AI names may be truncated, but full AI names are present in tables below.

We then evaluated what specific commodity-AI combinations contributed most to categorical changes. We filtered only the top AIs that changed per category, then isolate commodities that shifted in their use of those AIs by at least 2-5% of the total change in acreage treated or pounds applied, depending on the number of AIs within the category. This hones in on the commodities with the biggest changes in use, but is not designed to capture cases where many commodities all shifted in use rates of a certain pesticide category, nor the AIs contributing the most to that category overall if they did not change between years.

For each commodity, we also show how much total planted acreage of the commodity shifted between years statewide to provide context to changes in treatments in that commodity.

For example, if 20% more acres of lettuce are grown in 2023 versus 2022, a 20% increase in pesticide use would not indicate a change in management practices, rather just more acres needing to be managed. Note: The PUR data is continually updated, so these summaries may not fully correlate to later PUR data queries.

Recreate DPR Summary Table

To ensure the validity of our analysis methods, we first recreate the Pesticide Use summary data presented in the DPR Annual Report. Note that the values here, while close, do not exactly mirror the numbers published in the DPR report. This is because OPCA has received revisions to the PUR database addressing known errors.

Table 1: Annual Changes in Pesticide Categories 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|---------------------------|------------|--------------|--------------|----------------|
| Biopesticides | 341,789 | 4 | 520,443 | 7 |
| Oils | -6,534,939 | -19 | 192,112 | 4 |
| Carcinogens | -2,008,071 | -6 | 402,352 | 6 |
| Cholinesterase Inhibitors | 133,506 | 5 | 50,474 | 2 |
| Fumigants | -3,254,377 | -9 | -18,066 | -8 |
| Groundwater Contaminants | -65,628 | -33 | -63,658 | -24 |
| Reproductive Toxins | -821,862 | -13 | 12,007 | 0 |
| Toxic Air Contaminants | -3,602,888 | -9 | -221,643 | -11 |

This data on annual changes in pesticide categories is the only data in this report that contains both agricultural and non-agricultural PUR data, which is what is presented in DPR's annual report. Agricultural PUR data contains information on all applications of pesticides on a field level, while non-agricultural PUR data is reported only on a county level and only once monthly. This makes it more difficult to examine specific use patterns in non-agricultural data. Values in specific category sections later in the report include only agricultural applications and may not match those numbers presented in DPR's report.

Note: During this review we have identified several significant errors in PUR data that have been flagged for review/correction. The above table reflects the data as it existed in the PUR database in 11/2025. Any corrections for outliers made in any of the categorical datasets are identified and specifically described below.

Results

Biopesticides

DPR defines biopesticides as “naturally occurring substances that control pests (biochemical pesticides) and microorganisms that control pests (microbial pesticides). The definition may also include new technologies that do not easily fit into one of those two categories.” A full list of biopesticides as defined by DPR is available [here](#).

From 2022-2023, both pounds of and acres treated with biopesticide AIs increased.

Table 2: Annual Changes in Biopesticide Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|---------------|------------|--------------|--------------|----------------|
| Biopesticides | 341,789 | 4 | 520,443 | 7 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either biopesticide acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Increases in the use of polyoxin d, zinc salts (fungicide), hydrogen peroxide (fungi/bactericide), (z,z)-11,13-hexadecadienal (Navel Orangeworm pheromone), and kaolin clay (multi-use coating) drove biopesticide use upwards, while reduced use of AF-36, azadirachtin, s-methoprene, and various bacillus strains (bio-insecticides) drove down use.

Note: OPCA removed all pesticide applications made to cannabis from the biopesticide analysis after the identification of several large outliers. Conflicting state and federal regulations may complicate pesticide use tracking in cannabis and lead to errors. DPR has been made aware of these outliers and has made corrections in the PUR database, but we chose to remove them here to reflect the available information at the time.

Figure 2: Statewide Biopesticide AI Use, 2022-2023

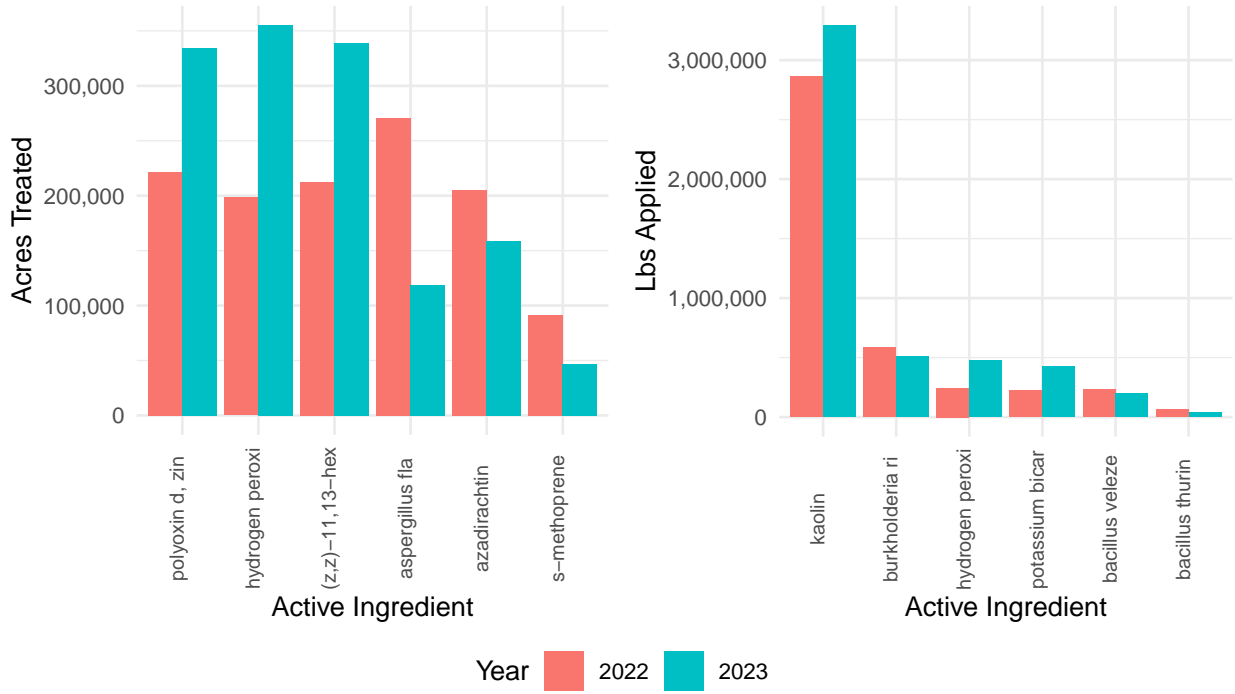


Table 3: Top Changes in Biopesticide AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|----------------------------------|--------------------|--------------------|--------------|-----|
| hydrogen peroxide | 198,336 | 354,957 | 156,621 | 79 |
| (z,z)-11,13-hexadecadienal | 212,840 | 338,707 | 125,867 | 59 |
| polyoxin d, zinc salt | 221,648 | 334,349 | 112,701 | 51 |
| s-methoprene | 91,266 | 46,811 | -44,455 | -49 |
| azadirachtin | 205,053 | 158,905 | -46,148 | -23 |
| aspergillus flavus strain: af-36 | 270,857 | 118,871 | -151,986 | -56 |

Table 4: Top Changes in Biopesticide AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|----------------------------------|------------------|------------------|------------|-----|
| kaolin | 2,862,120 | 3,290,739 | 428,619 | 15 |
| hydrogen peroxide | 244,305 | 476,976 | 232,671 | 95 |
| potassium bicarbonate | 226,596 | 428,003 | 201,407 | 89 |
| bacillus thuringiensis aizawai | 66,032 | 35,144 | -30,888 | -47 |
| bacillus velezensis strain: d747 | 234,309 | 195,717 | -38,592 | -16 |
| burkholderia rinojensis (a396) | 582,370 | 510,816 | -71,554 | -12 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 3% of the total change in either acres treated or pounds applied of biopesticides between 2022 and 2023. Changes in use in almond and pistachio were most important, with increased Navel Orangeworm (NOW) pheromone use (“z,z”) in both commodities, increased polyoxin d fungicide in almond, and decreased use of AF-36 (an aflatoxin reducing agent) in pistachio. Mating disruption with NOW pheromone has been increasingly adopted in nut crops, and has higher efficacy when larger area-wide programs are coordinated. Polyoxin D zinc salt fungicide products target a variety of fungal pathogens in tree nut production, including *Alternaria* and blossom blights. AF-36 is a competing *Aspergillus flavus* strain that doesn’t produce aflatoxin, a dangerous byproduct of natural *Aspergillus* growth with low contamination thresholds in nut crops. Almond decreased use of s-methoprene, which is an insect growth regulator used in ant baits.

Kaolin clay usage increased in citrus, tomato, and walnut production independent of statewide planted acreage. Kaolin clay is applied to crops as a protective coating against various threats, ranging from blocking insect feeding to reducing fungal growth to preventing sunburn.

Brassicas, lettuce, and grape all saw significant increased use of hydrogen peroxide products, despite decreases in statewide acreage. Hydrogen peroxide is a component of several fungicide products, either alone or mixed with other active ingredients. Potassium bicarbonate, which increased in usage in grape, is a fungicide used similarly to hydrogen peroxide.

Citrus saw decreased use of *Burkholderia rinojensis*, a biological insecticide/miticide; in citrus this could have targeted Asian citrus psyllid or various other pest species including mites and lepidopterans.

