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PESTICIDES FOR SPECIALTY CROPS

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This pamphlet is designed to help commercial growers of specialty vegetable crops select pest control measures for use against insects, weeds, and diseases in their farming operations. Many of the crops listed here are relatively new to California, and few or no pesticides may be specifically registered for use on those crops. The crop protection materials selected for use in this publication have a broad range of activity in controlling or managing most vegetable pests. It is very important that you use only those pesticides listed for your specific crop or pest, whether it be insect, weed, or disease.

We encourage you to consult a pest control professional or a University of California Cooperative Extension farm advisor for the best pest management recommendation. Safe and effective pest control relies on the proper monitoring and identification of pests and beneficial insects. Cultural and biological control measures should be considered and implemented if possible. Chemical control measures should only be used when you expect crop losses to exceed the cost of control and when other control measures are ineffective. When it comes to maximizing the benefits of pest management measures, proper timing and application methods are often as important as the choice of material.

You should also make yourself familiar with such terms as *Signal Word, Restricted Entry Interval (REI),* and *Pre-Harvest Interval (PHI).* These terms are explained below.

SIGNAL WORD

The signal word gives the user a general idea of how toxic or harmful a pesticide product is to people. The signal word always appears on the front of the label in easily seen letters.

A highly hazardous pesticide will always have the word **"DANGER"** on the label. If the pesticide is hazardous because it is highly poisonous, the label will carry the word **"POISON"** accompanied by a skull and crossbones along with **"DANGER."**

A pesticide that is moderately hazardous or toxic will have the word **"WARNING"** on the label.

The least hazardous pesticides have the word **"CAUTION"** on the label. Even these pesticides can be harmful if they are used carelessly.

RESTRICTED ENTRY INTERVAL (REI)

The Restricted Entry Interval is the period of time you must wait before it is safe to go into a field that has been treated with a particular pesticide. You should not go into the field without special protective clothing until the restricted entry period is over. This period usually lasts from 12 hours to 3 days, but it may extend to several weeks for some pesticides.

The federal REI is listed on the pesticide label under Agricultural Use or next to the crop or application method to which it applies. Keep in mind, however, that for a number of pesticides California regulations have established REIs that are longer than those found on the label. The Agricultural Commissioner in your county can provide you with a list of current California REIs. If you must enter a field before the restricted entry period is over, you must wear appropriate clothing and equipment.

PRE-HARVEST INTERVAL (PHI) STATEMENT

The Pre-Harvest Interval (PHI) is the period of time after the application of a pesticide to a crop during which harvest of that crop is prohibited. This interval is necessary to ensure that the crop will meet the established pesticide residue tolerances.

The crop or crop group you are treating must be included on the label of the pesticide that you are using.

ROTATIONAL CROP RESTRICTION

Users of any pesticide are cautioned to read the label for any restrictions on planting certain crops in the same field after using the pesticide on a current crop.

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Table 1. Pesticides for specialty crops, listed by crop (*see Table 2 for pests controlled by specific chemicals*)

