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INSECT PEST MANAGEMENT FOR COMMERCIAL VEGETABLE CROPS

- In August 1999, the United States Environmental Protection Agency (US EPA) announced changes in labeling for methyl parathion (PennCap-M) and azinphosmethyl (Guthion). Most uses of PennCap-M on fruits and vegetables were eliminated. In the year 2000, the only vegetable crops on which it may be used are beets, onions, white potatoes, and sweet corn. The final details of label changes for azinphosmethyl on vegetables were not available as this publication was prepared in September of 1999; growers are advised to consult current labels and the *Illinois Fruit and Vegetable News* (newsletter) for instructions on uses in the year 2000.
- The pyrethroid insecticide bifenthrin (Capture) was labeled recently for use on sweet corn, peas, beans, broccoli, Brussels sprouts, cabbage, cauliflower, Chinese cabbage, kohlrabi, cucumbers, muskmelon, watermelon, summer and winter squash, and eggplant. Capture is effective against a range of insect pests in these crops and will be particularly useful in the control of squash bug in cucurbits and corn earworm, European corn borer, and fall armyworm in sweet corn. Capture is a restricted-use insecticide. On the initial label governing Capture's use on vegetable crops, restricted-entry intervals (REIs) for workers are longer than for many insecticides. These intervals may be revised, so growers are advised to check current information during the 2000 crop season. To protect workers and themselves, growers MUST obey the legal REI.
- The insect growth regulator tebufenozide (Conform) is now labeled for use on crops listed under a cole crop grouping (including broccoli, Brussels sprouts, cabbage, bok choy, Napa cabbage, cauliflower, collards, kale, kohlrabi, mizuna, and mustard greens), a leafy vegetables grouping (including amaranth, celery, endive, lettuce, parsley, radicchio, rhubarb, spinach, and Swiss chard), and a fruiting vegetables grouping (including eggplant, pepper, and tomato). Conform is active against the larvae of Lepidoptera (caterpillars); target pests include looper, armyworm, European corn borer, and imported cabbageworm.
- The insecticide spinosad (SpinTor) was labeled for use in 1999 on cole crops, leafy greens, eggplant, peppers, tomatoes, and tomatillos. New labeling for SpinTor allows its use on potatoes, sweet corn, and sweet potatoes as well. SpinTor is effective against several Lepidopterous larvae (caterpillars) and against Colorado potato beetle larvae, thrips, and leafminers. It acts primarily as an acetylcholine mimic in much the same way as nicotine and imidacloprid (Admire and Provado) do.
- Wherever possible to use a substitute, Table 1 lists a botanical or microbial insecticide if one is reasonably effective against the target pest. The use of microbial and botanical insecticides is allowed by most certification programs that cover organic production.
- *Vegetable Insect Management—with Emphasis on the Midwest*, an illustrated 200-page book published in 1995, should be particularly useful to Illinois vegetable growers. For information or to order, contact Meister Publishing, (800)572-7740.
- The University of Illinois produces a newsletter covering timely issues in commercial fruit and

The information in this chapter is provided for educational purposes only. Product trade names have been used for clarity, but reference to trade names does not imply endorsement by the University of Illinois; discrimination is not intended against any product. The reader is urged to exercise caution in making purchases or evaluating product information.

Label registrations can change at any time. Thus the recommendations in this chapter may become invalid. The user must read carefully the entire, most recent label and follow all directions and restrictions. Purchase only enough pesticide for the current growing season.

vegetable production and pest management. *The Illinois Fruit and Vegetable News* is published weekly during the crop season and periodically in the off-season, for a total of 25 issues per year. For more information on subscriptions, contact Rick Weinzierl at (217)333-6651 or weinzier@uiuc.edu.

Insect control is a major concern for commercial vegetable producers. Processors, grocers, and most consumers do not purchase insect-damaged or insect-contaminated produce. At the same time, processors, distributors, and consumers are concerned about pesticide residues; they want to know that the health benefits provided by eating vegetables are not offset by any possible risks posed by pesticides that remain on fresh produce. To meet simultaneous demands for maximum pest control and minimum pesticide residues, careful selection and use of insecticides are essential steps in commercial vegetable production.

The guidelines in this chapter are not intended for use by home gardeners. Commercial producers should be trained and equipped to handle a variety of pesticides, including some that are highly toxic. Because few home gardeners are similarly trained or equipped, and because yield and cosmetic standards are not rigorous for the backyard garden, home gardeners are advised to choose among insecticides that are generally less hazardous to store, mix, and apply. A guide to insecticides for yard and garden use is presented in a separate publication. Call or write Marketing and Publications, 1917 S. Wright Street, Champaign, IL 61820; (217)333-2007.

Most of the information contained here is presented in table format. Table 1 lists the registered insecticides that are most likely to control specific target pests in specific commodities in Illinois. Information on the safety and effectiveness of individual insecticides was evaluated to develop these lists; not all registered and legal uses are presented in Table 1.

Table 3 provides a more complete list of insecticides registered for use on vegetables; it also summarizes mandatory preharvest intervals (the time that must elapse between final application and harvest) for applications to specific crops. Check individual product labels for additional restrictions, such as the use of crop residues (tops, trimmings, stalks, and so forth) for livestock feed. Certain insecticides listed in Table 3 are not among the best choices for the control of Illinois vegetable pests, but they are registered and may be used legally. Consequently, the information in Table 3 may be useful where drift, overspray, or other contamination is a concern.

Pesticides may be identified by common chemical names (not capitalized) or by trade names (capital-

ized). Because one or more manufacturers may assign different trade names to products containing the same active ingredient, two or more commercial insecticides may be virtually identical. The tables in this chapter list insecticides by common chemical names with trade names in parentheses.

Where insecticides must be used, several important steps help to ensure safety and effectiveness. Applicators must read and follow label instructions. Labels specify maximum application rates, maximum number of applications, and the preharvest interval. Labels also specify the crops on which an insecticide may be applied; application to crops or sites not specified on the label is illegal and can result in fines or imprisonment or both. To document the legal use of insecticides, producers should keep records of insecticide applications for every field. For restricted-use pesticides, these records must include (1) the brand or product name and US EPA registration number for the pesticide applied; (2) the total amount of the product (formulated product, not active ingredient) applied; (3) the location of the application; (4) the size of the treated area; (5) the crop, commodity, or site treated; (6) the month, day, and year of application; and (7) the name and certification or license number of the applicator. Although these record-keeping rules cover only restricted-use pesticides, we strongly urge applicators to keep complete records on all pesticide applications.

Pesticides classified for restricted use (identified in the tables by asterisks) may be purchased only by a licensed private or commercial pesticide applicator and applied only by or under the direct supervision of a licensed applicator. The Illinois Department of Agriculture (IDA) is responsible for testing and licensing pesticide applicators; contact an IDA or Extension office for information on training and examination programs. Farmers may apply general-use pesticides (not restricted) according to label directions without obtaining a private applicator's license. Whenever any pesticide is used, applicators must take proper safety precautions to prevent excessive or unnecessary exposures that might endanger themselves, other workers, or family members. After pesticides are applied, reentry restrictions must be observed.

The list of insecticides registered for use on specific crops may change at any time during the year. Label changes are announced through newsletters and other media. Producers should also check with an Extension office for information updates.

In addition to the use of insecticides, integrated pest management programs for vegetable insects should include appropriate cultural practices (such as the selection of resistant varieties, the purchase of

insect-free transplants, and the destruction of crop residues after harvest) and the use of alternatives to chemical insecticides when possible. Although using effective cultural and biological control options does not eliminate the need for conventional insecticides, the application of such products can be reduced on farms where an integrated approach is practiced.

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Table 1. Insecticides recommended for the control of insects in commercial vegetable crops

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
ASPARAGUS			
Asparagus beetle	Treat spears during the harvest season if infestations exceed 5 to 10 adults per 100 crowns or if eggs are present on more than 2% of the spears. Treat ferns postharvest if infestations exceed 5 to 10 adults per 10 crowns.		
	carbaryl (Sevin)	1 to 2 lb	1 day.
	chlorpyrifos (Lorsban)	1 lb	1 day.
	malathion	1 lb	1 day.
	*methomyl (Lannate)	0.45 to 0.90 lb	1 day.
	methoxychlor	1 to 2 lb	3 days.
	*permethrin (Ambush or Pounce)	0.05 to 0.1 lb	1 day. Do not exceed 0.4 lb a.i./acre/season.
	rotenone	Follow label directions.	1 day.
Cutworms	Treat spears when infestations exceed 1 larva per 10 crowns.		
	chlorpyrifos (Lorsban)	1 lb	1 day.
	*methomyl (Lannate)	0.45 to 0.90 lb	1 day.
	*permethrin (Ambush or Pounce)	0.1 lb	1 day. Do not exceed 0.4 lb a.i./acre/season.
Asparagus aphid	Rarely a serious pest in the Midwest. Treat ferns with chlorpyrifos, malathion, or rotenone as listed for asparagus beetle or with azadirachtin (Align or Neemix) according to product labels.		
BEANS			
Seed maggot	chlorpyrifos (Lorsban 50SL)	2 oz/100 lb seed	Seed treatment.
	diazinon 50WP	0.5 oz/bu seed	Apply as a planter-box treatment. Alternatively, purchase seed that has been pretreated. Seed treatments should not be applied earlier than 90 days before planting.
Bean leaf beetle	Peak numbers of beetles occur in late May to early June, then again in August to September. Treat seedlings if defoliation is severe. After establishment, plants withstand moderate defoliation and suffer no loss in yield. Control even light infestations after pods form to prevent cosmetic damage from feeding scars.		
	acephate (Orthene)	0.5 to 1.0 lb	14 days. (0 days for lima beans.) Do not use treated vines for feed.
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	1 lb	3 days.
	dimethoate	0.25 to 0.5 lb	0 days. Do not use treated vines for feed.
	methoxychlor	0.5 to 1.5 lb	3 days. 7-day PHI for feeding treated vines to livestock.
	rotenone	0.4 lb	1 day.
Potato leafhopper	Treat if populations exceed 1 adult per sweep or 1 nymph per 10 leaves. For plants smaller than the 2-true-leaf stage, treat if counts exceed 1 adult per 2 sweeps.		