Figure 3: Biopesticide AI Use by Commodity, 2022-2023

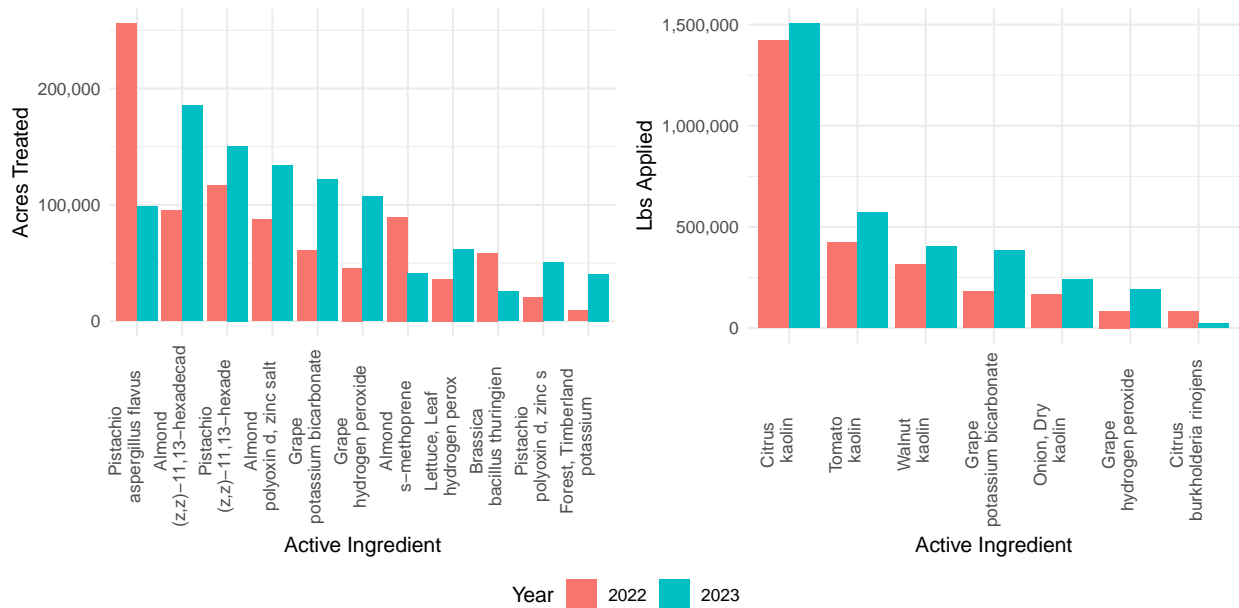


Table 5: Top Commodities Changes in Acres Treated (Biopesticides)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|----------------------------|----------------------------------|-----------------------|-----------------------|-----------------|-----|---|--------------|
| Almond | (z,z)-11,13-hexadecadienal | 94,962 | 185,375 | 90,413 | 95 | -3,844 | 0 |
| Grape | hydrogen peroxide | 45,787 | 107,420 | 61,633 | 135 | -45,542 | -6 |
| Grape | potassium bicarbonate | 60,622 | 121,952 | 61,330 | 101 | -45,542 | -6 |
| Almond | polyoxin d, zinc salt | 87,250 | 134,058 | 46,808 | 54 | -3,844 | 0 |
| Pistachio | (z,z)-11,13-hexadecadienal | 116,390 | 150,750 | 34,360 | 30 | 31,980 | 6 |
| Forest, Timber- land | potassium bicarbonate | 9,243 | 40,737 | 31,494 | 341 | NA | NA |
| Pistachio | polyoxin d, zinc salt | 20,789 | 50,686 | 29,897 | 144 | 31,980 | 6 |
| Lettuce, Leaf | hydrogen peroxide | 36,282 | 62,164 | 25,882 | 71 | -3,100 | -5 |
| Brassica | bacillus thuringiensis aizawai | 58,753 | 25,697 | -33,056 | -56 | -17,500 | -13 |
| Almond | s-methoprene | 89,465 | 41,412 | -48,053 | -54 | -3,844 | 0 |
| Pistachio | aspergillus flavus strain: af-36 | 255,861 | 98,425 | -157,436 | -62 | 31,980 | 6 |

Table 6: Top Commodities Changes in Pounds Applied (Biopesticides)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|------------|--------------------------------|---------------------|---------------------|---------------|-----|---|--------------|
| Grape | potassium bicarbonate | 181,669 | 382,882 | 201,213 | 111 | -45,542 | -6 |
| Tomato | kaolin | 422,955 | 570,385 | 147,430 | 35 | 32,174 | 12 |
| Grape | hydrogen peroxide | 84,834 | 190,791 | 105,957 | 125 | -45,542 | -6 |
| Walnut | kaolin | 312,837 | 404,993 | 92,156 | 29 | -51,920 | -14 |
| Citrus | kaolin | 1,422,663 | 1,503,695 | 81,032 | 6 | -9,008 | -3 |
| Onion, Dry | kaolin | 165,328 | 238,257 | 72,929 | 44 | -653 | -1 |
| Citrus | burkholderia rinojensis (a396) | 81,542 | 21,641 | -59,901 | -73 | -9,008 | -3 |

Oils

The oils category includes pesticides with a petroleum-based oil AI (botanical oils are not included in these totals).

From 2022-2023, pounds of oils applied fell while acres treated with oils increased.

Table 7: Annual Changes in Oil Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|----------|------------|--------------|--------------|----------------|
| Oils | -6,534,939 | -19 | 192,112 | 4 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either oil acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Oil active ingredients are few in number, with mineral oil representing nearly all use in the category. While total acreage treated with mineral oil increased slightly, the total amount of mineral oil fell significantly, driving the overall decrease in use in the category.

Identifying the drivers of changes in oil use is difficult, as mineral oil can be used as a pesticide directly, an adjuvant for other pesticides, for dust management, or various other purposes.

Figure 4: Statewide Oil AI Use, 2022-2023

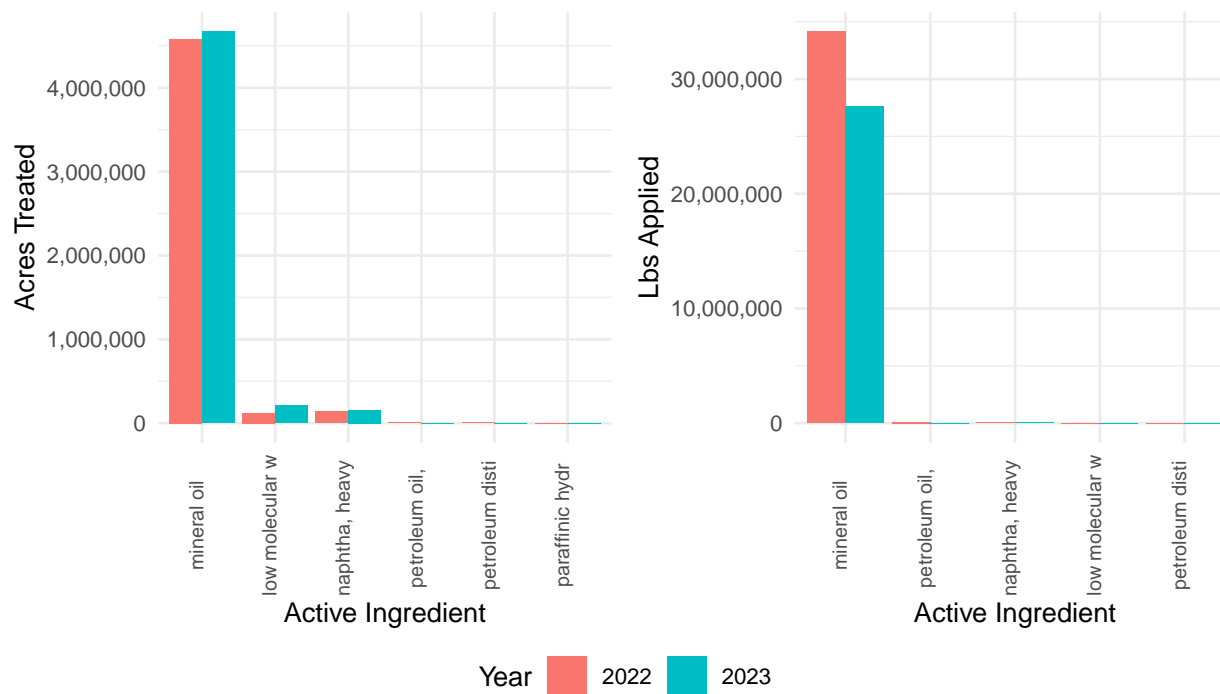


Table 8: Top Changes in Oil AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|-------------------------------------|-----------------------|-----------------------|-----------------|-----|
| low molecular weight paraffinic oil | 122,733 | 214,239 | 91,506 | 75 |
| mineral oil | 4,581,698 | 4,671,071 | 89,373 | 2 |
| naphtha, heavy aromatic | 137,387 | 155,734 | 18,347 | 13 |
| paraffinic hydrocarbons | 581 | 292 | -289 | -50 |
| petroleum distillates | 6,009 | 1,423 | -4,586 | -76 |
| petroleum oil, sulfurized | 7,793 | 2,691 | -5,102 | -65 |

Table 9: Top Changes in Oil AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|-------------------------------------|---------------------|---------------------|---------------|------|
| naphtha, heavy aromatic | 63,827 | 74,311 | 10,484 | 16 |
| low molecular weight paraffinic oil | 14,390 | 20,183 | 5,793 | 40 |
| petroleum distillates, aromatic | 3 | 0 | -3 | -100 |
| petroleum distillates | 2,225 | 422 | -1,803 | -81 |
| petroleum oil, sulfurized | 117,645 | 21,953 | -95,692 | -81 |
| mineral oil | 34,147,580 | 27,624,584 | -6,522,996 | -19 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 5% of the total change in either acres treated or pounds applied of oils between 2022 and 2023. The greatest reductions in oil use came from almond, which decreased 45% in lbs applied and 14% in acres treated. Rice acreage treated with mineral oil increased by 50%, however statewide rice acreage increased by double that from 2022-2023, suggesting a relative decrease in mineral oil usage in rice.

Pistachio increased mineral oil use substantially, while walnuts decreased use potentially due to walnuts decreasing statewide acreage. Inconsistent trends in nut crop oil use do not point to a single driving factor in mineral oil use among these three commodities.

Figure 5: Oil AI Use by Commodity, 2022-2023

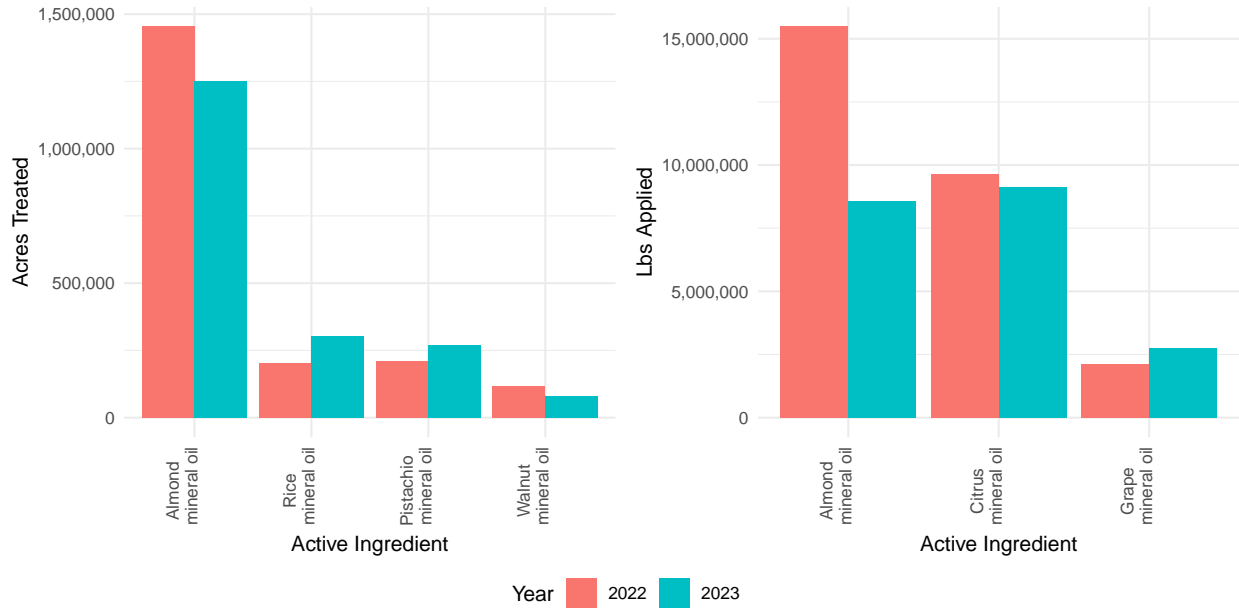


Table 10: Top Commodities Changes in Acres Treated (Oils)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|-----------|-------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Rice | mineral oil | 202,139 | 303,289 | 101,150 | 50 | 264,424 | 99 |
| Pistachio | mineral oil | 209,633 | 270,439 | 60,806 | 29 | 31,980 | 6 |
| Walnut | mineral oil | 118,659 | 79,385 | -39,274 | -33 | -51,920 | -14 |
| Almond | mineral oil | 1,454,047 | 1,250,306 | -203,741 | -14 | -3,844 | 0 |

