

F. Commodity Recommendations

Pesticide Use Disclaimer

THE LABEL IS THE LAW

Before using a pesticide, check the label for up to date rates and restrictions.

Labels can be downloaded from: <http://www.cdms.net/>, <https://www.greenbook.net/> or <http://www.agrian.com/labelcenter/results.cfm>

For more information on Pesticide Safety and the Pesticide Label see chapter D.

Guide to the Recommended Pesticide Tables in the Following Crop Sections:

- 1. Pesticides are listed by group or code number based on chemical structure and mechanism of action**, as classified by the Weed Science Society of America (WSSA) for herbicides, the Insecticide Resistance Action Committee (IRAC) for insecticides, and the Fungicide Resistance Action Committee (FRAC) for fungicides.
If the number is in bold font, the product may have resistance concerns.
- 2. For restricted use pesticides**, the restricted active ingredients are labeled with a *. (See section D 3.2.1 “Restricted Use Classification Statement” for more information).
- 3. In addition to the pesticides listed below, other formulations or brands with the same active ingredient(s) may be available. ALWAYS CHECK THE LABEL:**
 - a) to ensure a pesticide is labeled for the same use,**
 - b) to ensure the pesticide is labeled for the desired crop, and**
 - c) for additional restrictions.**
- 4. All pesticide recommendations are made for spraying a broadcast area of 1 acre** (43,560 square feet). **Adjust the rate for banded applications** (for more information, see section E 1.3 Calibrating Granular Applicators).
- 5. Check the label for the maximum amount of pesticide per application and the maximum number of applications per year.**
- 6. Bee Toxicity Rating (Bee TR):** N=nontoxic; L=minimum impact on bees; M=moderately toxic, can be used if dosage, timing and method of application are correct, but should NOT be applied directly to the crop if bees are present; H=highly toxic, severe losses expected, -- = data not available.

Horseradish

Horseradish is a hardy perennial from the Mustard family that is grown for its fleshy white roots in annual production systems. Roots that are left in the ground for two or more growing seasons become stringy and woody. If roots are not harvested or killed, horseradish can become a weed.

There are three types of horseradish: “**Common**” types have broad crinkled leaves and high quality, large, smooth roots, but they are susceptible to virus and white rust. “**Bohemian**” types have medium-sized narrow smooth leaves and somewhat lower quality roots. They are susceptible to virus but have some white rust tolerance. “**Big Top Western**” types have smooth, large upright leaves and large good quality roots; however, the roots are rough or corky on the surface. “Big Top Western” types have resistance to virus and white rust. Use locally selected horseradish strains that are adapted to the area.

Recommended Nutrients Based on Soil Tests

In addition to using the table below, check the suggestions on rate, timing, and placement of nutrients in your soil test report and chapter B Soil and Nutrient Management. Your state’s soil test report recommendations and/or your farm’s nutrient management plan supersede recommendations found below.

		Soil Phosphorus Level				Soil Potassium Level				
		Low	Med	High (Opt)	Very High	Low	Med	High (Opt)	Very High	
Horseradish	N (lb/A)	P ₂ O ₅ (lb/A)				K ₂ O (lb/A)				Nutrient Timing and Method
	150-200	200	150	100	0	200	150	100	0	Total nutrient recommended
	50	200	150	100	0	200	150	100	0	Broadcast and disk-in
	50-100	0	0	0	0	0	0	0	0	Sidedress 3-5 weeks after planting
	50	0	0	0	0	0	0	0	0	Sidedress 4-6 weeks after planting if needed

Apply 1.0 to 2.0 lb/A of boron (B) with broadcast fertilizer; see also Table B-7 in chapter B Soil and Nutrient Management.

Planting and Spacing

Sets are selected roots from the previous crop. They should be 10-12 inches long and ¼ to 5/8 inch in diameter. Do not allow roots to dry out before planting. To ensure proper orientation at planting, make a square cut at the end of the roots nearest the main root. Make a slanting cut at the other end and plant the slanting cut end downward.

