

A photograph of a forest floor covered in green ferns and flowering shrubs, with a solid purple horizontal bar at the top.

Herbicides and Forest Vegetation Management

**Controlling Unwanted Trees, Brush, and
Other Competing Forest Vegetation**

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Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone 814-865-6713.

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Produced by Information and Communication Technologies in the College of Agricultural Sciences

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CAT UH174 5M12/05ac4738

Introduction

There are a number of ways to manage vegetation: manual, mechanical, biological, cultural, and chemical. Integrated pest management (IPM) uses a combination of these techniques. This publication examines the use of herbicides to manage forest vegetation and attempts to set aside some misconceptions concerning herbicide use in forests. Forestry labeled herbicides are effective and environmentally sound; however, their use remains controversial. Out of necessity, forest landowners and resource managers are increasingly turning to herbicides for vegetation management.

Many factors are increasing the need for vegetation management and the use of herbicides. These factors include vegetation that interferes with forest regeneration, poorly planned and executed timber harvesting practices, declining pulpwood markets, and increasing abundance of invasive plant species. Let us briefly examine each of these factors.

1. Shade cast by dense fern understories inhibits seedling germination and growth.



Interfering vegetation consists of plants that inhibit the germination and growth of seedlings by casting dense shade on the forest floor. Interfering plants benefit from specific light conditions and selective browsing preferences by deer that remove or reduce other plant competitors. Poorly planned and executed timber harvests, known as “high grading,” leave behind trees with low commercial value. This has resulted in a shift toward less desirable tree species and poorer quality trees in our woodlots. With declining pulpwood markets, many overstocked stands of trees that would benefit from thinning are not receiving treatment. Thinning improves tree growth and insect and disease resistance. Lastly, the increasing abundance of invasive plants directly influences the ability of forests to retain native plant and wildlife diversity. Herbicides, when properly applied, can address all these issues safely, efficiently, and economically.

Herbicides are a proven safe and effective method for managing forest vegetation and are appropriate for achieving many objectives, including regeneration establishment, increased timber production, enhanced wildlife habitat, non-native plant control, and road and facility maintenance. When properly applied, herbicides can increase property value, productivity, aesthetics, and utility. However, understand that choices exist. A well-developed and implemented integrated pest management plan will include alternative vegetation control approaches with and without the use of herbicides. This publication will help you identify the most efficient, environmentally sound, and cost-effective solution for addressing your forest vegetation management needs.

2. Poorly executed timber harvests often leave behind trees of low commercial value.



3. Shady understory conditions and a low browsing preference by deer foster striped maple development.



4. Grasses can reduce regeneration potential by casting heavy shade and providing cover for seed-eating small mammals.



5. Mountain laurel forms dense thickets that interfere with forest regeneration.



Choosing the Right Forestry Herbicide and Application Method

No single herbicide, rate, or application method works for all vegetation management needs. Each situation requires advanced assessment to ensure that the lowest risk, most efficient, and most cost-effective control program is chosen. For a given situation the soil type, plant species, density, and size affect the herbicide prescription. Additional factors such as time of year and weather conditions are important because they affect plant growth, herbicide uptake, and translocation.

The section titled “Herbicide Summaries” on page 18 will help you quickly compare herbicides commonly used

in Pennsylvania. It conveys key points found on the product label and allows you to select those products best suited to your situation. Always carefully read and follow the product label directions, precautions, and restrictions before applying any pesticide.

The first consideration when selecting an herbicide is the target plant’s location. The pesticide product label refers to this as “site.” Some examples are rights-of-way, wildlife openings, forests, wetlands, and industrial sites. The front page of the product label lists currently labeled sites. Applying a pesticide to a site not listed on the label is illegal. This

6. Shrub honeysuckle (*Lonicera* spp.) and other invasive plants reduce native plant and wildlife diversity.



publication includes common herbicides currently labeled for forest sites in Pennsylvania (see Table 3 on page 18).

The Environmental Protection Agency (EPA) approves pesticide use and establishes restrictions. Only certified applicators can apply “restricted use” pesticides. Restricted use pesticides have a prominently displayed statement on the product label (see “Specimen Label” below). The restricted use statement will often indicate why the product has received a restricted use status.

Pesticides not containing the restricted use statement are referred to as “general use.” General use pesticides do not require applicator certification as long as the product is applied to property owned or rented by the applicator or their employer. Virtually all vegetation control in the forest involves the application of general use herbicides. This provides forest landowners in Pennsylvania an opportunity to address vegetation management needs on their own

properties without becoming certified. The necessity of safe herbicide handling and use carries with it the responsibility to read, understand, and follow label directions.

Product selectivity must be considered when choosing an appropriate herbicide. Selectivity refers to the resistance various classes of plants have to an herbicide. This will ensure that targeted species can be controlled by the chosen product. For example, some herbicides only control broadleaf weeds and woody vegetation and will not control grasses. Some herbicides are so selective that they can be applied directly over non-target plants. On the other hand, broad-spectrum herbicides are nonselective. Broad-spectrum herbicides can control all classes of plants. To protect nontarget plants, care must be taken when applying these types of herbicides.