Table 11: Top Commodities Changes in Pounds Applied (Oils)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|--------|-------------|------------------|------------------|------------|-----|-----------------------------------|-----------|
| Grape | mineral oil | 2,124,615 | 2,732,025 | 607,410 | 29 | -45,542 | -6 |
| Citrus | mineral oil | 9,645,654 | 9,131,431 | -514,223 | -5 | -9,008 | -3 |
| Almond | mineral oil | 15,484,385 | 8,578,160 | -6,906,225 | -45 | -3,844 | 0 |

Carcinogens

The carcinogens category included 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).

From 2022-2023, pounds of carcinogen AIs applied fell while acres treated with carcinogen AIs increased.

Table 12: Annual Changes in Carcinogen Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|-------------|------------|--------------|--------------|----------------|
| Carcinogens | -2,008,071 | -6 | 402,352 | 6 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either carcinogen acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Increased use of glyphosate (herbicide) and chlorothalonil (fungicide) drove total acreage treated with carcinogens upwards, while decreased spirodiclofen (miticide), diuron (herbicide), and mancozeb (fungicide) use drove it downwards.

Beyond the large contribution from glyphosate, various fumigant active ingredients (1,3-d, metam-sodium, and potassium n-methyldithiocarbamate (aka metam-potassium)), represent the largest portion of pounds of carcinogen AIs applied, given their high lbs/acre use rate. 1,3-d and metam-sodium use fell significantly, generating the overall drop in carcinogen lbs applied.

Figure 6: Statewide Carcinogen AI Use, 2022-2023

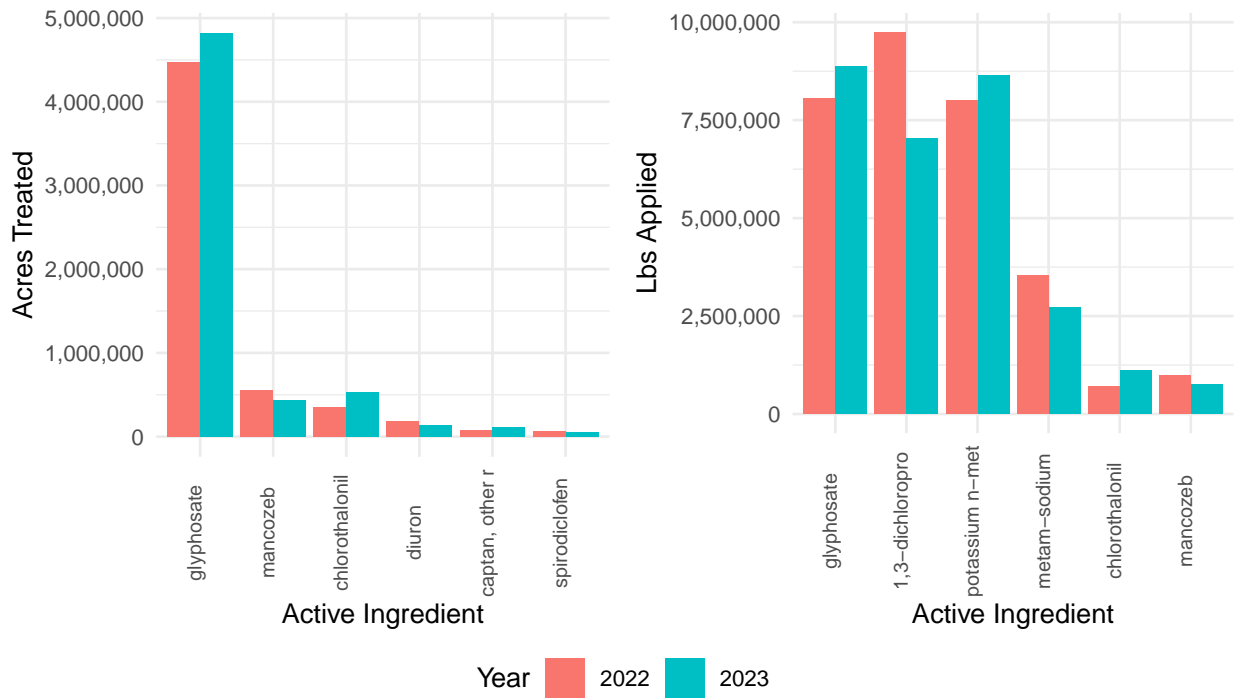


Table 13: Top Changes in Carcinogen AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|-----------------------|--------------------|--------------------|--------------|-----|
| glyphosate | 4,472,413 | 4,819,953 | 347,540 | 8 |
| chlorothalonil | 356,493 | 536,613 | 180,120 | 51 |
| captan, other related | 82,906 | 110,613 | 27,707 | 33 |
| spirodiclofen | 68,165 | 53,652 | -14,513 | -21 |
| diuron | 189,089 | 141,081 | -48,008 | -25 |
| mancozeb | 555,735 | 436,278 | -119,457 | -21 |

Table 14: Top Changes in Carcinogen AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|----------------------------------|------------------|------------------|------------|-----|
| glyphosate | 8,058,856 | 8,864,807 | 805,951 | 10 |
| potassium n- methylthiocarbamate | 8,005,694 | 8,633,739 | 628,045 | 8 |
| chlorothalonil | 704,733 | 1,098,094 | 393,361 | 56 |
| mancozeb | 978,895 | 754,771 | -224,124 | -23 |
| metam-sodium | 3,532,618 | 2,714,688 | -817,930 | -23 |
| 1,3-dichloropropene | 9,749,522 | 7,023,406 | -2,726,116 | -28 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 5% of the total change in either acres treated or pounds applied of carcinogens between 2022 and 2023. Increased glyphosate use was driven mostly by pistachio, corn, almond, and uncultivated (fallowed) agricultural land. Uncultivated ag land increased in acreage by 24% from 2022-2023, which partially explains the increase in herbicide use there. Tomatoes had significantly increased use of the fungicide chlorothalonil; this trend may reverse in the future as in Jan 2025 EPA released an interim decision reducing maximum application rates and increasing PPE requirements for some handlers of chlorothalonil.

In walnuts, use of the fungicide mancozeb fell significantly, representing the single largest decrease in carcinogen acreage by commodity. OPCA reviewed changes in total fungicide use in walnuts, and use of nearly all fungicide AIs fell between 2022 and 2023, suggesting lower fungal disease pressure overall rather than mancozeb being replaced with another fungicide AI.

Figure 7: Carcinogen AI Use by Commodity, 2022-2023

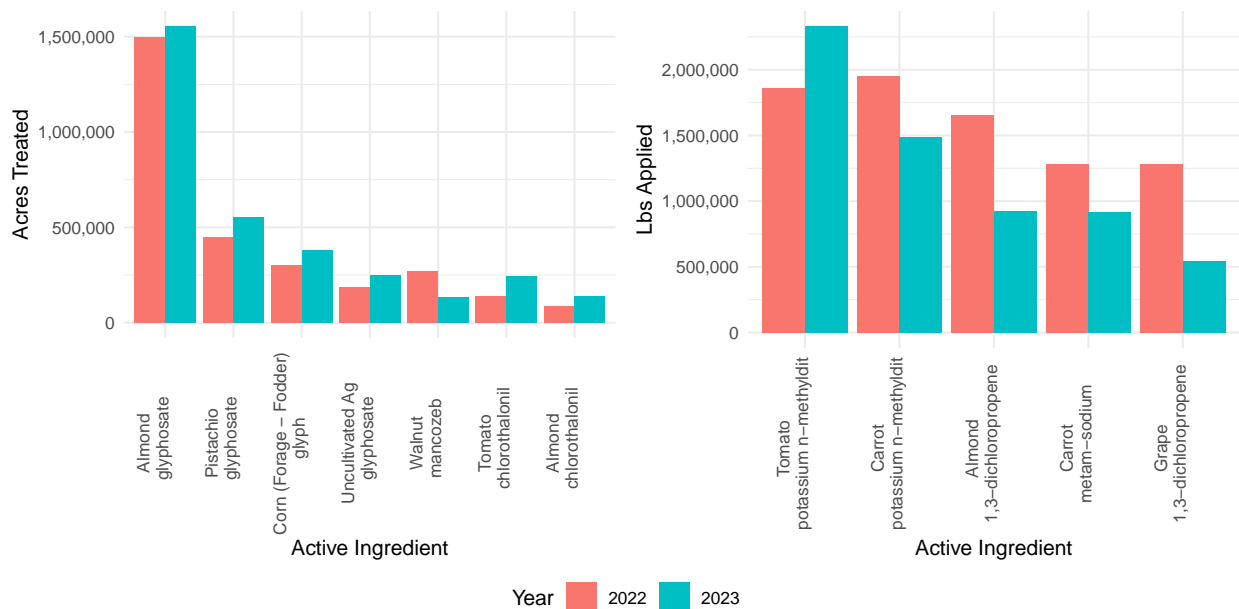


Table 15: Top Commodities Changes in Acres Treated (Carcinogens)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|-----------------|----------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Pistachio | glyphosate | 446,893 | 555,922 | 109,029 | 24 | 31,980 | 6 |
| Tomato | chlorothalonil | 136,821 | 244,985 | 108,164 | 79 | 32,174 | 12 |
| Corn (Forage) | glyphosate | 301,777 | 378,516 | 76,739 | 25 | 41,926 | 12 |
| Uncultivated Ag | glyphosate | 185,132 | 251,211 | 66,079 | 36 | 46,302 | 24 |
| Almond | glyphosate | 1,498,263 | 1,556,071 | 57,808 | 4 | -3,844 | 0 |
| Almond | chlorothalonil | 85,409 | 138,496 | 53,087 | 62 | -3,844 | 0 |
| Walnut | mancozeb | 270,912 | 133,793 | -137,119 | -51 | -51,920 | -14 |

Table 16: Top Commodities Changes in Pounds Applied (Carcinogens)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|--------|---------------------------------------|---------------------|---------------------|---------------|-----|---|--------------|
| Tomato | potassium n- methylthio- carbamate | 1,863,870 | 2,329,090 | 465,220 | 25 | 32,174 | 12 |
| Carrot | metam-sodium | 1,283,281 | 920,011 | -363,270 | -28 | -13,191 | -17 |
| Carrot | potassium n- methylthio- carbamate | 1,954,620 | 1,487,346 | -467,274 | -24 | -13,191 | -17 |
| Almond | 1,3-dichloropropene | 1,655,926 | 925,203 | -730,723 | -44 | -3,844 | 0 |
| Grape | 1,3-dichloropropene | 1,278,781 | 543,018 | -735,763 | -58 | -45,542 | -6 |

Cholinesterase Inhibitors

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

From 2022-2023, both pounds applied and acres treated of cholinesterase inhibiting AIs increased.