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
BEANS (CONT.)			
Potato leafhopper (cont.)	*bifenthrin (Capture)	0.025 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	1 lb	3 days.
	dimethoate	0.25 to 0.5 lb	0 days. Do not use treated vines for feed.
	endosulfan (Thiodan)	0.5 to 1 lb	3 days. Do not use treated vines for feed.
	*esfenvalerate (Asana)	0.03 lb	3 days. Do not exceed 0.2 lb a.i./acre/season. Do not use treated vines for feed.
	malathion	1 lb	1 day.
	*methomyl (Lannate)	0.45 lb	3 days. 7-day PHI for feeding treated vines to livestock.
Mexican bean beetle	methoxychlor	0.5 to 1 lb	3 days. 7-day PHI for feeding treated vines to livestock.
	acephate (Orthene)	0.5 to 1 lb	14 days. (0 days for lima beans.) Do not use treated vines for feed.
	carbaryl (Sevin)	1 lb	3 days.
Aphids	malathion	0.5 to 1 lb	1 day.
	acephate (Orthene)	0.5 to 1 lb	14 days. (0 days for lima beans.) Do not use treated vines for feed.
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	dimethoate	0.25 to 0.5 lb	0 days. Do not use treated vines for feed.
Corn earworm	malathion	1 lb	1 day.
	*methomyl (Lannate)	0.45 lb	3 days. 7-day PHI for feeding treated vines to livestock.
	Treat if pheromone-baited cone traps consistently capture earworm moths (more than 5 to 10 per night) and egg laying in beans is likely. Moths are most likely to deposit eggs in beans if surrounding corn fields are not silking.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	1.5 lb	3 days.
European corn borer	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.2 lb a.i./acre/season. Do not use treated vines for feed.
	*methomyl (Lannate)	0.45 lb	3 days. 7-day PHI for feeding treated vines to livestock.
	Operate one or more light traps beginning 1 to 2 weeks before bloom and until 1 week before harvest. If light traps capture more than 25 moths per night, begin insecticide applications when the first inch-long beans are present. Apply Lannate at 2- to 3-day intervals, Orthene or Pennncap-M at 5- to 7-day intervals. Larvae that hatch in the last 2 or 3 days before harvest will not mature enough to enter pods.		
	acephate (Orthene)	1 lb	14 days. Do not use treated vines for feed.
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	*methomyl (Lannate)	0.45 lb	3 days. 7-day PHI for feeding treated vines to livestock. Must be applied at 2- to 3-day intervals.
	*methyl parathion (Pennncap-M)	0.5 lb to 1 lb	3 days.
Spider mites	Mite outbreaks are rare in beans under sprinkler irrigation; outbreaks may occur late in the season during prolonged dry periods.		
	dimethoate	0.25 to 0.5 lb	0 days. Do not use treated vines for feed.
	*bifenthrin (Capture)	0.08 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
BEANS (CONT.)			
Whitefly	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact whiteflies to be effective.
Sprays of bifenthrin (Capture), dimethoate, endosulfan (Thiodan), esfenvalerate (Asana), or methomyl (Lannate) as listed for leafhopper or aphid control may also control whiteflies. Efficacy is likely to vary according to specific insecticide resistance levels in separate whitefly populations.			
PEAS			
Caterpillars, including loopers	In peas grown for processing, check for loopers and other larvae 10 days before harvest. If including loopers, treat if counts exceed 1 larva per 25 sweeps during the period 10 to 21 days before harvest to prevent contamination.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.1 lb a.i./acre/season. Do not use treated vines for feed.
	*methomyl (Lannate)	0.45 to 0.9 lb	1 day. 5-day PHI for livestock forage; 14-day PHI for pea-vine hay.
Aphids, including pea aphid	Treat if counts exceed 1 pea aphid per pod or 10 per sweep during the period 15 to 35 days before harvest.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	3 days. Do not exceed 0.20 lb a.i./acre/season.
	dimethoate	0.17 lb	0 days. 21-day PHI if treated vines are to be used for livestock feed. Limit of 1 application per season.
	*esfenvalerate (Asana)	0.015 to 0.03 lb	3 days. Do not exceed 0.1 lb a.i./acre/season. Do not use treated vines for feed.
	*methomyl (Lannate)	0.45 to 0.90 lb	1 day. 5-day PHI for livestock forage; 14-day PHI for pea-vine hay.
BROCCOLI, BRUSSELS SPROUTS, CABBAGE, AND CAULIFLOWER			
Cabbage maggot	Use in-furrow or broadcast applications of diazinon or Dyfonate at or just before planting. Use drenches of diazinon or Lorsban during transplanting. Diazinon resistance has been observed in some areas.		
	chlorpyrifos (Lorsban)	1.6 to 2.4 fl oz 4EC in 50 gal water/1,000 row ft of broccoli, Brussels sprouts, or cabbage 1.6 to 2.8 fl oz 4EC in 50 gal water/1,000 row ft of cauliflower	30 days. Apply to soil at base of transplants immediately after setting.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
BROCCOLI, BRUSSELS SPROUTS, CABBAGE, AND CAULIFLOWER (CONT.)			
Cabbage maggot (cont.)	diazinon	0.25 to 0.5 pt AG500 or 0.25 to 0.5 lb 50WP in 50 gal water. Use 0.5 to 1 cup per plant.	Apply to soil at base of transplants immediately after setting.
	diazinon *fonofos (Dyfonate)	3 lb 2 lb	Broadcast and incorporate before planting. Broadcast and incorporate before planting.

Scouting for aphids and foliage-feeding caterpillars: Check 5 to 10 randomly selected plants in each of 5 to 10 or more areas per field. For each plant, record the presence of any live larvae of diamondback moth, cabbage looper, or imported cabbage worm; classify each plant as infested or uninfested (note which pest species); for each plant also record whether or not aphids are present. Sample fields once or twice per week. Treat if the percent of plants infested by caterpillars exceeds the following levels for specific stages of development.

Broccoli and cauliflower:		Cabbage:	
Seedbed	10%	Seedbed	10%
Transplant to first flower or first curd	50%	Transplant to cupping	30%
Flower bud or curd to harvest	10%	Cupping to early head	20%
		Mature head	10%

Other scouting guidelines have also been proposed; contact the University of Illinois Department of Crop Sciences at (217)333-6651 for more information. Aphid control is recommended for cabbage whenever aphid colonies are detected. Control often can be delayed in broccoli and cauliflower until “clean-up” is necessary just before heading to prevent contamination at harvest. Aphid control in seedbeds is especially important for all these crops.

Aphids	diazinon	0.5 lb	7 days broccoli, Brussels sprouts, and cauliflower; 21 days cabbage. Do not exceed 5 applications per season
	dimethoate	0.25 to 0.5 lb	7 days for broccoli and cauliflower; 3 days for cabbage. Do not use on Brussels sprouts.
	endosulfan (Thiodan)	1 lb	7 days for broccoli and cabbage; 14 days for Brussels sprouts and cauliflower. Do not exceed 2 applications per season.
	imidacloprid (Provado)	0.05 lb	7 days. Allow at least 7 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	insecticidal soap	1.25 fl oz 49% concentrate/50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	naled (Dibrom)	1 lb	1 day.

Cabbage looper; diamondback moth; imported cabbage worm

Thorough coverage is important; some labels recommend wetting agents. In some areas, diamondback moth has become resistant to endosulfan, methomyl, permethrin, and other compounds; resistance levels vary within the state and locally. Use *Bt* products, especially before heading, to preserve natural enemies of caterpillars and aphids and to minimize problems from diamondback moth resistance to other insecticides.

