

# **Pesticide Use and Major Crops: Statewide Focus**

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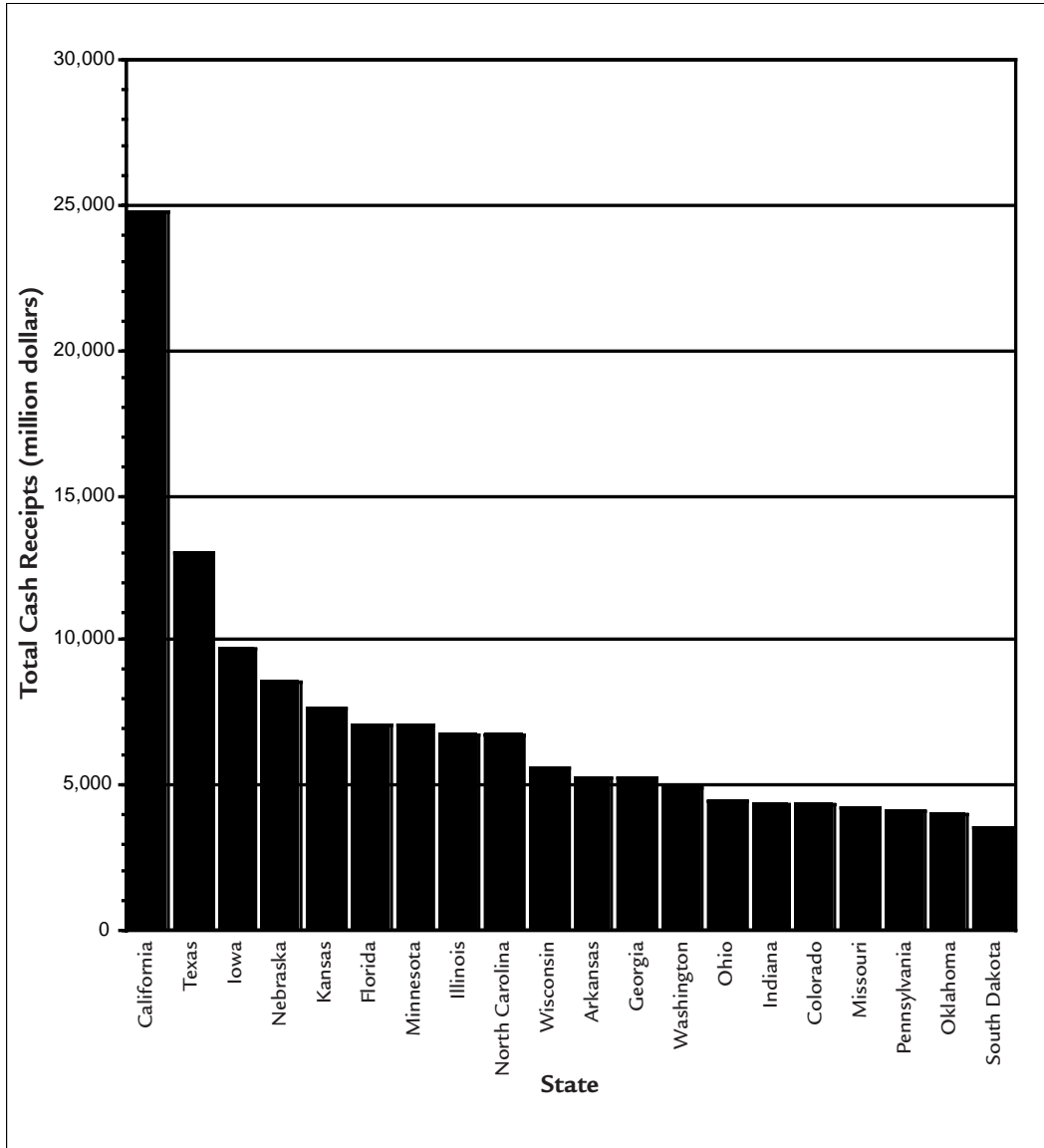
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### Top 20 States in 1999 Cash Farm Receipts (1999 U.S. Total Cash Receipts: \$188.6 billion)



COMPILED FROM:  
USDA, National Agricultural Statistics Service, Statistical Highlights of U.S. Agriculture 2000–2001;  
<http://www.usda.gov/nass/pubs/stathigh/2001/economics.pdf> (click on “Farm Economics and Demographics”)

**Crop and Livestock Commodities  
in which California Leads the Nation: 2000**

<b>Commodity</b>	<b>% of U.S. Production</b>	<b>U.S. Rank<sup>1</sup></b>
almonds, shelled <sup>2</sup>	99	1
apples	6	4
apricots	93	1
aquaculture	—	—
artichokes <sup>2</sup>	99	1
asparagus	52	1
avocados	89	1
barley	2	10
beans, dry	8	5
beans, snap	12	3
boysenberries	28	2
broccoli	88	1
Brussels sprouts <sup>2</sup>	99	1
cabbage, fresh market	19	2
carrots	66	1
cattle & calves	4	7
cauliflower	87	1
celery	94	1
cherries, sweet	23	2
corn, fresh market sweet	13	2
cotton lint, all	15	2
cottonseed	14	2
cucumbers, all	16	2
dates <sup>2</sup>	99	1
eggplant	22	3
eggs, chicken	7	4
escarole/endive	36	1
figs <sup>2</sup>	99	1
flowers & foliage <sup>3</sup>	—	1
garlic <sup>2</sup>	89	1
grain, corn	1	23
grain, sorghum	—	19
grapefruit, all	10	2
grapes, all	92	1
grapes, raisin	—	—
grapes, table	—	—
grapes, wine	—	—
greens, collard	6	4
greens, kale	66	1
greens, mustard	16	2
hay, alfalfa & other	6	2
hogs & pigs <sup>4</sup>	—	28
honey	14	2
kiwifruit <sup>2</sup>	99	1
lemons	86	1

