



Brendon Panke and Mark Renz

Invasive plants can thrive and aggressively spread beyond their natural range, disrupting ecosystems. The *Management of Invasive Plants in Wisconsin* series explains how to identify invasive plants and provides common management options. Management methods recommend specific timings for treatment, as well as expected effectiveness. For more information, go to: [fyi.uwex.edu/weedsci/category/invasive-plants-of-wisconsin](http://fyi.uwex.edu/weedsci/category/invasive-plants-of-wisconsin).

**UW**  
**Extension**  
Cooperative Extension

**NPM** 

# Garlic mustard

## (*Alliaria petiolata*)

**G**arlic mustard is an herbaceous biennial with stems 1–4' tall as flowering plant. First-year plants form a basal rosette that remains green through the winter. Second-year plants produce one to several flowering stems.

### Legal classification in Wisconsin:

Restricted

**Leaves:** First-year plants are 2–4" tall rosettes with 3–4 heart-shaped leaves, with a toothed margin. Second-year plants produce a flowering stalk with alternate, triangular leaves that are 2–3" wide. Foliage emits a distinct onion or garlic smell when crushed.

**Flowers:** Late spring to early summer of second year, producing numerous small, white, four-petaled flowers.

**Fruits and seeds:** Fruits are slender capsules (siliques) 1–2.5" long and contain a single row of oblong black seeds with a distinct ridge.

**Roots:** Taproot that often has a distinctive S-shaped curve near the top of the root.

**Similar species:** Creeping charlie (*Glechoma hederacea*) is often confused with garlic mustard, but its prostrate growth with stolons allows for differentiation from garlic mustard.

### Ecological threat:

- Invades upland forests, floodplain forests, savannas, yards, and roadsides. It is typically found in shaded areas, but can be found in full sun. Invasion of forests usually begins along the wood's edge, and progresses via streams, animal trails, and disturbed areas.

- Exudes antifungal chemicals into the soil that disrupt associations between mycorrhizal fungi and native plants, suppressing native plant growth.

## Non-chemical control Removal

**Effectiveness in season: 90–100%**

**Season after treatment: < 50%**

Pulling or cutting the root from the stem before flowering are effective individual plant control techniques. Pull if soil conditions allow for the removal of the taproot. Pulling second-year plants is easier than pulling first-year rosettes. Alternately, cut the entire taproot with a sharp shovel or spade 1–2" below the surface. If flowers are present, bag material and dispose of it in a landfill to avoid potential for seed spread.



## Mowing

**Effectiveness in season: 70–90%**  
**Season after treatment: < 50%**

Mowing as low as possible before the emergence of flowers can suppress garlic mustard. Plants may resprout and still flower. Monitor populations and repeat mowing if concerned about seed production. Care must be taken not to mow when mature seeds are present. Mowing will not eliminate first-year plants (rosettes). While mowing has been reported as an effective means of suppression, there is no data on how many years of mowing are required to control a population.

## Prescribed burning

**Effectiveness in season: 50–70%**  
**Season after treatment: < 50%**

Burn in spring before desirable vegetation begins growing, but after garlic mustard seedlings have emerged. Burning will control seedlings, but survival of second-year plants is variable depending upon fire intensity. Burning can stimulate germination of seedlings, but intensive management of these seedlings after the burn can dramatically reduce garlic mustard seeds in the soil. A handheld propane torch can be effective for treating seedlings.

## Manipulation of the environment

**Effectiveness in season: < 50%**  
**Season after treatment: < 50%**

Disturbed forest canopies with increased light penetration tend to experience increased invasion of garlic mustard. If the canopy of a forest becomes disturbed, plant or manage species present to increase light interception and restore the canopy as quickly as possible. Focus other management activities around these areas of canopy disturbance.

## Chemical control

### Foliar

Apply directly to individual plants or broadcast across an infested area. Broadcasted foliar applications are typically the most cost-effective treatment in dense infestations. Use lower rates on smaller plants and less dense populations and higher rates on larger plants and denser populations. If infestations are mixed with desirable vegetation, applications of herbicides without soil activity in the late fall through early spring can reduce injury to desirable plants since garlic mustard emerges earlier and goes dormant later than most desirable vegetation.