Table 17: Annual Changes in Cholinesterase Inhibitor Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|---------------------------|------------|--------------|--------------|----------------|
| Cholinesterase Inhibitors | 133,506 | 5 | 50,474 | 2 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either AIs listed as cholinesterase inhibitors' acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Increased thiobencarb (herbicide) use was the largest contributor to both lbs applied and acres, followed closely by oxamyl (insecticide).

Decreased use of the insecticides naled and methomyl caused the largest declines in the category.

Figure 8: Statewide Cholinesterase-Inhibiting AI Use, 2022-2023

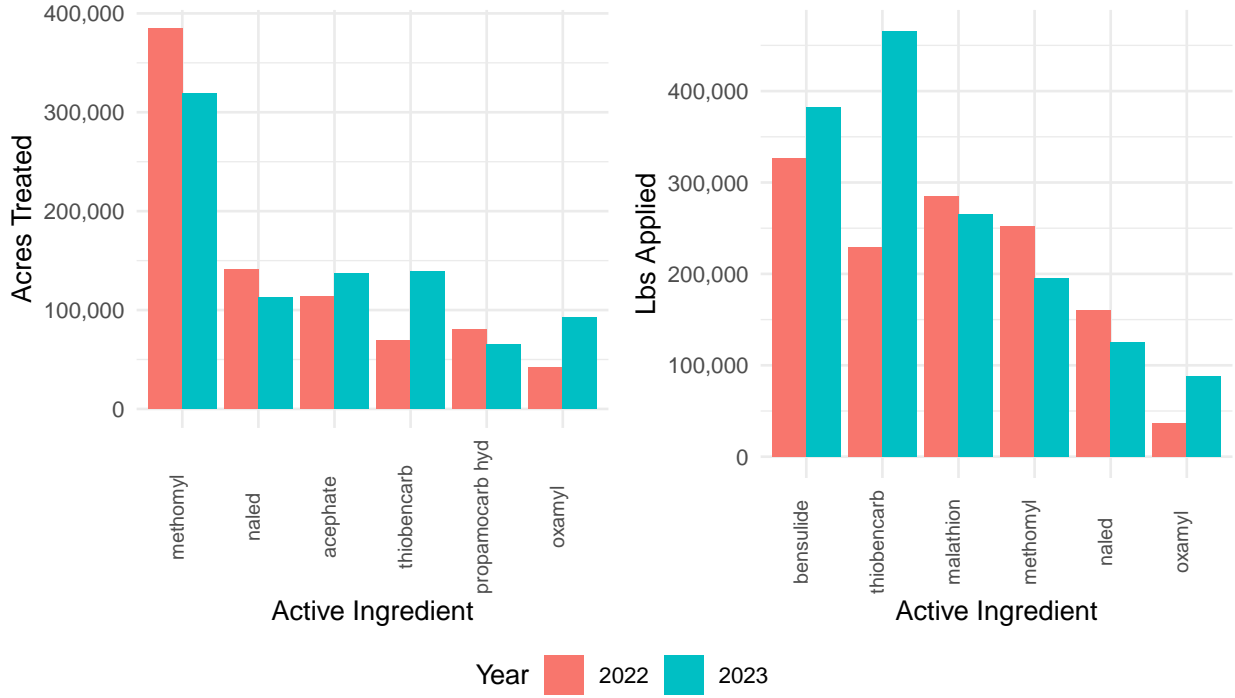


Table 18: Top Changes in Cholinesterase-Inhibiting AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|---------------------------|--------------------|--------------------|--------------|-----|
| thiobencarb | 69,419 | 139,075 | 69,656 | 100 |
| oxamyl | 41,780 | 92,335 | 50,555 | 121 |
| acephate | 113,568 | 136,920 | 23,352 | 21 |
| propamocarb hydrochloride | 80,089 | 64,922 | -15,167 | -19 |
| naled | 141,257 | 113,051 | -28,206 | -20 |
| methomyl | 384,261 | 319,034 | -65,227 | -17 |

Table 19: Top Changes in Cholinesterase-Inhibiting AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|-------------|------------------|------------------|------------|-----|
| thiobencarb | 229,657 | 465,503 | 235,846 | 103 |
| bensulide | 326,552 | 382,902 | 56,350 | 17 |
| oxamyl | 36,711 | 87,942 | 51,231 | 140 |
| malathion | 285,052 | 265,433 | -19,619 | -7 |
| naled | 160,174 | 125,512 | -34,662 | -22 |

| | | | | |
|----------|---------|---------|---------|-----|
| methomyl | 251,957 | 195,293 | -56,664 | -22 |
|----------|---------|---------|---------|-----|

Crop-Specific Changes We show commodity-AI combinations that represent at least 3% of the total change in either acres treated or pounds applied of cholinesterase inhibitors between 2022 and 2023. By a large margin, the most significant increase in cholinesterase inhibitor AI use came from thiobencarb in rice. Importantly, the increase in thiobencarb use almost perfectly matches the increase in rice acreage between 2022-2023, suggesting use on more total planted acres rather than any change in management practices. This is notable, as increased thiobencarb use in rice was greater than the total statewide increase in cholinesterase inhibitor AI use; had rice acreage not increased, total cholinesterase inhibitor use would have decreased statewide.

Cotton also had increased use of cholinesterase inhibitor insecticides, likely in connection to a large Lygus bug outbreak that year (see OPCA publication on the 2023 Lygus outbreak).

Methomyl use fell in lettuce and Brassica but rose in tomato, possible reflecting different pest pressures in coastal versus inland production.

Figure 9: Cholinesterase-Inhibiting AI Use by Commodity, 2022-2023

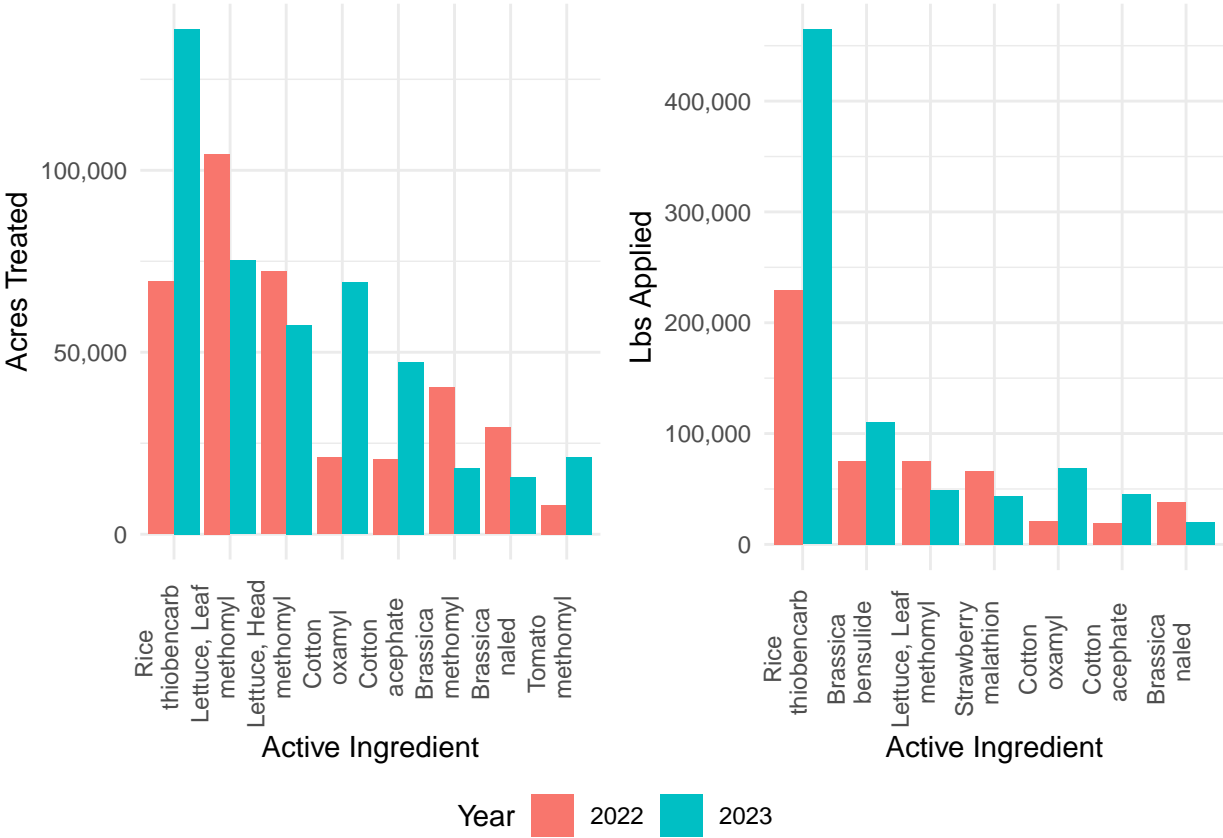


Table 20: Top Commodities Changes in Acres Treated (Cholinesterase Inhibitors)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|---------------|-------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Rice | thiobencarb | 69,419 | 138,826 | 69,407 | 100 | 264,424 | 99 |
| Cotton | oxamyl | 21,139 | 69,099 | 47,960 | 227 | -27,844 | -18 |
| Cotton | acephate | 20,657 | 47,299 | 26,642 | 129 | -27,844 | -18 |
| Tomato | methomyl | 8,018 | 21,254 | 13,236 | 165 | 32,174 | 12 |
| Brassica | naled | 29,318 | 15,543 | -13,775 | -47 | -17,500 | -13 |
| Lettuce, Head | methomyl | 72,205 | 57,484 | -14,721 | -20 | -11,800 | -11 |
| Brassica | methomyl | 40,380 | 18,075 | -22,305 | -55 | -17,500 | -13 |
| Lettuce, Leaf | methomyl | 104,416 | 75,275 | -29,141 | -28 | -3,100 | -5 |

Table 21: Top Commodities Changes in Pounds Applied (Cholinesterase Inhibitors)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|---------------|-------------|------------------|------------------|------------|-----|-----------------------------------|-----------|
| Rice | thiobencarb | 229,657 | 464,633 | 234,976 | 102 | 264,424 | 99 |
| Cotton | oxamyl | 21,124 | 68,822 | 47,698 | 226 | -27,844 | -18 |
| Brassica | bensulide | 74,990 | 110,334 | 35,344 | 47 | -17,500 | -13 |
| Cotton | acephate | 19,573 | 45,130 | 25,557 | 131 | -27,844 | -18 |
| Brassica | naled | 38,476 | 20,200 | -18,276 | -47 | -17,500 | -13 |
| Strawberry | malathion | 66,537 | 43,979 | -22,558 | -34 | -1,767 | -2 |
| Lettuce, Leaf | methomyl | 75,288 | 48,822 | -26,466 | -35 | -3,100 | -5 |

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. However, the analysis below does not include structural and other non-agricultural uses.

