

Foliar Herbicide Removal of Woody Invasive Species

woodyinvasives.org/management/foliar-herbicide/



Introduction to Chemical Control – Foliar Herbicide

Foliar herbicide application involves the use of equipment to coat the leaves of target plants with herbicide. It can be done as a spot treatment (often also called a directed or individual plant treatment), where herbicide is intentionally sprayed on target plants or a broadcast treatment where herbicide is applied at a consistent rate over the entire treatment area. For management of natural areas, broadcasted herbicide application is generally only practiced in areas of very dense invasive vegetation without significant desired vegetation or where the herbicide being used is selective and will not damage desirable plants.

Compared to the other herbicide application methods, foliar application involves lower concentrations of herbicides applied at moderate volumes (10-50 gallons/acre). There is higher potential for damage to non-target plants and drift than with other herbicide application methods. It can be difficult to gauge how much herbicide mixture is being used with spot treatments, especially for inexperienced applicators. Because of these risks, the WIGL Collaborative recommends that anyone who plans to conduct foliar applications undergo training via their state's pesticide certification program, even when not required to do so by law.

How it works

Herbicide is applied to actively photosynthesizing foliage. The leaves take up the chemical, and either directly impact the leaf tissue or translocate the herbicide to other parts of the plant. Herbicides differ in their mode of action (i.e., how they kill the plant), but all generally disrupt at least one of several essential functions. Some herbicides can also be taken up into

plants through the roots if applications reach the soil surface. Applicators should familiarize themselves with the properties of any herbicide before use and ensure appropriate measures are taken to maximize success and minimize off-target and environmental impact. This is best done by reading the herbicide label thoroughly.

Methodology in Detail

Timing Considerations

Seasonality

Foliar treatment is generally effective from the time the target plants are fully leafed out until foliage starts to change color in the fall (typically late spring through early fall in the Great Lakes region). However, certain woody invasive species such as the bush honeysuckles (*Lonicera* spp.) and wintercreeper (*Euonymus fortunei*) have an extended growing season and remain green later into the fall than other woody species. Foliar applications may be made on these species throughout the fall, which can minimize impacts on desirable plants.

Weather

Foliar application needs to be timed according to weather conditions as weather can impact the success of treatment. Application during drought can decrease effectiveness, and application during hot, dry weather can increase the risk of volatilization, drift, and off-target damage. Application shortly before rainfall may also cause treatment to be less effective. Knowledge of the rainfastness (time after application that is needed to guarantee control) is critical to avoid losses in effectiveness. Wind speed is also an important factor in the potential for herbicide drift. Wind speeds between 2-10 miles per hour are generally considered to have the lowest potential for drift. Any wind speeds lower or greater than this increase the risk for drift.

As the specific restrictions/recommendations are product specific always read the herbicide label carefully and follow instructions related to wind, humidity, and precipitation.

Regrowth

If foliar application is being applied to plants that are regrowing following prior physical or chemical treatment, it is important to allow sufficient regrowth. Ferrell et al. (2015) recommend allowing new shoots to grow 3-4' to increase the ratio of above-ground to below ground growth and improve treatment effectiveness. If this is not followed, foliar treatment may be less effective.

Species Considerations

The effectiveness of foliar-applied herbicide depends on the ability of the chemical to penetrate the cuticle (outer coating) of the leaves. Species with leaves that are described as glossy, shiny, waxy or leathery often have thick cuticles. Woody invasive species with leaves that may resist herbicide penetration include black alder, wintercreeper, glossy buckthorn, border privet, white mulberry, and Callery pear. Using the right surfactant (see Chemical Adjuvants and Additives below), avoiding foliar treatment during hot and dry periods, and using herbicide mix concentration on the higher end of the range recommended by the herbicide label can improve effectiveness on these species.

Choosing Herbicide

Herbicides that are suitable for foliar application to control woody plants are almost always systemic, meaning that they are absorbed into the target's tissues and transported throughout the plant. Contact herbicides, which only kill plant foliage, are generally not considered effective at controlling woody invasives. When choosing a systemic herbicide, a manager should consider the site characteristics, the species being treated, the desirable species in the treatment area, and the environmental behavior of the chemical (e.g., persistence in the soil) relative to long-term goals for the site.

In certain situations, it may make sense to plan a broadcast (non-targeted) application with a selective herbicide. In a natural areas context or in an area where turf grass is being maintained, it may be desirable to treat woody plants with a broadleaf-specific herbicide that has no action on grasses. Broadcast treatment is also used for projects involving complete conversion and restoration of the plant community (e.g., converting an old pasture or field into a prairie). If using a non-selective herbicide, spot treatment minimizes the risk of off-target damage, but there is still opportunity for off-target impacts from drift and deposition of the herbicide onto the soil surface. Experts recommend against using herbicides with significant soil on target plants growing under or next to valuable plants (Miller et al. 2015). Imazapyr is an example of a herbicide active ingredient with relatively high soil residence.

