FOREST SCIENCE FACT SHEET SERIES

Using Basal Bark Herbicide Applications to Control Understory Tree Species

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The latest U.S. Forest Service forest inventory and analysis data indicate the tree species composition of Pennsylvania's forests is changing. One indication of change is understory composition. Inventory data show that understory tree species are not the same as those found in the overstory. Species such as northern red oak, chestnut oak, white oak, and white pine that occupy the overstory are not well represented in the understory. By comparison, understory abundance of some species like red maple, American beech, blackgum, striped maple, and black birch is increasing. When forests are disturbed, either by natural or human-caused events, the existing understory species have the potential to change the composition of the next forest.

Recognizing and treating potential species composition changes using properly applied silvicultural practices is critical to forest sustainability. Controlling interfering plants prior to a planned harvest can increase the proportion of desirable species that regenerate successfully. Depending on ownership objectives, it is often useful to remove or target undesirable tree species, favoring species better suited to the site. Timber stand improvement practices, when properly applied, will shift species composition to meet landowner objectives and site conditions. Herbicides are a versatile tool for manipulating tree species composition.

Selective herbicide applications offer one of the safest, surest, and most efficient means for controlling unwanted understory tree species. Herbicides can control unwanted seedlings and saplings using directed foliar sprays, tree injection, soil spots, and basal bark sprays.

What Are Basal Bark Herbicide Applications?

Basal bark herbicide applications are made using a low-pressure backpack sprayer to thoroughly wet the lower 12–18 inches of the stem using a solid cone or flat fan nozzle. To be effective, it is important to thoroughly wet the entire stem, root collar area, and any exposed roots. Basal bark herbicides use an oil carrier (commercially available basal oil, diesel fuel, no. 1 or no. 2 fuel oil, or kerosene) to penetrate the bark. Trees with old or rough bark may require increased coverage to be effective.

Numerous products and active ingredients are labeled for use as basal bark applications (Table 1). Triclopyr is the most common active ingredient used. It is found in products such as Garlon 4 Ultra and Tahoe 4E. Triclopyr is a systemic herbicide, absorbed by the plant and translocated to tissues remote from the point of application. Triclopyr works by disturbing plant growth. It accumulates in plant meristems, cells where growth takes place, causing uneven cell division and growth. Triclopyr binds to soil organic matter and clay particles, which limits its movement in the soil and prevents root uptake by nontarget plants. Half the active ingredient is broken down by soil microorganisms and sunlight within 30–45 days following application.

Table 1. Basal bark herbicides.

Active Ingredient	Herbicide Trade Name(s)	Application Equipment	Application Method	Mixture (Rate)	Time of Year
2,4-D	DMA 4 IVM	Backpack sprayer	Wet base and root collar until spray begins to accumulate at ground line	2.6 oz/gal of water	Year-round, except when snow or water prevent spraying to ground line
Imazapyr	Chopper, Polaris SP, Stalker	Backpack sprayer (low volume)	Spray to wet lower 12–18 inches of stem, including root collar	8–12 oz in 1 gal diesel oil or penetrating oil	Year-round, except when snow or water prevent spraying to ground line
Triclopyr	Element 4, Garlon 4 Ultra, Tahoe 4E	Backpack sprayer, solid cone or flat fan nozzle	Spray to wet lower 12–15 inches of stem, including root collar area, using low volume and low pressure	20–30% in basal oil, diesel fuel, fuel oil, or kerosene	Year-round, except when snow or water prevent spraying to ground line
Triclopyr	Forestry Garlon XRT	Backpack sprayer, solid cone or flat fan nozzle	Thoroughly wet basal parts of brush and trees, including root collar, using low volume and low pressure	13–19% in basal oil, diesel fuel, fuel oil, or kerosene	Year-round, except when snow or water prevent spraying to ground line
Triclopyr	Pathfinder II, Relegate RTU	Backpack sprayer, solid cone or flat fan nozzle	Spray to wet lower 12–15 inches of stem, including root collar, using low volume and low pressure	Ready-to-use (petroleum distillate in the product)	Year-round, except when snow or water prevent spraying to ground line