*(continued)*

## Pesticide Use and Major Crops

Commodity	% of U.S. Production	U.S. Rank <sup>1</sup>
lettuce, all	75	1
lettuce, head	74	1
lettuce, leaf	89	1
lettuce, romaine	70	1
melons, cantaloupe	62	1
melons, honeydew	75	1
melons, watermelon	17	2
milk & cream	19	1
mushrooms, agaricus	15	2
nectarines <sup>2</sup>	99	1
nursery products <sup>2, 5, 7</sup>	20	1
oats	1	22
oil crops <sup>6</sup>	—	—
olives <sup>2</sup>	99	1
onions, all	40	1
oranges, all	22	2
oranges, navel & misc.	23	—
oranges, Valencia	21	—
peaches, all	71	1
peaches, clingstone	100	1
peaches, freestone	52	1
pears, all	73	2
pecans	2	8
peppers, all	—	—
peppers, bell	46	1
peppers, chili	30	2
pistachios <sup>2</sup>	99	1
plums	90	1
plums, dried <sup>2</sup>	99	1
potatoes (excluding sweet)	3	9
potatoes, sweet	18	2
pumpkins	20	2
radishes	31	2
raspberries	19	2
rice <sup>5</sup>	23	2
sheep & lambs	12	2
spinach, fresh market	68	1
squash	16	2
strawberries, all	82	1
strawberries, fresh market	79	1
strawberries, processing	90	1
sugar beets <sup>5</sup>	9	5
tangerines, mandarins, tangelos, & tangors	23	2
tomatoes, all	85	1
tomatoes, fresh market	30	2
tomatoes, processing	95	1

(continued)

## Pesticide Use and Major Crops

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turkeys	6	6
walnuts <sup>2</sup>	99	1
wheat, all	2	19
wool	9	3
other field crops	—	—
other fruits & nuts	—	—
other livestock & poultry	—	—
other vegetables and melons	—	—

<sup>1</sup> Based on quantity produced for crops and on quantity marketed for livestock and poultry products.

<sup>2</sup> Share of U.S. production based on 1997 Census of Agriculture.

<sup>3</sup> Includes cut flowers, potted plants, foliage plants, bedding plants, and indoor decoratives.

<sup>4</sup> California share of U.S. production is less than one-half percent.

<sup>5</sup> Extracted from Agricultural Commissioners' Annual Crop Reports.

<sup>6</sup> Includes sunflower, safflower, and canola.

<sup>7</sup> Includes trees, shrubs, vines, bulbs, turf, etc., not included in flowers and foliage category.

## California's Leading Agricultural Counties Ranked by Gross Value of Production, 2000

County	Rank 1999	Rank 2000	2000 Value of Production (\$1,000)	Leading Commodities
Fresno	1	1	3,418,622	grapes, poultry, cotton, tomatoes, milk
Tulare	2	2	3,066,533	milk, oranges (navel & Valencia), grapes, cattle & calves, plums
Monterey	3	3	2,923,255	lettuce (head & leaf), broccoli, strawberries, grapes, nursery products
Kern	4	4	2,208,541	grapes, citrus (all), cotton, milk (all), almonds
Merced	5	5	1,538,538	milk, chickens, tomatoes (all), cattle & calves, almonds
San Joaquin	6	6	1,348,709	grapes (all), milk (all), tomatoes (all), almond meats, cherries (all)
San Diego	7	7	1,253,834	flowers & foliage, nursery plants, avocados, eggs, tomatoes
Stanislaus	8	8	1,197,302	milk (all), almonds, chickens (all), cattle & calves, fruit and nut nursery
Riverside	9	9	1,048,562	milk, nursery products, grapes (table), eggs, lemons
Ventura	10	10	1,047,054	lemons, celery, strawberries (fresh market), avocados, nursery plants
Imperial	11	11	919,610	cattle, alfalfa, lettuce, carrots, sugar beets
Kings	12	12	885,062	milk (market), cotton, cattle & calves, hay (alfalfa), turkeys
Madera	14	13	748,199	grapes, milk, almonds and hulls, pistachios, nursery stock
Santa Barbara	15	14	739,504	broccoli, grapes (wine), strawberries, lettuce (head), cauliflower
San Bernardino	13	15	619,999	milk, cattle & calves, eggs, nursery products, oranges
Sonoma	16	16	585,039	grapes (wine), milk (market), livestock & poultry, cattle & calves, grapevines
San Luis Obispo	18	17	487,654	grapes (wine), broccoli, lettuce (head), cattle & calves, cut flowers
Orange	21	18	366,422	nursery stock and flowers (cut), strawberries, tomatoes, avocados, peppers (bell & misc.)
Colusa	19	19	345,987	rice, tomatoes (processing), almonds (meats), onion (seed), cattle & calves
Napa	27	20	343,948	grapes (wine), nursery & floriculture crops, cattle & calves, pasture & range, livestock & poultry products
Sutter	20	21	343,496	rice, dried plums (prunes), peaches, walnuts, tomatoes
Santa Cruz	17	22	337,913	strawberries (fresh market), raspberries, lettuce (head), nursery products, flowers (cut)
Yolo	22	23	302,736	tomatoes (processing), grapes (wine), rice, hay (alfalfa), seed crops

*(continued)*

## Pesticide Use and Major Crops

County	Rank 1999	Rank 2000	2000 Value of Production (\$1,000)	Leading Commodities
Santa Clara	31	24	300,900	nursery crops, mushrooms, flowers (cut), grapes (wine), peppers (bell)
Butte	24	25	291,345	rice, almonds, walnuts (English), dried plums (prunes), peaches (clingstone)
Sacramento	23	26	285,572	grapes (wine), milk, nursery stock, pears (Bartlett), corn (field)
Glenn	25	27	280,899	rice (paddy), dairy products, almonds, dried plums (prunes), cattle & calves
Los Angeles	26	28	268,158	plants (nursery), vegetables (root), onions (dry), peaches, hay (alfalfa)
San Benito	29	29	208,899	salad greens, nursery products, grapes (wine), livestock products, lettuce (leaf)
San Mateo	30	30	194,131	nursery stock & plants, mushrooms, flowers (potted & cut), forest products, Brussels sprouts
Solano	28	31	185,109	nursery stock, tomatoes (processing), grapes (wine), cattle & calves, hay (alfalfa)
Yuba	32	32	148,341	rice, dried plums (prunes), peaches, walnuts, cattle & calves
Mendocino	33	33	128,572	grapes (wine), pears (Bartlett), cattle & calves, milk, pasture
Siskiyou	34	34	118,981	hay (alfalfa), strawberry plants, cattle & calves, potatoes (Irish), irrigated pasture
Tehama	35	35	110,704	dried plums (prunes), walnuts (English), milk (market), cattle & calves, almonds

COMPILED FROM:  
California Agricultural Statistics Service, California Statistical Reports, Summary of County Agricultural Commissioners' Reports, Gross Value of Agricultural Production: <http://www.nass.usda.gov/ca/bul/agstat/indexcas.htm> (click on PDF link for "Agricultural Overview, 2000")