*azinphosmethyl (Guthion)	0.5 to 0.75 lb	15 days for broccoli and cauliflower; 7 days for Brussels sprouts; 21 days for cabbage. Do not exceed 3 applications per season. WP formulations are not restricted use.
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Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
BROCCOLI, BRUSSELS SPROUTS, CABBAGE, AND CAULIFLOWER (CONT.)			
	<i>Bacillus thuringiensis</i> <i>kurstaki</i> or <i>aizawai</i> (<i>Bt</i>) (Agree, Biobit, Cutlass, Dipel, Javelin, MVP, XenTari, and others) *bifenthrin (Capture)	Follow label directions. 0.033 to 0.10 lb	0 days. Kills only the caterpillar stage; must be eaten by larvae to be effective. <i>Bt</i> products are less effective against large (older) cabbage loopers than against younger loopers and other caterpillars. 7 days. Do not exceed 0.50 lb a.i./acre/ season.
	*cypermethrin (Ammo) endosulfan (Thiodan)	0.05 to 0.1 lb 1 lb	1 day. Do not exceed 0.6 lb a.i./acre/season. 7 days for broccoli and cabbage; 14 days for Brussels sprouts and cauliflower. Do not exceed 2 applications per season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not use on Brussels sprouts. Do not exceed 0.4 lb a.i./acre/season. Not labeled for diamondback moth.
	*lambda-cyhalothrin (Warrior)	0.015 to 0.03 lb	1 day for broccoli and cabbage. Do not exceed 0.24 lb a.i./acre/season. Do not apply to Brussels sprouts or cauliflower.
	*methamidophos (Monitor)	0.5 to 1 lb	14 or 21 days for broccoli; 14 days for Brussels sprouts; 28 days for cauliflower; 35 days for cabbage.
	*methomyl (Lannate)	0.23 to 0.9 lb	3 days for broccoli, Brussels sprouts, cauli- flower; 1 day for cabbage. Also aids in aphid control.
	*permethrin (Ambush, Pounce)	0.05 to 0.1 lb for broccoli, Brussels sprouts, and cauliflower; 0.05 to 0.2 lb for cabbage.	1 day. Do not exceed 0.8 lb a.i./acre/sea- son on broccoli, Brussels sprouts, and cauliflower. Do not exceed 1 lb a.i./ acre/season on cabbage.
	spinosad (SpinTor)	0.023 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. See label for further restrictions for resistance management.
	thiodicarb (Larvin)	0.4 to 1 lb	7 days. Do not use on Brussels sprouts. Do not exceed 6 lb a.i./acre/season.
	tebufenozide (Confirm)	0.09 to 0.12 lb	7 days. Do not exceed 0.84 lb a.i./acre/ season. NOT labeled against diamondback moth.
	*tralomethrin (Scout Xtra)	0.016 to 0.024 lb	5 days. Broccoli only; do not apply to cabbage, Brussels sprouts, or cauliflower. Do not exceed 0.2 lb a.i./acre/season.
	*zeta-cypermethrin (Mustang)	0.03 to 0.05 lb	1 day. Cabbage only; do not apply to broc coli, Brussels sprouts, or cauliflower. Do not exceed 0.3 lb a.i./acre/season.
Cutworm	*bifenthrin (Capture)	0.033 to 0.10 lb	7 days. Do not exceed 0.50 lb a.i./acre/ season.
	chlorpyrifos (Lorsban)	1 lb	21 days. Do not exceed 6 applications per season. Use 50W formulation. Do not mix with other pesticides or apply in extreme heat or drought.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Apply as basal spray after planting if cutworm damage occurs. Do not use on Brussels sprouts. Do not exceed 0.4 lb a.i./ acre/season.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
BROCCOLI, BRUSSELS SPROUTS, CABBAGE, AND CAULIFLOWER (CONT.)			
Cutworm (cont.)	*lambda-cyhalothrin (Warrior)		0.015 to 0.025 lb 1 day for broccoli and cabbage. Do not exceed 0.24 lb a.i./acre/season. Do not apply to Brussels sprouts or cauliflower.
Flea beetle	Critical stages for control: seedlings and transplants. Except for <i>Bacillus thuringiensis</i> , insecticides used to control cabbage looper and other caterpillars also control flea beetles.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	7 days. Do not exceed 0.50 lb a.i./acre/season.
	carbaryl (Sevin)	0.5 to 1 lb	3 days.
	imidacloprid (Provado)	0.05 lb	7 days. Allow at least 7 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	rotenone	0.4 lb	1 day.
Onion thrip	Thrips control may be necessary in cabbage as heads begin to form. Capture, Cygon, or Monitor as used for aphid control also gives some control of thrips. See Table 2 for varietal susceptibility to thrips damage.		
	*cypermethrin (Ammo)	0.075 to 0.1 lb	1 day. Do not exceed 0.6 lb a.i./acre/season.
	*zeta-cypermethrin (Mustang)	0.04 to 0.05 lb	1 day. Cabbage only; do not apply to broccoli, Brussels sprouts, or cauliflower. Do not exceed 0.3 lb a.i./acre/season.
RADISHES AND TURNIPS (ROOTS)			
Cabbage maggot	Use in-furrow applications at planting for radishes and turnips. Also apply a diazinon drench to turnips 30 days after planting.		
	chlorpyrifos (Lorsban)	1 fl oz 4E or 33 oz 15G/1,000 row ft	Apply only at planting. Use 4E as a drench (minimum of 40 gal water/acre); place 15G in seed furrow.
	diazinon	0.5 lb	14 days. For turnips, apply as a drench over the row 30 days after planting. Also controls flea beetles.
	diazinon	2.5 oz 14G/1,000 row ft	Apply only at planting; place in seed furrow.
Aphid and flea beetle	carbaryl (Sevin)	1 lb	7 days. Does not control aphids.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days for radishes. Allow at least 7 days between applications. Do not exceed 5 applications per season. Not for aphid control. Do not apply to turnips.
	diazinon	0.5 lb	14 days.
	dimethoate	0.25 lb	14 days. Turnips only. May not control flea beetles.
	insecticidal soap	1.25 fl oz 49% concentrate/50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	malathion	1 lb	7 days. Not labeled against flea beetles.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
COLLARDS, KALE, MUSTARD GREENS, AND TURNIP GREENS			
Aphid	Treat seedlings if aphid densities exceed 1 per plant; treat established plants if aphid densities exceed 4 to 10 per plant.		
	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	diazinon	0.5 lb	10 days for collards, kale, and mustard greens. 14 days for turnip. Do not exceed 5 applications per season.
	dimethoate	0.25 lb	14 days.
	endosulfan (Thiodan)	0.75 lb	21 days. Use 2EC formulation. Apply only once a season. Do not use on turnips grown for roots.
	imidacloprid (Admire)	See label for rates per linear foot of row based on row spacings.	21 days. Apply to soil as a band or furrow treatment at bedding or seeding, post-seeding drench, as a side-dress, or in trickle irrigation. Do not use on turnips grown for tops or roots.
	imidacloprid (Provado)	0.05 lb	7 days for collards, kale, and mustard greens. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season. Do not apply to turnips grown for tops or roots.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	naled (Dibrom)	1 lb	1 day for collards and kale. Do not apply to mustard greens or turnip greens.
Cutworm	carbaryl (Sevin)	2 lb	14 days.
	chlorpyrifos (Lorsban)	1 lb	21 days. Collards and kale only. Use 50W formulation. Do not exceed 6 applications per season. Do not mix with other pesticides or apply in extreme heat or drought.
Leafhopper	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	carbaryl (Sevin)	0.5 to 1 lb	14 days.
	dimethoate	0.25 lb	14 days.
	malathion	1 lb	7 days.
	methoxychlor	0.5 to 1 lb	14 days for collards, kale, and turnip greens. 7 days for turnip roots. Do not apply to mustard greens.
Cabbage looper; diamond back moth; imported cabbage worm	For most commercial markets, treat if 5% of plants are infested with larvae of any of these species. Higher infestation levels may be tolerated, depending on market demands. Thorough coverage is necessary; some labels recommend wetting agents. In some areas, diamondback moth has become resistant to endosulfan, methomyl, permethrin, and other compounds; resistance levels vary within the state and locally. Use <i>Bt</i> products, especially when plants are small, to preserve natural enemies of caterpillars and aphids and to minimize problems from diamondback moth resistance to other insecticides.		
	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
COLLARDS, KALE, MUSTARD GREENS, AND TURNIP GREENS (CONT.)			
Cabbage looper; diamondback moth; imported cabbage worm (cont.)	<i>Bacillus thuringiensis</i> <i>kurstaki</i> or <i>aizawai</i> (<i>Bt</i>) (Agree, Biobit, Cutlass, DiPel, Javelin, MVP, XenTari, and others)	Follow label directions.	0 days. Kills only the caterpillar stage; must be eaten by larvae to be effective. <i>Bt</i> products are less effective against large (older) cabbage loopers than against younger loopers and other caterpillars.
	diazinon	0.5 lb	10 days for collards, kale, and mustard greens. 14 days for turnip greens (and roots). Do not exceed 5 applications/season.
	endosulfan (Thiodan)	0.75 lb	21 days. Use 2EC formulation. Apply only once per season. Do not use on turnips grown for roots.
	*methomyl (Lannate)	0.45 to 0.9 lb	10 days. Also aids in aphid control.
	methoxychlor	0.5 to 1 lb	14 days for collards, kale, and turnip greens. 7 days for turnip roots. Do not apply to mustard greens.
	naled (Dibrom)	1 to 2 lb	1 day. Do not apply to mustard greens or turnip greens.
	*permethrin (Ambush, Pounce)	0.05 to 0.1 lb	1 day for collards and turnip greens. Do not apply to kale or mustard greens. Do not exceed 8 applications to collards or 4 applications to turnip greens per season.
	spinodosad (SpinTor)	0.023 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. Label does not include turnips grown for roots. See label for further restrictions for resistance management.
	tebufenozide (Confirm)	0.09 to 0.12 lb	7 days. Do not exceed 0.84 lb a.i./acre/season. NOT labeled against diamondback moth. NOT labeled for use on turnips grown for tops or roots.
Flea beetle	Except for <i>Bacillus thuringiensis</i> , insecticides used to control cabbage looper and other caterpillars also kill flea beetles.		
	carbaryl (Sevin)	1 lb	14 days.
	imidacloprid (Provado)	0.05 lb	7 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season. Do not use on turnips grown for tops or roots.
	rotenone	See product label.	1 day for collards. Do not apply to kale, mustard greens, or turnip greens.
HORSERADISH			
Diamondback moth	Populations build in late summer but rarely warrant control. Horseradish tolerates substantial feeding (removal of greater than 30% of leaf tissue) by diamondback moth without reduction in yield (root growth). If treatment is warranted, thorough coverage is necessary; some labels recommend wetting agents. In some areas, diamondback moth has become resistant to endosulfan, methomyl, permethrin, and other compounds; resistance levels vary within the state and locally. Use <i>Bt</i> products to preserve natural enemies of caterpillars and aphids and to minimize problems from diamondback moth resistance to other insecticides.		
	<i>Bacillus thuringiensis</i> <i>kurstaki</i> or <i>aizawai</i> (<i>Bt</i>) (Agree, Biobit, Cutlass, DiPel, Javelin, MVP, XenTari, and others)	Follow label directions.	0 days. Kills only the caterpillar stage; must be eaten by larvae to be effective.
	*permethrin (Pounce, Ambush)	0.1 lb	22 days. Do not exceed 3 foliar applications per season.
Beet leafhopper	Beet leafhopper transmits the brittle root pathogen. Treat if more than a few beet leafhoppers are collected in the area before mid-August.		
	*methomyl (Lannate)	0.45 lb	65 days.
	*permethrin (Ambush, Pounce)	0.1 lb	22 days. Do not exceed 3 foliar applications per season.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
HORSERADISH (CONT.)			
Imported crucifer weevil	*permethrin (Ambush, Pounce)	0.1% a.i. solution	At planting. Treat if sets are infested or fields have a history of weevil damage. Soak sets 30 minutes and air dry before planting.
	*permethrin (Ambush, Pounce)	0.2 lb	22 days. Examine crowns in early August. Apply foliar spray if adult weevil populations exceed 1 to 3 per 10 plants, or use weevil history to determine potential for damage. Do not exceed 3 foliar applications per season.
LEAF LETTUCE, SPINACH, AND SWISS CHARD			
Aphid and leafminer	Treat seedlings if aphid densities exceed 1 per plant; treat established plants if aphid densities exceed 4 to 10 per plant. Treat seedlings for leafminer control if eggs or mines are present on 50% of the plants; as plants near harvest, treat to limit mines to no more than 5% of the leaves.		
	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	diazinon	0.25 to 0.5 lb	14 days.
	dimethoate	0.25 lb	14 days.
		0.75 to 1 lb	14 days for leaf lettuce; 21 days for spinach. Do not apply to Swiss chard. Do not exceed 6 lb a.i./acre/season on lettuce or 1 application/per season on spinach.
	endosulfan (Thiodan), imidacloprid(Admire)	See label for rates per linear row ft based on row spacings.	21 days. Apply to soil as a band or in-furrow treatment at bedding or seeding, as a post-seeding drench, as a side-dress, or in trickle irrigation. Do not use on Swiss chard.
	imidacloprid (Provado)	0.05 lb	7 days for leaf lettuce. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season. Do not use on Swiss chard.
	insecticidal soap	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. For aphid control. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	spinosad (SpinTor)	0.094 to 0.156 lb	1 day. For leafminer control (not aphids). Do not exceed 0.45 lb/acre/crop. See label for further resistance management restrictions.
	Leafhopper	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
carbaryl (Sevin)		0.5 to 1 lb	14 days.
dimethoate		0.25 lb	14 days.
malathion		1 lb	14 days for leaf lettuce; 7 days for spinach and Swiss chard.
methoxychlor		0.5 to 1 lb	14 days for lettuce and spinach. Do not use on Swiss chard.
Caterpillars, including loopers	See comments under "Broccoli. . ." regarding diamondback moth resistance to endosulfan, methomyl, and permethrin.		
	<i>Bacillus thuringiensis kurstaki</i> or <i>Aizawai</i> (<i>Bt</i>) (Agree, Biobit, Cutlass, DiPel, Javelin, MVP, XenTari, and others)	Follow label directions.	0 days. Kills only the caterpillar stage; must be eaten by larvae to be effective.
