

# HORSERADISH

Horseradish belongs to the Mustard family and is grown for its roots. The fleshy white roots resemble parsnip in shape. Horseradish is a hardy perennial grown in annual production systems. Roots left in the ground two or more growing seasons become stringy and woody. Because of its perennial nature, if roots are not harvested or killed, horseradish can become a weed.

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

## Recommended Nutrients Based on Soil Tests

Before using the table below, refer to important notes in the Soil and Nutrient Management chapter in Section B and your soil test report. These notes and soil test reports provide additional suggestions to adjust rate, timing, and placement of nutrients. Your state’s soil test report recommendations and/or your farm’s nutrient management plan supercede recommendations found below.

Horseradish	Pounds N per Acre	Soil Phosphorus Level				Soil Potassium Level				Nutrient Timing and Method
		Low	Med	High	Very	Low	Med	High	Very	
				(Opt.)	High			(Opt.)	High	
		Pounds P <sub>2</sub> O <sub>5</sub> per Acre				Pounds K <sub>2</sub> O per Acre				
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 pounds of boron (B) per acre with broadcast fertilizer. See Table B-9 for more specific boron recommendations.

### Sets for Planting

Sets are selected roots from the previous crop. They should be 10 to 12 inches long and 1/4 to 5/8 inch in diameter. Do not allow them to dry out before planting. To ensure proper orientation of roots at planting, make a square cut at the end of the root nearest the main root, and at the other end make a slanting cut. Plant the slanting cut end downward.

### Planting and Spacing

Plant in late April to early May. Place sets at an angle in a furrow so the top end will be 1 inch deep and the bottom 2 inches deep. Or, use a dribble to make a slanted planting hole. Or, plant sets leaving several inches above the soil surface and cover 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 to 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; however, soil conditions may prevent winter harvesting. Store horseradish in the dark with temperatures between 32° and 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

Identify the weeds in each field and select recommended herbicides that control those weeds. See Tables E-3 and E-4. Match preplant incorporated and preemergence herbicide rates to soil types and percent organic matter in each field. Determine the preharvest interval (PHI) for the crop. See Table E-4 and consult the herbicide label. Find the herbicides you plan to use in the Herbicide Resistance Action Committee’s (HRAC) **Herbicide Site of Action Table E-8** and follow the recommended good management practices to minimize the risk of herbicide resistance development by weeds in your fields.

### Preemergence

DCPA--6.0 to 10.5 lb/A. Apply 8.0 to 14.0 pints per acre Dacthal 6F immediately after planting to control annual grasses and some broadleaf weeds.

Oxyfluorfen--0.5 lb/A. Apply 2.0 pints per acre Goal 2XL or 1 pint of GoalTender 4F immediately after planting to control certain broadleaf weeds. Emerged plants which receive direct or indirect (drift) spray contact will be injured. It may be desirable to cultivate immediately prior to

application to remove germinated 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.

S-metolachlor--0.95 to 1.90 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E in New Jersey. The use of this product is legal ONLY if a waiver of liability provided by the local growers' association has been signed by the grower, all fees have been paid, and a label has been provided by the association.** Apply 1.0 to 2.0 pints per acre Dual Magnum 7.62E after planting, but before weeds or crop emerge to control annual grasses, yellow nutsedge, and certain broadleaf weeds, including galinsoga. Dual Magnum will NOT control emerged weeds. Use the lower rate on coarse textured soils low in organic matter, and the higher rate on fine textured soils and soils high in organic matter. Read and follow all notes and precautions on the label. DO NOT incorporate Dual Magnum prior to planting. Make only one application per crop. Observe a minimum preharvest interval of 64 days after application. **Other generic versions of metolachlor and s-metolachlor may be available, and may or may not be labeled for use in the crop.**

Sulfentrazone--0.07 to 0.25 lb/A. **Trial Use Only! No crop safety data is available in the Mid-Atlantic states.** Apply 2.25 to 8 fluid ounces per acre Zeus to weed free soil before the crop has emerged to control many annual weeds, including morninglory species, and to suppress or control yellow nutsedge. Use the lower rate on coarse-textured (sandy) soils low in organic matter, and the higher rate on fine-textured (silt and clay) soils and soils high in organic matter. Primarily controls broadleaf weeds. Tank-mix with Dacthal or Dual Magnum to control annual grasses.

### Postemergence

Clethodim--0.094 to 0.125 lb/A. Apply 6.0 to 8.0 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12.0 to 16.0 fluid ounces of Select Max 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select will not consistently control goosegrass. The use of oil concentrate with Select 2EC 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 nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 30 days.

Sethoxydim--0.2 to 0.5 lb/A. Apply 1.0 to 2.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution)

postemergence to control annual grasses and certain perennial grasses. **The use of oil concentrate 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 nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, and broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 60 days and apply no more than 5.0 pints per acre in one season.

### Postharvest

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone SL 2.0 or OLF for postharvest desiccation of the crop in Delaware, New Jersey and Virginia.** Apply 2.4 pints per acre Gramoxone SL 2.0 or OLF as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. See the label for additional information and warnings.

### Insect Control

**THE LABEL IS THE LAW. PLEASE REFER TO THE LABEL FOR UP TO DATE RATES AND RESTRICTIONS.**

**NOTE:** Copies of specific insecticide product labels can be downloaded by visiting the websites [www.CDMS.net](http://www.CDMS.net) or [www.greenbook.net](http://www.greenbook.net). Also, specific labels can be obtained via web search engines.