Herbicide activity is an important consideration when selecting a product. Activity refers to how the product

enters the plant—whether through the foliage, stem, or roots. Some herbicides will have more than one type of activity. When treating vegetation in the forest understory, be sure the product will not affect the overstory trees through soil activity.

The size and number of stems, number of acres, and time of year will influence your application method choice (see “Forest Herbicide Application Methods” on page 8). For example, if trees to be controlled are greater than 8 inches in diameter, a frill girdle or stem injection application method is appropriate. If the site contains 40 acres of fern in the understory, a ground foliar broadcast treatment using mechanization such as a skidder-mounted mist blower would be the most appropriate application method. The product label is your best source for application methods and rate information. Be sure to select the application method that will use the least amount of product to control the targeted plants.

Applicators of restricted use products must be certified and have a level of competence to ensure proper handling and application.

Before applying any herbicide, it is important to properly calibrate equipment. A calibration check will show the amount of product applied under given field conditions and involves making a trial run over a known area and measuring the amount of material applied. By adjusting equipment to control application volume or chemical concentration the proper rate is obtained. Calibration is important because:

- applying pesticide at rate greater than labeled is illegal;
- nozzles and other equipment settings may vary depending upon operating conditions;
- cost-effective applications need to be made at proper rates.

Specimen Label

RESTRICTED USE PESTICIDE

May Injure (Pl) ystoxic) Susceptible Non-fungal Plants. For retail sale and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification. Commercial certified applicators must also ensure that all persons involved in these activities are informed of the precautionary statements.

 **Dow AgroSciences**

Tordon^{*} 101 Mixture

Specialty Herbicide

*Trademark of Dow AgroSciences LLC

Forest Herbicide Application Methods—Cut Surface Treatments

Frill Girdle (Hack and Squirt)

Use hatchet, machete, or similar device to make frill or cut at a downward angle at proper spacing, following label recommendations. Cuts should penetrate through the bark into living cambium tissue (the wood next to the bark) and produce a cupping effect to hold herbicide. Spray measured quantity into cuts using squirt bottle. Do not allow material to run out of cut. Not recommended for use during heavy sap flow in spring.

Uses

Generally used to control individual trees greater than 5 inches in diameter.

7. Hatchet and spray bottle for hack and squirt applications.



8. Making frill cuts to receive herbicide.



Stem Injection

Use a hatchet or lance-type tree injector calibrated to deliver the proper amount of herbicide with each blow. Following label recommendations, penetrate through the bark into the living cambium tissue at properly spaced intervals. Not recommended for use during heavy sap flow in spring.

Uses

Generally used to control individual trees greater than 5 inches in diameter.

9. Hypo-hatchet blade showing injector port.



10. Hypo-hatchet injects calibrated volume with each blow.



11. The E-Z Ject lance injects capsules into stems.



12. Compression stroke implants capsule through bark.



Cut Stump

For water-soluble herbicide mixtures, spray or paint the cambial area (the wood next to the bark) of freshly cut stumps immediately after cutting. If using an oil-soluble mixture, treatments can be applied to stumps up to 1 month following cutting. In this case, spray the sides of the stump to the root collar and the cambium area around the entire circumference of the cut surface until thoroughly wet, but not to the point of runoff.

Uses

Used to control resprouting of cut hardwood stumps.

13. Cut stump treatment prevents resprouting.



14. Treat only the cambial area of cut stumps.



Forest Herbicide Application Methods—Bark, Foliage, and Soil Treatments

Basal Bark

Using a low-pressure backpack sprayer, thoroughly wet the lower 12 to 15 inches of the stem completely around tree including the root collar area. Do not spray to the point of runoff.

Uses

Generally used to control thin-barked trees when they are less than 6 inches in basal diameter.

15. For small trees, spray from ground line to a height of 12 to 15 inches.



16. Basal bark treatments use an oil carrier to penetrate the bark.



Foliar Spray

Using aerial or ground spray application equipment such as a helicopter, skidder, or backpack sprayer, mist herbicide mixture onto the foliage of targeted plants. Direct the spray to evenly cover plant foliage. Do not spray to the point of runoff.

Uses

Used to control many woody plants, herbaceous weeds, grasses, and vines.

17. Use a backpack sprayer to mist spray evenly over plants.



18. Mechanical air-blast sprayer treats understory vegetation up to 20 feet in height.



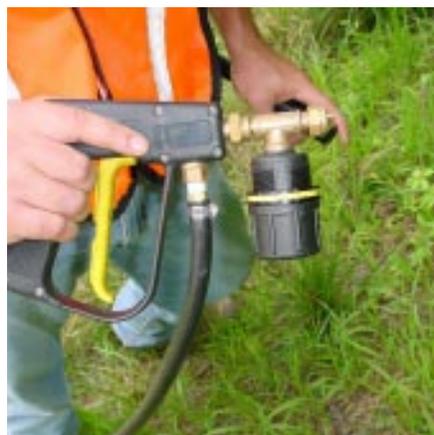
Basal Soil

Using an exact-delivery spotgun applicator, direct the spray at the soil within 2 to 3 feet of the target plant root collar, or in a grid pattern across the entire treatment area. The square grid pattern can range from 3 to 6 feet between soil application spots.

