

# Horseradish

Horseradish is usually grown commercially as an annual in Wisconsin. One-year-old secondary roots are selected and detached from primary roots at harvest for planting the following year. When grown as a perennial, the main roots are harvested, and secondary roots broken off during harvest will provide root material for the next year's crop.

In Wisconsin, horseradish is grown on sands, sandy loams, and organic soils. Such soils should be well drained and stone free. Irrigation is recommended for profitable horseradish production on very sandy soils.

## Planting

**Rows:** 30–36 inches.

**Plants in row:** 12–18 inches apart.

Use set roots that are 1/4–1/2 inch thick and 12–14 inches long. Lay roots flat in shallow furrows with the crown end resting slightly higher than the basal end. Cover the sets with 2–4 inches of soil, then firm the soil using a roller.

After the plant is established, lift the crown end slightly to break off the new secondary roots from the upper portion. The remaining secondary roots at the basal end will nourish the set and young plant. Removing the secondary crown roots allows enlargement of the set root, yielding high-quality primary roots.

## Lime and fertilizer

**Lime:** Use dolomitic lime to maintain a pH of 6.8.

**Fertilizer rates:** On sands/sandy loams with a pH of 6.5 or higher, the soil test value for phosphorous should be in the range of 60 ppm. The potassium soil test should be in the range of 140 ppm. Use annual nitrogen, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O recommendations listed in the table below.

**Application:** Broadcast lime and fertilizer and work in before planting. Sidedress annual applications at planting.

**Nitrogen:** On irrigated sands, apply 25% of the nitrogen at planting. Apply the remainder in at least two applications after crop emergence. Split applications reduce the potential for nitrate leaching.

**Micronutrients:** Irrigated sands may require additional sulfur and boron.

## Annual nitrogen, phosphate, and potash recommendations for horseradish

Nitrogen		Phosphate and potash		
Organic matter (%)	Amount to apply (lb/a)	Yield goal (t/a)	Amount P <sub>2</sub> O <sub>5</sub> to apply* (lb/a)	Amount K <sub>2</sub> O to apply* (lb/a)
<2	160	6	50	160
2.0–9.9	120			
10–20	100			
>20	75			

\*Amounts shown are for optimum (O) soil test levels. Apply 50% of this rate if soil test is high (H) and omit if soil test is excessively high (EH). If soil test is low (L) or very low (VL), increase rates according to soil test recommendations.

## Disease control in horseradish

Disease	Active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions	
<b>Alternaria leaf spot and white rust</b>	azoxystrobin	6.0–15.5 fl oz Aframe, Quadris Flowable, Satori, Willowood Azoxy 2SC	0	Quadris, Satori, and Cabrio belong to the Group 11 (strobilurin) category of fungicides. Do not exceed 1 application of any of these products before alternating with a fungicide having a different mode of action. Do not exceed 3 applications of strobilurin fungicides per year. Do not exceed 123.0 fl oz/a per season Quadris or 48.0 oz/a Cabrio per season.	
		6.0–20.0 fl oz AzoxyStar	0		
	pyraclostrobin	<i>Alternaria</i> : 8.0–12.0 oz Cabrio EG <i>white rust</i> : 8.0–16.0 oz Cabrio EG	0		
	boscalid	4.5 oz Endura	0		Do not make more than 5 applications per season. Do not apply more than 22.5 oz/a Endura per season.
	cyprodinil + fludioxonil	11.0–14.0 oz Switch 62.5WG	7		Ground application only. Do not apply more than 56.0 oz/a per season.
	fluxapyroxad + pyraclostrobin	4.0–5.5 fl oz Merivon	7		Also manages powdery mildew and Cercospora. Do not make more than 3 applications per acre per year.
<b>Pythium and Phytophthora root rot</b>	penthopyrad	16.0–30.0 fl oz Fontelis	0	Do not apply more than 61.0 fl oz/a per year. Do not apply more than two times before alternating to an effective fungicide with a different mode of action.	
	trifloxystrobin	2.0–3.0 oz Flint 1.9–2.9 fl oz Gem 500 SC	7	Do not apply more than 12.0 oz/a per year of Flint. Alternate fungicide modes of action for resistance management. Do not apply more than 11.5 fl oz/a per season of Gem 500 SC. Do not graze or feed foliage of treated crops.	
	azoxystrobin	0.4–0.8 fl oz Quadris/1,000 ft row		For soilborne/seedling disease control, see general information section on label.	
<b>Verticillium wilt root rot pathogens</b>	fenamidone	8.2 fl oz Reason 500 SC	14	Do not apply more than 24.6 fl oz/a per year. Do not apply more than one time before alternating to an effective fungicide with a different mode of action.	
	fluopicolide	3.0–4.0 fl oz Presidio	7	Tank mix with another effective, labeled fungicide of another mode of action for resistance management. Recommended spray interval is 10 days.	
	mefenoxam	1.0–2.0 pt Ridomil Gold SL	—	Preplant-incorporated application or surface application at planting. Preplant to top 2 inches of soil.	
	mefenoxam + azoxystrobin	0.34 fl oz Uniform/1,000 ft row	—	For Pythium damping-off and root rots. Also manages Rhizoctonia seedling blight. Apply Uniform as an in-furrow spray in minimum of 5 gal water per acre spray volume.	
	metalaxyl	0.75 fl oz/100 lb seed Allegiance FL, Metalaxyl 265 ST	—	Follow manufacturer's directions. Do not use treated seed for feed or food.	
<b>Verticillium wilt root rot pathogens</b>	metam-sodium	50.0 gal Vapam HL, Metam, Sactagon 42		Knife into plow layer of soil at a rate of 50.0 gal/a or on sandy soils only apply through the irrigation system in 0.6–1.0 inches of water in the fall. An approved backflow prevention valve must be used when applying fumigant through irrigation system. Do not apply if significant rainfall is forecast in the next 24 hours. Fields must be monitored during and after application. Soil temperature must be below 75°F. Fumigant cannot be applied through an irrigation system within 1/4 mile of an institution such as a hospital, school, or prison.	

