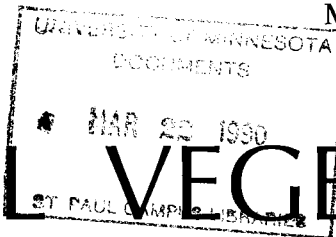


AG-FO-1882—Revised 1990



# COMMERCIAL VEGETABLE

## Weed, Insect, and Disease Control Guide: Eggplant, Peppers, Tomatoes

W. D. Hutchison, F. L. Pflieger, Leonard B. Hertz, and J. D. Pokorny

Pesticide suggestions in this guide are based on current state and federal registrations and tolerances set by the Environmental Protection Agency (EPA). *Directions given in this guide and on current container labels should be read, understood, and followed carefully in order to control pests and diseases effectively without causing excessive residues to remain on the crops.* The following information is up to date at the time of this printing. Information regarding any changes during the 1990 season will be made available to all commercial growers.

Suggestions for sampling and action thresholds are sometimes based on local studies, but are often derived from those of other states in the North Central Region, especially Michigan, due to lack of local data.

This publication is for your information. The University of Minnesota and its officers or employees make no claims or representations that the chemicals discussed will or will not result in residues on agricultural commodities and assume no responsibility for results of their use.

**State and Federal laws require that only certified applicators may use or supervise the application of certain pesticides with restricted uses. Information about certification is available from your county extension agent-agriculture.**

### RATES OF APPLICATION FOR INSECTICIDES AND FUNGICIDES

Sometimes small amounts of insecticides or fungicides are listed in terms of tablespoons and teaspoons. These always mean level measures—not rounded or heaping.

Recommendations may be given in terms of pounds or gallons of commercial preparation or as pounds of active ingredient per acre. "Pounds active ingredient" means the equivalent of 100-percent chemical. For example: 2 pounds of 50-percent methoxychlor wettable powder contains 1 pound of actual methoxychlor; 4 pounds of a 25-percent wettable powder contains 1 pound of active ingredient, and 20 pounds of a 5-percent dust contains 1 pound of active ingredient.

If you are preparing sprays that contain emulsifiable concentrates, read the label to determine how many pounds of active ingredient are in each gallon of concentrate. For example, 25-percent methoxychlor emulsifiable concentrate contains 2 pounds of active ingredient per gallon. If you wish to apply 1 pound of actual methoxychlor per acre, decide on the amount of liquid you want to apply per acre and add 1/2 gallon of 25-percent methoxychlor concentrate to the amount of water needed for 1 acre.

Most insecticides and fungicides can be mixed. Read the label instructions for specific combinations.

### 1990 Herbicide, Insecticide, and Fungicide Suggestions

### EGGPLANT

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Germinating annual weeds	Dacthal 75 W (DCPA)	12 lb.	Apply 4-6 weeks after transplanting to weed-free ground.
	Devrinol 50W (napropamide)	2-4 lb.	Apply prior to transplanting and incorporate to a depth of 1 to 2 inches. Use lower rate on sandy soils.
Emerged weeds	Gramoxone Extra (paraquat)	3 pt.	Apply before, during, or after planting, but <i>before crop emergence</i> . Include 1 pt. nonionic surfactant per acre.
	Roundup 3E (glyphosate)	2 qt.	Apply to emerged weeds before planting the crop. Wait 3 days before planting.
Emerged grasses	Poast 1.5E (sethoxydim)	1 pt	Apply to actively growing grasses. Include 1 qt. crop oil concentrate per acre.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, DF—dry flowable, DG—dispersible granules, D—dust, E—emulsifiable concentrate, F—flowable, G—granules, S—solution, SL—soluble liquid, SP—soluble powder, and W—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

\*Restricted use pesticide. POST TREATED AREAS WHEN REQUIRED BY LABEL.