Uses

Used as a treatment to control many annual and perennial weeds and woody plants.

19. Spotgun dispenses measured volume with each trigger pull.



20. Spot spray mix to soil around plant base.



Forestry Herbicide Toxicity

Many people believe that any product referred to as a “pesticide” is highly toxic and unsafe at any application rate. This is simply not the case for forestry herbicides. Research and development have produced products that are effective, low risk, and environmentally friendly when applied and used according to the label. Active ingredients used in forestry have passed rigorous EPA testing for toxicity and environmental fate.

Toxicity refers to a product’s ability to cause injury or illness to living organisms. A pesticide’s acute toxicity is the basis for assigning its toxicity category. Acute toxicity is based on a single, short-term exposure by one of three routes—swallowing (ingestion), breathing (inhalation), or through the skin (dermal). Acute toxicity is usually expressed as LD₅₀ (lethal dose 50). This is the amount of the product lethal by ingestion to 50 percent of a population of test animals (usually rats) under laboratory conditions. LD₅₀ values are expressed in milligrams of pesticide per kilogram of body weight (mg/kg). The larger the LD₅₀ value, the less toxic the chemical.

The LD₅₀, or acute toxicity value, is the basis for assigning the signal word (see Table 1 on page 12). Signal words must appear in large letters on the front panel of every pesticide label. They are “Caution,” “Warning,” “Danger,” or “Danger-Poison” with skull and crossbones. The designation indicates the relative acute toxicity to humans and other animals. Signal words allow the user to quickly assess the acute toxicity rating. They also assist the user in selecting the least toxic product that will provide the desired level of plant control.

Table 2 provides the signal words and acute oral toxicity values for many commonly used forestry herbicide chemicals. To provide an understanding of relative acute toxicity, the table includes LD₅₀ values for commonly used chemicals and products such as table salt and caffeine.

How can a product be so effective at killing plants and have such a low toxicity to humans, wildlife, and fish? For example, glyphosate has an LD₅₀ value greater than 4,000 mg/kg, which is practically nontoxic. Yet, glyphosate is one of the most effective active ingredients in forestry herbicides. Herbicide effectiveness relates to the mode of action. In general, forestry labeled herbicides use biochemical pathways unique to plants. These pathways do not occur in humans or animals, providing very low toxicity and extremely effective herbicides.

Table 1. Signal Words and Symbols.

By law, every pesticide label must include a signal word. The signal word gives the user an immediate indication of the product's acute toxicity to humans and animals. The signal word is found on the front panel of the product label along with the statement "Keep Out of Reach of Children." Signal words allow the user to select the least toxic chemical that will provide the desired control level.

Caution	Product is slightly toxic or practically nontoxic either orally, dermally, or through inhalation; or causes slight eye or skin irritation. Acute oral LD ₅₀ values are greater than 500 mg/kg.
Warning	Product is moderately toxic either orally, dermally, or through inhalation; or it may cause moderate eye and skin irritation. Acute oral LD ₅₀ values range from 50 to 500 mg/kg.
Danger	Without the skull and crossbones symbol, this word is used on products that cause severe skin irritation or eye damage, more so than what the acute oral LD ₅₀ might suggest.
Danger Poison (skull and crossbones)	Displayed with a prominent skull and crossbones to indicate that the product is highly toxic based on either oral, dermal, or inhalation toxicity. Acute oral LD ₅₀ values range from a trace to 50 mg/kg.

Note: LD₅₀ is the quantity or dose of a chemical lethal to 50 percent of test animals under laboratory conditions. It is expressed in milligrams (mg) of chemical per unit of body weight, expressed in kilograms (kg).

Source: Hock, W. K., ed. 1996. *Pesticide Education Manual: A Guide to Safe Use and Handling*. 3rd ed. University Park, Pa.: The Pennsylvania State University.

Table 2. Relative Toxicity of Commonly Used Forestry Herbicides.

Trade Names	Common Name	Signal Word	Toxicity (LD ₅₀)
Accord, Foresters, Razor	glyphosate	Caution	4,873
Arsenal, Chopper, Stalker	imazapyr	Caution	>5,000
Escort XP, Patriot	metsulfuron methyl	Caution	>5,000
Garlon, Tahoe, Pathfinder	triclopyr	Caution or Danger	630
Krenite	fosamine	Caution	>5,000
Oust XP, Spyder	sulfometuron methyl	Caution	>5,000
Tordon	picloram	Caution	>5,000
Transline	clopyralid	Caution	4,300
Vanquish	dicamba	Caution	1,039
Velpar	hexazinone	Danger	1,690
Compare to:	Sodium chloride (salt)		3,000
	Tylenol (Acetometaphin)		1,944
	Motrin (Ibuprofen)		636
	Malathion		290
	Sevin (Carbaryl)		230
	Caffeine		192

Toxicity based on oral LD₅₀ value for rats.

