

Herbicide Reference Guide For Vegetation Management

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Trees	Shrubs	Vines	Grasses	Forbs	Mixtures
Species	Herbicide	Treatment and Mixing Rates			
callery pear (Bradford) <i>Pyrus calleryana</i> 'Bradford'	Garlon 3A (triclopyr)	Foliar: 2% solution + surfactant (June – September) Cut-stump & stem injections: 50% solution			
	Glyphosate (41%)	Foliar: 3% solution + surfactant (June – September) Cut-stump & stem injections: 50% solution			
	PastureGard HL (triclopyr & fluroxypyr)	Foliar: 2–3% solution + surfactant (June – September)			
	Garlon 4 (triclopyr)	Basal bark treatment: 20% solution in a labeled basal oil product			
mimosa <i>Albizia julibrissin</i>	Garlon 3A	Foliar: 4% solution + surfactant (June – September) Cut-stump & stem injections: 50% solution			
	Arsenal AC* (imazapyr)	Foliar: 1% solution + surfactant (June – September) Cut-stump & stem injections: 10% solution			
	Glyphosate (41%)	Foliar: 4–5% solution + surfactant (June – September) Cut-stump & stem injections: 50% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			
royal paulownia, princess or empress tree <i>Paulownia tomentosa</i>	Garlon 3A	Foliar: 2% solution + surfactant (July – September) Cut-stump & stem injections: 50% solution			
	Arsenal AC*	Foliar: 1% solution + surfactant (July – September) Cut-stump & stem injections: 10% solution			
	Glyphosate (41%)	Foliar: 3% solution + surfactant (July – September) Cut-stump & stem injections: 50% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			
tree-of-heaven <i>Ailanthus altissima</i>	Garlon 3A	Foliar: 2% solution + surfactant (July – September) Cut-stump & stem injections: 50% solution			
	Arsenal AC*	Foliar: 1% solution + surfactant (July – September)			
	Glyphosate (41%)	Foliar: 3% solution + surfactant (July – September) Cut-stump & stem injections: 50% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			
autumn olive <i>Elaeagnus umbellata</i>	Garlon 3A	Foliar: 3% solution + surfactant (April – October) Cut-stump & stem injections: 50% solution			
	Arsenal AC*	Foliar: 1% solution + surfactant (April – October) Cut-stump & stem injections: 10% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			
blackberry <i>Rubus spp.</i>	Escort XP or MSM 60* (metsulfuron-methyl)	Foliar: 1 oz/ac (broadcast) or 1 gram/gal water (spot-spray) + surfactant (June – September) • If mowed, then wait until the following growing season to spray			
	Glyphosate (41%)	Foliar: 3–5% solution + surfactant (July – August) • More effective after flowering			
	Garlon 3A	Foliar: 2–3% solution + surfactant (July – August)			
	Garlon 4	Foliar: 2–3% solution + surfactant (July – August)			
	PastureGard HL	Foliar: 2–3% solution + surfactant (July – August)			
bush honeysuckles <i>Lonicera spp.</i>	Glyphosate (41%)	Foliar: 2% solution + surfactant (July – September) Cut-stump: 50% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			
Chinese privet <i>Ligustrum sinense</i>	Glyphosate (41%)	Foliar: 2% solution + surfactant (October – December; March – September) • Best immediately after warm-season species go dormant • Late summer applications may not be as effective and require 2.5–3% Cut-stump & stem injections: 50% solution			
	Arsenal AC*	Foliar: 1% solution + surfactant (June – October) Cut-stump & stem injections: 10% solution			
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product			