Crop	Insecticides/acaricides (for insects and mites)	Fungicides (for diseases)	Herbicides (for weeds)
Amaranth	Ambush, pyrethrins, Trigard	–	–
Artichoke	Ambush, Dimilin, Neemix, Supracide	Ridomil, sulfur	Devrinol, Goal, Kerb, Poast
Asparagus	Ambush, Lannate, Malathion, oil, Sevin	Aliette, Ridomil, sulfur	Devrinol, Treflan
Basil, sweet basil	Bts, M-Pede, Neemix, Pyrellin, pyrethrins	—	Devrinol
Bean (all)	Asana, Bts, Diazinon, Dimethoate, Kelthane, Lannate, Malathion, Neemix, oil, Sevin, Thiodan	Benlate, Bravo, Champ, copper sulfate, Ridomil, Rovral, sulfur	Poast, Treflan
Bean, green (Kentucky Wonder, Blue Lake)	Bts, Dimethoate, Malathion, Sevin	Benlate, Bravo, sulfur	Dual, Eptam, Poast, Treflan
Beet	Diazinon, Malathion, Neemix, oil, Sevin	Copper sulfate, sulfur, Ridomil	Pyramin, Ro-Neet, Spin-Aid
Bitter Melon	Ambush, Neemix, Pyrellin, pyrethrins	Aliette, Ridomil	—
Bok Choy (leafy *Brassica*)	Neemix	sulfur	DCPA
Broccoli (Chinese, raab, rapini, gai lon)	Admire, Ambush, Bts, Dimethoate, Lannate, Malathion, Neemix, Provado, Sevin, Thiodan	Aliette, Benlate, sulfur, Ridomil	Poast, Prefar, Treflan
Brussels Ssprouts	Admire, Ambush, Diazinon, Lannate, Malathion, Neemix, Provado, Sevin, Thiodan	Benlate, Bravo, Champ, copper sulfate, sulfur	Prefar, Treflan
Cabbage (daigai choy, Chinese, gai choy, napa)	Admire, Ambush, Bts, Diazinon, Dimethoate, Malathion, Neemix, Provado, pyrethrins, Sevin, Thiodan	Aliette, Benlate, copper sulfate, Ridomil, sulfur	Poast, Prefar, Roundup, Treflan
Carrot	Asana, Diazinon, Lannate, Malathion, Neemix, Sevin, Thiodan, Vydate	Bravo, copper sulfate, Ridomil, sulfur	Fusilade, Treflan
Cauliflower	Admire, Ambush, Diazinon, Dimethoate, Lannate, Neemix, Provado, Sevin, Thiodan	Bravo, Champ, copper sulfate, Ridomil, sulfur	Goal, Poast, Prefar, Treflan
Chard (Swiss)	Ambush, Diazinon, Dimethoate, Lannate, Malathion, Neemix, Sevin, Trigard	—	—
Chayote root, christophenes	pyrethrins	—	—
Chive	Bts, M-Pede, Pyrellin, pyrethrins	—	—
Cilantro	Bts, pyrethrins, Neemix, Pyrellin	—	—
Cole crops (watergreen Thai green, packchoy, water spinach)	Bts, M-Pede, Malathion, Provado, Pyrellin, pyrethrins	sulfur	Treflan
Collard	Admire, Asana, Diazinon, Dimethoate, Lannate, Neemix, Provado, Sevin	sulfur	Treflan
Corn, sweet	Ambush, Asana, Bts, Diazinon, Lannate, Malathion, oil, Pyrellin, pyrethrins, Sevin, Thiodan	Bravo, sulfur	Dual, Prowl
Cucumber	Diazinon, Kelthane, Lannate, Malathion, Neemix, Sevin, Thiodan, Vydate	Benlate, Bravo, Champ, Ridomil, sulfur	Curbit, Poast, Prefar, Treflan
Cucurbit (sinqua, luffa, Chinese okra cucumber, cherry round, upo, pepinos)	Admire*, Ambush, Bts, Kelthane, pyrethrins, Sevin, Trigard	Benlate, Bravo, Ridomil, sulfur	Poast, Prefar, Treflan
Dill	Bts, Pyrellin, pyrethrins	Benlate (grown for seed)	—
Eggplant (western, Japanese, Thai)	Admire, Ambush, Asana, Bts, Lannate, Malathion, Pyrellin, pyrethrins, Sevin, Thiodan, Trilogy	copper sulfate, Manex, Ridomil, sulfur	Devrinol, Poast, Prefar, Roundup, Treflan
Garlic	Ambush, Bts, Malathion, Neemix, Pyrellin, pyrethrins	Bravo, Ridomil, Rovral, sulfur	Fusilade, Goal, Poast, Prowl
Ginger	Neemix	Ridomil	—
Ginseng	—	Aliette, Champ, Ridomil	—
Gourd, Chinese wax	Ambush, Neemix	Ridomil	—
Green (collard, mustard, rape, kale)	Admire, Ambush, Bts, Lannate, Malathion, Neemix, Provado, Sevin	Aliette, Benlate, sulfur	Poast, Treflan
Horseradish	Ambush, Malathion, Neemix, Sevin	Ridomil	—
Kale	Admire, Diazinon, Dimethoate, Lannate, Malathion, Neemix, Provado, Sevin	sulfur	Treflan
Kohlrabi	Admire, Bts, Malathion, Neemix, Provado, Pyrellin, pyrethrins, Sevin	Aliette, Benlate, Manex	Poast

*Use allowed under a Section 18. Check with your County Agricultural Commissioner regarding availability.

