

TITLE: Herbicide Application Information Sheet

DESCRIPTION: Pesticides are an important and effective tool used for forest management, however danger and risk may be involved. By being aware of the dangers of herbicides, you can plan your application to avoid these issues (and if a problem occurs, know how to remediate it effectively). This article provides information on how the most common applications are conducted and the tools required to do them.

Active Ingredient (Brand)	Application Methods	Invasive Species Treated	Notes
Glyphosate (Accord XRT II) <i>For use near water – AquaNeat with a water safe surfactant</i>	Foliar, Hack and Squirt, Drill and Fill, Cut Stump	Japanese Knotweed, Phragmites, Poison Hemlock, Poison Ivy/Oak, Beech, Honeysuckle, Black Locust, Multiflora Rose, Black Jetbead, Swallow-Wort, Japanese Barberry, Buckthorn, Tree of Heaven (<i>Ailanthus</i>), Garlic Mustard, Japanese Stiltgrass, Mile-A-Minute, Mountain Laurel, Fern, and more	Signal – Caution. One of the most versatile herbicides that does not persist long in the soil. Often used with imazapyr to increase effectiveness (ex. Cut stump solution - 50% glyphosate, 2% Imazapyr). Less prone to translocation (flash) than imazapyr.
Impazapyr (Arsenal)	Foliar, Hack and Squirt, Drill and Fill, Cut Stump	Japanese Knotweed, Phragmites, Poison Ivy, Honeysuckle, Multiflora Rose, Wild Grape, Beech, Black Locust, Russian Olive, Japanese Barberry, Buckthorn, Bittersweet and more	Signal – Caution. Often used with glyphosate and stays more active within the soil, leading to translocation. Translocation can help kill dense thickets but may result in non-targets being affected.
Triclopyr 3A (Garlon 3A)	Foliar, Hack and Squirt, Cut Stump, Injection	Beech, Black Locust, Poison Ivy/Oak, Japanese Barberry, Autumn Olive, Privet, Multiflora Rose, Buckthorn, Honeysuckle, Tree of Heaven and more	Signal – Danger (Risk for eye damage). Good for “hard-to-kill” species. Half-life is low (30-46 days). Translocation risk is low-moderate.
Triclopyr 4 (Garlon 4 Ultra)	Foliar, Basal Bark (with oil), Cut Stump (with oil)	Beech, Buckthorn, Poison Ivy/Oak, Black Locust, Tree of Heaven, Swallow-Wort, Autumn Olive, Privet, Black Jetbead, Japanese Barberry, Honeysuckle, Giant Hogweed, Mountain Laurel, Bittersweet and more	Signal – Caution. This chemical is an ester, which means it often needs to be mixed with oil for it to work. It should be evaluated when spraying for the risk of spraying oil in the forest in addition to herbicide. This also requires the use of specialty spraying equipment made of brass fittings, as the oil corrodes plastic.
Sulfometuron-methyl (Oust XP)	Foliar	Ferns, Japanese Stiltgrass, Mile-A-Minute, and more	Signal – Caution. This chemical is a water-soluble granule. It is particularly good for treating grasses and weeds. This chemical is pre-emergent (can kill vegetation before it sprouts).

A different brand of herbicide may be used if it has the same active ingredient, make sure the label allows treatment of target

Safety – When applying pesticide, proper PPE should be worn. Specific information regarding required PPE can be found on the pesticide label on the front side of the pesticide bottle. At minimum, proper PPE consists of nitrile/latex gloves, protective eyewear, long sleeve shirt, and pants.

Treatment Methods

- **Foliar** – The herbicide is mixed at a lower concentration with water and is sprayed on the leaves of target plants. The goal is to spray 100% of leaves on the plant to the point where the leaves are wet, but the herbicide is not dripping. A dye should be added to the mixture, so that it is easy to see what has and has not been treated. This treatment method is a good way to treat invasives but is difficult to utilize for stems that are taller than head height. A surfactant should be used. These either come mixed into the concentrate or need to be added while mixing. When in doubt, refer to the label. Surfactants help the herbicide stick to the leaf for the herbicide to work.
- **Hack and Squirt** – The herbicide is mixed at a higher concentration with water. This treatment method requires “incisions” to be made in the tree, and chemical being sprayed into the pocket that’s created. A sharp hatchet is useful for creating these pockets. Hacks should have ~1 inch between them going all the way around, “girdling” the tree. As much herbicide should be sprayed into the pocket as possible without the chemical dripping out the sides of the incision created. This treatment method can be used on trees of any size. Larger trees will die standing, and they will break apart from the top over a few years until they finally fall. This can be a safe way to kill larger nuisance trees, such as beech, without having to cut them down. A dye should be added to the mixture, so that it is easy to see what has and has not been treated.
- **Drill and Fill** - The herbicide is mixed at a higher concentration with water. This is a closely related alternative treatment method to the hack and squirt method. This method involves drilling small diameter holes into the tree and injecting herbicide with a syringe, filling the holes.
- **Cut Stump** - The herbicide is mixed at a higher concentration with water. This treatment type involves cutting the plant and immediately applying herbicide to the stump. It is best to immediately treat the stump after cutting the stem, as the plant can seal the wound quickly. Once the wound is sealed, the stump will no longer absorb the herbicide. This can be a great treatment method if you have a friend to help, as one person can cut the stems as the other is following treating the stumps. A dye should be added to the mixture, so that it is easy to see what has and has not been treated.

