

# COMMERCIAL VEGETABLE Weed, Insect, and Disease Control Guide: Beets, Carrots, Lettuce, Onions, Parsnips, Radishes, Rutabagas, Turnips, Spinach

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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.

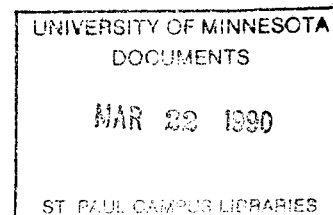
Recommendations may be given in terms of pounds or gallons of commercial preparation or as pounds of active ingredient per acre. "Pounds active ingredient" means the equivalent of 100-percent chemical. For example: 2 pounds of 50-percent methoxychlor wettable powder contains 1 pound of actual methoxychlor;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

**Table 1. Characteristics of Nematicides**

Trade name	Active ingredients	Hazards to mammals†		Effective against		
		Oral	Dermal	Nematodes	Soil fungi	Weed seeds
Brozone Brom-O-Sol	methyl bromide (68.6%) chloropicrin (1.4%)		serious inhalation hazard	*	*	*
Chloropicrin Picfume Larvicide Chlor-O-Pic	trichloronitromethane (99%)		serious inhalation hazard	*	*	*
D-D Mixtures D-D Vidden D	1,3-dichloropropene-1,2-dichloropropane and related chlorinated hydrocarbons	moderate	low	*		



**Table 1. Characteristics of Nematicides (continued)**

Trade name	Active ingredients	Hazards to mammals†		Effective against		
		Oral	Dermal	Nematodes	Soil fungi	Weed seeds
Dorlone	ethylene dibromide (18.9%) 1,3-dichloropropenes and related C <sub>3</sub> hydrocarbons (79.9%)	moderate	moderate	*		
DowFume MC-2 Brom-O-Gas	methyl bromide (98%) and chloropicrin (2%)	<b>serious inhalation hazard</b>		*	*	*
DowFume MC-33 Terr-O-Gas	methyl bromide (67%) and chloropicrin (33%)	<b>serious inhalation hazard</b>		*	*	*
Ethylene Dibromide DowFume W-85 Soilbrom-85	1,2-dibromoethane	moderate	moderate	*		
Ethoprop (Mocap)	O-ethyl, S,S-dipropyl phosphorodithioate	<b>high</b>	<b>high</b>	*		
Telone	1-3-dichloropropene and related chlorinated hydrocarbons (100%)	moderate	moderate	*		
Vapam VPM	sodium methyl dithiocarbamate (32.7%)	low	moderate	*	*	*
Terr-O-Cide 15	1,2-dibromoethane (40%) and chloropicrin (15%) —or—	moderate	moderate	*	*	
Terr-O-Cide 30	1,2-dibromoethane (36%) and chloropicrin (30%)					
Terr-O-Cide 15-D	1,3-dichloropropene-1,2-dichloropropane and other halogenated C <sub>3</sub> compounds (85%) and chloropicrin (15%) —or—	moderate	low	*		
Terr-O-Cide 30-D	1,3-dichloropropene-1,2-dichloropropane and other halogenated C <sub>3</sub> compounds (70%) and chloropicrin (30%)					

†Most fumigants are vesicants that cause severe burns when in contact with skin or mucous membranes. Avoid direct contact and INHALATION of these materials.

**Table 2. 1990 Herbicide, Insecticide, and Fungicide Suggestions**

**BEETS (table)**

Weeds	Herbicide†	Amount/acre commercial product	Formulation		Remarks and limitations
			Recommended	Product/acre	
Germinating and emerged annuals	Pyramin 4.2 F (pyrazon)	3 qt.			Apply after seeding but before weeds are 2 inches tall.
Germinating annuals	Ro-neet 6E (cycloate)	2½ qt.			Apply and incorporate immediately. <i>Not effective on muck soils.</i>
	Antor 4E (diethyl-ethyl)	5 qt.			Apply and incorporate immediately or apply on soil surface after seeding. Needs rain or irrigation to activate.
Emerged broadleaves	Spin-aid 1.3E (phenmedipham)	3 qt.			Apply when beets are past 4 true leaves and weeds are less than two inches tall. Don't use more than 25 gallons of spray solution per acre. Does not control redroot pigweed.
Emerged annuals and perennials	Roundup 3E (glyphosate)	2 qt.			Apply to emerged weeds before planting or as a directed spray without contacting beets or after harvest in the fall.