Plant in late April to early May. Place sets at an angle in a furrow so the top will be 1 inch deep and the bottom 2 inches deep. Alternatively, use a dribble to make a slanted planting hole, or leave several inches above the soil surface and cover sets by forming ridges in the row. Sets should point in the same direction that the cultivator will go, e.g., for two-row cultivator, two rows in one direction and the next two rows in the opposite direction. Space rows 34--36 inches apart with 18 inches between sets in the row.

Harvesting and Storage

Dig roots as needed. In an annual system, the set will become the main root which is the largest and most valuable for market. For maximum growth, harvest once tops have died due to frost. Alternatively, tops can be cut off as close to the soil surface as possible. Then wait several days before harvesting. Roots overwinter, but winter soil conditions may prevent harvesting. Store horseradish in the dark with temperatures between 32-40°F (0-4°C) and 98% relative humidity. Roots exposed to light become green. Roots can be stored for 8-9 months. If storage and temperature conditions cannot be met, consider harvesting the following spring by digging the roots as soon as new growth starts to appear. Select the top performing lateral roots for the next crop

Weed Control

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Recommended Herbicides

1. Identify the weeds in each field and select recommended herbicides. More information is available in the “Herbicide Effectiveness on Common Weeds in Vegetables” (Table E-2) in chapter E Pest Management.
2. Minimize herbicide resistance development. Identify the herbicide site of action group number and follow recommended good management practices; **bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.** Include non-chemical weed control whenever possible.

1. Preemergence						
Group	Product Name	Product Rate	Active Ingredient (* = Restricted Use)	Active Ingredient Rate	PHI (d)	REI (h)
3	Dacthal 6F Dacthal W-75	8.0 to 14.0 pt/A 6.0 to 14 lb/A	DCPA	6.0 to 10.5 lb/A	25	12
-Labeled for preemergence; incorporation is not recommended. -Labeled for applications over the top of transplants without injury (will not control emerged weeds). -Primarily controls annual grasses and a few broadleaf weeds, including common purslane. Results have been most consistent when used in fields with coarse-textured soils low in organic matter and when the application are followed by rainfall or irrigation. -Maximum application not addressed on label.						
14	Goal 2XL GoalTender 4F	2.0 pt/A 1 pt/A	oxyfluorfen	0.5 lb/A	--	48
-Apply immediately after planting but before emergence of new leaves. -Emerged leaves that receive direct herbicide application will be injured. It may be desirable to cultivate immediately prior to application to remove emerged weeds. Delay cultivation after Goal application, when possible, to reduce deactivation of Goal by incorporation. -Do not use Goal herbicide on horseradish plantings which are weak or under stress due to temperature, disease, fertilizer, nematodes, insects, pesticides, drought, or excessive moisture. -Do not apply more than 2 pt/A of Goal 2XL per crop or no more than 1 pt/A per crop of GoalTender.						
14	Zeus 4L or Spartan Charge 3.5EC	2.25 to 8 fl oz/A 2.9 to 10.2 fl oz/A	sulfentrazone	0.07 to 0.25 lb/A	--	12
-Labeled for preplant, preemergence or preplant incorporated. Do not incorporate to a depth greater than 2 inches. -Preemergence applications should be made at least 5 days prior to crop emergence. -Do not apply more than 8 oz/A per 12-month period. -Prepackaged mixtures with sulfentrazone include Authority Elite 7SE or BroadAxe 7SE: Authority Elite or BroadAxe at 25 fl oz = 21 fl oz Dual Magnum 7.62E + 5.3 fl oz of Spartan Charge.						
15	Dual Magnum 7.62E generic metolachlor 8EC	1.0 to 1.3 pt/A 1.0 to 2.0 pt/A	s-metolachlor metolachlor	0.95 to 1.27 lb/A 0.95 to 1.91 lb/A	--	24
-Apply after planting, but before crop emergence; Dual will not control emerged weeds. Primarily controls annual grasses, certain broadleaf weeds, and nutsedge. Do not make more than one application per crop; do not apply more than 1.33 pt/A per crop. -Prepackaged mixtures with s-metolachlor include Authority Elite 7SE or BroadAxe 7SE: Authority Elite or BroadAxe at 25 fl oz = 21 fl oz Dual Magnum 7.62E + 5.3 fl oz of Spartan Charge.						