Continued...

Table 1. (continued; *see Table 2 for pests controlled by specific chemicals*)

Crop	Insecticides/acaricides (for insects and mites)	Fungicides (for diseases)	Herbicides (for weeds)
Leek	Bts, Diazinon, Malathion, Neemix, pyrethrins, rotenone, Sevin	Bravo, Ridomil	Poast
Lettuce, leaf	Admire, Diazinon, Dimethoate, Lannate, Malathion, Neemix, Thiodan, Trigard	Champ, copper sulfate, Ridomil, sulfur	Poast
Melon (all or unspecified)	Admire*, Ambush, Bts, Diazinon, M-Pede, Malathion, Pyrellin, pyrethrins, Sevin	Aliette, Benlate, copper sulfate, Dithane, Manex	Poast, Roundup, Treflan
Melon (Chinese winter)	Diazinon	Benlate	Roundup
Mint	Bts, Malathion, Pyrellin, pyrethrins	Bravo, sulfur	Goal, Treflan
Moagua	Ambush, pyrethrins	Aliette	—
Mushroom	Ambush, Diazinon, Malathion	—	—
Okra	Bts, Malathion, Sevin	—	Roundup, Treflan
Onion (bulbs, green, shallot)	Ambush, Bts, Diazinon, Malathion, pyrethrins	Bravo, sulfur	Goal (bulb only), Treflan (bulb only), Poast
Parsley	Ambush, Bts, Diazinon, Lannate, Malathion, Neemix, Sevin	Aliette	Prometryne, Roundup
Pea (all)	Asana, Dimethoate, Malathion, Neemix, Sevin, Thiodan	Champ, copper sulfate, Ridomil, sulfur	Poast
Pea (all sweet)	Asana, Bts, Diazinon, Lannate, Malathion, Sevin, Thiodan	sulfur	Goal, Poast, Roundup
Pea (blackeye, cowpea)	Malathion, pyrethrins, Sevin	Ridomil, sulfur	Poast, Prowl, Treflan
Pea (sugar)	Bts, Diazinon, Malathion, Sevin	sulfur	Poast, Roundup
Peanut	Asana, Bts, Diazinon, Lannate, Malathion, Omite, Pyrellin, pyrethrins, Sevin	Dithane, Bravo, copper sulfate, Ridomil, sulfur	Dual, Poast, Treflan
Pepper	Admire, Asana, Ambush (bell), Diazinon, Dimethoate, Kelthane, Lannate, Malathion, Neemix, oil, Provado, Thiodan, Trigard, Vydate	Champ, copper sulfate, Ridomil, sulfur	Devrinol, Poast, Prefar, Treflan
Pepper (bell, chili, Thai, Chinese chi, Anaheim, jalapeño, sweet, pimentos)	Admire, Ambush, Bts, Diazinon, Kelthane, Malathion, Provado, pyrethrins, Sevin	Ridomil, sulfur	Devrinol, Poast, Roundup, Treflan
Radish	Diazinon, Malathion, Neemix, Sevin	Ridomil	Treflan
Radish (daikon)	Diazinon, Pyrellin, pyrethrins	—	—
Rhubarb	Neemix	—	—
Spinach	Ambush (leafy veg), Diazinon, Dimethoate, Lannate, Malathion, Neemix, Sevin, Thiodan, Trigard	copper sulfate, Ridomil	Poast, Ro-Neet, Spin-Aid
Squash (Chinese, Peter Pan)	Ambush, Bts, Diazinon, Malathion, Sevin	Aliette, copper sulfate, Manex	Poast, Roundup
Squash (summer)	Ambush, Asana, Diazinon, Kelthane, Lannate, Malathion, Neemix, oil, Sevin, Thiodan, Vydate	Bravo, copper sulfate, Ridomil, sulfur	Poast, Prefar
Squash (winter)	Asana, Diazinon, Kelthane, Malathion, Neemix, oil, Sevin, Thiodan, Vydate	Bravo, copper sulfate, Ridomil, sulfur	Poast, Prefar
Squash (zucchini)	Diazinon, Pyrellin, pyrethrins, Sevin	Benlate, Bravo	—
Strawberry	Agri-Mek, Bts, Kelthane, Lannate, Malathion, Sevin, Thiodan, Vendex	Aliette, Benlate, Bravo, Ridomil, Rovral, sulfur, Topsin	Devrinol, Poast
Taro	pyrethrins	—	—
Tomatillo	Admire, Provado	—	Poast
Tomato	Admire, Asana, Diazinon, Dimethoate Kelthane, Lannate, Malathion, Neemix, oil, Provado, Sevin, Thiodan, Trigard, Vydate	Aliette, Benlate, Bravo, Champ, copper sulfate, Ridomil, sulfur	Devrinol, Poast, Treflan
Tomato (cherry)	Admire, Bts, Diazinon, Malathion, Provado, Pyrellin, pyrethrins, Sevin	Benlate, copper sulfate, Dithane, Manex, sulfur	Eptam, Poast, Roundup, Treflan
Turnip	Bts, Diazinon, Dimethoate Lannate, Malathion, Neemix, Pyrellin, pyrethrins, Sevin	Benlate, Ridomil, sulfur	Treflan (turnip greens only)