Source: The Vermont SIRI MSDS Index, <http://hazard.com/msds/index.php/>.

Personal Protective Equipment

Personal protective equipment (PPE) reduces exposure to pesticides. The type of PPE used depends on the product and the type of application. The greatest risk of pesticide exposure occurs when handling concentrates during mixing and loading. Failing to follow appropriate safety precautions and application procedures can lead to exposure from diluted chemicals. Pesticide container labels specify the minimum amount of PPE recommended by the manufacturer. Exceeding the manufacturer's recommendations for PPE lowers exposure risks.

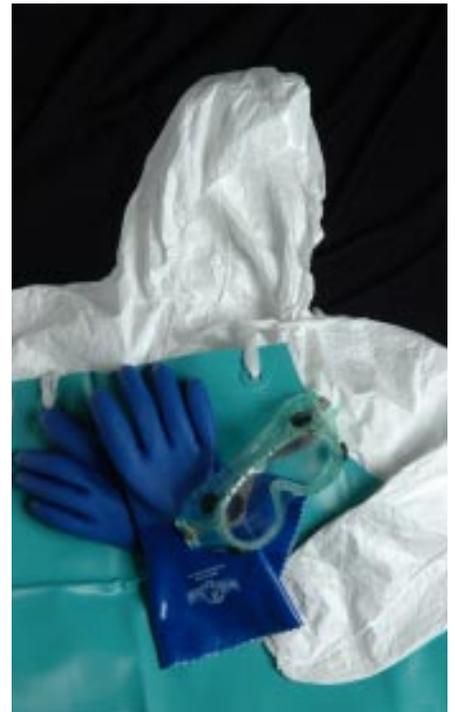
21. Minimum protection consists of long-sleeved shirt, long pants, shoes, and socks.



22. Some forestry herbicides may require additional PPE including protective eyewear and chemical-resistant gloves.



23. Other products require mixers to wear coveralls or chemical-resistant aprons.



Forestry Herbicide Application: Talking Points

All of us need to be concerned about the long-term impacts of our forest management practices and the use of herbicides. After reviewing the chemical properties and product safety, we can draw the conclusion that proper use according to the label may improve forest productivity and not adversely affect biodiversity. The environmental impacts of forestry herbicide applications are generally minimal¹ for the following reasons:

1. Forestry herbicides are applied at very low rates (2 ounces to 2 quarts per acre) and on a very small percentage of the land annually.
2. Generally, only one application is made over an 80- to 100-year rotation for hardwood regeneration establishment.
3. Forestry herbicides are very low in acute toxicity. Of the 26 herbicides described in this publication, LD₅₀ values range from 1,000 to more than 5,000 mg/kg, classifying them as either only slightly toxic or practically nontoxic.
4. Forestry herbicides do not bioaccumulate in the food chain. When ingested, these chemicals pass very quickly through the body and are excreted in urine and feces.
5. Forestry herbicides are biodegradable and do not persist in the environment. All of these chemicals have relatively short half-lives and undergo biological decomposition.

6. The potential human health risks from forestry herbicides are negligible. They are less hazardous than manual and mechanical methods of vegetation control.

These points provide a strong argument for using forestry herbicides. Despite the relatively low risk to humans, animals, and the environment, practicing care and environmental stewardship during application is essential to ensure continued product availability. Remember to always read and follow the label—it is a legal document.

¹ Revised from K. McNabb, *Environmental Safety of Forestry Herbicides*, Alabama Cooperative Extension System, 1997.

Silvicultural Objectives and Chemical Control Methods for Forestry

Land managers can use forestry herbicides to increase forest productivity by controlling competing and interfering vegetation. In general, herbicide applications reduce competition and improve survival and growth. Herbicides can control herbaceous and woody competing vegetation for natural or artificial regeneration, as well as for timber stand improvement practices and thinning.

Timber Stand Improvement

Objective

Remove poorly formed trees and/or undesirable species from a timber stand to make room for more desirable growing stock. Regulates species composition and improves stand quality.

Herbicide Application Methods

Frill Girdle (Hack and Squirt)
Stem Injection
Basal Bark

24. Hack and squirt application deadens undesirable standing trees.



25. Basal bark treatment removes shade cast by understory saplings.



26. Basal bark treatment controls grapevines (*Vitis* spp.).



continued on next page

Silvicultural Objectives and Chemical Control Methods for Forestry (continued)

Precommercial Thinning

Objective

To control stand density and species composition by thinning dense stands of conifers or hardwoods. Increases individual tree growth by reducing stand density and allowing for crown expansion.

Herbicide Application Methods

Frill Girdle (Hack and Squirt)

Stem Injection

Basal Bark

27. Hack and squirt application to thin poletimber hardwood stand.



28. Hack and squirt treated poletimber pine stand.



29. Use continuous frill girdle cuts and herbicide to deaden competing trees.



Site Preparation

Objective

To control preexisting competing herbaceous and interfering woody vegetation prior to planting or establishing natural regeneration. Creates conditions conducive to the establishment and growth of the desired species.