	*methomyl (Lannate)	0.45 to 0.9 lb	7 days for spinach; 10 days for lettuce and Swiss chard. Also aids in aphid control.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 2.0 lb a.i./acre/season. Do not feed or graze treated plants.
	spinosad (SpinTor)	0.062 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. See label for further resistance management restrictions.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
LEAF LETTUCE, SPINACH, AND SWISS CHARD (CONT.)			
Caterpillars, including loopers (cont.)	tebufenozide (Confirm)	0.09 to 0.12 lb	7 days. Do not exceed 0.84 lb a.i./acre/season.
	thiodicarb (Larvin)	0.4 to 0.75 lb	14 days. Do not exceed 1.5 lb a.i./acre/season.
Flea beetle	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	carbaryl (Sevin)	1 lb	14 days.
	methoxychlor	0.5 to 1 lb	14 days for lettuce and spinach. Do not apply to Swiss chard.
	rotenone	See product label.	1 day for lettuce and spinach. Do not apply to Swiss chard.
CARROTS			
Cutworm	*cyfluthrin (Baythroid)	0.025 lb	0 days. Allow at least 7 days between applications. Do not exceed 5 applications per season.
	diazinon	2 to 4 lb	Broadcast and incorporate just before planting in fields that have a history of frequent cutworm damage.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	7 days. Do not exceed 0.5 lb a.i./acre/season.
Aster leafhopper	Control aster leafhoppers only to reduce aster yellows, the disease that they transmit. Contact the Department of Crop Sciences, University of Illinois, (217)333-6651, for information on leafhopper infectivity and varietal susceptibility to aster yellows.		
	carbaryl (Sevin)	1 to 1.5 lb	7 days.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Allow at least 7 days between applications. Do not exceed 5 applications per season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	7 days. Do not exceed 0.5 lb a.i./acre/season.
	*methomyl (Lannate) methoxychlor	0.45 to 0.9 lb 2 lb	1 day. 7 days for roots; 14 days for tops.
Aphid	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	diazinon	0.5 lb	14 days.
Carrot weevil adults	*cyfluthrin (Baythroid)	0.044 lb	0 days. Allow at least 7 days between applications. Do not exceed 5 applications per season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	7 days. Do not exceed 0.5 lb a.i./acre/season.
CUCUMBERS, MELONS, PUMPKINS, AND SQUASH			
To reduce bee kill in vine crops, apply insecticides only late in the day after blossoms have closed.			
Striped and spotted cucumber beetles	Control striped and spotted cucumber beetles to prevent bacterial wilt in cucumbers and melons. In these crops, treat if beetle infestations exceed 0.1 to 1 per plant. In squash and pumpkins, treat if infestations exceed 5 beetles per plant.		
	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	carbaryl (Sevin)	1 lb	3 days. Sevin XLR is the formulation of carbaryl that is least toxic to honey bees.
	carbaryl plus feeding attractants (Adios, SLAM)	0.065 lb carbaryl	3 days. Low toxicity to honey bees.
	*carbofuran (Furadan)	Use 2.4 oz Furadan 4F/1,000 row ft.	Band-apply to soil at planting.
	methoxychlor	0.5 to 1.5 lb	7 days; 1 day if less than 0.875 lb a.i./acre is applied.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	0 days. Do not exceed 1.6 lb a.i./acre/season.
	rotenone	See product label.	1 day.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
CUCUMBERS, MELONS, PUMPKINS, AND SQUASH (CONT.)			
Aphid	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	diazinon	0.5 lb	7 days for cucumbers and summer squash; 3 days for melons and winter squash. Do not apply to pumpkins.
	dimethoate	0.25 lb	3 days, melons only. Do not apply to cucumbers, pumpkins, or squash.
	endosulfan (Thiodan)	0.5 to 1 lb	2 days for cucumbers, melons, and squash; 1 day for pumpkins. Do not exceed 3 lb a.i./acre/year. Also controls cucumber beetles; aids in controlling squash bug and squash vine borer.
	insecticidal soap	1.25 fl oz 49% (M-Pede) concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	malathion	1 lb	1 day for cucumbers, melons, and squash; 3 days for pumpkins.
Squash bug	Treat when first eggs begin to hatch (around June 15 to July 15) if infestations exceed 1 to 1.5 egg masses per plant. Treat when squash bug nymphs are young because registered insecticides are not very effective against older nymphs or adults.		
	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.25 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.2 lb	0 days. Do not exceed 1.6 lb a.i./acre/season.
	sabadilla	5 lb, or see product label.	1 day.
Leafhopper	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	dimethoate	0.25 lb	3 days, melons only. Do not apply to cucumbers, pumpkins, or squash.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.25 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.2 lb	0 days. Do not exceed 1.6 lb a.i./acre/season.
Squash vine borer	When vines begin to run, scout twice weekly for red and black clear-winged moths and for entrance holes and frass. Treat as soon as early damage occurs and again 5 to 7 days later. Then continue scouting; treat as soon as new damage is noted.		
	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	carbaryl (Sevin)	1 lb	3 days. Use Sevin XLR to minimize bee kill.
	endosulfan (Thiodan)	0.5 to 1.5 lb	2 days. Do not exceed 3 lb a.i./acre/season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.25 lb a.i./acre/season.
	methoxychlor	0.5 to 1 lb	7 days. 1 day if less than 0.875 lb a.i./acre.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.6 lb a.i./acre/season.
	rotenone	See product label.	1 day.
Pickeworm	Begin weekly sprays in mid-August if damage begins to occur. Not a common problem.		
	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	carbaryl (Sevin)	1 lb	3 days. Use Sevin XLR to minimize bee kill.
	endosulfan (Thiodan)	0.5 to 1 lb	2 days for cucumbers, melons, and squash; 1 day for pumpkins. Do not exceed 3 lb a.i./acre/season. Also controls cucumber beetles; aids in controlling squash bug and squash vine borer.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	3 days. Do not exceed 0.25 lb a.i./acre/season.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
CUCUMBERS, MELONS, PUMPKINS, AND SQUASH (CONT.)			
Mite	*abamectin (Agri-Mek)	0.01 to 0.02 lb	7 days. Do not exceed 0.056 lb a.i./acre/season.
	*bifenthrin (Capture)	0.08 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	dicofol (Kelthane)	0.35 to 0.6 lb	2 days. Apply in 40 to 100 gal water/acre.
	dimethoate	0.25 lb	3 days, melons only. Do not apply to cucumbers, pumpkins, or squash.
Cutworm	Treat young plants if infestations exceed 1 to 2 larvae per 100 plants.		
	*bifenthrin (Capture)	0.04 to 0.10 lb	3 days. Do not exceed 0.30 lb a.i./acre/season.
	*esfenvalerate (Asana)	0.05 lb	3 days. Do not exceed 0.25 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	0 days. Do not exceed 1.6 lb a.i./acre/season.
Whitefly	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use enough spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact whiteflies to be effective.
Sprays of bifenthrin (Capture), dimethoate (for melons only), endosulfan (Thiodan), or esfenvalerate (Asana) as listed for leafhopper or aphid control also may control whiteflies. Efficacy is likely to vary according to specific insecticide resistance levels in separate whitefly populations.			
ONIONS			
Onion maggot	Practice crop rotation to reduce onion maggot attack. Use soil insecticides at planting as furrow or broadcast applications. Populations in some areas may be resistant to diazinon. Foliar sprays for adult suppression are not effective.		
	chlorpyrifos (Lorsban)	1 lb	In-furrow at planting (granular or EC formulations).
	diazinon	1 lb	Preplant broadcast. Incorporate 1 to 2 in. by disking.
	*fonofos (Dyfonate)	2 to 4 lb	In-furrow at planting.
Thrip	Check for thrips as bulbs begin to form. Thresholds vary from 10 to 25 per plant for susceptible varieties to as many as 45 per plant for more tolerant varieties. Onion varieties that are more susceptible to thrips injury include Brown Beauty 20, Colorado 6, Early Red Stockton, Mambo, Red Baron, Redman, Sweet Perfection, Tango, Valdez, and White Delight. Moderately tolerant varieties include El Charro, Snow White, Vega, X 201, and Zapotec. A more tolerant variety is White Keeper. Where insecticides are needed, treat during early bulb stage. Infestations are greatest in hot, dry weather. Direct ground-applied sprays to the center of plants. Wetting agents are recommended.		
	*azinphosmethyl (Guthion)	0.5 lb	28 days for dry onions; 14 days for green onions. Do not exceed 3 applications per season. 25W and 2S formulations are not restricted use. Some thrips populations are resistant.
	*cypermethrin (Ammo)	0.08 to 0.1 lb	7 days. Dry bulb onions only. Do not exceed 0.5 lb a.i./acre/season.
	diazinon	0.5 lb	14 days.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	14 days. Do not exceed 0.24 lb a.i./acre/season.
	malathion	1 lb	3 days.
	*methomyl (Lannate)	0.45 lb	7 days.
	*methyl parathion (PennCap-M)	0.5 lb	15 days.
	*permethrin (Ambush, Pounce)	0.15 to 0.3 lb	1 day. Dry bulb onions only. Do not exceed 2.4 lb a.i./acre/season.
	*zeta-cypermethrin (Mustang)	0.04 to 0.05 lb	7 days. Bulb onions only. Do not exceed 0.25 lb a.i./acre/season.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
PEPPERS			
Aphid	Use the insecticides below to control aphids where colonies are building. Insecticides are not effective for preventing or controlling aphid-borne viral diseases in peppers.		
	acephate (Orthene)	0.5 to 1 lb	7 days.
	dimethoate	0.25 lb	0 days.
	endosulfan (Thiodan)	0.5 to 1 lb	1 day at low rate; 4 days at high rate. Do not exceed 2 applications per season.
	imidacloprid (Admire)	See label for rates based on row spacings.	21 days. Apply to soil as a band or in-furrow treatment at bedding or seeding, as a post-seeding drench, as a side-dress, or in trickle irrigation.
	imidacloprid (Provado)	0.05 lb	0 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	*methomyl (Lannate)	0.45 lb	3 days.
European corn borer	Treat at about 5-day intervals when peppers are fruiting if light traps are capturing more than 5 to 10 European corn borer moths per night. Likelihood of damage is reduced if nearby corn is suitable for corn borer egg laying.		
	acephate (Orthene)	1 lb	7 days.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	7 days. Allow at least 7 days between applications. Do not exceed 0.26 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.2 lb	3 days. Do not exceed 1.6 lb a.i./acre/season.
	spinosad (SpinTor)	0.062 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. See label for further resistance management restrictions.
	tebufenozide (Confirm)	0.09 to 0.25 lb	7 days. Do not exceed 1.0 lb a.i./acre/season.
Flea beetle, Colorado potato beetle	acephate (Orthene)	0.5 lb	7 days.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	7 days. Do not exceed 0.35 lb a.i./acre/season. Early season pest.
	imidacloprid (Admire)	See label for rates based on row spacings.	21 days. Apply to soil as a band or in-furrow treatment at bedding or seeding, as a post-seeding drench, as a sidedress, or in trickle irrigation.
	rotenone	See product label.	1 day.
	spinosad (SpinTor)	0.035 to 0.070 lb	1 day. Do not exceed 0.45 lb a.i./acre/season.
Whitefly	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	imidacloprid (Admire)	See label for rates based on row spacings.	21 days. Apply to soil as a side-dress or in trickle irrigation in late season as whiteflies appear.
	imidacloprid (Provado)	0.05 lb	0 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact whiteflies to be effective.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
POTATOES			
Colorado potato beetle; cutworm; flea beetle; potato leafhopper	Populations of Colorado potato beetle are resistant to one or more insecticides in most areas. Field kits for detecting insecticide resistance are available from Michigan State University. Contact the University of Illinois Department of Crop Sciences at (217)333-6651 for information. If registered insecticides fail to give control, switch to another insecticide class. Rotate crops to delay infestations.		
	Suggested thresholds for potato pests:		
	Colorado potato beetle—For spring adults on young plants, 20 to 30% defoliation; or, more conservatively, 2 adults per plant. Summer larvae and summer adults, during bloom, 5 to 10% defoliation, 5 larvae per plant, or 3 to 5 adults per plant.		
	Cutworms and loopers—For summer foliage feeding, prebloom, 4 per foot of row; postbloom, 8 per foot of row.		
	Green peach aphid—30 per 100 leaves.		
	Potato aphid—50 per 100 leaves.		
	Potato leafhopper—2 adults per sweep or 1 adult per sweep plus 15 nymphs per 25 leaves.		
	Tarnished plant bug (Lygus bug)—1 per sweep.		
	Miscellaneous defoliators—20% defoliation at flowering; more damage is tolerable before and after bloom.		
	*abamectin (Agri-Mek)	0.01 to 0.02 lb	14 days. Do not exceed 2 applications per crop. Use at least 20 gal water per acre. Do not feed or graze treated foliage.
	<i>Bacillus thuringiensis</i> <i>san diego</i> (= <i>Bt tenebrionis</i>) (Foil, M-Trak, Novodor)	Follow label directions.	0 days. For Colorado potato beetle only. These strains of <i>Bt</i> kill only the early larval stages; they will not kill adults.
	carbaryl (Sevin)	2 lb (cutworms: 4 lbs)	0 days.
	*carbofuran (Furadan)	0.5 to 1 lb	14 days. Do not apply more than 8 times per season. Not labeled for cutworms.
	cryolite (Kryocide and others)	10 to 12 lb	0 days. Do not exceed 96 lb/acre/season.
	endosulfan (Thiodan)	0.5 to 1 lb	1 day. Do not exceed 6 applications or 6 lb a.i./acre/season.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	7 days. Do not exceed 0.35 lb a.i./acre/season.