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Leaf miner	malathion (Cythion)	5E	2 pt.	1¼	7 day phi.
	diazinon (AG 500)	4E	½-1 pt.	¼-½	10 day phi.
Cutworms	carbaryl (Sevin) *methomyl (Lannate)	20% B	5-10 lb	1-2	3 day phi roots, 14 days tops.
		1.8L	2 pt.	0.45	0 day phi for roots; 14 day phi
		90SP	½ lb		for tops. 90SP is NOT restricted use.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, D—dust, E—emulsifiable concentrate, F—flowable, G—granules, L—liquid concentrate, S—solution, and W—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
\*Restricted use pesticide. Post treated areas when required by label.

## BEETS (continued)

Diseases	Chemical†	Remarks
Seed rot, damping-off	Captan,Thiram	There are many different fungicide formulations for seed treatments made by several different companies. Read and follow all label instructions.
Fungal foliar disease Cercospora	Basic Copper Sulfate	

## CARROTS

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Emerged annual weeds	stoddard solvent	40-60 gal.	Apply postemergence to weeds not larger than 1 inch. Carrot roots should not be larger than 1/4 inch in diameter. Crop injury may occur when temperature exceeds 75° F.
Emerged broadleaves	Lorox 50 DF (linuron)	1 1/2-2 1/2 lb	Apply after carrots are at least 3 inches tall. Use higher rate when the weeds are over 2 inches tall. Multiple applications may be made but do not exceed 2 qt. Lorox/acre/year.
	Sencor 4F (metribuzin)	1/2 pt.	Apply when carrots have 5-6 true leaves, but before weeds are 1 inch tall. Second application can be made up to 60 days of harvest.
Annual grasses and some broadleaves	Treflan 4E (trifluralin)	1/2-1 qt.	Apply before planting and incorporate into soil 2-3 inches. Use lowest rate on sandy soils. <i>Do not use on muck or peat soils.</i>
Annual and perennial weeds	Roundup 3E (glyphosate)	2 qt.	Apply to emerged weeds before or prior to crop emergence. <u>Do not contact carrots.</u>
Emerged grasses	Fusilade 2000 IE (Fluazifop-P)	1/2-1 qt.	Use highest rate on perennial grasses, such as quackgrass. Include crop oil concentrate, 1 qt./acre.

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Aphids	diazinon (e.g., AG 500)	4E	1 pt.	0.5	10 day phi.
	malathion (Cythion)	5E, WP	0.75-1.5 pt	0.5-1	7 day phi.
	*parathion	4E, WP	1-2 pt	0.5-1	4 day phi. Do not use tops for food or feed.
	mevinphos	4E	1/4-1/2 pt	0.13-0.25	1 day phi.
Aster leafhopper	carbaryl (Sevin)	XLR plus 80%W	2 pt.	1	NTL.
	*esfenvalerate (Asana XL)	0.66E	1 1/4 pt. 5.8-9.6 fl. oz.	0.03-0.05	7 day phi. Ground application only. Do not exceed 0.5 lb AI/acre/season.
	methoxychlor	2E	8 pt.	2	14 day phi if tops are used; 7 days roots.
	malathion	5E	2 1/2 pt.	1 1/2	7 day phi.
	*methomyl (Lannate)	1.8L 90SP	2-4 pt. 1/2-1 lb	.45-.90	1 day phi. 90SP is NOT restricted use.
	mevinophos	4E	1 pt.	0.5	1 day phi.
	*parathion	4E	1 pt.	0.5	4 day phi. Do not use tops for food or feed.
Carrot weevil adults	*esfenvalerate (Asana XL)	0.66E	9.6 fl oz	0.05	7 day phi. Do not exceed 0.5 lb AI/acre/season.
	malathion	5E	2 1/2 pt.	1 1/2	7 day phi.
Cutworms	carbaryl (Sevin)	20% B	5-10 lb	1-2	3 day phi.
	*esfenvalerate (Asana XL)	0.66E	5.8-9.6 fl oz	.03-.05	7 day phi. Do not exceed 0.5 lb AI/acre/season.
	*methomyl (Lannate)	1.8L 90SP	1-2 pt. 1/4-1/2 lb	0.22-0.45	1 day phi.

