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Controlling Non-Native Invasive Plants in Ohio's Forests: Garlic Mustard (*Alliaria petiolata*)



Kathy Smith, Extension Program Director—Forestry
School of Environment and Natural Resources
The Ohio State University

Annemarie Smith, Invasive Species Forester
Ohio Department of Natural Resources
Division of Forestry



Garlic mustard (*Alliaria petiolata*) is a cool-season biennial herbaceous plant first observed in the United States in the mid 1800s. It was introduced from Europe either accidentally or intentionally as a cooking herb. It is extremely tolerant of shaded conditions and is capable of establishing extensive, dense colonies in woodlands. In such situations, it out-competes and displaces native plants (wildflowers, trees, and shrubs) and the wildlife species that depend on them. Typically garlic mustard starts its forest invasion via edges and trails. Seeds can be further spread throughout the stand on animals, on shoes and boots, and on off-road vehicles. They can also be carried in streams and rainwater runoff. Within a short span of time, a small infestation can overtake large areas of the forest floor and persist. There is some evidence that garlic mustard roots produce a chemical that inhibits

the growth of other plants nearby. This suppression of native competitors contributes to the fast rate of spread of garlic mustard.

Identification

First Year Plants

The first year foliage of garlic mustard is a basal rosette (a circular whorl of leaves at the same height), formed of 3–8 rounded to kidney-shaped leaves with wavy-toothed margins. It has a wrinkled appearance and stays green all winter. (Figure 2)



Figure 2. First year basal rosettes.

Second Year Plants

During the second year, one to several 2–4 foot tall flower stalks are produced. (Figure 3)



Figure 3. Second year plants.

- **Leaves:** Leaves are alternately arranged and are heart-shaped to triangular in appearance; they are 1–3 inches long and 1–4 inches wide, with wavy-toothed margins. When crushed, they give off a garlic odor.
- **Flowers:** In mid to late spring, a cluster of small ($\frac{1}{4}$ inch), white flowers with 4 petals appear at the end of the flower stalk. (Figure 4)



Figure 4. Garlic mustard flowers.

- **Seeds:** Seed pods, produced by early to mid summer, are 1–2.5 inches long and four-sided. The plants die after seed formation. Seeds are black (when ripe), small, and are produced in a row inside the seed pods. An average plant will easily produce more than one hundred seeds. (Figure 5)
- **Roots:** Garlic mustard has a taproot that is slender and white.

Control Methods

When trying to control garlic mustard, there are only a few options available to the landowner. The size of the infestation plays a critical role in what method a landowner may choose. If the infestation is small and not well established, hand pulling plants



Figure 5. Garlic mustard seeds.

can be the simplest method to implement. Once garlic mustard has established itself, the goal is to limit or completely prevent the plants from contributing further seed to the seed bank.

Mechanical Control

It is best to remove plants **prior** to flowering in the spring. Garlic mustard can be pulled or dug, though this will need to be done for several years, as seed is reported to remain viable in soil for 5 or more years. It is important to remove as much root as possible since garlic mustard can sprout from root fragments. Do not pile pulled plants where roots will stay moist, as the plants can continue to develop. If pulling after plants have begun to flower (not recommended), the plants need to be bagged since garlic mustard seeds can still ripen after the plants are uprooted. Bagged plants should be disposed of either by burning or burying deeply where they won't be disturbed. Do not compost!

Garlic mustard can also be cut a few inches above the soil surface just after the flower stalks have elongated but before the flowers have opened. Monitoring is a must, as sometimes the remaining plant will send out new flower stalks. If seed heads have been formed they need to be cut, collected, and destroyed.

In some areas a weed torch may be used for spot-killing of newly germinated seedlings. Weed torches have small cylinders of propane which create flames that can be used to quickly kill tender seedlings with-

out permanently damaging surrounding plants. Use a weed torch only when the conditions are wet so that the flames won't ignite surrounding fuels. Employ caution anytime fire is used as a tool. Care needs to be taken to ensure that conditions (avoid dry or windy periods) will not allow flames to escape the intended target area. All local open burning regulations must be followed!

Foliar Herbicide

In areas with extensive garlic mustard populations, a very effective tool is the use of an herbicide applied to the foliage early in the growing season prior to the formation of seed pods. The first year rosettes can also be treated late into the fall (mid-October) after native plants have gone dormant for the season, thus reducing the chance of impacting non-target species.

While some populations of garlic mustard can be treated using a sprayer (backpack, hand, etc.), there are other foliar herbicide applicators such as wicks that can be utilized for small populations. Wicks can be used as a hand application method, or larger wicks can be mounted on ATVs and tractors. The method chosen should depend on the size of the infestation, site conditions (topography, soil moisture, etc.), and access to and comfort level with the equipment.

Summary

Label recommendations should be followed to maximize the potential for successful control. At a minimum, monitor treated areas for several years to determine if complete control is achieved, keeping in mind that garlic mustard **seed can stay viable in the soil for 5 years or more**. Preventing spread requires great diligence. When using equipment to control a population, completely clean the equipment to ensure that any seed attached to it is not spread further. This includes workers' shoes and boots as well as tires of any vehicles used in the operation.

Herbicides, like all pesticides, are approved (labeled) for specific uses by the Environmental Protection Agency. Approved uses and application methods are listed and described on the pesticide's label. The herbicides listed in this fact sheet were appropriately labeled at the time of publication. Because pesticide labeling may change at any time, you should verify that a particular herbicide is still labeled for your intended use. At the time of this writing, copies of most herbicide labels and MSDS could be obtained online at the Crop Data Management Systems web site: <http://www.cdms.net/manuf/manuf.asp>. Others are available through the individual manufacturer's web site. Ohio State University Extension and the Ohio Division of Forestry do not endorse any of the products mentioned and assume no liability resulting from the implementation of these recommendations.

Table 1. Herbicide recommendations for controlling garlic mustard.

Herbicide	Example Brand Names	Comments ¹
glyphosate	Roundup, Accord, and others (at least 41% active ingredient)	Apply solution of 1–2% herbicide (vol/vol) in water; add a surfactant if not in herbicide.
triclopyr	Garlon 3A, Tahoe 3A	Apply 2% solution (vol/vol) of herbicide in water.*

*A surfactant (e.g., X-77, Activator, etc.) at .25% vol/vol rate may be added to the various triclopyr formulations when foliar spraying.

¹These comments are not intended to be a substitute for the herbicide labels. To ensure the safe and effective use of the herbicides recommended in this publication read the label and MSDS (Material Safety and Data Sheet).

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Keith L. Smith, Ph.D., Associate Vice President for Agricultural Administration and Director, Ohio State University Extension
TDD No. 800-589-8292 (Ohio only) or 614-292-1868