Species	Herbicide	Treatment and Mixing Rates
multiflora rose <i>Rosa multiflora</i>	Arsenal AC*	Foliar: 1% solution + surfactant (August – October)
	Glyphosate (41%)	Foliar: 2–3% solution + surfactant (May – October)
	Escort XP or MSM 60*	Foliar: 1 gram/gal water (spot-spray) + surfactant (July – September)
	PastureGard HL	Foliar: 1.5–2% solution + surfactant (May – October)
	Garlon 4	Basal bark treatment: 20% solution in a labeled basal oil product
bicolor lespedeza (shrub lespedezas) <i>Lespedeza bicolor</i> <i>Mow or mulch 2 months prior to herbicide application for extensive infestations</i>	Glyphosate (41%)	Foliar: 2% solution + surfactant (July – September)
	Garlon 4	Foliar: 2% solution + surfactant (July – September)
	Garlon 3A	Foliar: 2–3% solution + surfactant (July – September)
	PastureGard HL	Foliar: 1 oz/1 gal water + surfactant (July – September)
English ivy <i>Hedera helix</i>	Glyphosate (41%)	Foliar: 3–5% solution (March) + MSO (1%) • Treatment when new leaves are emerging is optimum • Plan for follow-up treatments as needed (i.e., annual monitoring is important)
	Escort XP or MSM 60*	Foliar: 1.6 oz/ac + surfactant (October)
kudzu <i>Pueraria montana var. lobata</i>	PastureGard HL	Foliar: 3% solution + surfactant (June – October) • Will likely require multiple applications
	Tordon 22K* (picloram)	Foliar: 3% solution + surfactant (June – October) • This is a restricted use herbicide
	Milestone* (aminopyralid)	Foliar: 7 oz./ac (broadcast) or 0.5 oz/gal water (spot-spray) + surfactant (June – October)
	Garlon 3A	Foliar: 3% solution + surfactant (June – October) • Will likely require multiple applications
	Transline* (clopyralid)	Foliar: 21 oz/ac + surfactant (May – July)
	Escort XP or MSM 60*	Foliar: 4 oz/ac + surfactant (July – August)
oriental bittersweet <i>Celastrus orbiculatus</i>	Garlon 3A	Foliar: 3% solution + surfactant (July – October)
	Glyphosate (41%)	Foliar: 3% solution + surfactant (July – October)
	PastureGard HL	Foliar: 2% solution + surfactant (May – October)
wintercreeper <i>Euonymus fortunei</i>	Garlon 3A	Foliar: 5% solution + surfactant (October – November; February – March) • Will likely require multiple treatments
	PastureGard HL	Foliar: 1.5–2% solution + surfactant (October – November; February – March)
	Glyphosate (41%)	Foliar: 5% solution + MSO (1%) (October – November; February – March)
bermudagrass <i>Cynodon dactylon</i>	Arsenal or Arsenal AC*	48 oz/ac of Arsenal or 24 oz/ac of Arsenal AC + surfactant (June – July; just prior to flowering) • Will likely require follow-up spot-treatments • If follow-up treatment is needed during the same year imazapyr is used at these rates, apply glyphosate at 5% for spot-treatments
	Glyphosate (41%)	5 qt/ac (broadcast) or 5% solution (spot-spray) + surfactant (June – July) • Will likely require multiple treatments
Chinese silvergrass <i>Miscanthus sinensis</i>	Arsenal AC*	24–48 oz/ac (broadcast) or 1% solution (spot-spray) + surfactant (August – October) • Spray before flowers mature into seed • Will likely require follow-up applications
	Glyphosate (41%)	2–4 qt/ac (broadcast) or 5% solution (spot-spray) + surfactant (August – October) • Spray before flowers mature into seed • Will likely require follow-up applications