Herbicide Application Methods

Foliar Spray

Basal Bark

Basal Soil

30. KMC track skidder with air-blast sprayer treating understory vegetation.



31. Understory vegetation controlled to encourage natural regeneration.



Release Operations

Objective

To free young stands of planted or naturally established seedlings from competing or interfering vegetation that threatens to suppress growth. Gives the released trees enough light and growing space to develop.

Herbicide Application Methods

Frill Girdle (Hack and Squirt)
Stem Injection
Cut Stump
Foliar Spray
Basal Bark

32. Pine release using skidder-mounted air-blast sprayer.



33. Aerial pine release operation with helicopter and support truck.



34. Tree shelters can protect seedlings from herbicide.



Invasive Plant Control

Objective

To remove invasive plants that influence the forest's ability to retain native plant and wildlife diversity. Invasive plants are best controlled early when they are identified and before they have opportunities to spread.

Herbicide Application Methods

Frill Girdle (Hack and Squirt)
Stem Injection
Cut Stump
Foliar Spray
Basal Bark
Basal Soil

35. Foliar application of multiflora rose.



36. Basal bark application used to control tree-of-heaven.



Herbicide Summaries

Table 3. Herbicides Commonly Used in Forestry.

Herbicides commonly used in forestry are available under a variety of trade names. Therefore, it is best to become familiar with common names (active ingredient). The following table lists herbicides effective for controlling competing vegetation in northeastern hardwood and coniferous forests alphabetically by common name. The trade name and manufacturer are shown in the columns that follow. Trade names are grouped according to active ingredient. This table is strictly a guide and is not all inclusive. No endorsement or support of an individual product or company is given or implied.

Common Name (Active Ingredient)	Trade Name	Manufacturer
2,4-D	DMA 4 IVM	Dow AgroSciences
Clopyralid	Transline	Dow AgroSciences
Dicamba	Vanquish	Nufarm Turf and Specialty
Fosamine	Krenite S	DuPont
Glyphosate	Accord Concentrate	Dow AgroSciences
	Foresters'	Nufarm Turf and Specialty
	Razor	Nufarm Turf and Specialty
	Razor Pro	Nufarm Turf and Specialty
Glyphosate and Imazapyr	OneStep	BASF
Hexazinone	Velpar DF	DuPont
	Velpar L	DuPont
Imazapyr	Arsenal AC	BASF
	Chopper	BASF
	Stalker	BASF
Metsulfuron Methyl	Escort XP	DuPont
	Patriot	Nufarm Turf and Specialty
Picloram	Tordon K	Dow AgroSciences
Picloram and 2,4-D	Tordon 101 Mixture	Dow AgroSciences
	Pathway	Dow AgroSciences
Sulfometuron Methyl	Oust XP	DuPont
	Spyder	Nufarm Turf and Specialty
Sulfometuron Methyl and Metsulfuron Methyl	Oust Extra	DuPont
Triclopyr	Garlon 3A	Dow AgroSciences
	Garlon 4	Dow AgroSciences
	Pathfinder II	Dow AgroSciences
	Tahoe 3A	Nufarm Turf and Specialty
	Tahoe 4E	Nufarm Turf and Specialty

The following section summarizes pertinent information on commonly applied forestry herbicides labeled for use in Pennsylvania. This information is taken from product labels and material safety data sheets. (See <http://www.greenbook.net/> for more information.) Summaries are organized alphabetically by trade name.

Accord Concentrate

Common Name: Glyphosate—53.8%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage or cut surface

Mode of Action: Inhibits the production of an enzyme necessary for producing essential amino acids; also inhibits the synthesis of chlorophyll, causing the leaves to lose color

Selectivity: Nonselective, broad-spectrum control

Precautions: Avoid herbicide contact with foliage and green stems of desirable plants and trees

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: Controls annual and perennial weeds, grasses, vines, and woody plants; ground broadcast treatments for hardwood brush and fern control; ground or aerial broadcast treatments for pine release; specific formulation available for pine planting site preparation; can be used in and around water and wetlands found on forestry sites

Arsenal AC

Common Name: Imazapyr—53.1%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage, cut surface, and root uptake

Mode of Action: Accumulates in plant meristems (growth regions); inhibits the synthesis of an enzyme responsible for producing certain amino acids only found in plants

Selectivity: Conifers generally resistant

Precautions: Do not apply to areas where roots of sensitive desirable plants may extend

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: For postemergence and residual control of many grasses, herbaceous weeds, vines, and woody vegetation throughout the life cycle of coniferous forests; used primarily for site preparation and conifer release

Chopper

Common Name: Imazapyr—27.6%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, waterproof gloves, shoes, and socks.