	imidacloprid (Admire)	0.18 to 0.31 lb	Apply at planting to seed pieces in seed furrow or according to label as a bedding, side-dress, or hilling application. Rate varies with row spacing.
	imidacloprid (Provado)	0.05 lb	7 days. Allow at least 7 days between applications. Do not exceed 0.2 lb a.i./acre/season. Do not use Provado as a foliar spray if Admire was used at planting.
	methoxychlor	0.5 to 1 lb	0 days.
	*oxamyl (Vydate)	2 to 4 lb	In seed furrow at planting in a minimum of 20 gal water/acre.
		0.5 to 1 lb	7 days. Foliar spray.
	*permethrin (Ambush, Pounce)	0.05 to 0.2 lb	7 days. Do not exceed 2.4 lb a.i./acre/season.
	*phorate (Thimet G)	2 to 3 lb	90 days. Place at side(s) of row at planting, but not in direct contact with seed pieces. Low rate on light soils; high rate on heavier soils; do not use on muck soils. Not labeled for cutworms. Also aids in aphid control.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
POTATOES (CONT.)	phosmet (Imidan)	1 lb	7 days. For machine-harvested fields only.
	rotenone	Follow label directions.	1 day. For Colorado potato beetle and flea beetles.
	spinosad (SpinTor)	0.047 to 0.094 lb	7 days. Do not exceed 0.33 lb a.i./acre/season. May be applied by chemigation.
Aphid	dimethoate	0.25 to 0.5 lb	0 days. Also controls leafhoppers.
	endosulfan (Thiodan)	0.5 to 1 lb	1 day. Do not exceed 6 applications or 6 lb a.i./acre/season.
	imidacloprid (Provado)	0.05 lb	7 days. Allow at least 7 days between applications. Do not exceed 0.2 lb a.i./acre/season. Do not use Provado as a foliar spray if Admire was used at planting.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/ 50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	*methomyl (Lannate) *oxamyl (Vydate)	0.45 to 0.9 lb 0.5 to 1 lb	6 days. Also controls leafhoppers and flea beetles. 7 days. Foliar spray.
Blister beetles	carbaryl (Sevin)	0.5 to 1 lb	0 days.
	rotenone	Follow label directions.	1 day.
Wireworm and white grub	*phorate (Thimet G)	2 to 3 lb	90 days. Place at side(s) of row at planting but not in direct contact with seed pieces. Low rate on light soils; high rate on heavier soils; do not use on muck soils.
Dyfonate also is labeled for wireworm control but not for white grubs.			
SWEET CORN			
Corn rootworm	Crop rotation (with corn following any crop except corn) prevents root damage from corn rootworms. (See Chapter 1 for exceptions to this rule.) Apply a soil insecticide if corn is planted in the same field as last year <i>and</i> no earworm/corn-borer control programs were followed. (Where foliar insecticides were used fairly often for earworms or corn borers in sweet corn, they also controlled rootworm beetles and prevented egg laying.)		
	chlorpyrifos (Lorsban G)	1 lb	In-furrow or band at planting.
	*cyfluthrin plus tebupirimphos (Aztec)	See label.	In-furrow or band at planting.
	fonofos (Dyfonate G)	1 lb	In-furrow or band at planting.
	*phorate (Thimet G)	1 lb	In-furrow or band at planting.
	*tefluthrin (Force 1.5G and 3G)	See label for rates based on row spacings.	In-furrow or band at planting.
	*terbufos (Counter G)	1 lb	In-furrow or band at planting.
Cutworm	Use postemergence sprays at the 3- to 5-leaf stage if 3% of plants are cut and cutworms are still feeding. Ground applications to the base of plants are most effective.		
	chlorpyrifos (Lorsban)	1 to 1.5 lb	35 days.
	*cyfluthrin (Baythroid)	0.0125 to 0.025 lb	0 days. No more than 10 applications/crop.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
SWEET CORN *cont.)			
Cutworm (cont.)	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.2 lb a.i./acre/season.
Flea beetle	Use varieties that are resistant to Stewart's wilt to reduce the threat of flea beetles.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	1 day. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	1 to 2 lb	2 days.
	*carbofuran (Furadan)	2.5 fl oz Furadan 4F/1,000 row ft	Apply in furrow at planting. Apply if overwintering flea beetle populations are high and varieties that are susceptible to Stewart's wilt must be used.
	chlorpyrifos (Lorsban)	1 to 1.5 lb	35 days.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.2 lb a.i./acre/season.
Japanese beetle	Control beetles if silk clipping threatens pollination. Ground-applied sprays directed to the ear zone are most effective. Sprays (except <i>Bt</i>) used for corn earworm or European corn borer also control Japanese beetle if it is present.		
	carbaryl (Sevin)	1 lb	2 days.
European corn borer	Because sweet corn–planting dates vary over a period of several weeks, a range of plant stages may be attacked by first- and second-generation borers (usually in June, then late July to August, respectively). Plant maturity at the time of attack (not the generation of corn borer) determines the type of damage and the appropriate insecticides for control. See also the insecticides listed for corn earworm control if applications are to be made during silking.		
Whorl-stage corn	Scout for shot-hole feeding on leaves and for larvae in whorls. Treat during late whorl if more than 15% of plants show larval feeding. Treat before larvae bore from the whorl into the stalk.		
	<i>Bacillus thuringiensis kurstaki</i> (<i>Bt</i>) (Biobit, Cutlass, DiPel, Javelin, MVP, and others)	Follow label directions.	0 days. Apply granules by air or ground and liquids by ground sprays with nozzles directly over the whorl. <i>Bt</i> kills only larvae, not adult moths; Bt does not adequately protect sweet corn if attack occurs during tasseling and ear formation.
	*bifenthrin (Capture)	0.033 to 0.10 lb	1 day. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	2 lb	2 days. Not as effective as other insecticides listed here.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Not more than 10 applications per crop.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.2 lb a.i./acre/season. Apply every 5 days as needed.
	spinosad (SpinTor)	0.047 to 0.094 lb	1 day. Do not exceed 0.45 lb a.i./acre/season. May be applied by chemigation.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
SWEET CORN (CONT.)			
European corn borer (cont.) <i>Tassel emergence through harvest</i>	Observe light traps for corn borer moths. Treat if counts exceed 50 moths per trap per night. Treat every 5 to 7 days until 10 to 12 days before harvest.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	1 day. Do not exceed 0.20 lb a.i./acre/season.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Not more than 10 applications/crop.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*methomyl (Lannate)	0.23 to 0.45 lb	0 days. 3 days for forage or grazing. Re-treat at 1- to 3-day intervals. Apply by ground with sprays directed to ear zone.
	*methyl parathion (PennCap-M)	0.5 to 1 lb	3 days. 12 days forage or grazing. Avoid treating during pollen shed to reduce bee injury. (Not highly effective against corn earworm.)
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.2 lb a.i./acre/season. Apply every 5 days as needed.
	spinosad (SpinTor)	0.047 to 0.094 lb	1 day. Do not exceed 0.45 lb a.i./acre/season. May be applied by chemigation.
Corn earworm	<i>Fresh-market corn:</i> If traps are capturing earworm moths, treat at 2- to 5-day intervals from first silk until 90% or more of the silks are brown (usually 4 to 6 applications). <i>Processing corn:</i> If pheromone traps capture more than 10 moths/trap/night, treat at 3- to 6-day intervals from first silk until 90% of the silks are brown.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	1 day. Do not exceed 0.20 lb a.i./acre/season.
	carbaryl (Sevin)	2 lb	2 days. Apply by ground to ear zone. During pollen shed, apply late in the day to reduce bee kill. Sevin XLR is less hazardous to bees than Sevin wettable powder.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Not more than 10 applications per crop.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day. Do not exceed 0.5 lb a.i./acre/season. Apply by ground to ear zone.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*methomyl (Lannate)	0.23 to 0.45 lb	0 days. 3 days for forage or grazing. Apply by ground to ear zone.
	*permethrin (Ambush, Pounce)	0.1 to 0.2 lb	1 day. Do not exceed 1.2 lb a.i./acre/season. Apply by ground to ear zone.
	spinosad (SpinTor)	0.047 to 0.094 lb	1 day. Do not exceed 0.45 lb a.i./acre/season. May be applied by chemigation.
Sap beetle and picnic beetle	carbaryl (Sevin)	2 lb	2 days. During pollen shed, apply late in the day to reduce bee kill. Sevin XLR is less hazardous to bees than Sevin wettable powder.
	diazinon	1 lb	7 days.
	malathion	1 lb	5 days.
Corn leaf aphid	malathion	1 lb	5 days.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
SWEET CORN (CONT.)			
Fall armyworm	*cyfluthrin (Baythroid)	0.044 lb	0 days. Not more than 10 applications per crop.
	*lambda-cyhalothrin (Warrior)	0.03 lb	1 day. Do not exceed 0.48 lb a.i./acre/season.
	*methomyl (Lannate)	0.45 lb	0 days; 3 days for forage or grazing. Apply by ground to ear zone.
	spinosad (SpinTor)	0.023 to 0.094 lb	1 day. Do not exceed 0.45 lb a.i./acre/season. May be applied by chemigation.
SWEET POTATOES			
Wireworm	chlorpyrifos (Lorsban)	2 lb	Broadcast and immediately incorporate before planting.
	diazinon	3 to 4 lb	Broadcast and immediately incorporate before planting.
Flea beetle	carbaryl (Sevin)	1 to 2 lb	0 days. See label for notes on sweet potato weevil control.
	endosulfan (Thiodan)	0.5 lb	1 day. Do not exceed 3 applications or 3 lb a.i./acre/season. See label for notes on sweet potato weevil control.
Sweet potato weevil	Notify the University of Illinois Department of Crop Sciences, (217)333-6651, if the sweet potato weevil, a serious pest in southern states, is detected in Illinois fields.		
TOMATOES AND EGGPLANTS			
Cutworm	Treat transplants if infestations exceed 1 larva per 10 plants.		
	carbaryl (Sevin)	2 lb	3 days.
	*cyfluthrin (Baythroid)	0.044 lb	0 days. Allow 7 days between applications. Do not exceed 6 applications per season. Do not apply to eggplant.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day for tomato; 7 days for eggplant. Do not feed or graze treated vines. Do not exceed 0.5 lb a.i./acre/season.
	*lambda-cyhalothrin (Warrior)	0.015 to 0.025 lb	5 days for tomato and tomatillo. Do not exceed 0.36 lb a.i./acre/season. Do not apply to eggplant.
	*methomyl (Lannate)	0.45 lb	1 day for tomato; 5 days for eggplant.
	spinosad (SpinTor)	0.023 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. See label for further resistance management restrictions.
	tebufenozide (Confirm)	0.09 to 0.25 lb	7 days. Do not exceed 1.0 lb a.i./acre/season.
Flea beetles	Treat if infestations exceed 2 beetles per 10 leaves.		
	*bifenthrin (Capture)	0.033 to 0.10 lb	7 days. Do not exceed 0.20 lb a.i./acre/season. Eggplant only; not for use on tomatoes.
	carbaryl (Sevin)	2 lb	3 days.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day for tomato; 7 days for eggplant. Do not feed or graze treated vines. Do not exceed 0.5 lb a.i./acre/season.
	*lambda-cyhalothrin (Warrior)	0.015 to 0.025 lb	5 days for tomato and tomatillo. Do not exceed 0.36 lb a.i./acre/season. Do not apply to eggplant.
	methoxychlor	0.5 to 1.5 lb	7 days; 1 day if less than 0.875 lb a.i./acre is applied.
	rotenone	See product label.	1 day.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
TOMATOES AND EGGPLANTS (CONT.)			
Aphid	Treat if 25 to 50% of plants are infested by wingless aphids; count only wingless aphids that indicate colonies have started.		
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Allow 7 days between applications. Do not exceed 6 applications per season. Do not apply to eggplant.
	diazinon	0.25 lb	1 day for tomato. Do not apply to eggplant.
	dimethoate	0.25 lb	7 days for tomato. Do not apply to eggplant.
	imidacloprid (Provado)	0.05 lb	0 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact aphids to be effective.
	malathion	1 lb	1 day for tomato; 3 days for eggplant.
	*methomyl (Lannate)	0.45 to 0.9 lb	1 day for tomato; 5 days for eggplant.
Corn earworm; European corn borer; hornworm; cabbage looper	Treat to control corn earworm (tomato fruitworm) when tomatoes are fruiting and pheromone-baited cone traps capture 20 or more moths per night. Treatment may be delayed if no eggs are present on leaves. Moths deposit few eggs in tomatoes if nearby corn is silking.		
	<i>Bacillus thuringiensis kurstaki</i> or <i>aizawai</i> (Bt) (Agree, Biobit, Cutlass, DiPel, Javelin, MVP, XenTari, and others)	Follow label directions.	0 days. Kills caterpillar stage (larvae) only, not adult moths; larvae must eat treated foliage.
	*bifenthrin (Capture)	0.033 to 0.10 lb	7 days. Do not exceed 0.20 lb a.i./acre/season. Eggplant only; not for use on tomatoes.
	carbaryl (Sevin)	2 lb	3 days.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days for tomato. Allow at least 7 days between applications. Do not exceed 0.26 lb a.i./acre/season. Do not use on eggplant.
	*esfenvalerate (Asana)	0.03 to 0.05 lb	1 day for tomato; 7 days for eggplant. Do not feed or graze treated vines. Do not exceed 0.5 lb a.i./acre/season.
	*lambda-cyhalothrin (Warrior)	0.015 to 0.025 lb	5 days for tomato and tomatillo. Do not exceed 0.36 lb a.i./acre/season. Do not use on eggplant.
	*methomyl (Lannate)	0.45 to 0.9 lb	1 day for tomato; 5 days for eggplant.
	spinosad (SpinTor)	0.062 to 0.125 lb	1 day. Do not exceed 0.45 lb/acre/crop. See label for further restrictions for resistance management.
	tebufenozide (Confirm)	0.09 to 0.25 lb	7 days. Do not exceed 1.0 lb a.i./acre/season. Not labeled against corn earworm/tomato fruitworm.
Colorado potato beetle	*abamectin (Agri-Mek)	0.01 to 0.02 lb	7 days for tomato Do not exceed 0.056 lb a.i./acre/season. Do use on eggplant.
	*bifenthrin (Capture)	0.033 to 0.10 lb	7 days. Do not exceed 0.20 lb a.i./acre/season. Eggplant only; not for use on tomatoes.