**California's Leading Farm Products: Top Twenty (2000)**

Farm Product	Value (\$ in millions) and Rank	
	2000	1999
Milk & Cream	\$3,704 (1)	\$4,091 (1)
Grapes, All	2,836 (2)	2,656 (2)
Nursery Products	2,247 (3)	2,008 (3)
Lettuce, All	1,484 (4)	1,130 (5)
Cattle & Calves	1,267 (5)	1,223 (4)
Tomatoes, All	951 (6)	1,118 (6)
Cotton Lint	898 (7)	672 (11)
Flowers & Foliage	842 (8)	775 (8)
Strawberries	767 (9)	876 (7)
Hay, All	730 (10)	767 (9)
Almonds	682 (11)	688 (10)
Broccoli	537 (12)	433 (14)
Chickens, All	471 (13)	515 (12)
Avocados	362 (14)	327 (16)
Carrots	347 (15)	451 (13)
Oranges, All	346 (16)	404 (15)
Celery	310 (17)	210 (25)
Walnuts	289 (18)	251 (19)
Onions, All	263 (19)	246 (20)
Peppers, Bell	257 (20)	221 (23)

SOURCE: California Agricultural Statistics Service, <http://www.nass.usda.gov/ca/bul/agstat/indexcas.htm> (click on PDF link for "Agricultural Overview, 2000")



## Pesticide Classification Based on Target Pests and Pesticide Functions

PESTICIDE TYPE	FUNCTION	PESTICIDE CHEMICAL* (BRAND NAME)
acaricide	kills mites	propargite (Omite) fenbutatin-oxide (Vendex)
algaecide	kills algae	copper sulfate dichlone endothall (Hydrothol 191)
attractant	attracts pests	pheromones baits miscellaneous chemicals
avicide	kills birds	aminopyridine (Avitrol) starlicide Ornitrol
bactericide	kills bacteria	oxytetracycline (Mycoshield) copper compounds
defoliant	removes plant foliage	endothall (Accelerate) thidiazuran (Dropp) tributyl phosphorotrithioite (Folex)
desiccant	removes water from arthropod pests	boric acid powder silica gel diatomaceous earth
fungicide	kills (or suppresses) fungi	benomyl (Benlate) copper sulfate chlorothalonil (Bravo)
growth regulator	regulates plant or animal growth	gibberellic acid (Pro-Gibb) chlorocarbamate (Sprout Nip) methoprene (Precor)
herbicide	kills weeds	atrazine bromoxynil (Buctril) trifluralin (Treflan) paraquat (Gramoxone) petroleum oil
insecticide	kills insects	diazinon permethrin (Ambush) azinphos-methyl (Guthion) methyl parathion petroleum oils
molluscicide	kills snails or slugs	Snarol mesurool triphenmorph (Frescon) clonitralid (Bayluscide) antimycin (Fintrol)

\*Some chemicals listed here may not be currently registered as pesticides.

*(continued)*

## Pesticide Use and Major Crops

PESTICIDE TYPE	FUNCTION	PESTICIDE CHEMICAL* (BRAND NAME)
nematicide	kills nematodes	carbofuran (Furadan) phosphoramidate (Nemacur) dicloropropene (Telone)
piscicide	kills fish	rotenone Lamprecide
predacide	kills mammal predators	strychnine zinc phosphide compound 1080
repellent	repels animals or invertebrates	DEET methiocarb (Mesurol) avitrol thiram
rodenticide	kills rodents	chlorophacinone strychnine hydroxycoumarin (Warfarin) diphacinone (Diphacin) brodifacoum (Talon) bromadiolone (Maki)
silvicide	kills trees and woody shrubs	tebuthiuron (Spike) petroleum oils

\*Some chemicals listed here may not be currently registered as pesticides.

## Pesticide Chemical Groups

CHEMICAL TYPE	EXAMPLE*	MODE OF ACTION
<b>INSECTICIDES</b>		
petroleum oils	supreme oil, superior oil	physical toxicants
organochlorines	DDT, methoxychlor hexachlorocyclohexanes cyclodienes (chlordane, thiodan) polychloroterpenes (toxaphene)	axonic poisons axonic poisons central nervous system synaptic poisons axonic poisons
organophosphates		
aliphatic derivatives	malathion, dimethoate, disulfoton (Di-Syston)	central nervous system synaptic poisons
phenyl derivatives	ethyl parathion, methyl parathion, sulprofos (Bolstar)	central nervous system synaptic poisons
heterocyclic derivatives	diazinon, azinphos-methyl (Guthion), chlorpyrifos (Lorsban, Dursban), phosmet (Imidan)	central nervous system synaptic poisons
organosulfurs	propargite (Omite)	axonic poisons (also inhibit metabolism and respiration)
carbamates	carbaryl (Sevin), methomyl (Lannate), aldicarb (Temik), propoxur (Baygon), bendiocarb (Ficam)	central nervous system synaptic poisons
formamidines	chlordimeform (Galecron), amitraz (Baam)	adrenergic insecticides
thiocyanates	thanite	interferes with cellular respiration and metabolism
dinitrophenols	dinoseb, dinocap (Karathane)	metabolic inhibitors
organotins	cyhexatin (Plictran), fenbutatin-oxide (Vendex)	metabolic inhibitors
botanicals	nicotine rotenone sabadilla ryania pyrethrum	postsynaptic poison metabolic inhibitor muscle poison muscle poison axonic poison (also inhibits mixed function oxidase when mixed with a synergist)
pyrethroids	permethrin (Ambush and Pounce), fenvalerate (Pydrin), allethrin (Pynamin), resmethrin (Synthrin)	axonic poisons (also inhibit mixed function oxidase when mixed with a synergist)

*(continued)*

\*Some of the materials listed on this table may no longer be registered for use as pesticides in the United States.

## Pesticide Use and Major Crops

CHEMICAL TYPE	EXAMPLE*	MODE OF ACTION
<b>INSECTICIDES</b> <i>(continued)</i>		
inorganics	silica gel, boric acid sulfur	physical toxicants interferes with electron transport, also a cellular poison
	arsenic	inhibits respiration
fumigants	methyl bromide ethylene dibromide hydrogen cyanide chloropicrin, vapam, telone, naphthalene	narcotic and alkylating agent narcotic narcotic and alkylating agent narcotic
microbials	<i>Bacillus thuringiensis</i> viruses fungi	various various various
insect growth regulators	methoprene, diflubenzuron (Dimilin), other chitin synthesis inhibitors	influence growth and development
<b>HERBICIDES</b>		
inorganics	sodium chlorate	desiccant
petroleum oils	summer oil, dormant oil	physical toxicants
organic arsenicals	MSMA, DSMA, cacodylic acid	interfere with cellular respiration and metabolism and other functions
phenoxyaliphatic acid	2,4-D, 2,4,5-T, diclofop methyl (Hoelon)	multiple actions
amides	propanil (Kerb), napropamide (Devrinol), alachlor (Lasso), metolachlor (Dual)	inhibit root and shoot growth
substituted anilines	trifluralin (Treflan), oryzalin (Surflan), pendimethalin (Prowl)	inhibit root and shoot growth
substituted ureas	tebuthiuron (Spike), diuron (Karmex), fenuron (Dybar)	block photosynthesis
carbamates	propham (Chem Hoe), barban, asulam (Asulox)	block photosynthesis and interfere with cell division
thiocarbamates	molinate (Ordram), cycloate (Ro-Neet), butylate (Sutan)	interfere with cellular respiration and metabolism, block photosynthesis, and inhibit root and shoot growth

*(continued)*

\*Some chemicals listed here may not be currently registered as pesticides.