Aster leafhoppers are pests of vegetables only because they transmit the organism responsible for the disease aster yellows. Insecticide reduces aster yellows transmission through reduction of leafhopper numbers. Different varieties of carrots have different susceptibility to this disease, and the amount of the disease organism that the leafhoppers are carrying (the level of inoculum) differs at different times. For more information on the susceptibility of particular carrot varieties and information on the Wisconsin system for determining when it will pay to spray for leafhoppers, contact your county extension office.

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

\*Restricted use pesticide. Post treated areas when required by label.

**CARROTS (continued)**

Diseases	Chemical†	Remarks
Seed rot, damping-off	Thiram	There are many different fungicide formulations for seed treatments made by different companies. Read and follow label instructions.
Fungal foliar diseases: Alternaria and Cercospora leaf spot	C-O-C-S W, Bravo, Basic Copper Sulfate, Citcop, Super Tin 4L, Copper-Count-N	Bravo is available in the following formulations: Bravo 500, Bravo 720, Bravo 90 DG, Bravo Flowable, and Bravo W-75
Alternaria blight	Rovral 50W or 4F	Continue applications every 7-14 days while conditions favor disease development.
Cercospora leaf spot	Kocide 606F, Kocide 101	
Aster yellows		Control aster leafhopper. See carrot insects.
Soil diseases: Rhizoctonia	Telone II	Rotate to crops other than carrot or radish.
Root knot nematode	Telone II	Crop rotation with corn; if this is not possible the use of soil fumigants may be necessary.

**LETTUCE**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Annual weeds	Balan 1.5 L (benefin)	4 qt.	Apply before planting and incorporate. <i>Do not use on muck or peat soils.</i> Direct seeded lettuce only.
	Prefar 4E (bensulide)	6 qt.	Apply preplant and incorporate or preemergence and irrigate into the soil.
	Kerb 50 W (pronamide)	2-4 lb.	Apply before or after seeding, but before weeds emerge. High rate on muck soil. Will suppress quackgrass. Must be incorporated or irrigated into the soil.
Emerged annual and perennial weeds	Roundup 3E (glyphosate)	2 qt.	Apply to emerged weeds before planting or after planting, but before lettuce emerges. Do not contact lettuce.
Emerged annuals	Gramoxone Extra (paraquat)	3 pt.	Apply to emerged weeds before or after planting but before lettuce emerges.
Emerged grasses	Poast 1.5E (sethoxydim)	1-1½ pt.	Apply to actively growing grasses. Include 1 qt. crop oil concentrate/acre. Maximum, 3 pt./acre/year.

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Leafhoppers	carbaryl (Sevin)	XLR plus	1-2 pt	½-1	3 day phi head lettuce; 14 days leaf lettuce.
	dimethoate (Cygon, DeFend, Dimex, Rebelate)	4E	½ pt	¼	7 day phi head lettuce; 14 days leaf lettuce. 4 day re-entry.
	*disulfoton (Di-Syston)	15% G	4-8 oz/ 1,000 ft of row	1-2	60 day phi. Do not use on transplanted lettuce. Do not apply directly on the seed. Use the higher rate only on heavy organic soils. Note plant injury warning on label. Do not place treated zones closer together than 6 inches. 24-hr. re-entry.
	malathion	5E	2 pt	1.25	7 day phi.
	*methomyl (Lannate)	1.8L 90SP	1-4 pt ¼-1 lb	0.22-0.90	7 day phi for 0.22-0.45 lb AI/acre; 10 day phi if >0.45 lb AI/acre. 90SP is NOT restricted use.
	*permethrin (Ambush, Pounce)	2E 3.2E	6.4-12.8 fl oz 4-8 fl oz	0.1-0.2	1 day phi. Do not graze or feed crop refuse. Do not apply more than 2 lb AI/acre/season.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, D—dust, DF—dry flowable, DG—dispersible granules, E—emulsifiable concentrate, F—flowable, G—granules, L—liquid concentrate, S—solution, and W—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
\*Restricted use pesticide. Post treated areas when required by label.