Insects	Chemical†	Formulation		Dosage	Remarks and limitations
		Recommended	Product/acre		
Regularly check 15 to 20 plants in each of five areas of the field. Look for aphids, flea beetles, or cutworms and their damage. Cutworms are more likely to be abundant in a weedy field. If you find suspected cutworm damage, check the ground around the plants for hiding worms.					
Aphids	endosulfan (Thiodan)	3E 50WP	2/3 qt. 1 lb	0.5 lb.	1 day phi. Do not exceed 2 applications/season.
	malathion	5E	1 pt.	5/8 lb.	3 day phi.
	*methomy (Lannate)	90SP 1.8L	1/4-1 lb 1-4 pt.	.22-.90 lb.	5 day phi. 90SP not restricted use; avail. in water-soluble packages
	*oxydemetonmethyl (MetaSystox-R)	2E	2 pt.	1/2 lb.	7 day phi. Not more than three applications. 48-hr. re-entry.
	*oxamyl (Vydate L)	2E	2-4 pt	0.5-1.0 lb.	1 day phi.
Colorado potato beetle	carbaryl (Sevin)	XLR plus	2 pt.	1.0 lb.	NTL.
	endosulfan (Thiodan)	3E 50WP	2/3 qt. 1 lb	0.5 lb.	1 day phi. Do not exceed 2 applications/season.
	*esfenvalerate (Asana XL)		5.8-9.6 fl. oz.	.03-.05 lb.	7 day phi. Do not exceed 0.35 lbs. AI/acre/season.
	*oxamyl (Vydate L)	2E	2-4 pt.	0.5-1.0 lb.	1 day phi.
	*permethrin (Ambush, Pounce)	2E 3.2E 25W	12.8 fl. oz. 8 fl. oz. 12.8 fl. oz.	0.2 lb.	3 day phi. Do not exceed 3.0 lbs AI/acre/season. 25W available in water-soluble packages.
Cutworms	carbaryl (Sevin)	XLR plus 20% B	4 pt. 5-10 lb.	2 lb. 1-2 lb.	NTL. NTL.
Flea beetles	carbaryl (Sevin)	XLR plus	2 pt.	1 lb.	NTL.
	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl. oz.	.03-.05 lb.	7 day phi. Do not exceed 0.35 lb. AI/acre/season.
	endosulfan (Thiodan)	3E	2/3 qt.	0.5 lb.	1 day phi. Do not exceed 2 applications/season.
	*permethrin (Ambush)	2E 25W	6.4-12.8 fl. oz. 6.4-12.8 fl. oz.	.1-.2 lb.	3 day phi. Do not exceed 3.0 lb AI/acre/season.

Diseases	Chemical†	Remarks
Seed rot, damping off Soil treatment	Thiram	There are several fungicide formulations for seed treatments made by several different companies. Read all label instructions. Apply to soil at time of seeding and follow with 2 post directed applications at 30 day intervals. Ridomil may cause yellowing of leaves. Do not apply within 7 days of harvest.
	Ridomil 2E	
Verticillium wilt	Terr-o-Gas 98 Terr-o-Gas 67	If possible, avoid planting in wilt-infested soils.

**PEPPERS (TRANSPLANTED)**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Germinating annuals	Treflan 4E (trifluralin)	1-2 pt.	Apply before transplanting and incorporate. Use lower rate on sandy soils. Not effective on muck soils.
	Devrinol 50W (napropamide)	2-4 lb.	Apply before transplanting and incorporate. Use lower rate on sandy soils.
	Dacthal 75W (DCPA)	12 lb.	Apply 4-6 weeks after transplanting. Should have weed-free ground.
Emerged grasses	Poast 1.5E (sethoxydim)	1 pt.	Apply to actively growing grasses. Include 1 qt/A crop oil concentrate.
Emerged annuals	Gramoxone Extra 2.5E (paraquat)	3 pt.	Apply before transplanting to emerged weeds or after transplanting but do not contact planted peppers.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, DF—dry flowable, DG—dispersible granules, D—dust, E—emulsifiable concentrate, F—flowable, G—granules, S—solution, SL—soluble liquid, SP—soluble powder, and W—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
\*Restricted use pesticide. POST TREATED AREAS WHEN REQUIRED BY LABEL.