Eggplant

Hops

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Leafy greens

Melon

Mint

Onion

## Insect control in horseradish<sup>a</sup>

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Aphids</b>	alpha-cypermethrin	3.2–3.8 fl oz *Fastac	1	Apply when pests reach or exceed established thresholds. Do not apply more than 11.4 fl oz of Fastac per acre per crop season.
	flupyradifurone	7.0–10.5 fl oz Sivanto	7	Foliar application. Apply when pests reach or exceed established thresholds. Do not apply more than 28.0 fl oz of Sivanto per acre per crop season.
	imidacloprid	0.31–0.74 fl oz Admire Pro/1,000 ft row	21	Admire may only be applied once per season. Apply Provado every 5 days as needed. Do not exceed 3 applications per season. Maximum imidacloprid use per season is 0.5 lb ai/a from any formulation.
		4.4–10.5 fl oz Admire Pro	21	
		3.5 fl oz Provado	7	
	0.94–1.25 lb malathion	several formulations	7	
	0.45 lb methomyl	1.5 pt *Lannate LV 0.5 lb *Lannate SP	65	Do not exceed 1.8 lb ai/a per season.
	thiamethoxam	1.5–3.0 oz Actara 25WDG	7	Do not apply more than 12.0 oz of Actara 25WDG or Platinum 2SC and no more than 4.01 oz Platinum 75SG per acre per crop season and apply sufficient water volume after in-ground application to ensure incorporation into the seed zone. Actara is applied as a foliar spray.
		5.0–12.0 fl oz Platinum 2SC	30	
		1.7–4.01 oz Platinum 75SG	30	
0.02–0.025 lb zeta-cypermethrin	3.2–4.0 oz *Mustang Maxx	1	Apply at thresholds and do not exceed 24.0 oz/a Mustang Maxx per season.	
0.04–0.1 lb zeta-cypermethrin + bifenthrin	4.0–10.3 fl oz *Hero	21	Do not apply more than 0.2 lb ai/a per season. Do not make more than 2 applications per season.	
<b>Beet leaf-hopper</b>	alpha-cypermethrin	1.8–3.8 fl oz *Fastac	1	Apply when pests reach or exceed established thresholds. Do not apply more than 11.4 fl oz of Fastac per acre per crop season.
	flupyradifurone	7.0–10.5 fl oz Sivanto	7	Foliar application. Apply when pests reach or exceed established thresholds. Do not apply more than 28.0 fl oz of Sivanto per acre per crop season.
	imidacloprid	0.31–0.74 fl oz Admire Pro/1,000 ft row	21	Admire may only be applied once per season. Apply Provado every 5 days as needed. Do not exceed 3 applications per season. Maximum imidacloprid use per season is 0.5 lb ai/a from any formulation.
		4.4–10.5 fl oz Admire Pro	21	
		3.5 fl oz Provado	7	
	0.45 lb methomyl	1.5 pt *Lannate LV 0.5 lb *Lannate SP	65	Treat when migrating beet leafhoppers are collected (usually July–August) or when brittle root disease is detected in fields.
	0.1 lb permethrin	*Ambush, *Pounce	22	Several formulations; see label for rate. Do not exceed three foliar applications per season.
	thiamethoxam	1.5–3.0 oz Actara 25WDG	7	Do not apply more than 12.0 oz of Actara 25WDG or Platinum 2SC and no more than 4.01 oz Platinum 75SG per acre per crop season and apply sufficient water volume after in-ground application to ensure incorporation into the seed zone. Actara is applied as a foliar spray.
		5.0–12.0 fl oz Platinum 2SC	30	
		1.7–4.01 oz Platinum 75SG	30	
0.011–0.025 lb zeta-cypermethrin	1.76–4.0 oz *Mustang Maxx	1	Apply at thresholds and do not exceed 24.0 oz/a Mustang Maxx per season	