Certain herbicides in certain formulations are known to have adverse impacts on surface water, doing significant harm to aquatic life. If the site where a foliar application is being considered has a high water table (saturated or near-saturated soils) or surface water present, an herbicide labeled/approved for this type of setting should be selected (read environmental hazards section on the label). Two of the most common herbicide active ingredients for use on woody invasives – glyphosate and triclopyr – come in both aquatic safe and unsafe formulations.

Due to differences in species biology, certain chemicals or chemical mixtures work better on some species than others. Herbicide product labels include a list of weed species controlled. If a species does not appear on a product label's control list, it does not necessarily mean

that the herbicide will not work but that the manufacturer has not tested it and does not guarantee efficacy. University programs and state agencies engaged in forestry and invasive species control are often great sources of species-specific herbicide recommendations. The Midwest Invasive Plant Network consolidated these recommendations for many species in its Invasive Plant Control Database.

Chemical Adjuvants and Additives

Adjuvants are chemicals added to herbicide to improve performance in some way. It is commonly recommended on product labels and by experts to add a non-ionic surfactant to herbicide for foliar application. A non-ionic surfactant reduces the surface tension between droplets of herbicide and leaf surfaces, enhancing the chemical's ability to fully coat the leaves and improving uptake. Always read the herbicide label carefully for surfactant recommendations and to ensure surfactant compatibility. An aquatic-safe surfactant should be used if applying at a site with surface water present.

Herbicide dye is a recommended addition to any product being used for a spot treatment. Use of a dye will allow applicators to track which plants have been treated, and can also alert any other site users that herbicide was recently applied.

Equipment for Application

Spot Treatment

A backpack sprayer is the most common equipment for directed foliar application. In a natural areas setting, it is important for the tank to be a streamlined shape and to be impact and puncture-resistant to facilitate movement through brush without leaks (Miller et al. 2015). Backpack sprayers have two pump types: piston or diaphragm. The piston type can achieve higher pressures, but the diaphragm type is more durable and can generate pressure suitable for most targeted applications (Duncan 2019a, Miller et al. 2015). Experts frequently recommend additions to backpack sprayers for increased precision and operator efficiency, including a comfort harness, a wand-mounted pressure gage, a metal wand, and stainless steel nozzle tips (Duncan 2019a, Miller et al. 2015). The nozzle tip is one of the most important parts of any spray set-up because it determines the shape, angle and droplet size of the spray. The University of Illinois recommends a nozzle that produces medium or course droplets for application of systemic foliar herbicide (2012). Using a nozzle that produces overly fine droplets increases the risk of drift, while using one that produces overly large droplets can decrease effectiveness. The narrower the angle of the nozzle, the easier it will be to prevent overspray onto non-target plants (Miller et al. 2015).

A chemical-proof hand spray bottle can be used for targeted foliar application to seedlings, ground cover and regrowth for small projects. Similarly, there are also rope wick and foam roller hand tools that can be used for foliar application on seedlings or other low growth. The

handles of these tools are usually 3-4' long, made of PVC, and have hollow reservoirs for herbicide which is fed to a permeable wick (usually made of cotton rope) or a foam roller. These tools may be suitable and cost effective for small projects and eliminate the risk of drift, but are likely too limited in herbicide capacity for larger jobs.

Broadcast Treatment

Broadcast treatments are usually accomplished using multiple spray nozzles that apply a uniform amount of herbicide across an area. Most nozzles are attached to booms mounted on tractors or trucks, but there are some boomless vehicle mounted nozzles that can be affixed to vehicles suitable for challenging terrain (ATVs, UTVs). For low-growing vegetation, there are also mounted wick applicators available. Similar to hand tools, vehicle mounted wick applicators do not produce drift, but may not be durable enough for use on all sites. Helicopters and fixed wing aircraft can also be outfitted with booms for aerial application. For any broadcast spraying, it is critical that the nozzles be appropriate for the project and calibrated to deliver a specified amount of chemical per acre treated. Specialized training should be completed before using broadcast equipment.

Personal Protective Equipment

Always follow personal protective equipment recommendations on the herbicide product label.