Table 1. Insecticides recommended for the control of insects in commercial vegetable crops (cont.)

Crop, pest	Insecticide	Rate (a.i./acre)	Preharvest interval (PHI), comments
TOMATOES AND EGGPLANTS (CONT.)			
Colorado potato beetle (cont.)	carbaryl (Sevin)	1 to 2 lb	3 days.
	*cyfluthrin (Baythroid)	0.025 to 0.044 lb	0 days. Allow 7 days between applications. Do not exceed 6 applications per season. Do not use on eggplant.
	diazinon	0.5 lb	1 day for tomato. Do not use on eggplant.
	*esfenvalerate (Asana)	0.05 lb	1 day for tomato; 7 days for eggplant. Do not feed or graze treated vines. Do not exceed 0.5 lb a.i./acre/season.
	imidacloprid (Provado)	0.03 to 0.05 lb	0 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	*lambda-cyhalothrin (Warrior)	0.02 to 0.03 lb	5 days for tomato. Do not exceed 0.36 lb a.i./acre/season. Do not use on eggplant.
	spinosad (Spin Tor)	0.035 to 0.070 lb	1 day. Use against larvae. Do not exceed 0.45 lb/acre/crop. See label for further resistance management restrictions.
Spider mite	*abamectin (Agri-Mek)	0.01 to 0.02 lb	7 days for tomato. Do not use on eggplant.
	*bifenthrin (Capture)	0.10 to 0.80 lb	1 day. Do not exceed 0.20 lb a.i./acre/season.
	dicofol (Kelthane MF)	0.5 to 0.75 lb	2 days for tomato. Do not exceed 2 applications per season. Do not use on eggplant.
	dimethoate	0.25 lb	7 days for tomato. Do not use on eggplant.
Fruit fly and picnic beetle	Late-season pests (August to October). Treat to prevent fruit damage if pests are present.		
	carbaryl (Sevin)	2 lb	3 days.
	diazinon	0.5 lb	1 day for tomato. Do not apply to eggplant.
Whitefly	azadirachtin (Align, Neemix)	10 to 20 g (See labels.)	0 days.
	endosulfan (Thiodan)	0.5 to 1 lb	2 days. Do not exceed 6 applications or 3 lb a.i./acre/season.
	imidacloprid (Admire)	See label for rates based on row spacings.	21 days. Apply to soil as a side-dress or in trickle irrigation in late season as whiteflies appear.
	imidacloprid (Provado)	0.5 lb	0 days. Allow at least 5 days between applications. Do not exceed 0.24 lb a.i./acre/season.
	insecticidal soap (M-Pede)	1.25 fl oz 49% concentrate/50 gal water (See comments.)	0 days. Use sufficient spray to wet all infested plant surfaces. Rotate sprays or rinse foliage to avoid more than 3 consecutive sprays. Must contact whiteflies to be effective.
Sprays of bifenthrin (Capture) (eggplant only), dimethoate, esfenvalerate (Asana), or methomyl (Lannate) as listed for aphid or flea beetle control also may control whiteflies. Efficacy is likely to vary according to specific insecticide-resistance levels in separate whitefly populations.			