2. Postemergence						
Group	Product Name	Product Rate	Active Ingredient (* = Restricted Use)	Active Ingredient Rate	PHI (d)	REI (h)
1	Select 2EC Select Max 0.97EC Poast 1.5EC	6 to 8 fl oz/A 9.0 to 16.0 fl oz/A 1.0 to 2.5 pt/A	clethodim sethoxydim	0.07 to 0.12 lb/A 0.2 to 0.3 lb/A	30 60	24 12
-Select 2EC: use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). Select Max: use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution). Poast: use COC at 1.0% v/v. -The use of COC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to NIS when grasses are small and soil moisture is adequate. -Use lower labeled rates for annual grass control and higher labeled rates for perennial grass control. -Yellow nutsedge, wild onion, wild garlic, and broadleaf weeds will not be controlled. -Controls many annual and certain perennial grasses, including annual bluegrass, but Poast is preferred for goosegrass control. For best results, treat annual grasses when they are actively growing and before tillers are present. Control may be reduced if grasses are large or under hot or dry weather conditions. -If repeat applications are necessary, allow 14 days between applications. Rainfastness is 1 h. -Do not tank-mix with or apply within 2 to 3 days of any other pesticide, unless labeled, as this may increase the risk of crop injury or reduce the control of grasses. -Do not apply more than 8 fl oz of Select 2EC in a single application and do not exceed 2 pt/A for the season; do not apply more than 16 fl oz of Select Max in a single application and do not exceed 4 pt/A for the season. -Do not apply more than 2.5 pt/A Poast in single application and do not exceed 5 pt/A for the season.						
15	Outlook 6E	12 to 21 fl oz/A	dimethanamid	0.56 to 0.98 lb/A	40	12
-Apply postemergence from the 2-leaf to the 8-leaf stage. Outlook will not control emerged weeds. -Do not exceed the maximum labeled for the soil type.						

3. Other Labeled Herbicides These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns.						
Group	Product Name	Active Ingredient (* = Restricted Use)				
7	Lorox	linuron				
14	Aim	carfentrazone				

Insect Control

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Aphids

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV	1.5 pt/A	methomyl*	65	48	H
1B	Malathion 57 EC	1.0 to 2.0 pt/A	malathion	7	24	H
4A	Actara 25WDG	1.5 to 3.0 oz/A	thiamethoxam	7	12	H
4A	Admire Pro	4.4 to 10.5 fl oz/A	imidacloprid - soil	21	12	H
4A	Admire Pro	1.2 fl oz/A	imidacloprid - foliar	7	12	H
4D	Sivanto Prime or 200 SL	7.0 to 10.0 fl oz/A	flupyradifurone	7	4	M
29	Beleaf 50SG	2.0 to 2.8 oz/A	flonicamid	3	12	L

Beet Leafhoppers

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
1A	Sevin XLR Plus	0.5 to 1.0 qt/A	carbaryl	7	12	H
4A	Actara 25WDG	1.5 to 3.0 oz/A	thiamethoxam	7	12	H
4A	Admire Pro	4.4 to 10.5 fl oz/A	imidacloprid - soil	21	12	H
4A	Admire Pro	1.2 fl oz/A	imidacloprid - foliar	7	12	H
4D	Sivanto Prime or 200 SL	7.0 to 10.5 fl oz/A	flupyradifurone	7	4	M

Cutworms See also section E 3.1. Soil Pests - Detection and Control.