The Garlon 4 Ultra (triclopyr 60.45 percent) label indicates two types of basal bark treatments:

1. **Basal bark treatment:** Mix 1–5 gallons of Garlon 4 Ultra in enough oil to make 100 gallons of mixture (1–5 percent). Apply with a backpack sprayer using low pressure (20–40 psi). Thoroughly wet the basal parts of brush and tree trunks to a height of 12–15 inches from the ground. Spray until runoff at the ground line is noticeable.
2. **Low-volume basal bark treatment:** Mix 20–30 gallons of Garlon 4 Ultra in enough oil to make 100 gallons of mixture (20–30 percent). Apply with a backpack sprayer using low pressure and a solid cone or flat fan nozzle. Thoroughly wet the lower stems, including the root collar area of brush and tree trunks. Do not spray to the point of runoff.


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Basal bark treatment spraying lower 12–18 inches of stem.


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Treating American beech stems in northern hardwood understory.

What Are Basal Bark Herbicide Applications Used For?

Basal bark applications are used to control thin-barked trees generally less than 6 inches in basal diameter. It is most commonly used in hardwood forest management timber stand improvement projects to remove undesirable and invasive tree and shrub species. These applications are also used to establish desirable regeneration by removing the low shade cast by dense understories of undesirable saplings such as striped maple, American beech, and eastern hophornbeam. Basal bark treatments are also effective for controlling grapevines (*Vitis* spp.).

When Can Basal Bark Herbicide Applications Be Made?

Basal bark herbicides can be applied any time of year, including winter months, except when snow prevents spraying to the ground line or when stem surfaces are saturated with water.

Applied Research Results: Basal Bark Herbicide Application Rate Study

Traditional understory low-volume basal bark treatments using triclopyr have used herbicide mixtures at concentrations of 20–30 percent. Preliminary work conducted in 2006 found that much lower rates are effective at controlling most common problem understory tree species represented in Pennsylvania.

The objective of the study was to develop a recommendation for the lowest possible effective basal stem herbicide application rate achieving an acceptable level of control. Lower rates reduce chemical use, protect the environment, and significantly lower treatment cost.

Methods

The study examined the effectiveness of Garlon 4 (61.6 percent triclopyr) at controlling five less-desirable tree species commonly found in forest understories in Pennsylvania: American beech (*Fagus grandifolia*), striped maple (*Acer pensylvanicum*), red maple (*Acer rubrum*), eastern hophornbeam (*Ostrya virginiana*), and black birch (*Betula lenta*). Three herbicide concentrations were applied: 1 percent, 2.5 percent, and 5 percent solutions using Garlon 4 in commercially available basal oil. Applications were made at two separate times of the year, early spring (dormant season, pre-leaf-out) and late summer (growing season). Applications were made using a CO_2-powered, hand-held sprayer equipped with a B&G Extenda-Ban Ultra Low Volume Basal Wand with drip-proof extension valve and a TeeJet 5500-Y2 Adjustable ConeJet nozzle.

Table 2. Treatments examined (% Garlon 4).

Spring	Summer
1%	1%
2.5%	2.5%
5%	5%

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Herbicide concentration was indicated by color. The number of bands indicated the season, one for spring, two for summer.

Trees selected were assigned one of six treatments using a random number table. Since American beech is a root-suckering species, sprout patches beneath a parent tree were divided in half vertically, up and down slope. One half was treated in spring and the other in summer for each herbicide concentration examined. For all other species, 30 stems were selected for each treatment. Ninety stems of each species were treated each season. Treatments were replicated spring and summer, for a total of 180 stems of each species. Herbicide solutions were applied completely around the lower 15 inches of each stem, including the root collar. Stem sizes varied from 0.1 to 7 inches DBH (diameter at breast height).

Table 3. Treatment locations.