**PEPPERS (TRANSPLANTED) (continued)**

Insects	Chemical†	Formulation		Remarks and limitations	
		Recommended	Product/acre Dosage		
Regularly check 15 to 20 randomly selected plants from each of five locations in the field for aphids. If you notice European corn borer (ECB) eggs or larvae or if the catch of female ECB moths in nearby black light traps equals or exceeds four per night for three consecutive nights when peppers are forming, insecticide treatments are necessary to protect the crop. For adequate protection against ECB, subsequent sprays will be needed at 5-7 day intervals (depending on insecticide and weather) while moth flights continue or until harvest, unless crop is sidedressed with granular insecticide.					
European corn borer	acephate (Orthene)	75SP	1-1 1/3 lb.	3/4-1 lb.	7 day phi.
	carbaryl (Sevin)	XLR plus	3 pt.	1 1/2 lb.	NTL.
	*carbofuran (Furadan)	15G	13 lb.	2 lb.	21 day phi. Sidedress 2 to 4 weeks after planting. Treat again, but with 20 lb. 15G, 4 to 6 weeks later if second brood develops. 24-hr. re-entry.
	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl. oz.	0.03-0.05 lb.	7 day phi. Do not exceed 0.35 lb. AI/acre/season.
Aphids	*permethrin (Pounce, Ambush)	3.2E 2E	8 fl. oz. 12.8 fl. oz.	0.2 lb. 0.2 lb.	3 day phi. Do not exceed 1.6 AI/acre/season.
	acephate (Orthene)	75SP	2/3 lb.	1/2 lb.	7 day phi. Do not exceed 7 applications/season.
	malathion (Cythion)	5E	1 1/2 pt.	1 lb.	3 day phi.
	*methomyl (Lannate)	1.8L 90SP	2 pt. 1/2 lb.	0.45 lb.	3 day phi
	dimethoate (Cygon, DeFend, Dimex, Rebelate)	4E	1/2-2/3 lb.	1/4-1/3 lb.	3 day phi. 90SP not restricted use. NTL. Note: 4-day re-entry.
	endosulfan (Thiodan)	3E	2/3 qt.	1/2 lb.	1 day phi. Do not exceed more than 2 applications/season.
	*oxamyl (Vydate L)	2E	2-4 pt.	0.5-1.0 lb.	7 day phi.
	*oxydemetonmethyl (Metasystox R)	2E	2 pt.	1/2 lb.	NTL. 48-hr. re-entry. Not more than two applications/season.

Diseases	Chemical†	Remarks
Seed rot, damping off	Captan, Thiram	There are many different fungicide formulations for seed treatment made by several different companies. Read and follow all label instructions.
Field soil treatment: Root rot, damping off	Ridomil 2E	See peppers.
Fungal foliar diseases: Cercospora leaf spot	Basic Copper Sulfate, K-Cop, Copper-Count-N	
Anthracnose	Basic Copper Sulfate	
Alternaria leafspot	Basic Copper Sulfate	
Bacterial diseases: Xanthomonas	Basic Copper Sulfate, Citcop 4E, Kocide 404S, Kocide 606, K-Cop, Kocide 101, Copper-Count-N	Symptoms on foliage appear as small areas of dead tissue surrounded by a yellow border.
Cucumber mosaic		See aphid and weed control. Virus-infected plants are severely stunted with leaf mosaic.

**TOMATOES**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
<b>SEEDED</b>			
Germinating annuals	Devrinol 50W (napropamide)	2-4 lb.	Apply before seeding and incorporate. Use lower rate on sandy soils. Seeded or transplanted.
Emerged annuals	Gramoxone Extra (paraquat)	3 pt.	Apply prior to planting or after seeding, but before tomatoes are up.
Emerged broadleaves	Sencor 4F or Lexone 4L (metribuzin)	1 pt.	Apply when tomatoes have 5 to 6 leaves and before weeds are 2 inches tall. Do not apply more than 1 qt./acre/year or within 3 days after periods of cool, wet, and cloudy weather.
Emerged weeds	Roundup 3E (glyphosate)	2 qt.	Seeded only. Apply to emerged weeds before planting crop. Wait 3 days to plant.
Emerged grasses	Poast 1.5E (sethoxydim)	1 pt.	Apply to actively growing grasses. Include 1 qt. crop oil concentrate per acre.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, DF—dry flowable, DG—dispersible granules, D—dust, E—emulsifiable concentrate, F—flowable, G—granules, S—solution, SL—soluble liquid, SP—soluble powder, and W—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

\*Restricted use pesticide. POST TREATED AREAS WHEN REQUIRED BY LABEL.