## Pesticide Use and Major Crops

CHEMICAL TYPE	EXAMPLE*	MODE OF ACTION
HERBICIDES ( <i>continued</i> )		
triazines	atrazine (Aatrex), simazine (Princep), metribuzin (Lexone), cyanazine (Bladex)	block photosynthesis
aliphatic acids	TCA, dalapon	unknown
substituted benzoic acids	dicamba (Banvel), DCPA, chloramben (Amiben)	unknown
phenol derivatives	dinoseb	destroy cell membranes, also a desiccant
nitriles	dichlobenil (Casoron), bromoxynil (Buctril)	interfere with cellular respiration and metabolism and inhibit carbon dioxide fixation
bipyridyliums	diquat, paraquat	destroy cell membranes, desiccant, and block photosynthesis
microbials	<i>Phytophthora palmivora</i> (Devine)	destroy plant cells
uracils	bromacil (Hyvar-X), terbacil (Sinbar)	block photosynthesis
sulfonylureas	chlorsulfuron (Glean), sulfomethuron-methyl (Oust)	interfere with cell division
miscellaneous herbicides	endothall, glyphosate (Roundup), oxyfluorfen (Goal)	inhibit metabolism and protein synthesis
PLANT GROWTH REGULATORS		
auxins	IAA, 2,4-D, VAR	act on DNA-RNA protein system to increase or retard growth rate
gibberellins	ProGibb, Release	important in shoot elongation, control of dormancy, and fruit maturation
cytokinins	zeatin, kinetin	promote cell division, bud growth; used to prolong storage of fresh produce
ethylene generators	ethephon (Ethrel)	stimulate seed germination and sprouting; regulate flower, leaf, and fruit drop
FUNGICIDES		
inorganic fungicides	copper sulfur	enzyme inhibitor metabolic inhibitor

(*continued*)

\*Some chemicals listed here may not be currently registered as pesticides.

## Pesticide Use and Major Crops

CHEMICAL TYPE	EXAMPLE*	MODE OF ACTION
FUNGICIDES ( <i>continued</i> )		
dithiocarbamates	thiram, maneb, ferbam, ziram, Vapam, zineb	enzyme inhibitors
thiazoles	ethazol (Terrazole)	enzyme inhibitors
triazines	anilazine	inhibits metabolism and protein synthesis
substituted aromatics	hexachlorobenzene, chlorothalonil (Bravo), chloroneb	enzyme inhibitors
dicarboximides	captan, folpet, captafol (Difolatan)	enzyme inhibitors
oxathiins	carboxin, oxycarboxin	metabolic inhibitors
benzimidazoles	benomyl (Benlate), thiabendazol, thiophantate (Topsin)	inhibit metabolism and protein synthesis
acylalanines	metalaxyl (Dual)	
triazole	tridimefon (Bayleton)	
piperazine	triforine	
imides	iprodione (Rovral), vinclozolin (Ronilan)	
quinones	chloranil, dichlone	enzyme inhibitors
aliphatic nitrogen compounds	dodine	inhibit metabolism and protein synthesis
fumigants	chloropicrin, methyl bromide	
antibiotics	streptomycin, cycloheximide	

\*Some chemicals listed here may not be currently registered as pesticides.

## Signal Words of Pesticide Toxicity Categories

PESTICIDE LABEL SIGNAL WORDS			
HAZARD INDICATORS:	<i>DANGER</i>	<i>WARNING</i>	<i>CAUTION</i>
oral LD <sub>50</sub> *	up to and including 50 mg/kg	from 50 to 500 mg/kg	greater than 500 mg/kg
inhalation LC <sub>50</sub> *	up to and including 0.2 mg/liter (0-2,000 ppm)	from 0.2 to 2 mg/liter (2,000-20,000 ppm)	greater than 2 mg/liter (greater than 20,000 ppm)
dermal LD <sub>50</sub> *	up to and including 200 mg/kg	from 200 to 2,000 mg/kg	greater than 2,000 mg/kg
eye effects	corrosive; corneal opacity not reversible within 7 days	corneal opacity reversible within 7 days; irritation persisting for 7 days	no corneal opacity; irritation reversible within 7 days
skin effects	corrosive	severe irritation at 72 hours	moderate irritation at 72 hours

\*LD<sub>50</sub> values represent milligrams (mg) of the pesticide per kilogram (kg) of body weight of the test animals. LC<sub>50</sub> values represent the milligrams of pesticide per liter of air inhaled by the test animals.

### Oral LD<sub>50</sub> Values for Some Pesticides

CHEMICAL	BRAND NAME	LD <sub>50</sub>	TYPE OF PESTICIDE
aldicarb	Temik	0.79	insecticide
methyl parathion	Penncap-M	3	insecticide
azinphos-methyl	Guthion	11	insecticide
paraquat	Gramoxone Extra	150	herbicide
diazinon	D-z-n diazinon	300	insecticide
2,4-D	Weedone	375	herbicide
carbaryl	Sevin	500	insecticide
copper hydroxide	C-O-C-S	1,000	fungicide
pendimethalin	Prowl	1,250	herbicide
malathion	Cythion	1,375	insecticide
ziram	Ziram	1,400	fungicide
propargite	Omite	2,200	acaricide
iprodione	Rovral	3,500	fungicide
trifluralin	Treflan	3,700	herbicide
glyphosate	Roundup	4,300	herbicide
simazine	Princep	5,000	herbicide
capatafol	Difolatan	6,200	fungicide
benomyl	Benlate	>10,000	fungicide
chlorothalonil	Bravo	>10,000	fungicide
oryzalin	Surflan	>10,000	herbicide
<i>B. thuringiensis</i>	Dipel	15,000	insecticide
methoprene	Precor	34,600	insect growth regulator

\*LD<sub>50</sub> values may vary due to formulation types. These values are shown for comparative purposes only. Some chemicals listed may no longer be in use as pesticides.