Tree Species	Location	County
American beech	Portage, Portage Water Authority	Cambria
Striped maple	Allen Seeger Road, Rothrock State Forest	Huntingdon
Red maple	Valley Road, Rothrock State Forest	Huntingdon
Black birch	Middle Mountain, West Branch Forest	Clinton
Eastern hophornbeam	Stillhouse Road, Stone Valley Forest	Huntingdon

Study plots were examined and survival data collected midsummer the following growing season, thus allowing one full year following treatment. Survival was rated based on the percentage of canopy controlled, from complete control (100 percent) to no control (0 percent) tallied in 10 percent increments.

Table 4. Treatment and data collection dates.

Tree Species	Spring Treatment	Summer Treatment	Survival Data Collected
American beech	4/9/2008	7/7/2008	8/6/2009
Striped maple	4/10/2008	8/14/2008	7/17/2009
Red maple	4/10/2008	8/14/2008	7/16/2009
Black birch	4/15/2010	8/20/2010	8/28/2011
Eastern hophornbeam	4/20/2010	8/23/2010	8/30/2011

Table 5. Basal stem herbicide rate study results showing percent control.

	Spring			Summer		
	Garlon 4 Concentration			Garlon 4 Concentration		
Tree Species	1%	2.5%	5%	1%	2.5%	5%
American beech	69%	70%	99%	97%	97%	100%
Striped maple	66%	99%	97%	89%	94%	85%
Red maple	68%	82%	88%	88%	92%	98%
Black birch	74%	97%	97%	45%	67%	100%
Eastern hophornbeam	41%	88%	86%	16%	31%	64%

Results

Study results are summarized in Table 5, listed by individual treatment. For sake of discussion, trees showing 75 percent crown necrosis were considered controlled. Spring treatments of 1 percent concentration did not adequately control any of the five species. However, spring applications at 2.5 percent concentration controlled all species except beech. The spring application of 5 percent concentration was successful at controlling all five species examined.

Summer treatments at 1 percent concentration were inadequate to control black birch and hophornbeam. The results were similar for the 2.5 percent treatment. However, when the concentration was increased to 5 percent, black birch was 100 percent controlled. None of the summer application rates successfully controlled hophornbeam to a 75 percent level.

There are some differences between spring versus summer applications by species. Summer treatments are better at controlling beech, striped maple, and red maple. Each species was successfully controlled with summer applications of 1–5 percent concentrations. Striped maple and red maple responded well to all spring applications except for the 1 percent concentration; however, only the 5 percent concentration applied in the spring was successful at controlling beech.

The reverse holds true for black birch and hophornbeam; spring treatments provided better control. For black birch, the 2.5 percent rate was much more effective when applied in the spring versus summer. Hophornbeam was better controlled with the 2.5 and 5 percent application rates when applied in the spring.

Figure 1 combines all tree species to show a comparison of spring versus summer treatments at each application rate. When combined, spring applications appear to provide slightly better control. This may be explained by recalling that triclopyr herbicide acts on meristems, or growing tissues. Based on the combined results, the 1 percent application rate did not provide sufficient control to achieve a 75 percent control level for either summer or spring applications. The 2.5 percent application rate showed better results with the spring applications over the summer applications. The 5 percent application rate showed only slightly better control with spring applications versus summer applications, although both provided sufficient control, much greater than 75 percent.