Carriers: Water, penetrating oils, or seed oils

Activity: Absorbed through foliage, bark, cut surface, and root uptake

Mode of Action: Accumulates in plant meristems (growth regions); inhibits synthesis of enzyme responsible for producing certain amino acids only found in plants

Selectivity: Conifers generally resistant

Precautions: Do not apply to areas where roots of sensitive desirable plants may extend

Application Methods: Foliar spray, cut stump, basal bark

Uses: Used to control grasses, broadleaf weeds, vines, and woody vegetation for conifer crop species site preparation

DMA 4 IVM

Common Name: 2,4-D—46.3%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 1,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, protective eyewear, and waterproof gloves; for containers larger than 1 gallon, but smaller than 5, loaders transferring contents must wear coveralls or chemical-resistant apron

Carriers: Water

Activity: Absorbed through foliage, cut surface, and root uptake

Mode of Action: Selective systemic, acts as a growth regulator (synthetic auxin)

Selectivity: Little or no impact on grasses; can be applied over conifers once they have hardened off in late summer

Precautions: Can cause irreversible eye damage; drift or runoff may adversely affect aquatic invertebrates and nontarget plants; use caution when handling to prevent contamination of groundwater

Application Methods: Foliar spray, frill girdle, stem injection, cut stump, basal bark

Uses: Controls many annual and perennial broadleaf weeds, vines, and woody plants when they are actively growing; generally used for forest site preparation and conifer release including Christmas trees

Escort XP

Common Name: Metsulfuron methyl—60%

Formulation: Dispersible solid granule

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and, to a lesser degree, through root uptake

Mode of Action: Inhibits the synthesis of key amino acids found only in plants; stops growth in the growing tips of both the roots and the shoots; has both pre- and postemergence activity

Selectivity: Grasses show high tolerance to this product

Precautions: May adversely affect nontarget plants at very low levels from contact with drift, runoff, or root systems

Application Methods: Foliar spray, basal soil

Uses: Controls many annual and perennial weeds and woody plants, especially effective on kudzu vine and multiflora rose; primarily used to control undesirable weeds and hardwoods in conifer site preparation and release; may also be used to control many weed species on sites where yellow poplar is growing or is to be planted

Foresters'

Common Name: Glyphosate—53.8%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage or cut surface

Mode of Action: Inhibits the production of an enzyme necessary for producing essential amino acids; also inhibits chlorophyll synthesis, causing the leaves to lose color

Selectivity: Nonselective, broad-spectrum herbicide

Precautions: Avoid herbicide contact with foliage and green stems of desirable plants and trees

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: Controls annual and perennial weeds, grasses, vines, and woody plants; ground broadcast treatments for hardwood brush and fern control; ground or aerial broadcast treatments for pine release; used to control brush and weeds prior to planting; can be used in and around water and wetlands found on forestry sites

Garlon 3A

Common Name: Triclopyr—44.4%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 2,574 mg/kg for males, 1,847 mg/kg for females

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, protective eyewear, and chemical-resistant gloves

Carriers: Water

Activity: Absorbed through foliage or cut surface

Mode of Action: Acts as a systemic herbicide that deregulates plant growth metabolic pathways; accumulates in the plant meristems (growth regions), causing uneven cell division and growth

Selectivity: Little or no impact on grasses

Precautions: Can cause irreversible eye damage; use eye protection when mixing and handling concentrate; do not use in areas with permeable soils or shallow water tables; groundwater contamination may result

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: For controlling woody plants, broadleaf weeds, and vines; broadcast treatments for site preparation and release of spruce, fir, red pine, and white pine from competing hardwoods; may be used in and around standing water on forested sites

Garlon 4

Common Name: Triclopyr—61.6%

Formulation: Oil-soluble liquid, ester

Signal Word: Caution

Toxicity: Slightly toxic; oral LD₅₀: 1,581 mg/kg for males, 1,338 mg/kg for females

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, chemical-resistant gloves, shoes, and socks

Carriers: Water for foliar applications; for basal bark treatments use commercially available basal oil, diesel fuel, fuel oil, or kerosene

Activity: Absorbed through foliage, bark, or cut surface

Mode of Action: Acts as a systemic herbicide that deregulates plant growth metabolic pathways; accumulates in the plant meristems (growth regions), causing uneven cell division and growth

Selectivity: Little or no impact on grasses

Precautions: Do not apply to open water or ditches used to transport irrigation water

Application Methods: Foliar spray, basal bark, cut stump

Uses: For controlling unwanted woody plants, including mountain laurel, as well as annual and perennial weeds; broadcast treatments for site preparation and release of spruce, fir, red pine, and white pine from competing hardwoods; used to control cut stump resprouting of individual stems up to 6 inches in diameter; stumps can be treated up to one month following cutting; permissible for use in seasonally dry wetlands

Krenite S

Common Name: Fosamine—41.5%

Formulation: Water-soluble liquid (ammonium salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and cut surface

Mode of Action: When applied to foliage, it inhibits bud formation and susceptible species fail to leaf out; spraying only a part of a susceptible brush species will control only that portion, creating a trimming effect

Selectivity: Nonwoody plants are resistant

Precautions: Drift or spray mist contact with desirable plants may result in injury

Application Methods: Foliar spray and cut stump

Uses: Recommended for postharvest control of pine and hardwood species for southern pine planting site preparation; also used to control cut stump resprouting

One Step

Common Name: Glyphosate—69.51% and imazapyr—8.36%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Warning