Cutworms are moth larvae (caterpillars) that feed on roots and stems. They chew on stems at or near the soil line, severing young plants. Larvae are typically active at night, and spend most of this stage belowground. Cutworms are favored by less disturbed soils and debris covered soil surfaces. Conventional tillage and soil incorporation of crop debris helps reduce populations. Several species are capable of causing injury to young plants. There are usually 2 generations per season. If cutworm damage is anticipated, it is best to treat preventively.

Apply the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
3A	Bifenthrin 2EC, others	5.1 to 6.4 fl oz/A	bifenthrin*	21	12	H

Flea Beetles (FB), Harlequin Bugs

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
1A	Sevin XLR Plus (not labeled for harlequin bug)	1.0 qt/A	carbaryl	7	12	H
3A	Brigade 2EC, others	6.4 fl oz/A	bifenthrin*	21	12	H
4A	Actara 25WDG	1.5 to 3.0 oz/A	thiamethoxam	7	12	H
4A	Admire Pro	10.5 fl oz/A	imidacloprid - soil	21	12	H
4A	Admire Pro	1.2 fl oz/A	imidacloprid - foliar	7	12	H
5	Blackhawk 36WG (FB only)	1.7 to 3.3 oz/A	spinosad	3	4	M
5	Entrust SC (OMRI) (FB only)	4.0 to 10.0 fl oz/A	spinosad	3	4	M
5	Radiant SC (FB only)	5.0 to 6.0 fl oz/A	spinetoram	3	4	M

Imported Cabbageworm, Diamondback moth and Cabbage Looper

Early season infestations rarely warrant control because the plant can outgrow injury unless injury to the growing point prevents new leaf emergence. Mid-season defoliation thresholds are greater than 30% defoliation and defoliators are abundant.

Imported Cabbageworm, Diamondback moth and Cabbage Looper - continued on next page

Imported Cabbageworm, Diamondback moth and Cabbage Looper - continued

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
1B	Malathion 57 EC	1.0 to 2.0 pt/A	malathion	7	24	H
3A	Brigade 2EC, others	5.1 to 6.4 fl oz/A	bifenthrin*	21	12	H
5	Blackhawk 36WG	1.7 to 3.3 oz/A	spinosad	3	4	M
5	Radiant SC	6.0 to 8.0 fl oz/A	spinetoram	3	4	M
5	Entrust SC (OMRI)	3.0 to 6.0 fl oz/A	spinosad	3	4	M
11A	XenTari (OMRI)	0.5 to 1.5 lb/A	<i>Bacillus thuringiensis aizawai</i>	0	4	N
11A	Dipel DF, others (OMRI)	0.5 to 2.0 lb/A	<i>Bacillus thuringiensis kurstaki</i>	0	4	N
28	Coragen 1.67SC	3.5 to 7.5 fl oz/A	chlorantraniliprole - foliar	1	4	L

Imported Crucifer Weevil

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
3A	Permethrin	6.0 fl oz/A	permethrin* - foliar	30	12	H
3A	Permethrin	17 fl oz/100 gal	permethrin* - preplant dip	30	12	H

Thrips

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
1A	Lannate LV	1.5 pt/A	methomyl*	65	48	H
4A	Admire Pro	4.4 to 10.5 fl oz/A	imidacloprid - soil	21	12	H
5	Entrust SC (OMRI)	4.0 to 10.0 fl oz/A	spinosad	3	4	M
5	Radiant SC	6.0 to 8.0 fl oz/A	spinetoram	3	4	M
5	Blackhawk 36WG	1.7 to 3.3 oz/A	spinosad	3	4	M