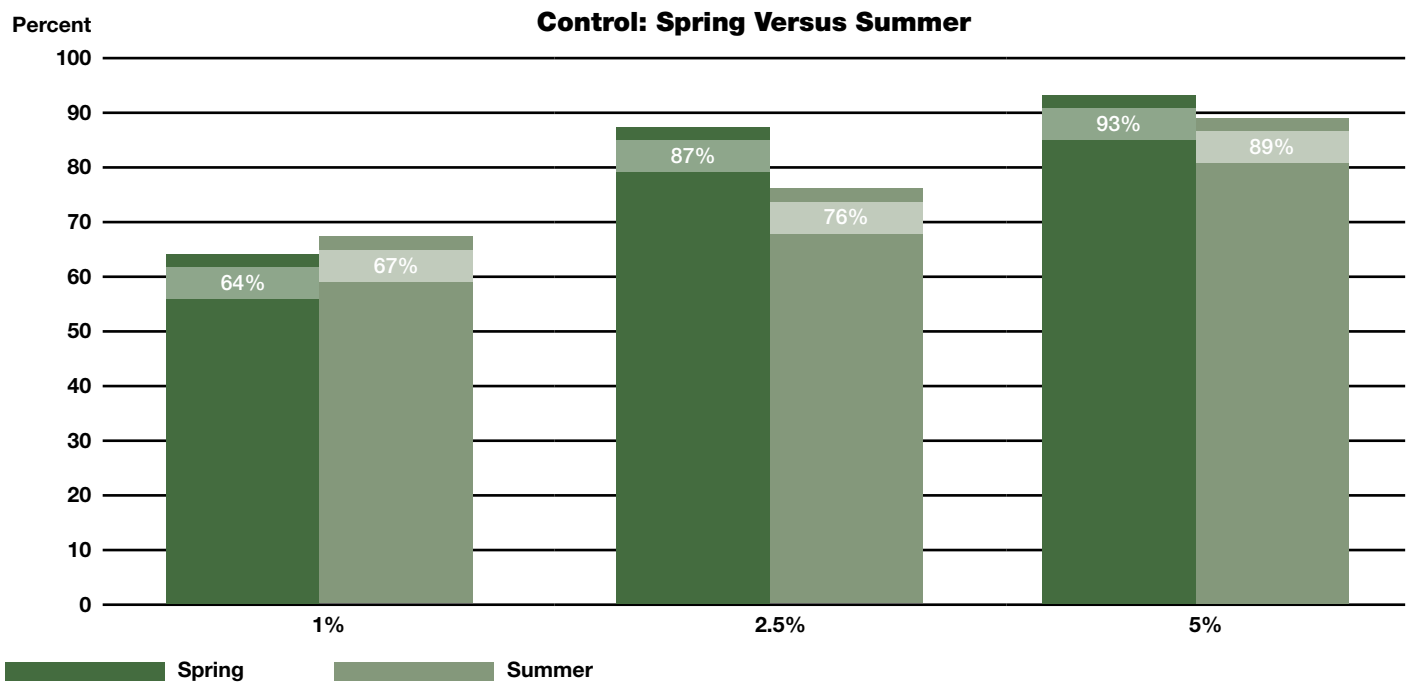

Figure 1. **All tree species combined for a comparison of Garlon 4 spring versus summer treatments.**

Conclusion: Management Implications

Basal bark herbicide treatments allow for targeted vegetation control with little danger of off-site and nontarget species damage. Basal bark applications are well suited for treating small-diameter stems (less than 6 inches in basal diameter). They are applicable for small ownerships and steep terrain often encountered in the Appalachians. Basal bark herbicide applications provide seasonal application flexibility, and using triclopyr, a wide range of species are controlled. The herbicide is non-restricted-use, meaning that forest landowners can purchase and apply it to their own properties without certification.

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Results of the 5 percent summer beech plot.

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Applying Garlon 4 summer treatments to black birch in the West Branch Forest.

The thin-barked species examined in this study (beech, striped maple, red maple, black birch, and hophornbeam) are effectively controlled using herbicide concentrations of Garlon 4 (61.6 percent triclopyr) as low as 1 percent depending on the species and time of year the application is made. This rate is much lower than the traditional 20–30 percent normally recommended for low-volume applications. Using identical equipment and making similar applications, we were able to achieve greater than 75 percent control for all species studied by applying a 5 percent Garlon 4 solution in the spring. Similar results were achieved when applying 5 percent solutions in summer on all species examined, with the exception of hophornbeam. Use of these lower concentrations could reduce herbicide costs by more than 75 percent.

When considering basal bark treatments for timber stand improvement and/or forest regeneration establishment projects, it is important to know what species are targeted for treatment. Pretreatment understory inventories are necessary to make proper herbicide prescriptions. The species mix may dictate time of year and herbicide concentration. This study suggests that adequate control can be achieved with reduced herbicide rates, thus decreasing the amount of chemical being applied and greatly lowering herbicide costs. A small investment of time to collect data and plan treatments can provide considerable financial savings.

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