From 2022-2023, both pounds applied and acres treated of fumigants decreased.

Table 22: Annual Changes in Fumigant Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|-----------|------------|--------------|--------------|----------------|
| Fumigants | -3,254,377 | -9 | -18,066 | -8 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either fumigant acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Most fumigant products have a high lb/acre use rate, making the pounds of AI applied scale much greater than other AIs. Additionally, in some cases applicators will report only the strip of area that is directly fumigated rather than report the acreage of the entire field being

fumigated, which reduces the total acres reported. For example, a 40 acre almond orchard may be fumigated before planting but if the fumigation equipment is only injecting into rows that account for 1/4 of the area of the orchard, some reports may list only 10 acres treated with fumigants. This contrasts to other forms of pesticide application like sprayers, which would report the full 40 acres treated.

The greatest change in fumigant use came from reductions in 1,3-dichloropropene use (“1,3-d”), which is a broadly used fumigant for a range of soil pests and pathogens. Aluminum phosphide, which is used primarily for control of burrowing rodents, also decreased in acreage treated. Potassium n- methylthiocarbamate (“metam potassium”), another broad-spectrum fumigant, increased in usage from 2022-2023.

Figure 10: Statewide Fumigant AI Use, 2022-2023

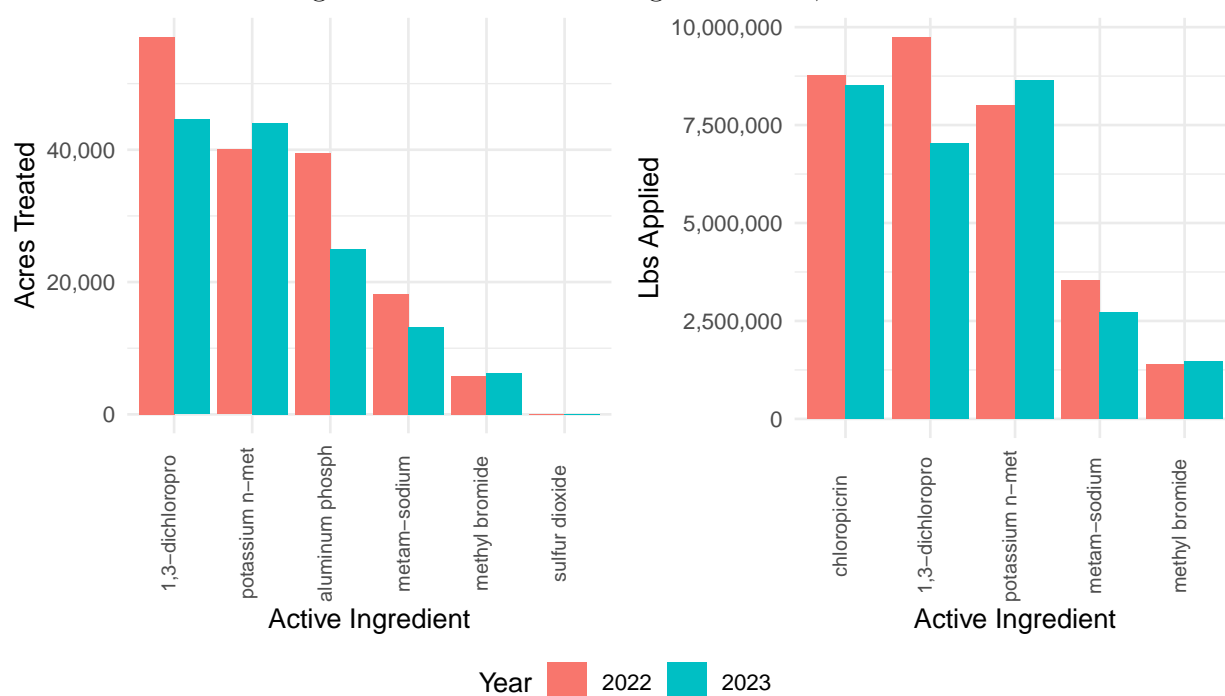


Table 23: Top Changes in Fumigant AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|----------------------------------|--------------------|--------------------|--------------|-----|
| potassium n- methylthiocarbamate | 40,018 | 44,045 | 4,027 | 10 |
| methyl bromide | 5,851 | 6,263 | 412 | 7 |
| sulfur dioxide | 68 | 93 | 25 | 37 |
| metam-sodium | 18,239 | 13,237 | -5,002 | -27 |
| 1,3-dichloropropene | 57,086 | 44,554 | -12,532 | -22 |
| aluminum phosphide | 39,510 | 25,000 | -14,510 | -37 |

Table 24: Top Changes in Fumigant AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|------------------------------------|---------------------|---------------------|---------------|-----|
| potassium n- methyldithiocarbamate | 8,005,694 | 8,633,739 | 628,045 | 8 |
| methyl bromide | 1,383,263 | 1,474,243 | 90,980 | 7 |
| chloropicrin | 8,773,430 | 8,515,650 | -257,780 | -3 |
| metam-sodium | 3,532,618 | 2,714,688 | -817,930 | -23 |
| 1,3-dichloropropene | 9,749,522 | 7,023,406 | -2,726,116 | -28 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 5% of the total change in either acres treated or pounds applied of fumigants between 2022 and 2023. Reductions in 1,3-d use occurred primarily in carrot, grape, and almond. For perennial crops like grape and almond, fumigation is used when new plantings are put in; reduced fumigant use may be the result of fewer new vineyards or orchards being established. However, the exact rate of new plantings can be difficult to estimate, as both orchard/vineyard removals and new plantings affect the total acreage of commodities.

Pounds of metam-potassium applied increased in tomato, however the total acreage treated increased by less than the increases in total tomato acreage, showing some change in metam-potassium use rate in tomato. For carrots, both pounds and acres treated with metam-potassium fell, largely in line with the total decrease in statewide carrot acreage.

Unfortunately, reports to the non-specific “Soil Fumigation/Preplant” category in PUR increased, making it more difficult to evaluate what drove the change.

Figure 11: Fumigant AI Use by Commodity, 2022-2023

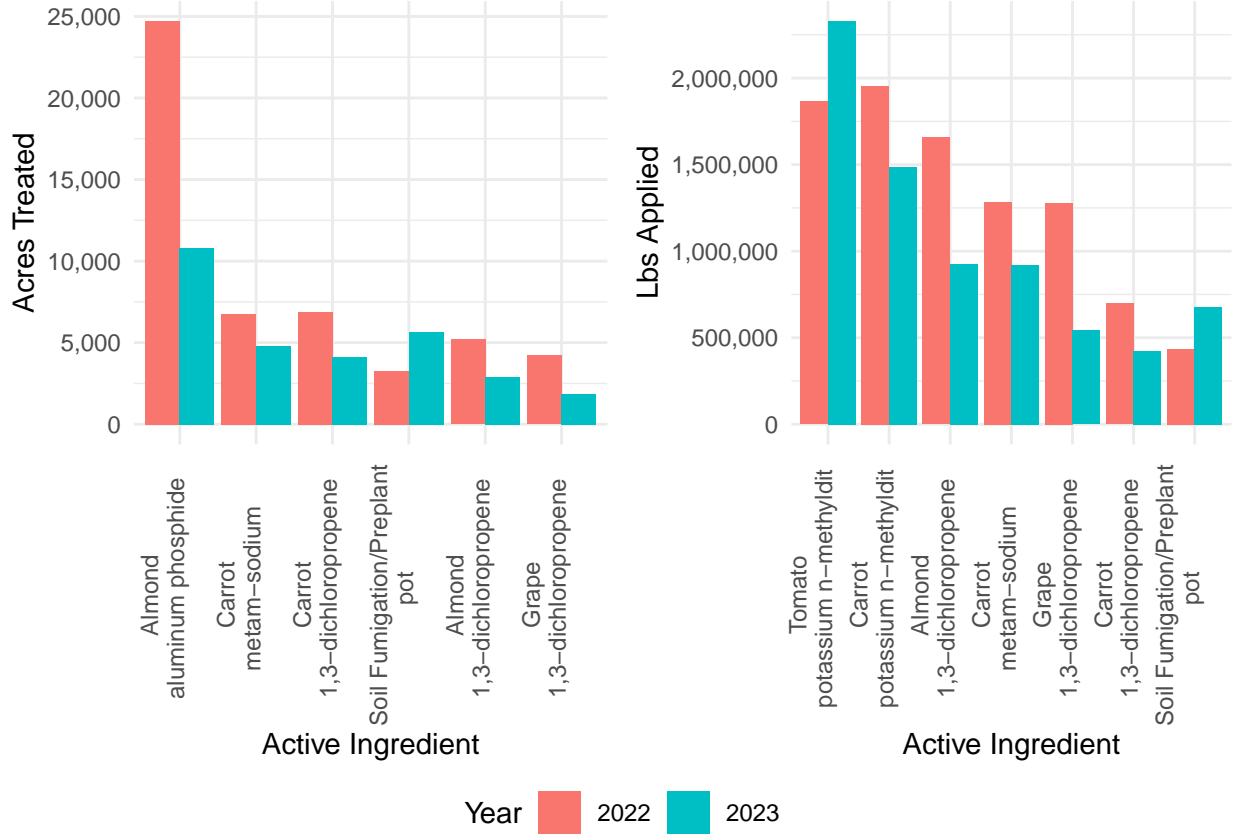


Table 25: Top Commodities Changes in Acres Treated (Fumigants)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|---------------------------|----------------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Soil Fumigation/ Preplant | potassium n- methyl. | 3,267 | 5,658 | 2,391 | 73 | NA | NA |
| Carrot | metam-sodium | 6,745 | 4,810 | -1,935 | -29 | -13,191 | -17 |
| Almond | 1,3-dichloropropene | 5,204 | 2,889 | -2,315 | -44 | -3,844 | 0 |
| Grape | 1,3-dichloropropene | 4,222 | 1,868 | -2,354 | -56 | -45,542 | -6 |
| Carrot | 1,3-dichloropropene | 6,874 | 4,133 | -2,741 | -40 | -13,191 | -17 |
| Almond | aluminum phosphide | 24,711 | 10,809 | -13,902 | -56 | -3,844 | 0 |