### Aphids

Apply one of the following formulations:  
imidacloprid--**soil** 4.4 to 10.5 fl oz/A Admire Pro (or OLF),  
**foliar** 1.2 fl oz/A Admire PRO (or OLF)  
flonicamid--2.0 to 2.8 oz/A Beleaf 50SG  
flupyradifurone--7.0 to 10.5 fl oz/A Sivanto 200 SL  
malathion--1.0 to 2.0 pts/A Malathion 57EC (or OLF)  
methomyl--1.5 pts/A Lannate LV  
thiamethoxam--1.5 to 3.0 oz/A Actara 25WDG

### Cutworms

Apply one of the following formulations:  
bifenthrin--5.1-6.4 fl oz/A Sniper

### Flea Beetles (FB), Harlequin Bugs

Apply one of the following formulations:  
bifenthrin--6.4 fl oz/A Sniper  
carbaryl--1.0 qt/A Sevin XLR Plus (or OLF)  
imidacloprid--**soil** 10.5 fl oz/A Admire PRO, **foliar** 1.2 fl oz/A Admire PRO  
spinosad--(**FB only**) 1.7 to 3.3 oz/A Blackhawk 36WG  
thiamethoxam--1.5 to 3.0 oz/A Actara 25WDG

### Imported Cabbageworm (and other caterpillars)

Apply one of the following formulations:  
*Bacillus thuringiensis*--0.12 to 1.5 lb/A Javelin (or OLF)  
**(OMRI listed)**  
bifenthrin--5.12 to 6.4 fl oz/A Sniper

HORSERADISH

chlorantraniliprole--3.5 to 5.0 fl oz/A Coragen  
 malathion--1.0 to 2.0 pt/A Malathion 57EC (or OLF)  
 spinosad--1.0 to 2.0 oz/A Entrust (OMRI listed)

**Leafhoppers (Note: Some species of leafhopper can transmit brittle root disease of horseradish).**

Apply one of the following formulations:  
 carbaryl--0.5 to 1.0 qt/A Sevin XLR Plus (or OLF)  
 flupyradifurone--7.0 to 10.5 fl oz/A Sivanto 200 SL  
 imidacloprid--soil 4.4 to 10.5 fl oz/A Admire Pro, **foliar** 1.2 fl oz/A Admire PRO  
 thiamethoxam--1.5 to 3.0 oz/A Actara 25WDG

**Thrips**

Apply one of the following formulations:  
 imidacloprid--soil 4.4 to 10.5 fl oz/A Admire Pro  
 methomyl--1.5 pts/A Lannate LV  
 spinetoram--6.0 to 8.0 fl oz/A Radiant SC  
 spinosad--1.7 to 3.3 oz Blackhawk 36WG or **1.0 to 2.0 oz/A Entrust (OMRI listed)**

Pesticide	Use Category <sup>1</sup>	Hours to Reentry	Days to Harvest
<b>INSECTICIDE</b>			
<i>Bacillus thuringiensis</i>	G	4	0
bifenthrin	R	12	21
carbaryl	G	12	7
chlorantraniliprole	G	4	1
fonicamid	G	12	3
flupyradifurone	G	4	7
imidacloprid (soil/foliar)	G	12	21/7
malathion	G	24	7
methomyl	R	48	65
spinetoram	G	4	3
spinosad	G	4	3
thiamethoxam	G	12	7
<b>FUNGICIDE (FRAC code)</b>			
azoxystrobin (Group 11)	G	4	0
Cabrio (Group 11)	G	12	0
chlorothalonil (Group M5)	G	12	14
Endura (Group 7)	G	12	0
Fontelis (Group 7)	G	12	0
Presidio (Group 43)	G	12	7
Ridomil Gold (Group 4)	G	12	0
Uniform (Groups 4 + 11)	G	0	AP
Vapam HL	R	48	0

See Table D-6.

<sup>1</sup>G = general, R = restricted, AP = At planting

**Disease Control**

**Damping-Off** (caused by *Pythium* and *Phytophthora*)

*Apply one of the following in a 7-inch wide band at planting:*

Ridomil Gold--1.0 to 2.0 pt 4SL/A  
 Ultra Flourish--2.0 to 4.0 pt 2E/A  
 MetaStar--4.0 to 8.0 pt 2EAG/A  
 Presidio--3.0 to 4.0 fl oz 4SC/A  
 azoxystrobin--0.4 to 0.8 fl oz 2.08F/1000 row ft or OLF  
 Uniform--0.34 fl oz 3.66SE/1000 ft row

**Bacterial Leaf Spot**

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

**Alternaria Leaf Spot and Cercospora Leaf Spot**

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

*When conditions favor disease development, apply one of the following and rotate between fungicides from different FRAC groups on a 7-14 day schedule:*

azoxystrobin--6.2 to 15.5 fl oz 2.08F/A or OLF  
 Cabrio--8.0 to 16.0 oz 20EG/A  
 Endura--4.5 fl. oz 0.7DF/A (Alternaria only)  
 Fontelis--16.0 to 30.0 fl. oz SC /A

**Ramularia Leaf Spot**

*When conditions favor disease development apply the following on a 7-10 day schedule:*

chlorothalonil--3.0 pts 6F/A

**White Rust**

Utilize 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.

*When conditions favor disease development, apply one of the following on a 7-14 day schedule:*

azoxystrobin--6.2 to 15.5 fl oz 2.08F/A or OLF  
 Cabrio--8.0 to 16.0 oz 20EG/A

**Verticillium wilt**

Apply through irrigation system 0.6-1.0 inches of water in the fall once.

Metam-sodium (Vapam HL)--50.0 gal/A