**LETTUCE (continued)**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations		
Cutworms, cabbage looper	carbaryl (Sevin)	20% B	5-10 lb	1-2	3 day phi for head lettuce; 14 days for leaf lettuce. NTL. Do not feed crop refuse. 7 day phi for 0.22-0.45 lb AI/acre; 10 day phi if >0.45 lb AI/acre. 90SP is NOT restricted use. 1 day phi. Do not graze or feed crop refuse. Do not apply more than 2 lbs AI/acre/season.
	endosulfan (Thiodan)	3E	1-1 1/3 qt	0.75-1	
	*methomyl (Lannate)	1.8L 90SP	1-4 pt 1/4-1 lb	0.22-0.90	
	*permethrin (Ambush, Pounce)	2E 3.2E	6.4-12.8 fl oz 4-8 fl oz	.1-.2	
	trichlorofon (Dylox)	25W 80SP	6.4-12.8 fl oz 1 1/4 lb	1	28 day phi. Do not use after heads begin to form. 24-hr. re-entry.
Greenhouse pests: aphids, fungus gnats, white flies, mealy bugs	malathion	15% aerosol		1 lb./50,000 cu. ft.	10 day phi.
	*parathion	10% aerosol		1 lb./50,000 cu. ft.	21 day phi. Check label for re-entry period and other precautions.

Diseases	Chemical†	Remarks
Seed rot, damping-off	Thiram, Ridomil 2E (head lettuce only)	There are several fungicide formulations for seed treatment made by several different companies. Read and follow all label instructions.
Fungal foliar diseases: Downy mildew HEAD LETTUCE	C-O-C-S W, Kocide 606 F	
Fungal foliar diseases: Botrytis gray mold Sclerotinia	Botran 75 W	Do not apply within 14 days of harvest.

**ONIONS**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
<b>SEEDED</b>			
Germinating annual grasses and some broadleaves	Dacthal 75 W (DCPA)	12 lb.	Apply after planting before the crop and weeds emerge. <i>For use on mineral soils only.</i>
Emerged broadleaves	Buctril 2E (bromoxynil)	1-1 1/2 pt.	Follow label directions carefully. Use 50-70 gallons water/acre where onions have 2 to 5 true leaves. Some damage may still occur.
	Goal 1.6 E (oxyfluorfen)	1/2 pt.	Do not apply until onions have two fully developed true leaves. Do not make more than three applications for a total of 2 1/2 pt./acre. Do not apply within 60 days of harvest. For best postemergence weed control, weeds should have 2 to 4 leaves.
Emerged grasses	Fusilade 2000 IE (fluazifop-P)	1.5 pt.	Apply to small actively growing grasses. Include 1 qt/A crop oil concentrate.
Emerged annual and perennial weeds	Roundup 3E (glyphosate)	2 qt.	Apply prior to planting or prior to crop emergence without contacting onions.
Emerged annuals	Gramoxone Extra 2.5 (paraquat)	3 pt.	Apply before or after planting but before crop emergence.

Prevention of sprouting in storage	Chemical†	Remarks and limitations
	3 lb. maleic hydrazide (1 gal. MN 30)	Apply 2 weeks before harvest but when bulbs are mature and tops still show green. Use in 100 to 140 gallons water. Do not add wetting agent. If applied too early, may cause some breakdown in storage.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, D—dust, DF—dry flowable, DG—dispersible granules, E—emulsifiable concentrate, F—flowable, G—granules, L—liquid concentrate, S—solution, and W—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
\*Restricted use pesticide. Post treated areas when required by label.