**TOMATOES (continued)**

<b>Weeds</b>	<b>Herbicide†</b>	<b>Amount/acre commercial product</b>	<b>Remarks and limitations</b>
<b>TRANSPLANTS</b>			
Emerged broadleaves	Sencor 4F or Lexone 4L (metribuzin)	1 pt.	Apply after transplanting when transplants recover from shock and show new growth. Weeds should be emerged but less than 2-inches tall. For other restrictions, see SEEDED—metribuzin.
Germinating annuals	Sencor 4F or Lexone 4L	1 pt.	Apply before transplanting and incorporate.
	Devrinol 50W (napropamide)	2-4 lb.	Apply before transplanting and incorporate. Use lower rate on sandy soils.
	Treflan 4E (trifluralin)	1-2 pt.	Apply before transplanting and incorporate. Use lower rates on sandy soils.
Emerged grasses	Poast 1.5E (sethoxydim)	1 pt.	Apply to actively growing grasses. Include 1 qt. crop oil concentrate per acre.

<b>Insects</b>	<b>Chemical†</b>	<b>Formulation</b>		<b>Remarks and limitations</b>	
		<b>Recommended</b>	<b>Product/acre Dosage</b>		
Regularly check 20 randomly selected plants from each of five locations in the field. Look for leafhoppers, spider mites, and cutworms and their damage. Where damage is seen, check that the insects are still present in a damaging stage. If cutworms are suspected to be the cause of observed damage, check the ground around the plants for hiding cutworms. They are more likely to occur in weedy parts of the field. At the same time, check 20 leaves from each location for aphids and for flea beetles and their damage.					
Aphids	diazinon	50W 4E	1/2 lb. 1/2 pt.	1/4 lb.	1 day phi.
	*demeton (Systox)	2E	1 pt.	1/4 lb.	3 day phi. 48-hr. re-entry.
	dimethoate (Cygon, De-Fend, Rebelate)	4E	1/2-1 pt.	1/4-1/2 lb.	7 day phi. 4-day re-entry.
	endosulfan (Thiodan)	3E	1-1 1/3 qt.	.75-1 lb.	2 day phi. 24-hr. re-entry.
	malathion	5E	3/4 pt.	1/2 lb.	1 day phi.
	malathion	actual per 50,000 ft. as aerosol		0.15 lb.	For greenhouse tomatoes. 15 hour phi.
	*parathion	4E	1/2 pt.	1/4 lb.	10 day phi. 48 hr. re-entry.
Colorado potato beetle	*parathion	actual per 50,000 ft. as aerosol		0.1 lb.	For greenhouse tomatoes. 10 day phi. Check label for cautions.
	carbaryl (Sevin)	XLR plus	2 pt.	1.0 lb.	NTL.
Cutworms Action threshold: 1 larva/10 plants	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl. oz.	.03-.05 lb.	1 day phi. Do not feed or graze treated vines. Do not exceed 0.5 lb. AI/acre/season.
	carbaryl (Sevin)	80S XLR plus 20% B	2 1/2 lb. 4 pt. 5-10 lb.	2 lb.	NTL.
Flea beetles Action threshold: 2 beetles/10 leaves	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl. oz.	0.03-0.05 lb.	1 day phi. Do not feed or graze treated vines. Do not exceed 0.5 lb. AI/acre/season.
	carbaryl (Sevin)	80S	2/3-1 1/4 lb.	1/2-1 lb.	NTL.
	endosulfan (Thiodan)	50W 3E	1-2 lb. 1-1 1/3 qt.	.75-1 lb.	2 day phi. 24-hr. re-entry.
	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl. oz.	0.03-0.05 lb.	1 day phi. Do not feed or graze treated vines. Do not exceed 0.5 lb. AI/acre/season.
Leafhoppers	methoxychlor	2E	4 pt.	1 lb.	1 day phi.
	carbaryl (Sevin)	XLR plus	1-2 pt.	1/2-1 lb.	NTL.
	dimethoate (Cygon, De-Fend, Dimex, Rebelate)	4E	1/2-1 pt.	1/4-1/2 lb.	7 day phi. 4-day re-entry.
	malathion	25W	5 lb.	1 1/4 lb.	1 day phi.
	methoxychlor	2E	6-8 pt.	1 1/2-2 lb.	1 day phi.

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\*Restricted use pesticide. POST TREATED AREAS WHEN REQUIRED BY LABEL.