### aminocyclopyrachlor + metsulfuron\*

**Effectiveness in season: 90–100%**  
**Season after treatment: 50–70%**

**Common name:** Streamline

**Rate: broadcast:** 4.75–9.5 oz/A  
 (aminocyclopyrachlor: 1.9–3.75 oz a.i./A  
 + metsulfuron: 0.6–1.2 oz a.i./A)

**spot:** 0.2–0.4 oz/gal  
 (aminocyclopyrachlor: 0.08–0.16 oz a.i./gal  
 + metsulfuron: 0.03–0.05 oz a.i./gal)

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Caution:** Do not apply directly to water or to areas where surface water is present. Avoid using Streamline in areas where soils are permeable, particularly where the water table is shallow since groundwater contamination may result. Streamline remains in the soil for months, depending on application rate, and has the potential to contaminate surface runoff water, especially on poorly draining soils or areas with shallow groundwater. Maintenance of a vegetative buffer strip is recommended between the areas Streamline is applied and surface water features. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants. Do not compost treated plants since herbicide can persist through composting process.

### bentazon\*

**Effectiveness in season: 50–70%**  
**Season after treatment: < 50%**

**Common name:** Basagran

**Rate:**

**broadcast:** 16–32 fl oz/A (0.5–1.0 lb a.e./A)

**spot:** Equivalent to broadcast rates.

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Caution:** Do not apply directly to water or to areas where surface water is present. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.

### glyphosate\*

**Effectiveness in season: 90–100%**  
**Season after treatment: < 50%**

**Common name:** Roundup

**Rate:**

**broadcast:** 0.75–1.5 lb a.e./A

**spot:** For a 3 lb a.e./gal product: 1–3% (0.03–0.09 lb a.e./gal)

**Timing:** Apply to rosettes in fall or spring, bolting, or to flowering plants. Use higher rates when air or soil temperatures drop below 40°F to maintain control.

**Remark:** Fall applications will only control rosettes and will not control seedlings that emerge in the spring.

**Caution:** Use product labeled for aquatic use if potential exists for solution to contact surface waters. Applications can result in bare ground since glyphosate is not selective. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.

\*Active ingredient (a.i.)

**imazapic\***  
**Effectiveness in season: 90–100%**  
**Season after treatment: 50–70%**

**Common name:** Plateau

**Rate:**

**broadcast:** 10–16 fl oz/A (0.15–0.25 lb a.e./A)

**spot:** 0.25–1.0% (0.005–0.02 lb a.e./gal)

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Caution:** Do not apply directly to water or to areas where surface water is present. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Imazapic can remain in the soil for months depending on application rate and has the potential to contaminate surface runoff water during this timeframe. Maintenance of a vegetative buffer strip is recommended between the areas Imazapic is applied and surface water features. Overspray or drift to desirable plants should be avoided, as even minute quantities of the spray may cause severe injury to plants.

**imazapic + glyphosate\***  
**Effectiveness in season: 90–100%**  
**Season after treatment: 50–70%**

**Common name:** Journey

**Rate:**

**broadcast:** 8 fl oz/A (imazapic: 0.05 lb a.e./A + glyphosate: 0.09 lb a.e./A)

**spot:** 0.6–2.4% (imazapic: 0.005–0.02 lb a.e./gal + glyphosate: 0.009–0.04 lb a.e./gal)

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Caution:** Do not apply directly to water or to areas where surface water is present. Applications can result in bare ground since glyphosate is not selective. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Imazapic can remain in the soil for months, depending on application rate, and has the potential to contaminate surface runoff water during this timeframe. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.

**imazapyr\***  
**Effectiveness in season: 90–100%**  
**Season after treatment: 50–70%**

**Common name:** Arsenal

**Rate:**

**broadcast:** 48–64 fl oz/A (0.75–1.0 lb a.e./A)

**spot:** 0.5–1.0% (0.01–0.02 lb a.e./gal)

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Caution:** Use product labeled for aquatic use if potential exists for solution to contact surface waters. Applications can result in bare ground since imazapyr is not selective and can remain in the soil for several months to more than a year, depending on application rate. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.

**metsulfuron\***  
**Effectiveness in season: 90–100%**  
**Season after treatment: 50–70%**

**Common name:** Escort

**Rate:**

**broadcast:** 0.25–1.0 oz/A (0.15–0.6 oz a.i./A)

**spot:** 0.04 oz/gal (0.02 oz a.i./gal)

**Timing:** Apply to rosettes in the fall or spring or to bolting plants.

**Remark:** Use lowest rate in spring. In fall use 0.5–1.0 oz/A to provide residual control of seedlings the following spring. Use higher rates in high organic matter soils.

**Caution:** Do not apply directly to water or to areas where surface water is present. Remains in the soil for months depending on application rate. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.