Regulations, Training, and Applicator Certification

Each Great Lakes jurisdiction has regulations regarding the registration and labeling of pesticide products and the training and certification of pesticide users. Note that not all herbicides are registered for use in all jurisdictions and it is illegal to use a product in a jurisdiction where it is not registered. In Ontario, Canada the use of most synthetic herbicides on non-agricultural and non-forestry land is prohibited by law. Persons seeking to use herbicide to control invasive plants for the benefit natural resources are required to seek an exemption under the Pesticide Act.

U.S. state governments generally require that any anybody applying herbicide on non-residential or non-farm properties or applying herbicide in exchange for payment undergo training and pass a certification or licensing exam (see program links below). Certain pesticides are labeled as restricted use at the federal and state levels that require certification for purchase and use in all cases. Ontario requires licensing of all persons seeking to apply pesticides. It is usually necessary to renew certification or licensing periodically. Managers should be certain that all staff and volunteers using herbicide have adequate training and certification. Any hired applicators should be asked for proof of current certification.

Pesticide Training and Certification
Programs:

IL IN MI MN NY OH ON PA WI

Testing Spraying Equipment against Specifications

Any piece of spraying equipment should be tested at least annually to ensure that the actual spray rate matches the intended rate. While nozzle tips are rated to a specific spray volume per unit time, frequent checks are needed to ensure this output is consistent among nozzles and meets the required discharge for application. Spray equipment can be tested by filling completely clean equipment with water, spraying into a bucket or container for one minute, and then comparing the actual collected output to the nozzle specification. If the collected output is consistently off from the specification by more than 10%, the nozzle should be replaced.

Knowing How Much Herbicide to Mix

Herbicide labels typically provide three pieces of important information to help calculate application rates, mix components, etc. These are:

- The maximum allowable application of product per acre per year
 - There is a maximum allowable amount of product per acre per application for some products
- The recommended concentration of herbicide mixture for foliar application
 - Concentrations are often given as an acceptable range
 - Recommended concentrations may be different for broadcast vs. spot treatment
 - Recommended concentrations may be different for woody vs. herbaceous species

For broadcast foliar applications using a backpack sprayer, there is a standardized calibration methodology used to calculate how much total herbicide mixture is needed to cover a total project site of known size by doing a test application with water only on a small area of known size. This method is detailed by Corteva Agriscience 2020, Jackson et al. 2017, and Gover et al. 2008. Once the amount of mix needed to treat an acre is known, concentration of herbicide can be calculated such that it falls within the label-recommended range and does not exceed annual or per application limits.

This calibration method can be modified to estimate the amount of mixture needed for spot treatments of woody plants as described by Jackson et al. 2017 and Gover et al. 2008, but this is only feasible if the targets being treated are all within roughly the same size class (requiring roughly the same amount of herbicide mixture) and if the average percent cover of targets is known for the site. Often this is not the case. For spot treatments, it may be

necessary to make a conservative estimate of how much mixture is needed and to remix as needed. The maximum amount of mixture per acre based on the herbicide concentration being used and the label-stated annual maximum should be calculated and followed.

Application Method

Users should always carefully follow the application instructions on the label of the herbicide being used and any additional instructions provided by the application equipment manufacturer. Herbicide labels provide instructions that are specific to the type of equipment being used (e.g., aerial or ground broadcast equipment or targeted equipment) and the management context (e.g., forestry use vs. other non-agricultural land vs. natural areas). Important label instructions include specifications and settings for the spraying equipment and the degree of coverage to achieve. Applying more product than the label recommends is not likely to make the treatment more effective and increases the risk of off-target impacts and other environmental harm.

Monitoring and Follow-up

Any invasive species treatment needs to be monitored for effectiveness and for invasive species regrowth in the years following treatment. Foliar treatments with most herbicides can usually be checked for effectiveness 3-4 weeks following treatment but determination of mortality often can't be assessed for a year or more following treatment. If a foliar treatment was largely ineffective, a higher concentration (within the label recommended range and annual limits) or a different herbicide or mix of herbicides may be necessary.

References and Further Reading

- Corteva Agriscience. 2020. Invasive Plant Management with Milestone and Other Herbicides: A Practical and Technical Guide (pdf).
- Ferrell, J, Enloe, S, and B Sellers. 2015. Herbicide application techniques for woody plant control. University of Florida, Institute of Food and Agricultural Sciences Extension. Doc # SS-AGR-260.
- Gover, A, Lloyd, K, Johnson, J and J Sellmer. 2008. Simple sprayer calibration. PennState Wildland Weed Management.
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- Miller, JH, Manning, ST and SF Enloe. 2015 (rev). A Management Guide for Invasive Plants in Southern Forests. United States Department of Agriculture, Forest Service, Southern Research Service. SRS-131.
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