Species	Herbicide	Treatment and Mixing Rates
cogongrass <i>Imperata cylindrica</i>	Arsenal AC*	24 oz/ac (broadcast) or 1-2% solution (spot-spray) + surfactant ¹ (August – October) - Works best when grass is approximately 1-2 feet tall - Will likely require follow-up applications
	Glyphosate (41%)	3-5 qt/ac (broadcast) or 4-5% solution (spot-spray) + 1% ammonium sulfate + surfactant (August – October) Repeat applications may be warranted the following spring and fall
Japanese stiltgrass <i>Microstegium vimineum</i> <i>Use higher rates later in the growing season</i>	Plateau* (imazapic)	4-8 oz/ac (broadcast) or 1-1.5% solution (spot-spray) + surfactant (May – July) - Provides both preemergence and postemergence control - Might kill walnut and hickory trees, so avoid spraying around or underneath them
	Glyphosate (41%)	1-2% solution + surfactant (April – June) A 0.5% solution can be used to minimize damage to some surrounding desirable native perennials
Johnsongrass <i>Sorghum halepense</i>	Plateau*	12 oz/ac (broadcast)+ MSO (1%) or NIS (0.25%) or 1-1.5% solution (spot-spray) (May – June) Works best when grass is approximately 18-24" tall and before flowering
	Glyphosate (41%)	3% solution + surfactant (May – August) - Will likely require multiple applications on established plants - Consider using a wick application once Johnsongrass is taller than the surrounding vegetation²
	Outrider* (sulfosulfuron)	1.5-2 oz/ac + surfactant Best for heavy infestation requiring broadcast applications
tall fescue (and other perennial cool-season grasses) <i>Schedonorus arundinaceus</i>	Glyphosate (41%)	2 qt/ac (broadcast) or 2-2.5% solution (spot-spray) + surfactant (November – mid-December) - Will likely require spot-treatment the following spring - Spring application is another option but will likely require follow-up application within 1-2 years
	Plateau*	12 oz/ac (broadcast) + MSO (1%) or NIS (0.25%) or 1-1.5% solution (spot-spray) + surfactant (fall or spring) A good herbicide choice if desirable species also are present
alligator weed <i>Alternanthera philoxeroides</i>	Habitat* (imazapyr) <i>aquatic approved</i>	2 qt/ac + MSO during the growing season Most effective on dry ground, likely to only top-kill if applied over water
	Habitat* + Glyphosate (41%) <i>aquatic approved</i>	2 qt/ac of imazapyr +2qt/ac of glyphosate + MSO during the growing season This mixture may be necessary if alligator weed develops resistance to imazapyr
garlic mustard <i>Alliaria petiolata</i>	Glyphosate (41%)	2-3% solution + surfactant (March – May)
	Garlon 4	2% solution + surfactant (March – May)
	Plateau*	4-6 oz/ac (broadcast) or 1-1.5% solution (spot-spray) + surfactant (March – May) - Provides both preemergence and postemergence control - Might kill walnut and hickory trees, so avoid spraying around or underneath them
Japanese knotweed <i>Reynoutria japonica</i>	Glyphosate (41%)	3-5% solution + surfactant (July – September) Mowing increases control significantly. Mow during the 1st week of June. Allow 1.5-2 months of regrowth followed by herbicide prior to flowering.
	Plateau*	12 oz/ac (broadcast) or 1-1.5% solution (spot-spray) + MSO (August – October)
musk thistle <i>Carduus nutans</i>	Plateau*	12 oz/ac (broadcast) or 1.5% solution (spot-spray) + MSO Most effective during the rosette stage
	Glyphosate (41%)	2% solution (rosette stage) or 3% solution (bolting stage) + surfactant
	Garlon 3A	1% solution (rosette stage) or 1.5% solution (bolting stage) + surfactant

Notes

This document does not replace the herbicide label. Always read and follow the herbicide label. The label is the law. Herbicides could potentially injure or kill desirable vegetation including trees. Read and follow the label to prevent killing desirable species.

Rates will vary depending on target species, plant growth stage, herbicide choice, site conditions, and overall objectives.

A higher percentage of herbicide may be warranted later in the growing season for foliar applications (refer to the label).

It is generally recommended to avoid applying herbicides during extreme drought, heat (e.g., above 85°), cold (e.g., below 50°), wet weather, cloudy conditions (i.e., for foliar applications), or windy conditions.

Always wear personal protective equipment (PPE).

Always wash clothing worn when applying herbicides separately from other laundry.

Various herbicides in this document may be available under different brand names. Before buying or applying any product, always compare the active ingredient(s) on the label to make sure you are selecting the correct herbicide.

Use EPA-approved aquatic herbicides when necessary. Always follow the label when working in and around water sources, including wetlands.

Glyphosate is a systemic, nonselective herbicide that injures or kills most plants, so use caution when applying around desirable plants.

53% active ingredient glyphosate products only need a 38.5% solution for stem injection and cut-stump treatments.

Garlon (triclopyr) is a selective, systemic herbicide designed to control woody plants and broadleaf weeds while leaving grasses largely unaffected.

Garlon 4 is the ester formulation and may volatilize above a certain temperature. Garlon 4 may provide better woody control than Garlon 3A via foliar treatment. Refer to the label.

Other triclopyr options:

Trycera (triclopyr acid) is a dual-purpose herbicide that is both oil and water soluble. It can be used for both basal and foliar treatments in terrestrial and aquatic environments with low volatility providing a versatile option to applicators.

Vastlan (triclopyr choline) is water soluble with improved worker safety and near-zero volatility, has an aquatic label, but is not designed for basal bark applications.

*Arsenal (i.e., imazapyr) products, Escort XP or MSM 60, Tordon 22K, Milestone, Transline, Plateau, Outrider, Habitat, and Duracor are soil active. Follow the label to avoid impact on non-target vegetation, particularly trees.