\*Restricted-use pesticide.

(continued)

<sup>a</sup>Adapted from Illinois pest control recommendations.

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## Insect control in horseradish<sup>a</sup> (continued)

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Diamond-back moth (DBM)</b>	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i>	Cutlass, DiPel, Javelin, and others	0	Rates vary with formulation; check the label. Must be eaten by caterpillars to be effective. Thorough coverage is necessary; some labels recommend wetting agents.
		1.0–2.0 lb Lepinox WDG	0	Treat early instar larvae before noticeable feeding damage occurs. Repeat as needed.
	0.5–1.5 lb <i>Bacillus thuringiensis</i> subsp. <i>tenebrionis</i>	Xentari		Treat early instar larvae before noticeable feeding damage occurs. Must be eaten to be effective. Thorough coverage is necessary. Repeat as needed.
	imidacloprid	0.31–0.74 fl oz Admire Pro/1,000 ft row 4.4–10.5 fl oz Admire Pro 3.5 fl oz Provado	21 21 7	Admire may only be applied once per season. Apply Provado every 5 days as needed. Do not exceed 3 applications per season. Maximum imidacloprid use per season is 0.5 lb ai/a from any formulation.
0.1 lb permethrin	*Ambush, *Pounce	22	Treat when larvae are small. Several formulations; see label for rate. Do not exceed three foliar applications per season. In some areas, DBM has become resistant to permethrin and other compounds; resistance levels vary within the state and locally. Use Bt products where resistance to these compounds has developed or to slow development of resistance.	
<b>Flea beetles</b>	<i>Treat only if you find large populations early in the season.</i>			
	alpha-cypermethrin	1.8–3.8 fl oz *Fastac	1	Apply when pests reach or exceed established thresholds. Do not apply more than 11.4 fl oz of Fastac per acre per crop season.
	0.5–2.0 lb carbaryl	Sevin	3	Several formulations; see label for rate.
	imidacloprid	0.31–0.74 fl oz Admire Pro/1,000 ft row	21	Admire may only be applied once per season. Apply Provado every 5 days as needed. Do not exceed 3 applications per season. Maximum imidacloprid use per season is 0.5 lb ai/a from any formulation.
		4.4–10.5 fl oz Admire Pro	21	
		3.5 fl oz Provado	7	
	0.046–0.063 lb spinetoram	6.0–8.0 oz Radiant SC	3	For suppression only. Do not apply more than 28.0 oz/a Radiant (0.219 lb ai) per crop and do not exceed 3 applications per year.
	thiamethoxam	1.5–3.0 oz Actara 25WDG	7	Do not apply more than 12.0 oz of Actara 25WDG or Platinum 2SC and no more than 4.01 oz Platinum 75SG per acre per crop season and apply sufficient water volume after in-ground application to ensure incorporation into the seed zone. Apply Platinum 2SC as an in-furrow spray or as a narrow surface band above the seedling and followed by irrigation. Actara is applied as a foliar spray.
		5.0–12.0 fl oz Platinum 2SC	30	
		1.7–4.01 oz Platinum 75SG	30	
	0.011–0.025 lb zeta-cypermethrin	1.76–4.0 oz *Mustang Maxx	1	Apply at thresholds and do not exceed 24.0 oz/a Mustang Maxx per season.
	0.04–0.1 lb zeta-cypermethrin + bifenthrin	4.0–10.3 fl oz *Hero	21	Do not apply more than 0.2 lb ai/a per season. Do not make more than 2 applications per season.
<b>Imported crucifer weevil</b>	<i>Crop rotation, destroying volunteers, use of insecticide dips for sets, and foliar insecticide sprays will help reduce weevil populations.</i>			
	0.1% solution permethrin	*Ambush (several formulations)	30	At planting. Soak sets 30 minutes and air dry before planting to kill eggs and larvae.