Disease Control

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Recommended Fungicides

Damping-Off caused by *Phytophthora*, *Pythium*, and *Rhizoctonia*

Code	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
Apply one of the following at planting (see label for application methods and restrictions):						
Phytophthora and Pythium root rot						
4	Ridomil Gold 4SL	0.5 to 1.0 pt/A	mefenoxam	5	48	N
4	Ultra Flourish 2E	2.0 to 4.0 pt/A	mefenoxam	5	48	N
4	MetaStar 2E AG	4.0 to 8.0 pt/A	metalaxyl	AP	48	N
Phytophthora, Pythium, and Rhizoctonia root rot						
4 + 11	Uniform 3.66SE	0.34 fl oz/1000 ft row. Avoid direct seed contact, which may cause delayed emergence.	mefenoxam + azoxystrobin	AP	0	N
Rhizoctonia root rot						
11	azoxystrobin 2.08F	0.40 to 0.80 fl oz/1000 ft row	azoxystrobin	AP	4	N

Bacterial Leaf Spot

Rotate away from cruciferous crops for at least 2 years if the field has a known history of disease. Avoid excessive irrigation and maintain proper drainage. Avoid cultivation or other activity when foliage is wet to minimize spread.

Leaf Spots caused by *Alternaria* and *Cercospora* spp.

Use resistant cultivars where available. A 3-year rotation to non-cruciferous crops may be required if the field has a history of disease.

Leaf Spots caused by Alternaria and Cercospora spp. - continued on next page

F Horseradish

Leaf Spots caused by Alternaria and Cercospora spp. - continued

Code	Product Name	Product Rate	Active Ingredient(s) (* = Restricted Use)	PHI (d)	REI (h)	Bee TR
When conditions favor disease development, apply one of the following on a 7-14 d schedule and rotate between fungicides with different FRAC codes as long as weather conditions favor disease development:						
7	Endura 70W	4.5 fl oz/A (Alternaria only)	boscalid	0	12	--
7	Fontelis 1.67SC	16.0 to 30.0 fl oz/A	penthiopyrad	0	12	L
11	azoxystrobin 2.08F	6.2 to 15.5 fl oz/A	azoxystrobin	0	12	N
11	Cabrio 20EG	8.0 to 16.0 oz/A	pyraclostrobin	0	12	N

Ramularia Stem and Leaf Spot In fields with a known history of Ramularia stem and leaf spot apply the following preventatively or when conditions favor disease development.

Code	Product Name	Product Rate	Active Ingredient(s) (* = Restricted Use)	PHI (d)	REI (h)	Bee TR
M05	chlorothalonil 6F	3.0 pt/A	chlorothalonil	14	12	N

Verticillium Wilt

Rotate away from fields with a known history of Verticillium wilt. Carefully inspect planting stock for discoloration, streaking and internal flecking. Plant only healthy planting material.

White Rust

Use certified, disease-free seed. A rotation to non-cruciferous crops may be required if the field has a history of disease. Manage weeds and volunteer hosts which may act as reservoirs for the pathogen. Plant "Big Top Western" types which have virus and white rust resistance.

Code	Product Name	Product Rate	Active Ingredient(s) (* = Restricted Use)	PHI (d)	REI (h)	Bee TR
When conditions favor disease development, apply one of the following on a 7 to 14-day schedule:						
11	azoxystrobin 2.08F	6.2 to 15.5 fl oz/A	azoxystrobin	0	12	N
11	Cabrio 20EG	8.0 to 16.0 oz/A	pyraclostrobin	0	12	N

For Immediate Medical Attention

Call 911

**For a Pesticide Exposure Poisoning
Emergency Call**



For All States

This number will automatically connect you to the poison center nearest to you.

Anyone with a poisoning emergency can call the toll-free telephone number for help. Personnel at the Center will give you first-aid information and direct you to local treatment centers if necessary.

For Pesticide Spills

Small Spills: See the product label for cleanup advice.

Large spills: Call the National Response Center at 1-800-424-8802 or CHEMTREC at 800-424-9300 (24 hours) - Industry assistance with emergency response cleanup procedures for large, dangerous spills.

Be aware of your responsibility to report spills to the proper state agency.