**ONIONS (continued)**

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
<p>Under most conditions, a preventive treatment for onion maggot at planting time will be necessary, but later use of foliar insecticides to suppress adult onion maggot flies is unlikely to be necessary or successful. Some onion maggots in Minnesota have shown resistance to diazinon. Thus, if some growers in the area have not obtained satisfactory control with diazinon in recent years, the population there may be resistant and it would be advisable to use a different product. Continuous planting of onions on the same ground will increase onion maggot problems. When possible, rotate with other crops.</p> <p>Once bulbs start to develop, regularly check 20 randomly selected plants in each of five (or more) locations in the field for onion thrips and the pale stippling or silvering of the onion leaves that their feeding causes. These tiny insects are quick moving and tend to hide on under surfaces, especially in the crevices where the onion leaves join the stem. They can build up to high numbers during periods of hot, dry weather. When spraying for thrips, direct the spray down the center of the plants. No insecticide resistance has been evident in Minnesota populations of onion thrips to date. In other parts of the country, however, thrips populations have been reported as showing resistance to several organophosphate insecticides, so onion sets or transplants from those regions may bring resistance into local populations.</p>					
Onion maggot	carbophenothion (Trithion)	8E	2 pt.	2	Furrow treatment at time of seeding or transplanting.
	chlorpyrifos (Lorsban)	15G	3.7 oz./1,000 row ft.	0.55 oz./1,000 row ft.	For direct seeded dry bulb onions only.
		4E	1.1 fl. oz./1,000 row ft.		Furrow treatment at planting time. 24-hr re-entry.
	diazinon	50W	2 lb.	1	As furrow drench.
		14G	14-28 lb.	2-4	Broadcast and incorporate into soil before planting.
	*fensulfothion (Dasanit)	15G	3.7 oz./1,000 row ft.	0.56 oz./1,000 row ft., any row spacing	Furrow treatment. Not for green onions. Under certain conditions may reduce yields.
	*fonofos (Dyfonate)	10G	6 oz./1,000 row ft.	1	For dry bulb onions only. Use only on soils with 10% or more organic matter.
ethion	10G	5-8.8 fl. oz. per 1,000 linear feet of row (with 15" rows this = 10-20 lb.)	1-2	Furrow treatment at planting time. Lower end of range for mineral soils, upper end for muck soils.	
Onion maggot adults, cutworms, stink bugs	*permethrin (Ambush Pounce)	2E	6.4-19.2 fl oz	0.1-0.3	1 day phi. Do not exceed 2.4 lb AI/acre/season.
		3.2E	4-12 fl oz		
Onion thrips, Action threshold for onion thrips: 60/100 plants during early bulb stage	azinphosmethyl (Guthion)	50 W	1 lb.	1/2	28 day phi dry onions, 7 days green onions. NOT more than 3 applications per season. 24-hr re-entry. Other formulations restricted use.
	malathion (Cythion)	5E	1 1/2 pt.	1	3 day phi.
	*methomyl (Lannate)	90SP	1 lb.	0.9	7 day phi; Wetting agent may increase efficacy. 90 SP formulation NOT restricted use.
		1.8L	4 pt.		
*permethrin (Ambush Pounce)	2E	9.6-19.2 fl oz	0.15-0.3	1 day phi. Do not exceed 2.4 lb AI/acre/season.	
		3.2E	6-12 fl oz		

Diseases	Chemical†	Remarks
Seed rot, damping-off	Thiram 30F, Thiram 42S, Ridomil 2E	There are many fungicide formulations for seed treatment made by different companies. Read and follow all label instructions.
ONIONS (dry bulbs, seed, & green onions) Downy mildew	Ridomil/Bravo 81W	Begin applications when conditions are favorable for disease development and continue at 14-day intervals until the threat of disease is over. Use a compatible spreader-sticker at rates recommended on product label. See label.

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, D—dust, DF—dry flowable, DG—dispersible granules, E—emulsifiable concentrate, F—flowable, G—granules, L—liquid concentrate, S—solution, and W—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
\*Restricted use pesticide. Post treated areas when required by label.