Methylated Seed Oil (MSO) might be recommended over non-ionic surfactant (NIS) with various herbicide applications (refer to the label). ¹Dyne-A-Pak surfactant may be preferable for cogongrass treatments.

²Check the glyphosate label for wick application to control Johnsongrass.

Examples of (foliar) spot-spray rates based on percent solution:

1% solution: 128 oz per gallon times .01 = 1.28 oz per gallon. A 4-gallon backpack sprayer would require 5 oz of herbicide + a surfactant.

2% solution: 128 oz per gallon times .02 = 2.56 oz per gallon. A 4-gallon backpack sprayer would require 10 oz of herbicide + a surfactant.

Cut-stump treatment: a technique where herbicide is applied to the cambium layer of a freshly cut tree stump. Large vines can be treated similarly by applying appropriate herbicide(s) to the cut surface of each vine stem. Vines are often difficult to control with foliar applications only.

Hack-and-squirt (stem injection): a technique that typically involves a hatchet and an herbicide spray bottle. A 45-degree hack through the bark layer and into the cambium layer followed with one squirt of herbicide (1ml of solution) per hack and around the tree following label instructions.

Girdle-and-spray (stem injection): a technique that typically involves a small chainsaw and an herbicide spray bottle. A chainsaw is used to cut through the bark layer and into the cambium layer followed by appropriate herbicide application into the girdle.

Example of cut-stump and stem injections:

50% solution = half herbicide + half water + dye in a container.

Basal bark treatment: a technique that involves applying oil-soluble herbicide to the lower 18 inches of the trunk of smaller trees and thin-barked species.

Example of basal bark treatment based on percent solution:

20% solution of herbicide mixed with a labeled basal oil product = 102 oz of herbicide per 4-gallon mix.

A percent solution is used for spot-spray applications. Amount of product per acre is used for broadcast applications. Calibrate equipment as appropriate.

Table 1. Working with Percentages for Spot-Spray Applications

Percent solution	Ounces per 1-gallon mix	Ounces per 4-gallon mix	Ounces per 25-gallon mix	Ounces per 45-gallon mix	Ounces per 60-gallon mix	Ounces per 65-gallon mix	Ounces per 100-gallon mix
0.25%	0.3	1.3	8	14.4	19.2	20.8	32
1%	1.3	5.1	32	57.6	76.8	83.2	128
1.5%	1.9	7.7	48	86.4	115.2	124.8	192
2%	2.6	10.2	64	115.2	153.6	166.4	256
2.5%	3.2	12.8	80	144	192	208	320
3%	3.8	15.4	96	172.8	230.4	249.6	384
5%	6.4	25.6	160	288	384	416	640
20%	25.6	102.4					
50%	64	256					

Measurement Conversions

Liquid

1 Cup = 8 fl. ounces or 16 tablespoons

1 Gallon = 128 fl. ounces or 8 pints or 4 quarts

1 tablespoon = 3 teaspoons or 0.5 ounces (liquid)

1% per gallon = 1.28 fluid ounces

Area Measurements

1 mile = 5,280 feet

1 acre = 43,560 sq. feet

1 yard = 3 feet

Calibration

Check other Extension publications for calibrating equipment such as UT Extension W315.

Cleaning

Carefully clean equipment after each use. Follow the label.

A triple rinse is often necessary for cleaning herbicide sprayers to prevent cross-contamination and vegetation damage.

A tank cleaner or neutralizer is highly recommended, and often required, when switching herbicides or changing target vegetation.

Herbicide Storage

Read the herbicide label. It provides information regarding proper storage and disposal.

Store herbicides in a cool, dry, and well-ventilated space.

Herbicides should generally be stored between 40-90°F. Do not allow products to freeze or reach over 110°F.

Store liquid herbicides on the bottom shelf and not on the floor.

Exposure to UV rays and direct sunlight can cause herbicides to break down, rendering them ineffective, unusable, or potentially hazardous.

Post warning signs and lock the storage facility when not in use.

Warning Labels

Caution - Slightly Toxic

Warning - Moderately Toxic

Danger - Highly Toxic (Skin and Eyes)

Danger/Poison - Highly Toxic (Acute Illness or Death)

Record Keeping

Label and date everything. Document and retain herbicide application records.

Other Resources

Herbicide Labels: <https://www.cdms.net/LabelsSDS/home>

Phone App: TankMix Corteva, Inc. for iPhone



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