Table 26: Top Commodities Changes in Pounds Applied (Fumigants)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|------------------------------|----------------------|---------------------|---------------------|---------------|-----|---|--------------|
| Tomato | potassium n- methyl. | 1,863,870 | 2,329,090 | 465,220 | 25 | 32,174 | 12 |
| Soil Fumigation/ Preplant | potassium n- methyl. | 434,704 | 676,552 | 241,848 | 56 | NA | NA |
| Carrot | 1,3-dichloropropene | 697,069 | 423,886 | -273,183 | -39 | -13,191 | -17 |
| Carrot | metam-sodium | 1,283,281 | 920,011 | -363,270 | -28 | -13,191 | -17 |
| Carrot | potassium n- methyl. | 1,954,620 | 1,487,346 | -467,274 | -24 | -13,191 | -17 |
| Almond | 1,3-dichloropropene | 1,655,926 | 925,203 | -730,723 | -44 | -3,844 | 0 |
| Grape | 1,3-dichloropropene | 1,278,781 | 543,018 | -735,763 | -58 | -45,542 | -6 |

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).

From 2022-2023, both pounds applied and acres treated of groundwater contaminant AIs decreased.

Table 27: Annual Changes in Groundwater Contaminant Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|--------------------------|------------|--------------|--------------|----------------|
| Groundwater Contaminants | -65,628 | -33 | -63,658 | -24 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either AIs listed as groundwater contaminants acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

There are few AIs listed as groundwater contaminants, and many do not have as widespread use as other categories. The largest contributors to decreased groundwater contaminant use were from reduced simazine (herbicide) and diuron (herbicide) use.

Figure 12: Statewide Groundwater Contaminant AI Use, 2022-2023

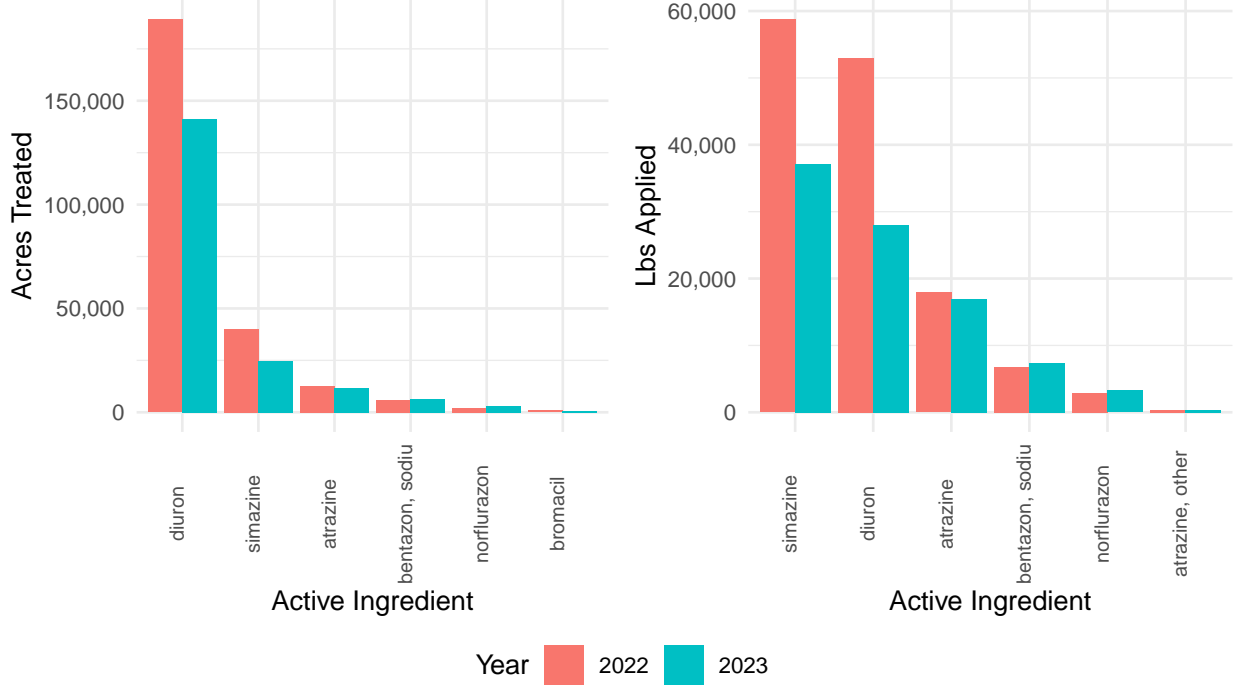


Table 28: Top Changes in Groundwater Contaminant AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|-----------------------|--------------------|--------------------|--------------|-----|
| norflurazon | 1,976 | 3,090 | 1,114 | 56 |
| bentazon, sodium salt | 5,779 | 6,285 | 506 | 9 |
| bromacil | 910 | 632 | -278 | -31 |
| atrazine | 12,619 | 11,647 | -972 | -8 |
| simazine | 40,126 | 24,734 | -15,392 | -38 |
| diuron | 189,089 | 141,081 | -48,008 | -25 |

Table 29: Top Changes in Groundwater Contaminant AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|-------------------------|------------------|------------------|------------|-----|
| bentazon, sodium salt | 6,775 | 7,329 | 554 | 8 |
| norflurazon | 2,871 | 3,231 | 360 | 13 |
| atrazine, other related | 340 | 322 | -18 | -5 |
| atrazine | 17,912 | 16,966 | -946 | -5 |
| simazine | 58,723 | 37,117 | -21,606 | -37 |

| | | | | |
|--------|--------|--------|---------|-----|
| diuron | 52,990 | 28,012 | -24,978 | -47 |
|--------|--------|--------|---------|-----|

Crop-Specific Changes We show commodity-AI combinations that represent at least 4% of the total change in either acres treated or pounds applied of groundwater contaminants between 2022 and 2023. Diuron and simazine use decreased widely across several commodities, including cotton, walnut, grape, alfalfa, and almond.

Decreased diuron use in cotton tracks reduced total cotton acreage, so it is unlikely that any practices changed. However, the other commodities had significantly reduced use independent of changes in total planted acreage.

Figure 13: Groundwater Contaminant AI Use by Commodity, 2022-2023

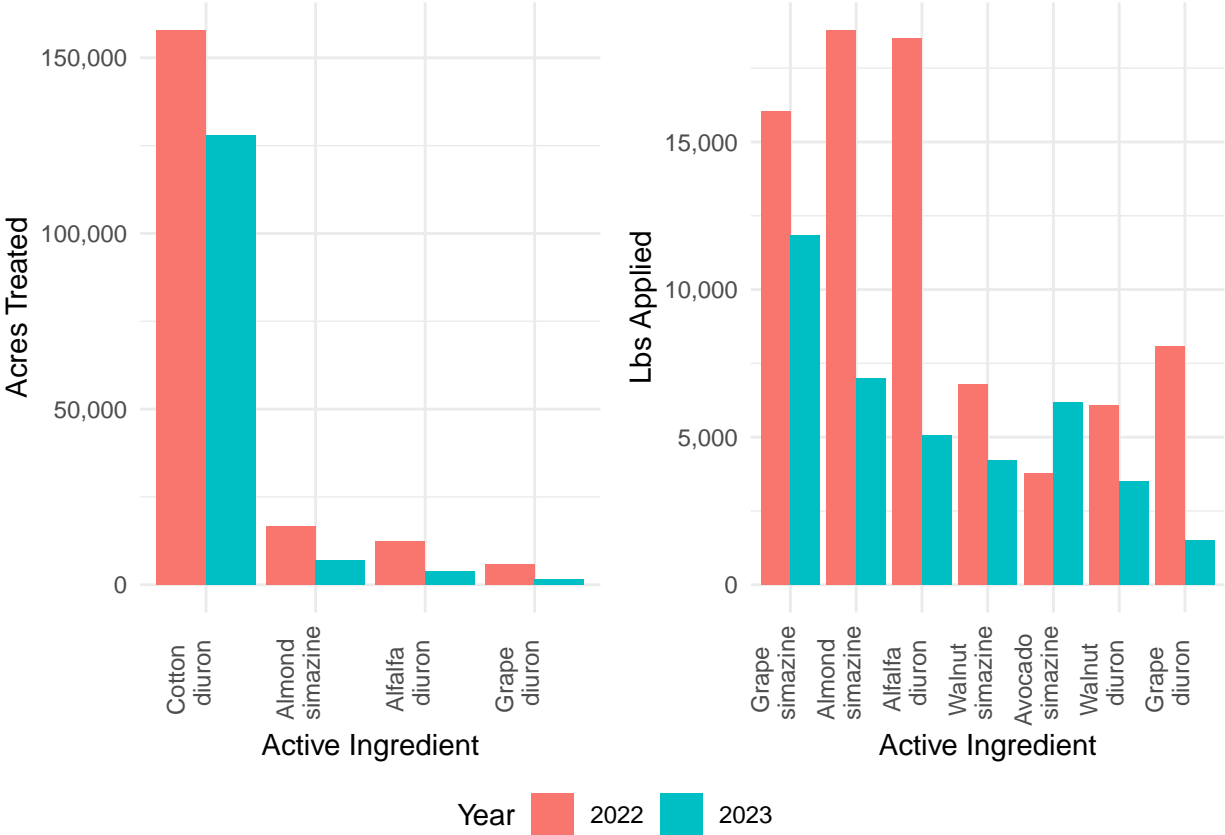


Table 30: Top Commodities Changes in Acres Treated
(Groundwater Contaminants)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|---------|----------|-----------------------|-----------------------|-----------------|-----|---|--------------|
| Grape | diuron | 5,776 | 1,643 | -4,133 | -72 | -45,542 | -6 |
| Alfalfa | diuron | 12,490 | 3,741 | -8,749 | -70 | -2,212 | 0 |
| Almond | simazine | 16,515 | 6,936 | -9,579 | -58 | -3,844 | 0 |
| Cotton | diuron | 157,892 | 127,897 | -29,995 | -19 | -27,844 | -18 |

Table 31: Top Commodities Changes in Pounds Applied
(Groundwater Contaminants)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|---------|----------|---------------------|---------------------|---------------|-----|---|--------------|
| Avocado | simazine | 3,766 | 6,182 | 2,416 | 64 | -322 | -1 |
| Walnut | simazine | 6,781 | 4,207 | -2,574 | -38 | -51,920 | -14 |
| Walnut | diuron | 6,087 | 3,497 | -2,590 | -43 | -51,920 | -14 |
| Grape | simazine | 16,057 | 11,854 | -4,203 | -26 | -45,542 | -6 |
| Grape | diuron | 8,079 | 1,500 | -6,579 | -81 | -45,542 | -6 |
| Almond | simazine | 18,790 | 7,008 | -11,782 | -63 | -3,844 | 0 |
| Alfalfa | diuron | 18,526 | 5,050 | -13,476 | -73 | -2,212 | 0 |

Reproductive toxins

The reproductive toxins category included 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.