### Oral LD<sub>50</sub> Values for Some Pesticides Used to Control Pests on Organically Grown Produce

CHEMICAL*	BRAND NAME	LD <sub>50</sub>	TYPE OF PESTICIDE
nicotine	Black Leaf 40	55	insecticide
rotenone	—	132	insecticide
Bordeaux mix	—	300	fungicide
copper hydroxide	Kocide	1,000	fungicide
copper oxychloride sulfate	C-O-C-S	1,000	fungicide
ryania	—	1,200	insecticide
pyrethrum	—	1,500	insecticide
silica aerogel	Dri-Die	3,160	insecticide
sabadilla	—	4,000	insecticide
cryolite	Kryocide	10,000	insecticide

\*Some of the materials on this list may not currently be registered as pesticides or be acceptable for use on organically grown produce.



## Pesticides Accepted for Use on or around Some Types of Organically Grown Produce\*

COMPOUND	TYPE	USE/COMMENTS
INSECTICIDES		
<i>Bacillus thuringiensis</i>	microbial	Controls many species of lepidopteran larvae and mosquito larvae (depending on the variety of the <i>B. thuringiensis</i> used).
boric acid	inorganic	A sorptive dust having a desiccant action. Controls cockroaches, ants, other household pests. Ineffective if dust gets wet.
cryolite	inorganic	Controls mites, moth larvae, beetles, weevils, and thrips.
diatomaceous earth	inorganic	A sorptive dust derived from the skeletons of microscopic marine organisms. As a desiccant, controls household pests such as cockroaches and ants. Also controls some plant pests.
granulosis virus	microbial	Controls codling moth.
lime	inorganic	Controls mites, some plant-sucking insects.
lime sulfur	inorganic	Controls mites and psylla.
nicotine sulfate	plant derivative	Controls aphids, thrips, leafhoppers, other sucking insects. Toxic to mammals.
petroleum oils	hydrocarbon	Controls aphids, psylla, scale insects, mites, aphid and mite eggs. May provide some control of other overwintering insects.
pheromones	attractants	Used mainly for monitoring to time other control measures. Sometimes used to confuse insects in localized area to disrupt mating. Occasionally used to catch large numbers of specific insects to reduce future generations.
pyrethrum	plant derivative	Broad spectrum of pests is controlled, including mosquitoes, flies, aphids, beetles, moth larvae, thrips, and mealybugs. Provides rapid knockdown of flying pests.
rotenone	plant derivative	Contact and stomach poison. Controls beetles, weevils, slugs, loopers, mosquitoes, thrips, fleas, lice, and flies. Also used for control of unwanted fish. Acts as a repellent and acaricide. Rotenone is slow acting and has a short residual. It is nontoxic to honey bees.
ryania	plant derivative	Controls codling moth, thrips, and the European corn borer.
sabadilla	plant derivative	Has contact and stomach poison action against cockroaches, several species of bugs, potato leafhopper, imported cabbage worm, house fly, citrus thrips, and the cattle louse. Is toxic to honey bees. Not highly toxic to mammals.

(continued)

\*Some pesticides on this list may not be currently approved for use on organically grown produce. Many materials listed in this table may no longer be registered as pesticides or their labels may restrict their use to specific pests, crops, or sites. Use all pesticides only in accordance with current federal and state labels.

## Pesticide Use and Major Crops

COMPOUND	TYPE	USE/COMMENTS
INSECTICIDES <i>(continued)</i>		
soaps	soap	Controls mites, aphids, and other plant-sucking arthropods. Can be phytotoxic under certain conditions. Soap must be specifically labeled for use as an insecticide.
sulfur	inorganic	Controls mites.
vegetable oils	plant derivative	As a contact spray, controls scale insects, aphids, and mites.
FUNGICIDES		
basic copper sulfate	inorganic	Controls early and late blight, scab, blotch, bitter rot, fire blight, downy mildew, black rot, leaf spot, melanose, greasy spot, brown rot, anthracnose, angular leaf spot, and others.
Bordeaux mix	inorganic	A slurry made of hydrated lime and copper sulfate. Controls brown rot and shot hole diseases in tree fruits. Controls some grape diseases. Also controls apple scab, blotch, apple black rot, melanose, anthracnose, early and late blight of potatoes and tomatoes, downy mildew, fire blight, leaf spot, peach leaf curl, and many other fungal diseases.
copper ammonium carbonate	inorganic	Controls angular leaf spot, alternaria leaf spot, cercospora leaf spot, early and late blight, bacterial blight, common blight, anthracnose, melanose, powdery mildew, downy mildew, and others.
copper hydroxide	inorganic	Controls cercospora leaf spot, bacterial blight, septoria, leaf blotch, anthracnose, halo blight, helminthosporium, downy mildew, leaf curl, early and late blight, angular leaf spot, melanose, scab, walnut blight, and others.
copper oxychloride sulfate	inorganic	Controls peach blight, peach leaf curl, damp-off, anthracnose, fire blight, shot hole fungus, pear blight, bacterial spot, walnut blight, brown rot, celery blight, downy mildew, early and late blight of vegetables, cherry leaf spot, septoria leaf spot, powdery mildew, melanose, scab, and others.
copper sulfate	inorganic	Suppresses development of fungal and bacterial organisms such as fire blight, cercospora leaf spot, early and late blight, bacterial blight, and others.
lime sulfur	inorganic	Controls powdery mildew, anthracnose, apple scab, brown rot, peach leaf curl, and others.
sulfur	inorganic	Controls brown rot, peach scab, apple scab, powdery mildew, downy mildew, rose black spot, and others.
terramycin	antibiotic derived from a fungus	Controls certain bacterial diseases in plants.

\*Some pesticides on this list may not be currently approved for use on organically grown produce. Many materials listed in this table may no longer be registered as pesticides or their labels may restrict their use to specific pests, crops, or sites. Use all pesticides only in accordance with current federal and state labels.