## ONIONS (continued)

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Botrytis leaf blight (blast) and purple blotch	Ridomil/Bravo 81W				See label.
<b>DRY ONIONS</b>					
Fungal foliar diseases:					
Alternaria (purple blotch)	Manzate 200 Dithane M-45, Bravo				Bravo is available in the following formulations: Bravo 500, Bravo 720, Bravo 90 DG, Bravo Flowable, and Bravo W-75.
Botrytis	Manzate 200, Dithane M-45, Bravo, Penncozeb, Rovral 50W or 4F*				*Apply when conditions become favorable for disease development. Continue applications at 7-14 day interval.
Downy mildew	Manzate 200, Dithane M-45, Penncozeb, Ridomil MZ58*				*Begin applications when conditions are favorable for disease, but before infection, and continue at 14 day intervals until the harvest or disease is over.
<b>GREEN ONIONS</b>					
Fungal foliar diseases:					
Alternaria (purple blotch)	Dyrene 50 W, Bravo				
Downy mildew	Bravo				
Botrytis	Dyrene 50 W, Bravo				

## PARSNIPS

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Emerged annuals	stoddard solvent	40 to 60 gal./acre	Apply after crop emergence. Weeds should be less than 1-inch tall and parsnips should have only 2 leaves.
Germinating and emerged annuals	Lorox 50 DF (linuron)	3 lb.	Apply after seeding but before crop emerges. Crop should be planted a minimum of 1/2-inch deep.
Emerged perennials and annuals	Roundup 3E (glyphosate)	2 qt.	Apply to emerged weeds before planting or after harvest. Use high rate on perennials.

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Aster leafhopper	carbaryl (Sevin) malathion	XLR plus	2 pt.	1	3 day phi.
		5E	1 1/2 pt.	1	7 day phi.

Diseases	Chemical†	Remarks
Brown canker		Plant resistant varieties such as Andover.
Alternaria leaf spot Botrytis, Downy mildew, and Rhizoctonia bottom rot	Bravo	Bravo is available in the following formulations: Bravo 500, Bravo 720, Bravo 90 DG, and Bravo Flowable.

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

\*Restricted use pesticide. Post treated areas when required by label.

## RADISHES

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations		
Emerged annuals and perennial weeds	Roundup 3E (glyphosate)	2 qt.	Apply prior to crop emergence or after harvest. Do not spray radish crop.		

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations	
		Recommended	Product/acre			
Cabbage maggot	diazinon	50W	3-4 lb.	1½-2	In seed furrow at planting time.	
		14G	10½-14 lb.			
	chlorpyrifos (Lorsban)	15G	3.3 oz./1,000 row ft.	0.5 oz./1,000 row ft.	In seed furrow at planting.	
		4E	1 fl. oz./1,000 row ft. in 40 gal. water	20 lb.		Furrow drench at planting time. 24 hr. re- entry
	*fonofos (Dyfonate)	10G		2	Broadcast, disk in before planting.	
Flea beetles	carbaryl (Sevin)	XLR plus	1-2 pt.	½-1	3 day phi.	
		50% W	1 lb.	½	10 day phi.	
	*esfenvalerate (Asana XL)	4E	1 pt.			
		0.66E	5.8-9.6 fl. oz.	0.03-0.05		7 day phi. Do not exceed 0.1 lb AI/acre/ season.
		5E	1½ pt.	1		7 day phi.
	malathion	2E	4 pt.	1	7 day phi.	

Diseases	Chemical†	Remarks
Seed rot, damping-off	Captan, Thiram	There are many fungicide formulations for seed treat- ment made by several different companies. Read and follow all label instructions.
Aphanomyces, Rhizoctonia, Fusarium wilt		Plant tolerant varieties such as Fancy Red, Far Red, and Feugo.

## RUTABAGAS AND TURNIPS

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations	
Annual weeds	Dacthal 75 W (DCPA)	12	Apply before crop and weeds emerge. <i>Not effective on muck or peat soils.</i>	
Emerged weeds	Gramoxone Extra 2.5E	3 pt.	<i>Turnips only.</i> Apply before, during or after planting but prior to crop emergence.	
Emerged perennials and annuals	Roundup 3E (glyphosate)	2 qts.	Apply to emerged weeds before planting or after harvest.	