From 2022-2023, pounds of reproductive toxin AIs applied decreased, while acres treated stayed about the same.

Table 32: Annual Changes in Reproductive Toxin Use 2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|---------------------|------------|--------------|--------------|----------------|
| Reproductive Toxins | -821,862 | -13 | 12,007 | 0 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either reproductive acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

Increased use of thiophanate-methyl (fungicide) and ethylene glycol (adjuvant) contributed most to increased use in the category. The use of both chemicals nearly doubled from 2022-2023.

Use of abamectin, one of the most widely used insecticides in California, fell by 5% in acres treated and drove a large portion of the acreage reductions in the category. However, reductions in use of the fumigant metam-sodium accounts for nearly all of the net decline in pounds of reproductive toxin AIs applied.

Figure 14: Statewide Reproductive Toxin AI Use, 2022-2023

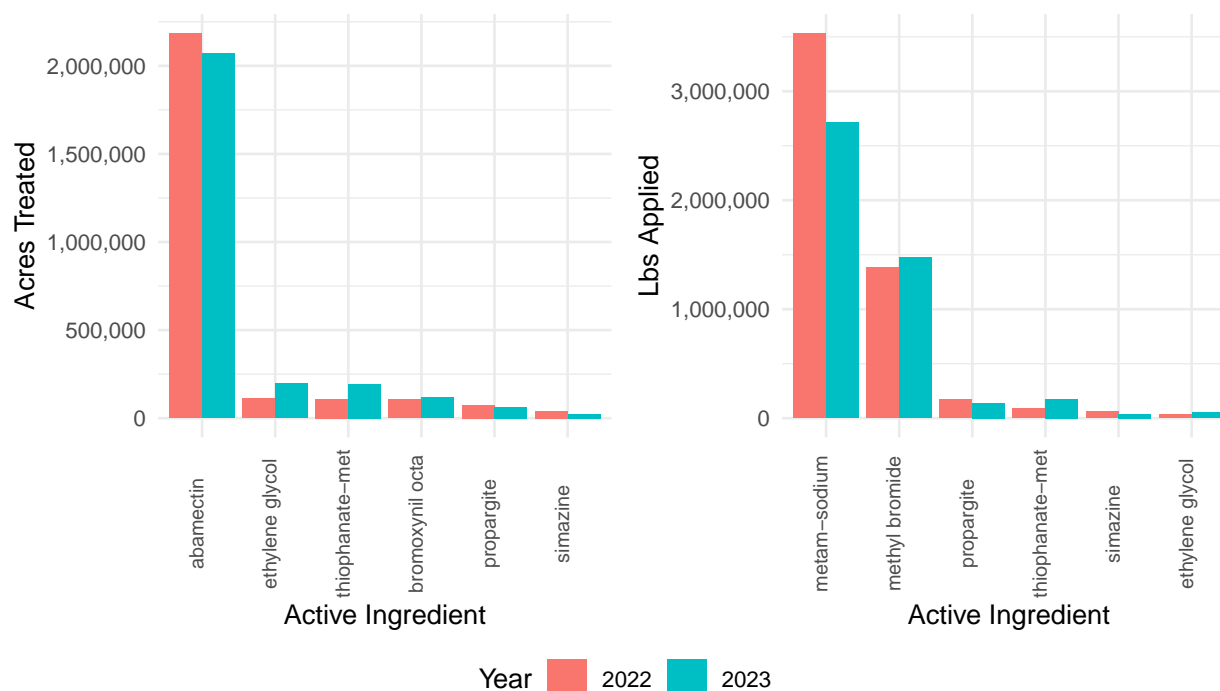


Table 33: Top Changes in Reproductive Toxin AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|----------------------|--------------------|--------------------|--------------|-----|
| thiophanate-methyl | 109,462 | 193,970 | 84,508 | 77 |
| ethylene glycol | 113,290 | 195,146 | 81,856 | 72 |
| bromoxynil octanoate | 107,353 | 116,853 | 9,500 | 9 |
| propargite | 74,269 | 63,884 | -10,385 | -14 |
| simazine | 40,126 | 24,734 | -15,392 | -38 |
| abamectin | 2,185,077 | 2,068,769 | -116,308 | -5 |

Table 34: Top Changes in Reproductive Toxin AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|--------------------|---------------------|---------------------|---------------|-----|
| methyl bromide | 1,383,263 | 1,474,243 | 90,980 | 7 |
| thiophanate-methyl | 89,997 | 177,232 | 87,235 | 97 |
| ethylene glycol | 32,287 | 53,514 | 21,227 | 66 |
| simazine | 58,723 | 37,117 | -21,606 | -37 |
| propargite | 170,042 | 140,595 | -29,447 | -17 |
| metam-sodium | 3,532,618 | 2,714,688 | -817,930 | -23 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 5% of the total change in either acres treated or pounds applied of reproductive toxins between 2022 and 2023. Almond production accounted for most of the increased use of thiophanate-methyl and ethylene glycol. Thiophanate-methyl is used for a variety of fungal pathogens in almond, while ethylene glycol is a common non-ionic spreader mixed with pesticides to improve their effectiveness.

Metam-sodium use shifted in strawberry, pepper, and potato, but the largest declines were in carrot. Carrot reduced acreage significantly from 2022-2023, which partially explains the declining use.

Abamectin use fell in both almond and walnut. Abamectin is a miticide that targets the same pest species for almonds and walnuts. This suggests that mite pressure in nut crops was lower statewide in 2023 than 2022.

Figure 15: Reproductive Toxin AI Use by Commodity, 2022-2023

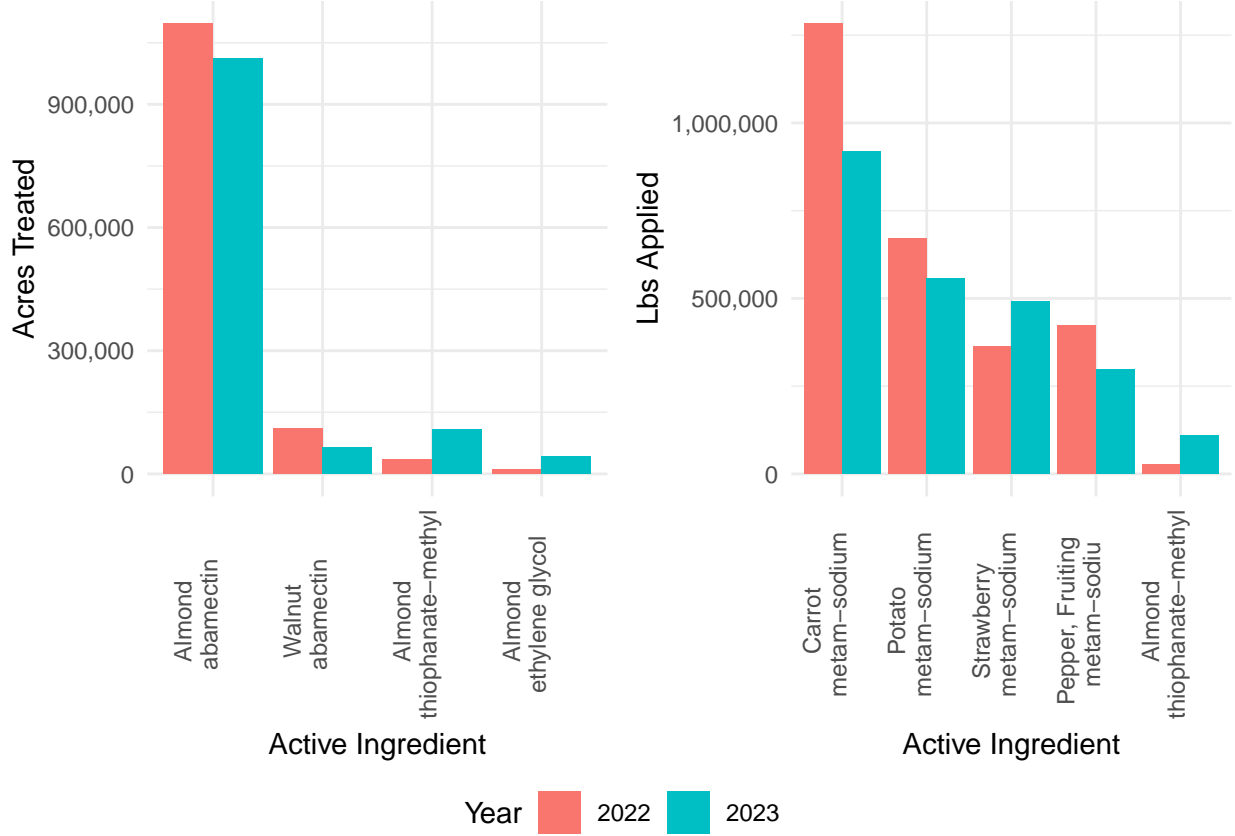


Table 35: Top Commodities Changes in Acres Treated (Reproductive Toxins)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|--------|--------------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Almond | thiophanate-methyl | 34,855 | 107,663 | 72,808 | 209 | -3,844 | 0 |
| Almond | ethylene glycol | 11,582 | 41,502 | 29,920 | 258 | -3,844 | 0 |
| Walnut | abamectin | 110,833 | 65,434 | -45,399 | -41 | -51,920 | -14 |
| Almond | abamectin | 1,096,864 | 1,012,415 | -84,449 | -8 | -3,844 | 0 |

Table 36: Top Commodities Changes in Pounds Applied (Reproductive Toxins)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|---------------------|--------------------|---------------------|---------------------|---------------|-----|---|--------------|
| Strawberry | metam-sodium | 362,422 | 492,032 | 129,610 | 36 | -1,767 | -2 |
| Almond | thiophanate-methyl | 28,339 | 108,633 | 80,294 | 283 | -3,844 | 0 |
| Potato | metam-sodium | 672,266 | 556,521 | -115,745 | -17 | 30 | 0 |
| Pepper, Fruiting | metam-sodium | 422,479 | 296,851 | -125,628 | -30 | 2,898 | 20 |
| Carrot | metam-sodium | 1,283,281 | 920,011 | -363,270 | -28 | -13,191 | -17 |

Toxic Air Contaminants

Toxic air contaminants (TACs) are defined as air pollutants that may cause or contribute to increases in serious illness or death, that may pose a present or potential hazard to human health, or pesticides identified as hazardous air pollutants per Section 7412 of Title 42 of the United States Code and pesticides determined to be TACs in consultation with the Office of Environmental Health Hazard Assessment.