## Insecticidal Chemicals Derived from Plants

INSECTICIDE	SOURCE	USES/COMMENTS
pyrethrum	Extract from dried flowers of certain chrysanthemum species.	Has contact, stomach, and fumigant poisoning action on insects. Is also toxic to cold-blooded animals. Kills aphids, mosquitoes, flies, fleas, mealybugs, cabbageworms, thrips, beetles, leafhoppers, lice, loopers, and many others. Insecticidal action is degraded rapidly by sunlight. Action is often enhanced by addition of piperonyl butoxide, a synergist.
pyrethrins	Chemical extracts of naturally occurring pyrethrum.	Similar uses as for pyrethrum. Many different pyrethrins are derived from pyrethrum. Some may have more specific action to certain insect pests and are safer to nontarget insects.
rotenone	Derived by grinding roots of of certain legume plants (68 different species). The United States supplies come primarily from roots of the cube plant.	Contact and stomach poison. Used to control beetles, weevils, slugs, loopers, mosquitoes, thrips, fleas, lice, and flies. Also used to control unwanted fish. Acts as a repellent and acaricide—nontoxic to honey bees. Rotenone is slow acting and has a short residual.
nicotine	An extract from several species of tobacco, usually used as the sulfate.	Registered for use on many types of crops. Used in greenhouses and household applications for control of aphids, thrips, leafhoppers, and other sucking insects. Kills by contact and fumigation poison activity. Toxic to people and domestic animals if used improperly. Used also to repel dogs and rabbits.
sabadilla	Obtained from the dried ripe seed of a South American lily plant.	Has contact and stomach poison action against cockroaches, several species of bugs, potato leafhopper, imported cabbageworm, house fly, thrips, and the cattle louse. Is toxic to honey bees but not highly toxic to mammals. Used on many types of tree and vine fruits, forage crops, and vegetables.
hellebore	Made from the dried rhizomes of several species of lily plants, many of which occur naturally in the United States.	Controls several types of insects but does not have high insecticidal activity. Hellebore is rapidly broken down by sunlight.
ryania	Made from the powdered roots, leaves, and stems of a native South American plant. A synergist is often used to enhance its activity.	This compound is effective against corn earworm, codling moth, German cockroach, house fly, mosquitoes, European corn borer, oriental fruit moth, and the imported cabbage worm. Ryania has low toxicity to mammals.

## Top 50 Pesticide Usage in California, 1998

Rank	Pesticide	Number of Applications	Pounds of Active Ingredient Applied
1	sulfur	188,315	78,094,920
2	oils (mineral; petroleum [unclassified])	33,859	26,738,335
3	metam-sodium	3,747	13,725,515
4	methyl bromide	9,229	13,566,206
5	copper hydroxide	58,818	5,293,976
6	glyphosate, isopropylamine salt	151,076	4,586,088
7	copper sulfate (pentahydrate)	6,165	3,371,516
8	chloropicrin	5,846	2,980,306
9	1,3-dichloropropene	836	2,911,385
10	calcium hydroxide	3,012	2,827,562
11	cryolite	10,612	2,439,360
12	sodium chlorate	6,209	2,413,051
13	chlorypyrifos	88,342	2,345,974
14	sulfuryl fluoride	3,346	2,173,338
15	maneb	49,391	1,596,876
16	ziram	9,058	1,553,810
17	captan	15,703	1,538,911
18	diuron	22,212	1,504,152
19	propargite	16,606	1,384,761
20	trifluralin	16,785	1,213,610
21	chlorothalonil	27,478	1,180,110
22	paraquat dichloride	36,449	1,045,483
23	molinate	3,430	1,006,025
24	nitrogen, liquified	137	1,003,749
25	mancozeb	23,345	987,237
26	diazinon	54,384	900,458
27	sodium tetrathiocarbonate	666	898,145
28	oryzalin	21,105	814,165
29	copper sulfate (basic)	5,347	814,077
30	simazine	23,697	794,393
31	ethephon	10,913	761,953
32	thiobencarb	2,240	724,926
33	methomyl	36,773	666,437
34	poly-i-para-menthene	66,538	656,893
35	lime-sulfur	1,909	656,157
36	phosmet	9,380	644,898
37	malathion	15,289	641,145
38	fosetyl-al	24,050	575,547
39	iprodione	37,521	571,879
40	disodium octaborate tetrahydrate	7,236	543,364
41	aldicarb	5,040	534,552
42	propanil	2,075	524,385
43	petroleum hydrocarbons	10,988	514,259
44	oxyfluorfen	43,882	501,641
45	alkylaryl poly(oxyethylene) glycol	48,313	496,087
46	s,s,s-tributyl phosphorotrithioate	3,840	439,047
47	carbaryl	9,098	426,893
48	2,4-d, dimethylamine salt	13,073	422,406
49	chlorine	159	422,252
50	pendimethalin	8,584	414,221

Top 50 Statewide Total Pounds A.I. Applied, 1998 = 192,842,436

**Top 10 Counties for Pesticide Usage in California, 2000\***

Rank	County	Lbs. AI Applied
1	Fresno	34,797,885
2	Kern	22,570,893
3	Tulare	16,457,558
4	San Joaquin	11,241,711
5	Madera	9,549,731
6	Monterey	9,044,485
7	Merced	7,621,119
8	Ventura	7,154,172
9	Imperial	7,144,584
10	Kings	<u>5,229,958</u>
	TOTAL	130,812,096
	All Other Counties	<u>56,754,837</u>
	<b>TOTAL†</b>	<b>187,566,933</b>

\*Reported uses include production agriculture and postharvest fumigation of crops, structural pest control, landscape maintenance, and other uses. Exempt from reporting are home and garden applications of pesticides, and most industrial and institutional uses.

†Because of database problems, only CalTrans data are included for Humboldt County.

**Pesticides Used on Major Crops in San Joaquin Valley**  
(from UCIPM Pest Management Guidelines)

**GRAPES**

(July 2000)

<b>PEST</b>	<b>PESTICIDE</b>
<b>INSECTS AND MITES</b>	
Webspinning Spider Mites	propargite (Omite®) fenbutatin-oxide (Vendex®) dicofol (Kelthane®) narrow range oil (Saf-T-Side®, etc.) insecticidal soaps (M-Pede®) neem oil (Trilogy®)
Leafhoppers	imidacloprid (Provado®) naled (Dibrom®) pyrethrin 6.0%/piperonyl butoxide (Pyrenone Crop Spray®) endosulfan (Thiodan®) methomyl (Lannate LV®, Lannate®) insecticidal soaps and narrow range oil carbaryl (Sevin®) dimethoate 25WP
Grape Leafroller	cryolite (Kryocide®, Prokil Cryolite®) <i>Bacillus thuringiensis</i> (various products) methomyl (Lannate LV®, Lannate®) carbaryl (Sevin®)
Omnivorous Leafroller	cryolite (Kryocide®, Prokil Cryolite®) <i>Bacillus thuringiensis</i> (various products) methomyl (Lannate LV®, Lannate®) carbaryl (Sevin®) phosmet (Imidan®) diazinon 50W
Orange Tortrix	cryolite (Kryocide®, Prokil Cryolite®) <i>Bacillus thuringiensis</i> (various products) methomyl (Lannate LV®, Lannate®) carbaryl (Sevin®)
Cutworms	carbaryl (Sevin®) methomyl (Lannate LV®, Lannate®) diazinon 50W
Grape Bud Beetle	dimethoate 25WP phosmet (Imidan®)
Pseudococcus Mealybugs	chlorpyrifos (Lorsban®) <u>PLUS</u> (optional): narrow range oil (Superior®, Supreme®) imidacloprid (Admire®) methomyl (Lannate LV®, Lannate®)
Vine Mealybug	imidacloprid (Admire®) chlorpyrifos (Lorsban®) <u>PLUS</u> (optional): narrow range oil (Superior®, Supreme®)