\*Active ingredient (a.i.)

sulfometuron*	sulfosulfuron*	triclopyr*
<b>Effectiveness in season: 90–100%</b> <b>Season after treatment: 50–70%</b>	<b>Effectiveness in season: 90–100%</b> <b>Season after treatment: 50–70%</b>	<b>Effectiveness in season: 70–90%</b> <b>Season after treatment: &lt; 50%</b>
<b>Common name:</b> Oust	<b>Common name:</b> Outrider	<b>Common name:</b> Garlon
<b>Rate:</b>	<b>Rate:</b>	<b>Rate:</b>
<b>broadcast:</b> 0.25–1.0 oz/A (0.2–0.75 oz a.i./A)	<b>broadcast:</b> 1.0–2.0 oz/A (0.75–1.5 oz a.i./A)	<b>broadcast:</b> 16–32 fl oz/A (0.5–1.0 lb a.e./A)
<b>spot:</b> Equivalent to broadcast rates.	<b>spot:</b> 0.01–0.02 oz/gal (0.008–0.02 oz a.i./gal)	<b>spot:</b> 1–2% (0.04–0.08 lb a.e./gal)
<b>Timing:</b> Apply to rosettes in the fall or spring or to bolting plants.	<b>Timing:</b> Apply to rosettes in the fall or spring or to bolting plants.	<b>Timing:</b> Apply to actively growing rosettes in the fall or spring or to bolting plants.
<b>Remark:</b> Use 0.25–0.5 oz/A in spring. In fall use 0.5–1.0 oz/A to provide residual control of seedlings the following spring. Use higher rates in high organic matter soils.	<b>Remark:</b> In fall use higher rates to provide residual control of seedlings the following spring. Use higher rates in high organic matter soils.	<b>Remark:</b> Fall applications will only control rosettes and will not control seedlings that emerge in the spring.
<b>Caution:</b> Do not apply directly to water or to areas where surface water is present. Applications can result in bare ground since sulfometuron is not selective and can remain in the soil for months depending on application rate and site conditions. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.	<b>Caution:</b> Do not apply directly to water or to areas where surface water is present. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.	<b>Caution:</b> Use product labeled for aquatic use if potential exists for solution to contact surface waters. Use of this chemical in areas where soils are permeable, particularly where the water table is shallow, may result in groundwater contamination. Overspray or drift to desirable plants should be avoided since even minute quantities of the spray may cause severe injury to plants.
<p>Herbicide information is based on label rates and reports by researchers and land managers. Products known to provide effective control or in common use are included. Those that do not provide sufficient control or lack information for effectiveness on target species have been omitted.</p> <p>References to pesticide products in this publication are for your convenience and not an endorsement of one product instead of a similar product. You are responsible for using pesticides in accordance with the label directions. <i>Read the label before any application.</i></p>		

This series of fact sheets was created in cooperation with University of Wisconsin-Extension Team Horticulture.

This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Award No. 2009-45060-06000.

**Copyright © 2012** by the Board of Regents of the University of Wisconsin System doing business as the division of Cooperative Extension of the University of Wisconsin-Extension. All rights reserved. Send copyright inquiries to: Cooperative Extension Publishing, 432 N. Lake St., Rm. 227, Madison, WI 53706, pubs@uwex.edu.

**Authors:** Mark Renz is an assistant professor and Extension weed scientist in agronomy, College of Agriculture and Life Sciences, University of Wisconsin-Madison and University of Wisconsin-Extension. Brendon Panke is an associate research specialist in agronomy, College of Agriculture and Life Sciences, University of Wisconsin-Madison. Cooperative Extension publications are subject to peer review.

**University of Wisconsin-Extension, Cooperative Extension**, in cooperation with the U.S. Department of Agriculture and Wisconsin counties, publishes this information to further the purpose of the May 8 and June 30, 1914, Acts of Congress. An EEO/AA employer, the University of Wisconsin-Extension, Cooperative Extension provides equal opportunities in employment and programming, including Title IX and ADA requirements. If you need this information in an alternative format, contact Equal Opportunity and Diversity Programs, University of Wisconsin-Extension, 432 N. Lake St., Rm. 501, Madison, WI 53706, diversity@uwex.edu, phone: (608) 262-0277, fax: (608) 262-8404, TTY: 711 Wisconsin Relay.

**This publication is available** from your county UW-Extension office ([www.uwex.edu/ces/cty](http://www.uwex.edu/ces/cty)) or from Cooperative Extension Publishing. To order, call toll-free: 1-877-947-7827 (WIS-PUBS) or visit our website: [learningstore.uwex.edu](http://learningstore.uwex.edu).

**Management of invasive plants in Wisconsin: Garlic mustard (A3924-07)**

I-10-12