- **Basal Bark** - The herbicide is mixed at a moderately higher concentration with oil. This application method involves spraying the bottom ~3 feet of the tree on all sides to kill the tree. The use of oil allows the chemical to penetrate through the bark so that the chemical is taken up by the layer of the tree that moves nutrients throughout. This causes the tree to die slowly. Larger trees will die standing, and they will break apart from the top over a few years until they finally fall. This can be a safe way to kill larger nuisance trees, such as beech, without having to cut them down. A dye should be added to the mixture, so that it is easy to see what has and has not been treated.

Seasonality and Timing

Herbicide Application Schedule

Treatment Method	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Foliar												
Cut Stump												
Basal Bark												
Hack and Squirt												

Actual schedule for applications may vary slightly based on herbicide used and weather conditions

The chart above can be used for helping to plan a timeframe for a project, but should not be used solely. Always refer to the pesticide label for the chemical you are using for exact timing of when it should be used for the treatment method of interest.

There may be multiple different treatment methods that are viable to treat the same population of invasives, each having their pros and cons. Foliar is great for treating shrubs and small trees quickly and efficiently. Cut stump is great for treating stems that are too tall for foliar or in areas that need a path cleared to get to. Basal bark is good for treating slightly larger trees, while having the option to treat them in winter. Hack and squirt (frill and girdle) is a good option for treating trees of all sizes, especially larger trees that aren't in need of being felled. A plan of action should be created to ensure that all desired treatment methods (especially if using different methods on the same project) are utilized in the timeframe that they are most effective.

The application of pesticides depends significantly on seasonality. Due to how different treatment methods work, different times of year have different effectiveness. For example, applying chemical via foliar is great in the summer months when the plant has leaves present to spray, while the fall-winter is good for hack and squirt because the nutrients in the plant are moving downwards to the roots in preparation for winter dormancy. For most applications it is not good to treat in early spring when the nutrients are moving up from the roots. The chemical is not very effective at this point.

There are a few conditions during effective spray periods to be aware of while applying pesticides. Potential rain forecasts should be strictly monitored to ensure that chemicals are not being washed away into unwanted areas. The pesticide label and safety sheets should have information regarding how long before/after rain the pesticide may be applied.

One factor that makes treatment timing and seasonality more unpredictable is climate change. As weather patterns continue to change, the timing becomes much less reliable. For example, if the winter gets consistently cold quickly, the hack and squirt season may be significantly shortened as the trees go dormant earlier. Also, we may have a summer that is particularly rainy, preventing applications for weeks at a time. This will lead to some uncertainty for timeframes as treatments have begun. All in all, it is best to have some flexibility to follow what the label dictates is acceptable for application conditions.

Equipment

Foliar – For foliar you will need a sprayer, mixing and measuring tools, and chemical (w/ indicator dye). Indicator dye is important so that you can distinguish sprayed and unsprayed areas, as the chemical and water mix will be clear without dye. Amazon, Lowes, and Tractor Supply both carry handheld sprayers in the 1-2 gallon range for around \$20. This may be sufficient for smaller projects. If your project is larger, Lowes and Amazon sell 4-gallon backpack sprayers that are effective for around \$100. For very large projects, Tractor Supply sells spray tanks that attach to ATVs and UTVs. The pump connects directly to your machine's battery. These can hold 25 gallons and sell for around \$500-\$2,000. If access to the infestation is good, these sprayers can make treatments extremely easy. It is recommended to use a funnel and measuring cup to assist with precise mixing.

- [4-gallon backpack sprayer](#)
- [2-gallon handheld sprayer](#)
- [1-gallon handheld sprayer](#)
- [25-gallon ATV/UTV sprayer](#)
- [Funnel](#)
- [Measuring cup](#)
- [Surfactant](#) – if label requires it
- [Spray Indicator Dye](#)

Hack and Squirt – For this treatment method you will need a sharp hatchet (\$30), a spray bottle (\$8), and chemical. Spray bottles should be rated for pesticides specifically. Zep spray bottles are a great option for this treatment method and are available at most hardware stores. It is recommended to use a funnel and measuring cup to assist with precise mixing.