## Pesticide Use and Major Crops

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Grape Phylloxera	carbofuran (Furadan®) sodium tetrathiocarbonate (Enzone®)
Thrips	carbaryl (Sevin®) methomyl (Lannate®) dimethoate 25WP
Western Grapeleaf Skeletonizer	cryolite (Kryocide®, Prokil Cryolite®) <i>Bacillus thuringiensis</i> (various products) methomyl (Lannate®) carbaryl (Sevin®)
False Chinch Bug	diazinon 50WP malathion 8 spray
Branch and Twig Borer	carbaryl (Sevin®)
Hoplia	carbaryl (Sevin®)
Vinegar Flies	pyrethrin/piperonyl butoxide (Pyrenone Crop Spray®)
Sharpshooters	imidacloprid (Provado Solupak®, Admire®) dimethoate 400

### DISEASES

Botrytis Bunch Rot	cyprodinil (Vanguard®) fenhexamid (Elevate®) benomyl (Benlate®) captan 50 WP iprodione (Rovral®) DCNA (Botran®) narrow range oil (JMS Stylet®, Omni®)
Powdery Mildew	azoxystrobin (Abound®) trifloxystrobin (Flint®) tebuconazole (Elite®) ampelomyces quisqualis (AQ 10 Biofungicide®) potassium bicarbonate (Kaligreen®) myclobutanil (Rally®) fenarimol (Rubigan®) triadimefon (Bayleton®) triflumizole (Procure®) sulfur (dust, wettable, flowable, or micronized) narrow range oil (JMS Stylet Oil®) insecticidal soap (M-Pede®)
Downy Mildew	azoxystrobin (Abound®) mancozeb maneb mefenoxam + copper hydroxide (Ridomil Gold/ Copper®) basic copper sulfate 99% copper hydroxide
Phomopsis Cane and Leafspot	azoxystrobin (Abound®) ziram 76DF captan 50WP mancozeb (Dithane M-45®) sulfur—micronized dry flowable lime sulfur

## Pesticide Use and Major Crops

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Eutypa Dieback	benomyl (Benlate®)
Bot Canker	benomyl (Benlate®)
Armillaria Root Rot (Oak Root Fungus)	methyl bromide sodium tetrathiocarbonate (Enzone®)
Crown Gall	gallex
<b>NEMATODES</b>	methyl bromide metam sodium (Vapam®, Soil Prep®) sodium tetrathiocarbonate (Enzone®) 1,3-dichloropropene (Telone II®) fenamiphos (Nemacur 3®)
<b>WEEDS</b>	glyphosate (Roundup®, etc.) oryzalin (Surflan AS®) napropamide (Devrinol 50 DF®) oxyfluorfen (Goal®) diuron (Karmex®, Direx®) simazine (Princep 4L®, Princep Caliber 90®, etc.) paraquat (Gramoxone Extra®) fluazifop-p-butyl (Fusilade DX®) sethoxydim (Poast®) sulfosate (Touchdown®, Touchdown 5®) clethodim (Prism®)

## ALMONDS

(February 2001)

### PEST

### PESTICIDE

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#### INSECTS AND MITES

Navel Orangeworm	esfenvalerate (Asana XL®) narrow range oil (Omni Supreme® and others) soybean oil (Stealth NOW®) chlorpyrifos (Lorsban®) azinphosmethyl (Guthion®) phosmet (Imidan®) <i>Bacillus thuringiensis</i> (various products) aluminum phosphide
Peach Twig Borer	narrow range oil (Superior®, Supreme®) <u>PLUS:</u> diazinon <u>OR</u> methidathion (Supracide®) <u>OR</u> naled (Dibrom®) <u>OR</u> chlorpyrifos (Lorsban®) <u>OR</u> phosmet (Imidan®) <i>Bacillus thuringiensis</i> (various products) mating disruptants (CheckMate PTB®, etc.) chlorpyrifos (Lorsban®) azinphosmethyl (Guthion®) methidathion (Supracide®) spinosad (Success®)
Oriental Fruit Moth	chlorpyrifos (Lorsban®) azinphosmethyl (Guthion®) phosmet (Imidan®) carbaryl (Sevin®)
Western Tent Caterpillar	<i>Bacillus thuringiensis</i> (various products)



## Pesticide Use and Major Crops

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Ants	pyriproxyfen (Distance Fire Ant Bait) abamectin (Clinch Ant Bait) chlorpyrifos (Lorsban®)
Webspinning Spider Mites	abamectin (Angri-Mek®) galendromus occidentalis propargite (Omite®) fenbutatin-oxide (Vendex®) clofentezine (Apollo®) cinnamaldehyde (Valero®) narrow range oil (Omni Supreme® and others) pyridaben (Pyramite®)
European Red Mite	narrow range oil (Superior®, Supreme®) propargite (Omite®) fenbutatin-oxide (Vendex®) clofentezine (Apollo®)
Brown Mite	narrow range oil (Superior®, Supreme®, Omni®)
San Jose Scale	narrow range oil (Superior®, Supreme®) <u>PLUS:</u> diazinon <u>OR</u> methidathion (Supracide®) <u>OR</u> chlorpyrifos (Lorsban®) <u>OR</u> carbaryl (Sevin®) <u>OR</u> pyriproxyfen (Esteem®) chlorpyrifos (Lorsban®) methidathion (Supracide®) narrow range oil (Superior®, Supreme®)
Tree Borers	carbaryl (Sevin®) chlorpyrifos (Lorsban®)
Leaffooted Bug	carbaryl (Sevin®) chlorpyrifos (Lorsban®)
Tenlined June Beetle	methyl bromide/chloropicrin
European Fruit Lecanium	dormant oil dormant oil <u>PLUS:</u> diazinon 50WP <u>OR</u> chlorpyrifos (Lorsban®) narrow range oil (Omni Supreme® and others)
Obliquebanded Leafroller	<i>Bacillus thuringiensis</i> (various products) spinosad (Success®)

## DISEASES

Alternaria Leaf Spot	azoxystrobin (Abound®) iprodione (Rovral®) iprodione (Rovral®)/narrow range oil
Brown Rot Blossom Blight	azoxystrobin (Abound®) benomyl (Benlate®) thiophanate methyl (Topsin M®) captan (various) iprodione (Rovral®) maneb myclobutanil (Rally®)
Shot Hole	azoxystrobin (Abound®) captan (various) iprodione (Rovral®) ziram fixed copper (various)