*Use restricted to certified (licensed) applicators only.

Table 2. Cabbage variety selection guidelines to thrips tolerance*Fresh-Market Varieties' Tolerance*

Minimum	Minimum to moderate	Moderate	Maximum
Charmont Market Prize Princess Protector (Quisto, Safekeeper) Solid Blue 690 SuperDaneb Supergreen	Conquest Grand Prize Showboat Superette Superpack ^a	Field Rocketa Ruby Ball (red) Solid Blue 780 Super Red 80 ^b Superelite	zalsoa Rio Verde Ruby Perfection (red) Solid Blue 770a

Storage Varieties' Tolerance

Minimum	Minimum to moderate	Moderate	Moderate to maximum	Maximum
Dakota Excel Lannox President Reeds Storage Hyb 4	Straton	Autoro (red) Bingo Bisleta Dacama Extra Ergon Fidello Green Winter Hinova Multitona Poldark Polinius Strukton	Pennant Picus	Aranaa Bantly Brutus Galaxya Horizonta Lotusa Manricoa Provitaa Starski Stonar Zerlina

Kraut and Slaw Varieties' Tolerance

Minimum	Minimum to moderate	Moderate	Moderate to maximum	Maximum
Hitoma Marvelton Predena Superdane	Atria Carlton Orbit Rodolfo Roundup Sagitta Superatta	Cacilea Grand Prize Hinova	Falcon	Bravo Ferry Morse 356a Grand SLAM ^a Izaicoa King Cole Little Rock Pete 63880 Reed's Hybrid 14 Rio Granda Royal Vantagea Superkraut Titanic 90

Note: Information adapted from Cornell University, Ithaca, NY, and the University of Minnesota.

^aBased on one trial.

^bBased on field observations in Minnesota.

Table 3. Minimum preharvest intervals (in days) of common insecticides registered for use on vegetable crops

	*abamectin (Agri-Mek)	acephate (Orthene)	azadirachtin (Align, Neemix)	*azinphosmethyl (Guthion)	<i>Bacillus thuringiensis aizawai</i>	<i>Bacillus thuringiensis kurstaki</i>	<i>Bacillus thuringiensis san diego</i>	*bifenthrin (Capture)	carbaryl (Sevin)	*carbofuran (Furadan)	chlorpyrifos (Lorsban)	cryolite (Kryocide)	*cyfluthrin (Baythroid)	*cypermethrin (Ammo)	diazinon (D-Z-N)	dicofol (Kelthane)	dimethoate	disulfoton (Di-Syston)	endosulfan (Thiodan)	*esfenvalerate (Asana)
Asparagus	0	...	0	0	...	...	1	...	1	...	...	...	...	...	...	...	...	...
Beans (snap)	...	14	0	...	0	0	...	3	3	...	...	...	...	...	7	7	0	...	3	3
Beets	0	...	0	0	...	...	3	...	...	...	...	...	14	...	...	...	...	...
Broccoli	0	15	0	0	...	7	3	...	21	S	...	...	7	...	7	...	7	3
Brussels sprouts	...	14	0	7	0	0	...	7	3	...	21	...	...	...	7	...	...	...	14	...
Cabbage	0	21	0	0	...	7	3	...	21	S	...	1	21	...	3	...	7	3
Carrots	0	...	0	0	...	...	7	...	...	...	0	...	14	...	...	...	7	7
Cauliflower	...	14	0	15	0	0	...	7	3	...	21	S	...	...	7	...	7	...	14	3
Celery	7	21	0	14	0	0	...	...	14	...	...	...	...	...	...	...	...	...	4	...
Chinese cabbage	0	...	0	0	...	7	14	...	21	...	...	...	10	...	...	...	...	3
Collards	0	...	0	0	...	...	14	...	21	S	...	...	10	...	14	...	21	7
Cucumber	7	...	0	1	0	0	...	3	3	P	...	X	...	7	7	...	...	2	2	3
Eggplant	0	21	0	0	0	...	3	...	...	...	...	...	...	...	...	...	1	7
Endive, escarole	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	...	...
Horseradish	0	...	0	0	0	...	3	...	...	...	...	...	...	...	...	...	...	...
Kale	0	...	0	0	...	...	14	...	21	...	...	...	10	...	14	...	21	...
Kohlrabi	0	...	0	0	...	7	3	...	21	...	...	...	...	...	...	...	...	...
Lettuce (leaf)	0	...	0	0	...	...	14	...	...	S	...	15	14	...	14	...	14	...
Melons	7	...	0	7	0	0	...	3	3	P	...	X	...	...	3	2	3	...	2	3
Mustard greens	0	...	0	0	...	...	14	...	...	S	...	...	10	...	14	...	21	...
Onion, bulb	0	28	0	0	...	...	...	...	...	P	...	...	7	14	...	...	...	...
Onion, green	0	14	0	0	...	...	...	...	...	...	...	...	14	...	...	...	...	...
Parsley	0	...	0	0	...	...	14	...	...	...	...	...	X	...	...	...	...	...
Parsnip	0	...	0	0	...	...	3	...	...	...	...	...	14	...	...	...	...	...
Peas	0	...	0	0	...	3	21	...	...	...	...	0	7	0	...	...	...	3
Pepper	7	7	0	...	0	0	...	...	3	...	...	X	7	...	5	2	0	...	1	7
Potato	14	...	0	7	0	0	0	...	0	14	...	...	...	...	35	...	0	...	1	7
Pumpkin	0	...	0	0	...	3	3	P	...	...	...	...	...	2	...	...	1	3
Radish	0	...	0	0	...	...	7	...	P	...	0	...	14	...	...	...	...	7
Rhubarb	0	...	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rutabaga	0	...	0	0	...	...	3	...	P	...	...	...	...	...	...	...	...	...
Spinach	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	21	...
Squash, summer	7	...	0	...	0	0	...	3	3	P	...	X	...	...	7	2	...	...	2	3
Squash, winter	7	...	0	...	0	0	...	3	3	P	...	...	...	...	3	2	...	...	2	3
Sweet corn	0	...	1	2	7	35	...	0	...	7	...	...	...	1	1
Sweet potato	0	...	0	0	...	...	0	...	P	...	...	...	P	...	...	...	1	...
Swiss chard	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	...	...
Tomato	7	...	0	0	0	0	0	...	3	...	...	X	0	...	1	2	7	...	2	1
Turnip, roots	0	...	0	0	...	...	7	...	P	...	...	...	14	...	...	...	...	...
Turnip, tops	0	...	0	0	...	...	14	...	P	...	...	...	14	...	14	...	21	...

Preharvest intervals (PHI) listed are minimums; at maximum application rates, the PHI for some products is greater than the period indicated here. Additional restrictions (limiting the total number of applications or restricting the use of treated plants for livestock feed) also may apply. S = apply to seeds or seedlings only; P = apply at or before planting or as early season side-dress according to label; X = preharvest interval not specified; ... = not registered for use on this crop.

*Use restricted to certified (licensed) applicators.

	*fonofos (Dyfonate)	imidacloprid (Admire, Provado)	*lambda-cyhalothrin (Warrior)	lindane (Isotox)	malathion (Cythion)	metaldetide	*methomyl (Lannate)	methoxychlor	*methyl parathion (Penncap-M)	naled (Dibrom)	*oxamyl (Vydate)	*permethrin (Ambush, Pounce)	*phorate (Thimet)	potassium salt soap (M-Pede)	pyrethrins plus PBO	rotenone	spinosad (SpinTor)	tebufenozide (Confim)	*tefluthrin (Force)	*terbufos (Counter)	thiodicarb (Larvin)	*tralomethrin (Scout X-tra)	*zeta-cypermethrin (Mustang)
P	...	...	S	1	X	1	3	...	...	1	1	...	P	0	0	1	...	...	...	...	...	...	...
P	...	...	S	1	X	3	3	...	...	1	...	...	...	0	0	1	...	...	...	...	...	...	...
P	7	1	S	7	X	0	14	...	15	...	...	...	...	0	0	1	...	...	...	...	...	...	...
P	7	...	S	3	X	3	14	...	...	1	...	1	...	0	0	...	1	7	...	...	7	5	...
P	7	...	S	7	X	3	14	...	...	1	...	1	...	0	0	...	1	7	...	...	...	...	...
P	7	1	S	7	X	1	3	...	...	1	...	1	...	0	0	...	1	7	...	...	7	...	1
...	...	...	...	7	X	1	14	...	...	...	P	...	...	0	0	1	...	...	...	...	...	...	...
P	7	...	S	7	X	3	7	...	...	1	...	1	...	0	0	...	1	7	...	...	7	...	...
...	...	...	...	7	X	7	...	...	...	1	14	1	...	0	0	1	1	7	...	...	...	...	...
...	7	...	...	...	...	10	...	...	...	...	...	1	...	0	0	...	1	7	...	...	14	...	...
...	7	...	S	7	X	10	14	...	...	1	...	1	...	0	0	1	1	7	...	...	...	...	...
...	...	...	S	1	X	1	7	...	...	...	1	0	...	0	0	1	...	...	...	...	...	...	...
...	0	...	...	3	X	5	7	...	...	1	3	...	...	0	0	1	1	7	...	...	...	...	...
...	7	...	...	7	X	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	14	...	...
...	...	...	...	7	X	65	...	...	...	...	22	...	...	0	0	...	...	...	...	...	...	...	...
...	7	...	S	7	X	10	14	...	...	1	...	...	...	0	0	...	1	7	...	...	...	...	...
...	7	...	...	7	X	...	7	...	...	...	...	...	...	0	0	...	1	7	...	...	...	...	...
...	7	...	P	14	X	...	14	...	...	...	1	...	...	0	0	1	1	7	...	...	14	...	...
...	...	...	S	1	X	1	7	...	...	1	0	...	...	0	0	1	...	...	...	...	...	...	...
...	7	...	...	7	X	10	...	...	...	...	...	...	...	0	0	...	1	7	...	...	...	...	...
P	...	1	...	3	X	7	...	15	...	...	1	...	...	0	0	1	...	...	...	...	...	...	7
...	...	...	...	3	X	7	...	15	...	...	...	...	...	0	0	0	...	...	...	...	...	...	...
...	7	...	...	21	...	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	...	...	...
...	...	...	...	7	X	...	...	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	3	X	1	7	...	...	1	...	...	...	0	0	1	...	...	...	...	...	...	...
P	0	...	...	3	X	3	7	...	...	7	3	...	...	0	0	1	1	7	...	...	...	...	...
P	7	...	...	0	X	6	0	5	...	7	7	P	...	0	0	1	1	...	1	...	...	...	...
...	...	...	S	3	X	...	7	...	...	...	0	...	...	0	0	...	...	...	...	...	...	...	...
P	...	...	...	7	X	...	7	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	1	...	...	0	0	...	1	7	...	...	14	...	...
...	...	...	...	3	X	...	7	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	7	...	S	7	X	7	14	...	...	...	1	...	...	0	0	1	1	7	...	...	14	...	...
...	...	...	S	1	X	1	7	...	...	1	0	...	...	0	0	1	...	...	...	...	...	...	...
...	...	...	S	1	X	...	7	...	...	...	0	...	...	0	0	...	...	...	...	...	...	...	...
P	...	1	...	5	X	0	7	3	...	...	1	P	...	...	...	1	1	...	P	P	...	...	...
...	...	...	...	...	X	...	0	...	...	P	...	...	...	0	0	...	1	...	...	...	...	...	...
P	...	...	...	7	X	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	...	...	...
...	0	5	P	1	X	1	7	...	...	1	...	...	...	0	0	1	1	7	...	...	14	...	...
...	...	...	...	7	X	10	14	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	7	X	...	7	...	...	...	1	...	...	0	0	1	1	...	...	...	...	...	...