*Use allowed under a Section 18. Check with your County Agricultural Commissioner regarding availability.

Table 2. Pests controlled by specific insecticides/acaricides, fungicides, and herbicides (*see Table 1 for chemicals approved for use on specific crops*)

Pesticide	Signal word	Pests controlled	REI hours	PHI days
Insectide/Acaricide				
Admire (imidacloprid) (early season, soil applied)	CAUTION	aphids, flea beetles, thrips, whiteflies	0 to 12	21
Agri-Mek (abamectin)*	WARNING	serpentine leafminers, spider mites	12	3
Ambush* (permethrin)	WARNING	aphids, caterpillars, flea beetles, leafminers, squash bugs	12	0 to 30
Asana* (esfenvalerate)	WARNING	aphids, caterpillars, flea beetles, squash bugs, whiteflies	12	1 to 7
Bts (*bacillus thuringiensis,* various strains)	CAUTION	caterpillars (armyworms, cutworm, saltmarsh, hornworms)	4	0
Diazinon*	CAUTION	aphids, beetles, caterpillars, soil insects, thrips	24	3 to 21
Dimethoate	WARNING	aphids, beetles, grasshoppers, leafhoppers, lygus bugs, spider mites	48	7 to 14
Dimilin (diflubenzuron)	CAUTION	artichoke plume moth	12	1
Kelthane (dicofol)	CAUTION WARNING DANGER	spider mites	12	2 to 21
Lannate* (methomyl)	DANGER	aphids, caterpillars, leafhoppers, thrips	48	1 to 14
M-Pede (potassium soaps)	WARNING	aphids, mites, mealybug, whiteflies	12	0
Malathion	CAUTION	aphids, beetles, caterpillars, leafhoppers	12	1 to 7 (21 days, parsley)
Neemix (azadiractin)	CAUTION	aphids, caterpillars, whiteflies	12	0
Omite (propargite)	DANGER	spider mites	21 days	21
Provado (imidacloprid) (foliar applied)	CAUTION	aphids, whiteflies	12	7
Pyrellin EC	CAUTION	aphids, leafhoppers, lygus bugs	12	12 hours
Pyrethrins	WARNING	aphids, caterpillars, leafhoppers, mites, stinkbugs, thrips, whiteflies	12	0
Sevin* (carbaryl)	WARNING CAUTION	caterpillars, cutworms, flea beetles, leafhoppers, stinkbugs	12	0 to 21
Supracide* (methidathion)	WARNING	artichoke plume moth	48	2 to 21
Thiodan* (endosulfan)	DANGER	aphids, flea beetles, squash bugs, thrips, whiteflies	24	2 to 21
Trigard	CAUTION	leafminers	12	7
Trilogy (neem oil)	CAUTION	spider mites	4	0
Vendex* (fenbutatin-oxide)	DANGER	spider mites	48	1
Vydate* (oxamyl)	DANGER	aphids, leafminers, mites, whiteflies	48	1
Fungicide				
Aliette (fosetyl-al)	CAUTION	downy mildew, leather rot, phytophthora root rot, red stele	12	12 hours to 31 days (110 days, asparagus)
Benlate (benomyl)	CAUTION	anthracnose, leaf blight, powdery mildew, white mold	24	0 to 28
Bravo 500 (chlorothalonil)	WARNING	blights, common leaf spot, downy mildew, gray mold, rust	48	7 to 14 (6 weeks, blackeye peas; 80 hours, mint)
Champ (copper hydroxide)	CAUTION	blights, gray mold, white mold	24	—
copper sulfate	WARNING	anthracnose, bacterial speck, spot, and blight downy mildew, leaf spot, powdery mildew	24	0