From 2022-2023, both pounds and acres treated with toxic air contaminants decreased.

Table 37: Annual Changes in Toxic Air Contaminant Use
2022-2023

| Category | Lbs Change | Lbs Change % | Acres Change | Acres Change % |
|------------------------|------------|--------------|--------------|----------------|
| Toxic Air Contaminants | -3,602,888 | -9 | -221,643 | -11 |

Active Ingredient Use The top 3 AIs contributing to positive or negative increases in either tac acreage or lbs applied are below. For some categories, an AI might be top in both acreage and lbs applied.

As is the case with other categories that include fumigants, large decreases in the pounds of fumigants applied (1,3-d, metam-sodium, and chloropicrin) drove down the total pounds of toxic air contaminants. This was minorly offset by increased use of metam-potassium.

Decreased use of mancozeb (fungicide) and 2,4-d (herbicide) contributed the most to decreased treated acreage, while increased use of captan (fungicide) increased treated acreage in the category.

Figure 16: Statewide Toxic Air Contaminant AI Use, 2022-2023

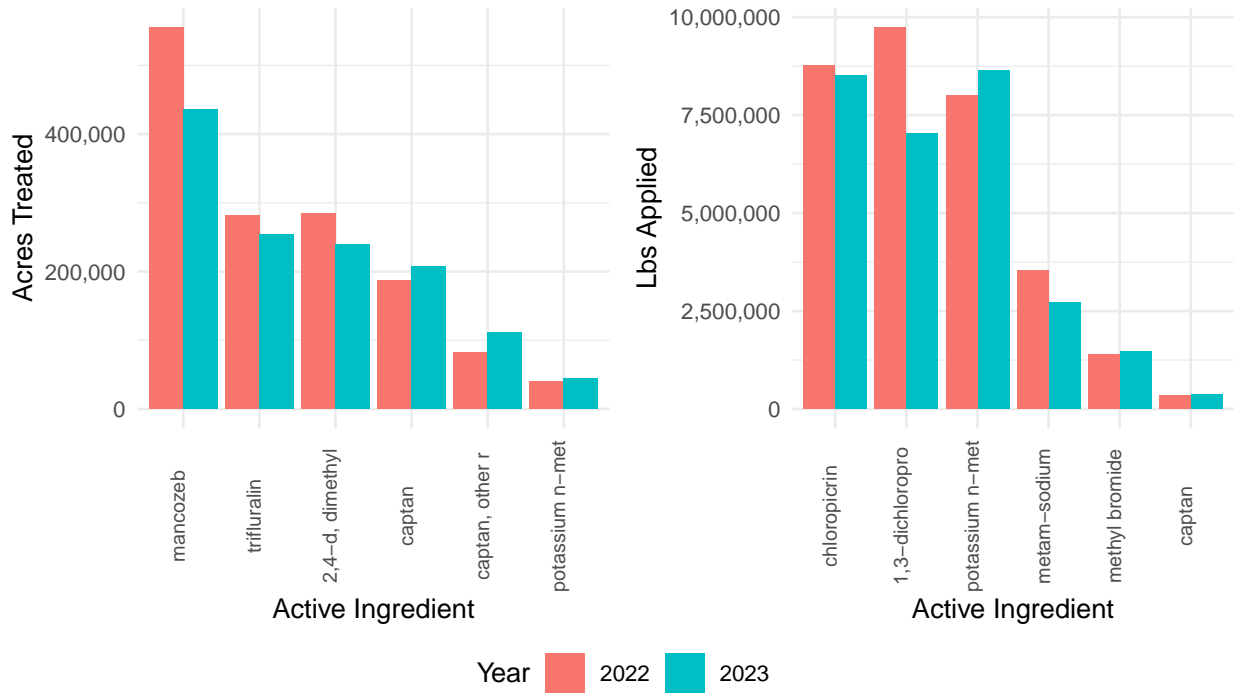


Table 38: Top Changes in Toxic Air Contaminant AIs (by Acres)

| AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % |
|----------------------------------|--------------------|--------------------|--------------|-----|
| captan, other related | 82,906 | 110,613 | 27,707 | 33 |
| captan | 187,331 | 206,871 | 19,540 | 10 |
| potassium n- methylthiocarbamate | 40,018 | 44,045 | 4,027 | 10 |
| trifluralin | 281,237 | 254,069 | -27,168 | -10 |
| 2,4-d, dimethylamine salt | 284,001 | 240,066 | -43,935 | -15 |
| mancozeb | 555,735 | 436,278 | -119,457 | -21 |

Table 39: Top Changes in Toxic Air Contaminant AIs (by Pounds)

| AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % |
|------------------------------------|---------------------|---------------------|---------------|-----|
| potassium n- methyldithiocarbamate | 8,005,694 | 8,633,739 | 628,045 | 8 |
| methyl bromide | 1,383,263 | 1,474,243 | 90,980 | 7 |
| captan | 332,684 | 367,946 | 35,262 | 11 |
| chloropicrin | 8,773,430 | 8,515,650 | -257,780 | -3 |
| metam-sodium | 3,532,618 | 2,714,688 | -817,930 | -23 |
| 1,3-dichloropropene | 9,749,522 | 7,023,406 | -2,726,116 | -28 |

Crop-Specific Changes We show commodity-AI combinations that represent at least 5% of the total change in either acres treated or pounds applied of toxic air contaminants between 2022 and 2023. As described in other sections, 1,3-d use fell significantly in carrot, grape, and almond. Declining carrot acreage partially explains decreased 1,3-d and metam-sodium use in that commodity, and fewer new plantings in grape and almond may explain the decline 1,3-d use.

Tomato accounted for large increases in both mancozeb and metam-potassium use. This could suggest additional soil-borne and foliar disease pressure in 2023 relative to 2022, potentially resulting from increased precipitation.

Mancozeb use in walnuts falls significant, moreso than total planted acreage declined in that period. As mentioned in the carcinogen section, use of nearly all fungicide AIs in walnuts fell between 2022 and 2023, suggesting lower fungal disease pressure overall rather than mancozeb being replaced with another fungicide AI.

Figure 17: Toxic Air Contaminant AI Use by Commodity, 2022-2023

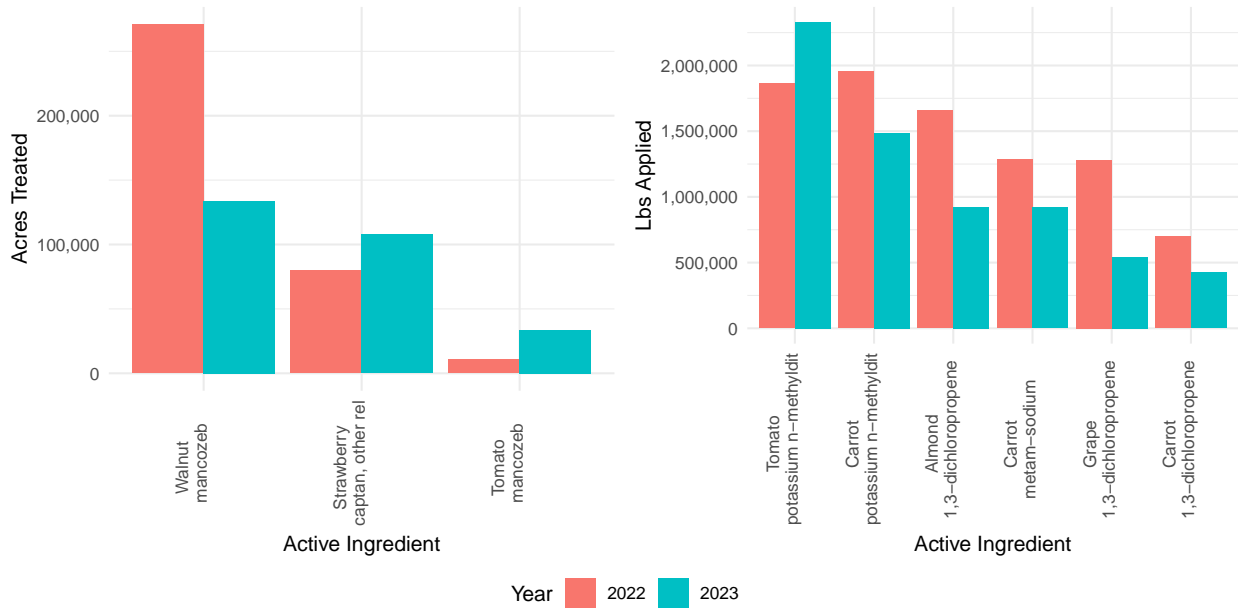


Table 40: Top Commodities Changes in Acres Treated (Toxic Air Contaminants)

| Crop | AI | Acres Treated 2022 | Acres Treated 2023 | Acres Change | % | Statewide Change in Planted Acres | Planted % |
|------------|-----------------------|--------------------|--------------------|--------------|-----|-----------------------------------|-----------|
| Strawberry | captan, other related | 79,860 | 107,694 | 27,834 | 35 | -1,767 | -2 |
| Tomato | mancozeb | 10,681 | 33,646 | 22,965 | 215 | 32,174 | 12 |
| Walnut | mancozeb | 270,912 | 133,793 | -137,119 | -51 | -51,920 | -14 |

Table 41: Top Commodities Changes in Pounds Applied (Toxic Air Contaminants)

| Crop | AI | Lbs Applied 2022 | Lbs Applied 2023 | Lbs Change | % | Statewide Change in Planted Acres | Planted % |
|--------|----------------------|------------------|------------------|------------|-----|-----------------------------------|-----------|
| Tomato | potassium n- methyl. | 1,863,870 | 2,329,090 | 465,220 | 25 | 32,174 | 12 |
| Carrot | 1,3-dichloropropene | 697,069 | 423,886 | -273,183 | -39 | -13,191 | -17 |
| Carrot | metam-sodium | 1,283,281 | 920,011 | -363,270 | -28 | -13,191 | -17 |
| Carrot | potassium n- methyl. | 1,954,620 | 1,487,346 | -467,274 | -24 | -13,191 | -17 |
| Almond | 1,3-dichloropropene | 1,655,926 | 925,203 | -730,723 | -44 | -3,844 | 0 |
| Grape | 1,3-dichloropropene | 1,278,781 | 543,018 | -735,763 | -58 | -45,542 | -6 |