Table 3. Minimum preharvest intervals (in days) of common insecticides registered for use on vegetable crops

	*abamectin (Agri-Mek)	acephate (Orthene)	azadirachtin (Align, Neemix)	*azinphosmethyl (Guthion)	<i>Bacillus thuringiensis aizawai</i>	<i>Bacillus thuringiensis kurstaki</i>	<i>Bacillus thuringiensis san diego</i>	*bifenthrin (Capture)	carbaryl (Sevin)	*carbofuran (Furadan)	chlorpyrifos (Lorsban)	cryolite (Kryocide)	*cyfluthrin (Baythroid)	*cymethrin (Ammo)	diazinon (D-Z-N)	dicofol (Kelthane)	dimethoate	disulfoton (Di-Syston)	endosulfan (Thiodan)	*esfenvalerate (Asana)
Asparagus	0	...	0	0	...	...	1	...	1	...	...	...	...	...	...	...	...	...
Beans (snap)	...	14	0	...	0	0	...	3	3	...	...	...	...	...	7	7	0	P	3	3
Beets	0	...	0	0	...	...	3	...	...	...	...	...	14	...	0	...	...	...
Broccoli	0	15	0	0	...	7	3	...	21	S	...	...	7	...	7	P	7	3
Brussels sprouts	...	14	0	7	0	0	...	7	3	...	21	...	...	...	7	...	...	P	14	...
Cabbage	0	21	0	0	...	7	3	...	21	S	...	1	21	...	3	P	7	3
Carrots	0	...	0	0	...	...	7	...	...	...	0	...	14	...	...	...	7	7
Cauliflower	...	14	0	15	0	0	...	7	3	...	21	S	...	...	7	...	7	P	14	3
Celery	7	21	0	14	0	0	...	...	14	...	...	...	...	...	...	...	...	...	4	...
Chinese cabbage	0	...	0	0	...	7	14	...	21	...	...	...	10	...	...	P	...	3
Collards	0	...	0	0	...	...	14	...	21	S	...	...	10	...	14	...	21	7
Cucumber	7	...	0	1	0	0	...	3	3	P	...	X	...	7	7	...	...	...	2	3
Eggplant	0	21	0	0	0	...	3	...	...	...	...	...	...	...	...	...	1	7
Endive, escarole	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	...	...
Horseradish	0	...	0	0	0	...	3	...	...	...	...	...	...	...	...	...	...	...
Kale	0	...	0	0	...	...	14	...	21	...	...	...	10	...	14	...	21	...
Kohlrabi	0	...	0	0	...	7	3	...	21	...	...	...	...	...	...	...	...	...
Lettuce (leaf)	0	...	0	0	...	...	14	...	...	S	...	15	14	...	14	P	14	...
Melons	7	...	0	7	0	0	...	3	3	P	...	X	...	...	3	2	3	...	2	3
Mustard greens	0	...	0	0	...	...	14	...	...	S	...	...	10	...	14	...	21	...
Onion, bulb	0	28	0	0	...	...	...	...	...	P	...	...	7	14	...	...	...	...
Onion, green	0	14	0	0	...	...	...	...	...	...	...	...	14	...	...	...	...	...
Parsley	0	...	0	0	...	...	14	...	...	...	...	...	X	...	...	...	...	...
Parsnip	0	...	0	0	...	...	3	...	...	...	...	...	14	...	...	...	...	...
Peas	0	...	0	0	...	3	21	...	...	...	...	0	7	0	...	...	...	3
Pepper	7	7	0	...	0	0	...	...	3	...	...	X	7	...	5	2	0	...	1	7
Potato	14	...	0	7	0	0	0	...	0	14	...	...	...	...	35	...	0	30	1	7
Pumpkin	0	...	0	0	...	3	3	P	...	...	...	...	...	2	...	...	1	3
Radish	0	...	0	0	...	...	7	...	P	...	0	...	14	...	...	...	...	7
Rhubarb	0	...	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Rutabaga	0	...	0	0	...	...	3	...	P	...	...	...	...	...	...	...	...	...
Spinach	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	21	...
Squash, summer	7	...	0	...	0	0	...	3	3	P	...	X	...	...	7	2	...	...	2	3
Squash, winter	7	...	0	...	0	0	...	3	3	P	...	...	...	...	3	2	...	...	2	3
Sweet corn	0	...	1	2	7	35	...	0	...	7	...	...	...	1	1
Sweet potato	0	...	0	0	...	...	0	...	P	...	...	...	P	...	...	...	1	...
Swiss chard	0	...	0	0	...	...	14	...	...	...	...	...	14	...	14	...	...	...
Tomato	7	...	0	0	0	0	0	...	3	...	...	X	0	...	1	2	7	P	2	1
Turnip, roots	0	...	0	0	...	...	7	...	P	...	...	...	14	...	...	...	...	...
Turnip, tops	0	...	0	0	...	...	14	...	P	...	...	...	14	...	14	...	21	...

Preharvest intervals (PHI) listed are minimums; at maximum application rates, the PHI for some products is greater than the period indicated here. Additional restrictions (limiting the total number of applications or restricting the use of treated plants for livestock feed) also may apply.

	*fonofos (Dyfonate)	imidacloprid (Admire, Provado)	*lambda-cyhalothrin (Warrrior)	lindane (Isotox)	malathion (Cythion)	metaldethyde	*methomyl (Lannate)	methoxychlor	*methyl parathion (Penncap-M)	naled (Dibrom)	*oxamyl (Vydate)	*permethrin (Ambush, Pounce)	*phorate (Thimet)	potassium salt soap (M-Pede)	pyrethrins plus PBO	rotenone	spinosad (SpinTor)	tebufenozide (Confim)	*tefluthrin (Force)	*terbufos (Counter)	thiodicarb (Larvin)	*tralomethrin (Scout X-tra)	*zeta-cypermethrin (Mustang)
P	...	...	...	S	1	X	1	3	...	...	...	1	...	0	0	1	...	...	...	...	...	...	...
P	...	...	...	S	1	X	3	3	...	1	...	...	...	0	0	1	...	...	...	...	...	...	...
P	7	1	S	7	X	0	14	15	...	...	...	...	...	0	0	1	...	...	...	...	...	...	...
P	7	1	S	3	X	3	14	14	...	1	...	1	...	0	0	...	1	7	...	...	7	5	...
P	7	...	S	7	X	3	14	...	1	...	...	1	...	0	0	...	1	7	...	...	...	...	...
P	7	1	S	7	X	1	3	...	1	...	...	1	...	0	0	1	1	7	...	...	7	...	1
...	...	...	S	7	X	1	14	...	...	P	...	...	...	0	0	1	...	...	...	...	...	...	...
...	7	...	S	7	X	3	7	...	1	...	...	1	...	0	0	...	1	7	...	...	7	...	...
...	...	...	S	7	X	7	...	...	1	14	...	...	...	0	0	1	1	7	...	...	...	...	...
...	7	...	S	7	X	10	...	...	...	...	...	1	...	0	0	1	1	7	...	...	14	...	...
...	...	...	S	1	X	1	7	...	...	1	0	...	...	0	0	1	...	...	...	...	...	...	...
...	0	...	...	3	X	5	7	...	...	1	3	...	...	0	0	1	1	7	...	...	...	...	...
...	7	...	...	7	X	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	14	...	...
...	...	...	...	7	X	65	...	...	...	...	22	...	...	0	0	...	...	...	...	...	...	...	...
...	7	...	S	7	X	10	14	...	1	...	...	...	...	0	0	...	1	7	...	...	...	...	...
...	7	...	...	7	X	...	7	...	...	...	...	...	...	0	0	...	1	7	...	...	...	...	...
...	7	...	P	14	X	...	14	...	...	...	1	...	...	0	0	1	1	7	...	...	14	...	...
...	...	...	S	1	X	1	7	...	...	1	0	...	...	0	0	1	...	...	...	...	...	...	...
...	7	...	...	7	X	10	...	...	...	...	...	...	...	0	0	...	1	7	...	...	...	...	...
P	...	1	...	3	X	7	...	15	...	...	...	1	...	0	0	1	...	...	...	...	...	...	7
...	...	...	...	3	X	7	...	15	...	...	...	...	...	0	0	0	...	...	...	...	...	...	...
...	7	...	...	21	...	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	...	...	...
...	...	...	...	7	X	...	...	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	3	X	1	7	...	1	...	...	...	...	0	0	1	...	...	...	...	...	...	...
P	0	...	...	3	X	3	7	...	...	7	3	...	...	0	0	1	1	7	...	...	...	...	...
P	7	...	...	0	X	6	0	5	...	7	7	P	...	0	0	1	1	...	1	...	...	...	...
...	...	...	S	3	X	...	7	...	...	...	0	...	...	0	0	...	...	...	...	...	...	...	...
P	...	...	...	7	X	...	7	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	1	...	0	0	...	1	7	...	...	14	...	...
...	...	...	S	3	X	...	7	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	7	...	...	7	X	7	14	...	...	...	1	...	...	0	0	1	1	7	...	...	14	...	...
...	...	...	S	1	X	1	7	...	...	1	0	...	...	0	0	1	...	...	...	...	...	...	...
...	...	...	S	1	X	...	7	...	...	...	0	...	...	0	0	...	...	...	...	...	...	...	...
P	...	1	...	5	X	0	7	3	...	...	...	1	P	...	...	1	1	...	P	P	...	...	...
...	...	...	...	...	X	...	0	...	...	P	...	...	...	0	0	...	1	...	...	...	...	...	...
...	...	...	...	7	X	10	...	...	...	...	1	...	...	0	0	...	1	7	...	...	14	...	...
P	0	5	P	1	X	1	7	...	...	1	...	...	...	0	0	1	1	7	...	...	...	...	...
...	...	...	...	7	X	10	14	...	...	...	...	...	...	0	0	...	...	...	...	...	...	...	...
...	...	...	...	7	X	...	7	...	...	...	1	...	...	0	0	1	1	...	...	...	...	...	...

S = apply to seeds or seedlings only; P = apply at or before planting or as early season side-dress according to label; X = preharvest interval not specified; ... = not registered for use on this crop.
 *Use restricted to certified (licensed) applicators.