Insects	Chemical†	Formulation		Dose lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Cabbage maggot	chlorpyrifos (Lorsban)	15G	4.6-9.2 oz./ 1,000 row ft.		Behind shoe and in front of press wheel.
		4E	1.6-3.3 fl. oz./ 1,000 row ft.		
	diazinon	14G	7½-28 lb.	1-4	Use in 40 gallons of water per acre. 24 hr. re-entry. Row or broadcast treatment before or at planting time. 1 lb. row; 4 lb. broadcast, plus a drench treatment over the row when flies appear for second generation. Turnips only.
		*fensulfothion (Dasanit)	15G	7-13 oz./ 1,000 ft. row or 2 fl. oz. spray concentrate	

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

\*Restricted use pesticide. Post treated areas when required by label.



**RUTABAGAS AND TURNIPS (continued)**

Insects	Chemical†				Remarks
Flea beetles	carbaryl (Sevin)	XLR plus	1-2 pt.	1/2-1	3 day phi roots, 14 days tops.
	diazinon	4E	1/2-1 pt.	1/2	10 day phi, turnips only.
	malathion (Cythion)	5E	1 1/2 pt.	1	3 day phi.
	methoxychlor	2E	4 pt.	1	7 day phi.

**SPINACH**

Weeds	Herbicide†	Amount/acre commercial product	Remarks and limitations
Germinating grasses and broadleaves	Antor 4E (diethatyl-ethyl)	3 qt.	Apply and incorporate before seeding and apply preemergence after seeding. Needs rain or irrigation to move into soil.
Emerged grasses	Fusilade 2000 1E (fluazifop-P)	1.5 pt.	Apply to actively growing grasses. Add 1 qt. crop oil concentrate/acre.
	Poast 1.5E (sethoxydim)	1 pt.	Add 1 qt. crop oil concentrate per acre. Apply to actively growing grasses.
Emerged annuals or perennial weeds	Roundup 3E (glyphosate)	2 qt.	Apply to emerged weeds in spring before spinach emerges. Do not contact spinach.

Insects	Chemical†	Formulation		Dose in lb AI/acre	Remarks and limitations
		Recommended	Product/acre		
Leaf miner	*azinphosmethyl (Guthion)	2E	2 pt	1/2	14 day phi. 24-hr. re-entry.
	diazinon (e.g., AG 500)	4E	1 pt	1/2	10 day phi.
	dimethoate (Cygon, De-Fend, Rebelate)	4E	1/2 pt	1/4	14 day phi. Note: 4-day re-entry.
	malathion (Cythion)	5E	2 pt	1 1/4	7 day phi.
	*permethrin (Ambush, Pounce)	2E	6.4-12.8 fl oz	0.1-0.2	1 day phi. Do not graze or feed treated foliage.
Loopers, armyworms, cutworms	*methomyl (Lannate)	25 WP	6.4-12.8 fl oz		
		3.2E	4-8 fl oz		
		1.8L 90SP	2-4 pt 1/2-1 lb	0.45-0.90	7 day phi. Do not apply to seedlings <3" diameter or when minimum daily temp is <32°F.

Diseases	Chemical†	Remarks
Seed rot, damping-off	Captan, Thiram,	There are many fungicide formulations for seed treatment made by several different companies. Read and follow all label instructions.
Soil treatment		
Root rot, damping-off	Ridomil 2E	See label for additional information.
White rust	Ridomil 2E	

†Abbreviations used in tables: phi—preharvest interval, NTL—no time limitations, B—bait, D—dust, E—emulsifiable concentrate, F—flowable, G—granules, L—liquid concentrate, S—solution, and W—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.  
 \*Restricted use pesticide. Post treated areas when required by label.

## NOTES

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### **CHEMIGATION OF PESTICIDES**

Minnesota Pesticide Control Law 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 approved for chemigation application can be applied by this method. Specific information on check valves, registration, and posting is available from MDA (612/297-2614).

**Do not use after 1990.**

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