- [Hatchet](#)
- [Spray bottle](#)
- [Funnel](#)
- [Measuring cup](#)
- [Spray Indicator Dye](#)

Drill and Fill – For this treatment method you will need a cordless drill with a 5/16” drill bit, a syringe for injecting the chemical (\$50), and chemical. Most people seem to like using repeater syringes that are meant to be used for cattle vaccines for these applications. These syringes most likely need to be found online, but Tractor Supply or Agway may carry them. It is recommended to use a funnel and measuring cup to assist with precise mixing.

- [Cordless drill](#)
- [5/16” wood drill bit](#)
- [Repeater Syringe](#)
- [Funnel](#)
- [Measuring cup](#)
- [Spray Indicator Dye](#)

Cut Stump – Depending on the size of the infestation and the individual trees, there may be a few options for equipment that can be used for the cut stump method. For cutting, If the project is small loppers or a bow saw would work great but would not be convenient for a project that is over an acre. Popular tools for cutting include loppers (\$30), bow saws (\$30), brush saws (\$800-\$1200), or chainsaws (\$200-\$1000). All of these can either be purchased online or at most hardware stores. Other tools may be used, as it depends on your preference and what you have available. For spraying the stump, a spray bottle as described in the hack and squirt method can be used (\$8). It is recommended to use a funnel and measuring cup to assist with precise mixing.

- [Husqvarna 120 chainsaw](#)
- [Stihl MS 250 chainsaw](#)
- [Echo 42.7 cc brush cutter](#)
- [Stihl FS 111 brush cutter](#)
- [Loppers](#)
- [Bow Saw](#)

- [Spray bottle](#)
- [Funnel](#)
- [Measuring cup](#)
- [Spray Indicator Dye](#)

Basal Bark – For this treatment you will need a specialty sprayer because oil is needed for the application. Normal sprayers use plastic fittings, which are corroded as oil runs through them. When the fittings corrode, it leads to the sprayer leaking. Specialty sprayers are made with brass fittings which are resistant to corrosion, but these sprayers are more expensive and not as easy to find. Birchmeier makes 4 gallon backpack sprayers that cost ~\$400 for one pack that are designed for this treatment method. These can be found online on the Birchmeier website.

- [Funnel](#)
- [Measuring cup](#)
- [4-gallon Birchmeier back sprayer with brass fittings](#)
- [Oil soluble spray indicator dye](#)



Stems that have been treated via “Cut Stump”



Tree being treated via "Hack and Squirt"



Plants being treated via "Foliar"



DAVID R. JACKSON

Tree being treated via “Basal Bark”

Human and Environmental Health

The resources below can be used to learn more regarding the risks associated with chemical treatments for both you and the environment.

- <https://extension.psu.edu/glyphosate-roundup-understanding-risks-to-human-health>
- <https://www.epa.gov/ingredients-used-pesticide-products/glyphosate>
- <https://wisc.pb.unizin.org/forestecologyoer/chapter/chapter-18-pesticides/>
- <https://npic.orst.edu/factsheets/24Dgen.html>

Herbicide

There are countless brands available for pesticides that contain the same active ingredients. Chemical costs can vary greatly, but they can be purchased from most home improvement stores, agriculture stores, and even Amazon. Before purchasing, you should check and make sure the active ingredient is correct and compatible with the treatment methods and target species outlined for your project.

Glyphosate –

- [Accord XRT II \(2.5 gallons concentrate\)](#)
- [FarmWorks 41% Glyphosate Grass and Weed Killer \(2.5 gallons concentrate\)](#)
- [FarmWorks 41% Glyphosate Grass and Weed Killer \(1 gallon concentrate\)](#)
- [Albaugh Gly-Star Plus 41% \(2.5 gallons concentrate\)](#)

Imazapyr –

- [Alligare Impazapyr 4 SL \(2.5 gallons concentrate\)](#)

Triclopyr 3A –

- [Corteva Garlon 3A \(2.5 gallons concentrate\)](#)

- [Alligare Triclopyr 3 \(2.5 gallons concentrate\)](#)

Triclopyr 4 –

- [Corteva Garlon 4 \(2.5 gallons concentrate\)](#)
- [Alligare Triclopyr 4 \(2.5 gallons concentrate\)](#)
- [Element 4 \(2.5 gallons concentrate\)](#)

Sulfometuron-methyl –

- [Bayer Oust XP \(3 lbs\)](#)
- [Alligare SFM 75 \(3 lbs\)](#)
- [Spyder \(3 lbs\)](#)

Questions and Further Assistance

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