* Restricted Use Pesticide

Continued...

Table 2. (continued; *see Table 1 for chemicals approved for use on specific crops*)

Pesticide	Signal word	Pests controlled	REI hours	PHI days
Dithane (mancozeb)	CAUTION	anthracnose, downy mildew, leaf spot, blight	24	5 to 7 (14 hours, peanut)
Manex (maneb)	CAUTION	anthracnose, blight, downy mildew, leaf spot, rust	24	7
Ridomil Gold EC (mefenoxam)	CAUTION	phytophthora, pythium	12	1 to 21
Rovral (iprodione)	CAUTION	alternaria, alternaria leaf spot, botrytis fruit rot, phomopsis soft rot, purple leaf spot, white mold	12	0 to 14
Sulfur (dusts or wettable formulations)	CAUTION	powdery mildew	24	—
Topsin (thiophanate-methyl)	CAUTION	blights, gray mold, white mold	12	1
Herbicide				
Curbit (ethalfluralin)	WARNING	pre-emergence control of broadleaf weeds and grasses (nightshades)	12	—
Devrinol^{50}DF (napropamide)	CAUTION	pre-emergence to weeds, controls many broadleaf and grass weeds	12	—
Dual (metolachlor)	CAUTION	pre-emergence to weeds, controls many broadleaf and grass weeds, nutsedge suppression	24	90 (peanut)
Eptam 7E (EPTC)	CAUTION	pre-emergence to weeds, control of many broadleaf and grass weeds	12	0 to 21
Fusilade (fluazifop)	CAUTION	postemergence to weeds, controls grass weeds only	12	—
Goal (oxyfluorfen)	WARNING	pre- and postemergence to weeds, controls many broadleaf weeds postemergence only on onion	24 24	60 (onion) 0 to 5
Kerb* (pronamide)	CAUTION	pre-emergence to weeds, control of many broadleaf and grass weeds	24	60 (artichoke)
Poast (sethoxydim)	WARNING	postemergence to weeds, controls grass weeds only	12	7–40
Prefar (bensulide)	CAUTION	pre-emergence on a wide range of grasses and some broadleaf weeds	12	—
Prometryn (prometryn)	WARNING	pre-emergence or postemergence to control broadleaf weeds (cheeseweed, burning nettle)	12	84 (parsley)
Prowl (pendimethalin)	CAUTION	pre-emergence to weeds, controls many broadleaf and grass weeds	12	60
Pyramin (pyrazon)	CAUTION	pre-emergence and postemergence to crop, controls broadleaf weeds	12	N/A
Ro-Neet (cycloate)	CAUTION	pre-emergence to weeds	12	—
Roundup (glyphosate)	WARNING CAUTION	postemergence to weeds, avoid contact on crop, controls many broadleaf, grass weeds, and perennials	4	14
Spin-Aid (phenmedipham)	WARNING	postemergence for broadleaf weeds (mustard, shepherdspurse, sowthistle)	24	40 (spinach) 60 (beets)
Treflan (trifluralin)	WARNING	pre-emergence control on a wide range of grasses and broadleaf weeds	12	—