Insects	Chemical†	Formulation		Remarks and limitations
		Recommended	Product/acre Dosage	
Fruit flies	Dust or spray fruit and hampers with synergized pyrethrins (Pyrenone, Pyroicide) to cover fruit lightly but thoroughly. Avoid crushing or cracking fruit.			
Spider mites	malathion	5E	3/4 pt.	1 day phi. Greenhouse vapor treatment. Check label for cautions. Check label for cautions.
	naled (Dibrom)	8E	.1 fl. oz./1000 ft.	
	*parathion tetradifon (Tedion)	10% aerosol 1E	1 lb./50,000 ft. 2 tsp./gal. or 1 qt./100 gal.	
Diseases	Chemical†			Remarks
Fungal foliar diseases:	Ridomil MZ 58			Begin applications when conditions are favorable for disease development, but before infection, and continue at 14-day intervals until threat of disease is over. Do not exceed 4 applications per season. Do not apply within 7 days of harvest.
Late blight	Ridomil/Bravo 81W			Begin applications when conditions are favorable for disease, but before infection, and continue at 14-day intervals until threat of disease is over. Do not exceed 4 applications per season. Do not apply within 7 days of harvest. See label.
Early blight, anthracnose, and gray leaf spot	Ridomil/Bravo 81W			Begin applications when conditions are favorable for disease development, but before infection, and continue at 14-day intervals. Under heavy disease pressure, use other effective EPA-registered fungicides between the Ridomil/Bravo 81W sprays. Do not exceed 4 applications per season. Do not apply within 7 days of harvest. See label.
Early blight and late blight	C-O-C-S W, Manzate 200 DF, Dithane M-45, Basic Copper Sulfate, Citcop, Dyrene 50 WP, Kocide 101, Copper-Count-N, Dithane F-45 F, Dithane DF, Penncozeb, Bravo			Bravo is available in the following formulations: Bravo 500, Bravo 720, Bravo 90DG, Bravo Flowable, and Bravo W75.
Anthracnose	Manzate 200 DF, Dithane M-45, Dyrene 50 WP, Basic Copper Sulfate, Dithane F-45 F, Dithane DF, Kocide 101, Penncozeb, Bravo 720			
Septoria	C-O-C-S W, Dyrene 50 WP, Basic Copper Sulfate, Dithane F-45F, Dithane DF, Dithane M-45, Kocide 101, Bravo, Ridomil/Bravo 81W			
Gray leaf mold and Stemphyllium gray leaf spot	Bravo, Manzate 200 DF, Dithane F-45 F, Dithane DF, Dithane M-45, Maneb 80 (gray leaf spot only)			
Aster yellows				Control leafhoppers; see tomato insects above.
Bacterial diseases:				
Bacterial spot	Manzate 200 DF, Citcop, Kocide 101, Kocide 404S, K-Cop, Kocide 606, Copper-Count-N, Basic Copper Sulfate			
Bacterial speck	Kocide 101, Kocide 606 F			
Bacterial canker	Basic Copper Sulfate			
Fusarium and Verticillium wilt				Plant Fusarium and Verticillium wilt resistant varieties.
Tomato greenhouse diseases:				
Early blight and late blight	Exotherm Termil			
Cladosporium leaf mold	Benlate 50 DF			
Botrytis gray mold	Exotherm Termil, Benlate 50 DF			

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\*Restricted use pesticide. POST TREATED AREAS WHEN REQUIRED BY LABEL.

**CHEMIGATION OF PESTICIDES**

Minnesota Pesticide Control Law as of 1988 requires each chemigation system used for applying pesticides with the irrigation water to be registered with the Minnesota Department of Agriculture (MDA) and contain the necessary approved anti-pollution check valves. Only pesticides displaying product label approval for chemigation application can be applied by this method. Minnesota law also requires the treated field to be posted throughout the period of chemigation application for any pesticide. Chemigation has the potential to allow the injected chemical to backflow into the water source when the irrigation pump shuts down if proper check valves and interlocks are not in place or maintained. Specific information on check valves and registration is available from the MDA (612/297-2614).

Chemigation can be an effective application method if the needed pesticide is suited for this practice and the irrigation and chemigation system is properly engineered and maintained. Accurate calibration of the irrigation system and the desired pesticide application rate is most important. Information on how to determine the chemical injection rate is available from the manufacturer and the Minnesota Extension Service offices.

**Do not use after 1990.**

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