\*Restricted-use pesticide.

(continued)

<sup>a</sup>Adapted from Illinois pest control recommendations.

### Insect control in horseradish<sup>a</sup> (continued)

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Imported crucifer weevil</b> (cont.)	0.2 lb permethrin	*Ambush, *Pounce	30	Apply if needed when adults are present on foliage (usually August). Several formulations; see label for rate. Do not exceed three foliar applications per season.
	0.011–0.025 lb zeta-cypermethrin	1.76–4.0 oz *Mustang Maxx	1	Apply at thresholds and do not exceed 24.0 oz/a Mustang Maxx per season.

\*Restricted-use pesticide.

<sup>a</sup>Adapted from Illinois pest control recommendations.

### Weed control in horseradish

Weed	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Annual weeds</b>	0.56–0.98 lb dimethenamid-P	12.0–21.0 fl oz Outlook	40	Apply only when horseradish is between the two-leaf and eight-leaf stage. Outlook will not control emerged weeds. Injury may occur when cool weather follows application. Use rate varies by soil type.
	up to 1.5 lb linuron	up to 3.0 lb Lorox DF		Make a single broadcast application after planting or during dormancy, but before leaves emerge in spring. Allow an irrigation or rainfall of 1/2 inch prior to application after planting. Use lower rates on lighter soils. Do not use on sand or loamy sand. Do not use on soils with less than 1% organic matter.
	s-metolachlor	1.0–1.33 pt Dual Magnum or Dual II Magnum		Apply once after planting but before weed or crop emergence. Use lower rates on relatively coarse-textured soils and higher rates on fine-textured soils.
<b>Annual broadleaves</b>	0.5 lb oxyfluorfen	2.0 pt Goal 2XL 1.0 pt GoalTender		Controls common lambsquarters, redroot pigweed, common purslane, shepherd's purse, and Pennsylvania smartweed. Apply after planting but before emergence of crop or annual weeds. Use flat fan nozzles in a minimum of 20 gal/a of water. For maximum activity, soil surface should be smooth and free of weed and crop residue. Avoid disturbing the soil surface after application for as long as weed control is desired. Cultural practices that redistribute or disturb the soil surface will decrease herbicidal activity. Rainfall or irrigation of 1/4 inch after application is necessary for herbicide activation. Do not apply through irrigation. Do not use when horseradish plantings are weak or stressed.
<b>Annual grasses and some broadleaves</b>	4.5–10.5 lb DCPA	6.0–14.0 lb Dacthal W-75 6.0–14.0 pt Dacthal FL		Make preemergence applications to weed-free soil immediately after planting. Use only on soils with 5% or less organic matter.
	0.07–0.25 lb sulfentrazone	2.25–8.0 oz Spartan 4F		Broadcast applications can be made in the fall, in the spring before planting, or after planting up to 5 days before crop emergence. Banded applications to row middles are permitted following crop emergence. Use rate is based on soil texture and organic matter. Do not exceed maximum annual use rate. See label for weeds controlled and other precautions.

(continued)

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## Weed control in horseradish *(continued)*

Weed	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Emerged weeds</b>	glyphosate	several manufacturers and formulations		See manufacturer's label to assure that the formulation is labeled for this crop and for specific instructions. May be applied at any time before the crop emerges. Apply before crop germination/growth on coarse sandy soils. Do not treat mowed or tilled weeds until they have resumed active growth and reached the recommended stage on the label. Unless otherwise stated, allow at least 7 days before tilling treated fields. Do not tank mix with soil-residual herbicides unless otherwise specified.
<b>Emerged grasses</b>	0.068–0.12 lb clethodim	9.0–16.0 oz Select Max	30	Apply to actively growing grasses. Repeat treatments may be made at 14-day intervals up to the maximum annual use rate. Do not cultivate grasses within 7 days before or after application. Include appropriate surfactant as required by product label. Do not apply if rain is expected within 1 hour.
	0.094–0.125 lb clethodim	6.0–8.0 oz Select 2EC	30	
	0.094–0.47 lb sethoxydim	0.5–2.5 pt Poast	60	Make postemergence applications to actively growing grasses within the size ranges indicated on the label. Check the label for wild proso millet or rescue treatment rate and for information on quackgrass control. Do not exceed 2.5 pt per application or 5 pt/a per season. Always add 2 pt/a of crop oil concentrate. Do not cultivate within 5 days before or 7 days after application.

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