* Restricted Use Pesticide

NOTE TO READERS

These guidelines represent the best information currently available to the authors and are intended to help you in making the best choices for an IPM program. Not all registered materials are mentioned and the registration status of pesticides may change from year to year. Always check with the label and with local Agricultural Commissioners for the most up-to-date information regarding registration, restrictions on pesticide use, and re-entry intervals. Updated information on pesticide use may also be obtained from the California State Department of Food and Agriculture, the University of California Integrated Pest Management Project and local Cooperative Extension offices. Permits for pesticide use are issued by the local Agricultural Commissioner's office and are required for the application of any pesticide on food crops grown for sale in California.

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PLANTS
PESTICIDE USE WARNING—READ THE LABEL

Pesticides are poisonous and must be used with caution. **READ THE LABEL CAREFULLY BEFORE OPENING A CONTAINER.** Precautions and directions **MUST** be followed exactly. Special protective equipment, as indicated on the label, must be used.

STORAGE. Keep all pesticides in original containers only. Store separately in a locked shed or area. Keep all pesticides out of the reach of children, unauthorized personnel, pets, and livestock. **DO NOT STORE** with foods, feeds, or fertilizers. Post warning signs on pesticide storage areas.

USE. The suggestions given in this publication are based upon best current information. Follow directions. Measure accurately to avoid residues exceeding established tolerances. Use exact amounts as indicated on the label, or use lesser amounts as suggested in this publication. Use a pesticide only on crops, plants, or animals shown on the label.

CONTAINER DISPOSAL and TRANSPORTATION. Consult your county agricultural commissioner for correct procedures for rinsing and disposing of empty containers. Do not transport pesticides in vehicles with foods, feeds, clothing, or other materials, and never in a closed cab with the vehicle driver.

RESPONSIBILITY. The grower is legally responsible for proper use of pesticides, including drift to other crops or properties, and for excessive residues. Pesticides should not be applied over streams, rivers, ponds, lakes, runoff irrigation, or other aquatic areas, except where specific use for that purpose is intended.

BENEFICIAL INSECTS. Many pesticides are highly toxic to honey bees and other beneficial insects. The farmer, the beekeeper, and the pest control industry should cooperate closely to keep losses of beneficial species to a minimum.

PROCESSED CROPS. Some processors will not accept a crop treated with certain chemicals. If your crop is going to

a processor, be sure to check with the processor before making a pesticide application.

POSTING TREATED FIELDS. When worker safety re-entry intervals are established, be sure to keep workers out and post the treated areas with signs when required, indicating the safe re-entry date.

PERMIT REQUIREMENTS. Many pesticides require a permit from the county agricultural commissioner before possession or use. When such compounds are recommended in this publication, they are marked with an asterisk (*).

PLANT INJURY. Certain chemicals may cause injury or give less than optimum pest control if used at the wrong stage of plant development, in certain soil types, when temperatures are too high or too low, when the wrong formulation is used, and when excessive rates or incompatible materials are used.

PERSONAL SAFETY. Follow label directions exactly. Avoid splashing, spilling, leaks, spray drift, or clothing contamination. **DO NOT** eat, smoke, drink, or chew while using pesticides. Provide for emergency medical care in advance.

FOR MORE INFORMATION

You'll find detailed information on many aspects of pest control and pesticide handling in these and other UC ANR publications:

The Safe and Effective Use of Pesticides, publication 3324
Integrated Pest Management for Cole Crops and Lettuce, publication 3307
UC IPM Pest Management Guidelines, publication 3339

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