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, protective eyewear, and chemical-resistant gloves

Carriers: Water

Activity: Absorbed through foliage and root uptake

Mode of Action: Translocated through plant and accumulates in meristematic (active growth) regions; inhibits synthesis of enzyme responsible for production of specific amino acids only found in plants

Selectivity: Nonselective, broad-spectrum control

Precautions: May cause substantial but temporary eye injury; do not apply to areas where roots of sensitive, desirable plants may extend

Application Methods: Foliar spray

Uses: Used as postemergent spray to control most annual and perennial grasses, broadleaf weeds, vines, and woody vegetation for conifer planting site preparation

Oust Extra

Common Name: Sulfometuron methyl—56.25% and metsulfuron methyl—15%

Formulation: Dispersible granule

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and roots

Mode of Action: Inhibits the synthesis of key amino acids only found in plants stopping growth in tips of both roots and shoots; has both pre- and postemergence activity

Selectivity: Coniferous species may be resistant

Precautions: Nontarget plants may be adversely affected by drift and runoff

Application Methods: Foliar spray

Uses: Used to control various woody plants, vines, and herbaceous weeds in conifer site preparation and release

Oust XP

Common Name: Sulfometuron methyl—75%

Formulation: Dispersible solid granule

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and roots

Mode of Action: Inhibits the synthesis of key amino acids only found in plants, which inhibits growth in growing tips of both roots and shoots; has both pre- and postemergence activity

Selectivity: Many coniferous and hardwood species are resistant

Precautions: Applications over trees suffering a loss of vigor or following bud break may injure or kill trees

Application Methods: Foliar spray

Uses: Controls annual and perennial grasses and broadleaf weeds; primarily used in conifer and hardwood plantations for site preparation and release; also used to control herbaceous weeds on hardwood natural regeneration sites

Pathfinder II

Common Name: Triclopyr—13.6%

Formulation: Ready-to-use, oil-soluble liquid (ester)

Signal Word: Caution

Toxicity: Slightly toxic; oral LD₅₀: 2,389 mg/kg for males, 1,000 mg/kg for females

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, chemical-resistant gloves, shoes, and socks

Carriers: Ready to use, no mixing required

Activity: Absorbed through bark and cut surface

Mode of Action: Acts by disturbing plant growth; accumulates in plant meristems (growth regions)

Selectivity: Little or no impact on grasses

Precautions: Do not apply directly to open water or to water present in wetlands; toxic to fish; untreated trees can be affected by movement of herbicide through root grafts with treated trees

Application Methods: Basal bark and cut stump

Uses: Used any time of year to control individual stems and cut stump resprouting; stumps can be treated up to one month following cutting

Pathway

Common Name: Picloram—5.4% and 2,4-D—20.9%

Formulation: Ready-to-use liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, chemical-resistant gloves, protective eyewear, shoes, and socks; for containers larger than 1 gallon, but smaller than 5, loaders transferring contents must wear coveralls or chemical-resistant apron

Carriers: Ready to use, no mixing required

Activity: Absorbed through cut surface and root uptake

Mode of Action: Concentrates in actively growing tissue (meristems), causing uneven cell growth and division

Selectivity: Will not harm grasses

Precautions: Affects nontarget plants at very low concentrations if product is allowed to drift off site or is applied within root zone of desirable trees; do not apply to soils with rapid permeability, shallow water tables, or to soils containing sinkholes over limestone bedrock

Application Methods: Cut stump, stem injection, frill girdle

Uses: Used to control unwanted trees and brush on forestry sites by using cut surface application methods

Patriot

Common Name: Metsulfuron methyl—60%

Formulation: Water-dispersible granules

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and, to a lesser degree, through root uptake

Mode of Action: Inhibits plant cell division; controls weeds primarily by postemergence activity, although some pre-emergence activity is present

Selectivity: Nonselective, broad-spectrum control; some native grasses resistant

Precautions: Nontarget plants may be adversely affected at very low levels from contact with drift, runoff, or root systems

Application Methods: Foliar spray, basal soil

Uses: Used for controlling and suppressing undesirable weeds and hardwoods on sites where conifers and yellow poplars are growing or are to be planted; also recommended to control certain noxious weeds including multiflora rose

Razor and Razor Pro (includes surfactant)

Common Name: Glyphosate—41%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, and protective eyewear

Carriers: Water

Activity: Absorbed through foliage or cut surface

Mode of Action: Inhibits production of enzyme necessary for producing essential amino acids; also inhibits chlorophyll synthesis, causing leaves to lose color

Selectivity: Nonselective, broad-spectrum control

Precautions: Causes moderate eye irritation; avoid herbicide contact with foliage and green stems of desirable plants and trees

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: Used in planting-site preparation for both conifer and hardwood species; applied as a release treatment over conifers following the first growing season

Spyder

Common Name: Sulfometuron methyl—75%

Formulation: Dispersible solid granule

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and root uptake

Mode of Action: Inhibits synthesis of key amino acids only found in plants by stopping growth in growing tips of both roots and shoots; has both pre- and postemergence activity