## Pesticide Use and Major Crops

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Anthracnose	azoxystrobin (Abound®) propiconazole (Break®) captan 50W maneb 80WP myclobutanil (Rally®)
Leaf Blight	azoxystrobin (Abound®) captan (various) ziram
Scab	azoxystrobin (Abound®) captan (various) lime sulfur ziram 76DF maneb 80 benomyl (Benlate 50SP®) <u>PLUS:</u> captan <u>OR</u> ziram <u>OR</u> maneb
Crown Gall	Agrobacterium radiobacter-84 (Galltrol®, Norbac®) gallex
Rust	wettable sulfur sulfur dust
Armillaria Root Rot (Oak Root Fungus)	methyl bromide
Verticillium Wilt	methyl bromide/chloropicrin
Phytophthora Root and Crown Rot	fosetyl-al (Aliette®) mefenoxan (Ridomil Gold® EC)
Bacterial Canker	methyl bromide

### **NEMATODES**

methyl bromide

### **WEEDS**

trifluralin (Treflan®, Trilin 5®)  
glyphosate (Roundup Ultra®, etc.)  
isoxaben (Gallery T&V®)  
oryzalin (Surflan®)  
napropamide (Devrinol 50DF®)  
pendimethalin (Prowl3.3EC®)  
oxyfluorfen (Goal 2 XL®)  
simazine (Princep Caliber 90®)  
norflurazon (Solicam DF®)  
paraquat (Gramoxone Extra®)  
sethoxydim (Poast®)  
sulfosate (Touchdown®)  
2,4-D (Orchard Master®)

# COTTON

(February 2001)

PEST	PESTICIDE
<b>INSECTS AND MITES</b>	
Cotton Aphid	imidacloprid (Provado®) imidacloprid (Gaucho®) aldicarb (Temik®) endosulfan 3EC chlorpyrifos (Lorsban®) oxydemeton-methyl (Metasystox-R®) prophenofos (Curacron®) amitraz (Ovasyn®) naled (Dibrom®) methomyl (Lannate LV®) insecticidal soap (M-Pede®) narrow range oil (Saf-T-Side®, etc.) azadirachtin (Neemix®) oxamyl (Vydate®) carbofuran (Furadan®)
Silverleaf Whitefly	insect growth regulators buprofezin (Applaud®) pyriproxyfen (Knack®) endosulfan (Thiodan®) bifenthrin (Capture®) oxamyl (Vydate®) prophenofos (Curacron®) chlorpyrifos (Lorsban®) acephate (Orthene®) <u>PLUS</u> : fenpropathrin (Danitol®) amitraz (Ovasyn®) insecticidal soap (M-Pede®) narrow range oil (Saf-T-Side®, etc.) azadirachtin (Neemix®)
Cotton Bollworm	<i>Bacillus thuringiensis</i> (various products) methamidophos (Monitor®) methomyl (Lannate LV®, Lannate®)
Tobacco Budworm	<i>Bacillus thuringiensis</i> (various products) esfenvalerate (Asana XL®) prophenofos (Curacron®) amitraz (Ovasyn®) sulfur dust insecticidal soap (M-Pede®) narrow range oil (Saf-T-Side®, etc.)
Stink Bugs	endosulfan (Thiodan®)
Thrips	acephate (Orthene®)
Cutworms	chlorpyrifos (Lorsban®)
Seedcorn Maggot	chlorpyrifos (Lorsban®) lindane acephate (Orthene 80 Seed Protectant®)

## Pesticide Use and Major Crops

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Alfalfa and Cabbage Loopers	<i>Bacillus thuringiensis</i> (various products) acephate (Orthene®) methomyl (Lannate®) tebufenozide (Confirm®) indoxacarb (Steward®)
Beet Armyworm	<i>Bacillus thuringiensis</i> (various products) chlorpyrifos (Lorsban®) esfenvalerate (Asana XL®) methomyl (Lannate®) tebufenozide (Confirm®) spinosad (Success®) indoxacarb (Steward®) diflubenzuron (Dimilin®) prophenofos (Curacron®) thiodicarb (Larvin®) bifenthrin (Capture®)
Western Yellowstriped armyworm	<i>Bacillus thuringiensis</i> (various products) acephate (Orthene®) methomyl (Lannate®) spinosad (Success®) tebufenozide (Confirm®) indoxacarb (Steward®)
Saltmarsh Caterpillar	<i>Bacillus thuringiensis</i> (various products) carbaryl (Sevin®) methomyl (Lannate®) spinosad (Success®) tebufenozide (Confirm®)
Cotton Leaf Perforator	aldicarb (Temik®) esfenvalerate (Asana XL®)
Omnivorous Leafroller and False Celery Leaf-tier	carbaryl (Sevin®) methomyl (Lannate LV®, Lannate SP®)
Pink Bollworm	gossypure (NoMate PBW MEC®) chlorpyrifos (Lorsban®) cypermethrin (Ammo®) esfenvalerate (Asana XL®)
Lygus Bug	aldicarb (Temik®) dimethoate 267 methamidophos (Monitor®) oxamyl (Vydate®) methidathion (Supracide®) acephate (Orthene®) imidacloprid (Provado®) bifenthrin (Capture®) cyfluthrin (Baythroid 2®) zeta-cypermethrin (Mustang®) tralomethrin (Scout X-TRA®)
Webspinning Spider Mites	abamectin (Zephyr®) dicofol (Kelthane®) propargite (Comite®) aldicarb (Temik®) phorate (Thimet®) hexythizox (Savey®)

## **Pesticide Use and Major Crops**

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Wireworms	lindane
Leafhoppers	aldicarb (Temik®) malathion 8E methamidophos (Monitor®)
Grasshoppers	carbaryl (Sevin®) malathion 8E naled (Dibrom®)

### ***NEMATODES***

Root Knot Nematode	aldicarb (Temik®) metam-sodium (Vapam®, Soil Prep®)
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### ***DISEASES***

Pythium	metalaxyl (Apron 11.5% TL®, Apron 28.35% F®)
Rhizoctoni	carboxin/PCNB (Vitavax-PCNB 17% + 17% F®) triadimenol (Baytan®) chloroneb/TCMTB (NuFlow-ND®) myclobutanil (NuFlow-M®)
Thielaviopsis	triadimenol (Baytan®) myclobutanil (NuFlow-M®)

### ***WEEDS***

prometryn (Caparol®)  
oxyfluorfen (Goal®)  
glyphosate (Roundup Ultra®)  
paraquat (Gramoxone Extra®)  
pendimethalin (Prowl®)  
trifluralin (Treflan®)  
metam-sodium (Vapam®, Soil Prep®)  
bromoxynil (Buctril®)  
clethodim (Prism®)  
diuron (Karmex®, Direx®)  
fluazifop (Fusilade®)  
MSMA  
sethoxydim (Poast®)  
pyrithiobac sodium (Staple®)