Selectivity: Many coniferous and hardwood species are resistant

Precautions: Causes moderate eye irritation; application over trees suffering a loss of vigor or following bud break may injure or kill those trees

Application Methods: Foliar spray

Uses: Controls many annual and perennial grasses and broadleaf weeds; used in the site preparation and release of both coniferous and hardwood plantings; controls competing vegetation for hardwood natural regeneration

Stalker

Common Name: Imazapyr—27.6%

Formulation: Emulsifiable concentrate

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, waterproof gloves, shoes, and socks

Carriers: Water, diesel oil, or recommended seed oils and penetrating oils

Activity: Absorbed through foliage, bark, cut surface, and root uptake

Mode of Action: Accumulates in plant meristematic regions (growth regions); inhibits the synthesis of an enzyme responsible for the production of certain amino acids found only in plants

Selectivity: Conifers generally resistant

Precautions: Toxic to plants at very low concentrations; do not apply to areas where roots of sensitive desirable plants extend

Application Methods: Frill girdle, stem injection, cut stump, and basal bark

Uses: Used to control individual stems and cut stump resprouting

Tahoe 3A

Common Name: Triclopyr—44.4%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 2,574 mg/kg for males, 1,847 mg/kg for females

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, protective eyewear, and chemical-resistant gloves

Carriers: Water

Activity: Absorbed through foliage and cut surface

Mode of Action: Acts as a systemic herbicide deregulating plant metabolic pathways; accumulates in plant meristems (growth regions), causing uneven cell division and growth

Selectivity: Little or no impact on grasses

Precautions: Can cause irreversible eye damage; do not use in areas with permeable soils and high water tables

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: Used to control broadleaf weeds and woody plants; directed spray applications for conifer release and broadcast applications for conifer planting site preparation

Tahoe 4E

Common Name: Triclopyr—61.6%

Formulation: Oil-soluble liquid (ester)

Signal Word: Caution

Toxicity: Slightly toxic; oral LD₅₀: 1,581 mg/kg for males, 1,338 mg/kg for females

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, shoes, socks, and chemical-resistant gloves

Carriers: Water for foliar applications; commercially available basal oil, diesel fuel, fuel oil, or kerosene for basal bark treatments

Activity: Absorbed through foliage, bark, or cut surface

Mode of Action: Acts as a systemic herbicide deregulating plant metabolic pathways; accumulates in plant meristems (growth regions), causing uneven cell division and growth

Selectivity: Established grasses are tolerant of treatment

Precautions: Toxic to fish—do not apply to open water

Application Methods: Foliar spray, basal bark, cut stump

Uses: Used to control broadleaf weeds and woody plants; controls cut stump resprouting and individual stems up to 6 inches in diameter; also used for planting site preparation and conifer release

Tordon 101 Mixture

Common Name: Picloram—10.2% and 2,4-D—39.6%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 2,598 mg/kg

Use Classification: Restricted use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, chemical-resistant gloves, protective eyewear, shoes, and socks. For containers larger than 1 gallon, but smaller than 5, mixers must wear coveralls or chemical-resistant aprons

Carriers: Water

Activity: Absorbed through foliage, cut surface, and root uptake

Mode of Action: Concentrates in active growing tissue (meristems), causing uneven cell growth and division

Selectivity: Broad-spectrum, although most grasses are resistant

Precautions: Causes irreversible eye damage; toxic to nontarget plants at very low concentrations; known to leach through soil into groundwater in areas where soils are permeable and water table is shallow

Application Methods: Foliar spray, cut stump, stem injection, frill girdle

Uses: Used for postemergence control of most annual and perennial weeds, woody plants, vines, and pre-emergence control of most annuals; used primarily for conifer planting site preparation

Tordon K

Common Name: Picloram—24.4%

Formulation: Water-soluble liquid (potassium salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: Restricted use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, waterproof gloves, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage

Mode of Action: Concentrates in active growing tissue (meristems), causing uneven cell growth and division

Selectivity: Most grasses are resistant

Precautions: Affects nontarget plants at very low concentrations if allowed to drift off site; do not apply to sites with highly permeable soils and high water tables or to soils with sinkholes over limestone bedrock; groundwater contamination may result

Application Methods: Foliar spray

Uses: Used to control annual and perennial broadleaf weeds, woody plants, and vines; primarily for conifer planting site preparation

Transline

Common Name: Clopyralid—40.9%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Practically nontoxic; oral LD₅₀: >5,000 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, waterproof gloves, shoes, and socks

Carriers: Water or oil

Activity: Absorbed through foliage and root uptake

Mode of Action: Acts as natural growth regulator by disrupting plant growth process; accumulates in plant growing points, resulting in plant death

Selectivity: Most established grasses are resistant

Precautions: Do not apply to soils with rapid permeability and shallow water table; applications to actively growing conifers and hardwoods may cause needle curling or leaf burning

Application Methods: Foliar spray

Uses: Provides postemergence control of most broadleaf weeds including thistle and kudzu vine; applied as either a site preparation or tree release application for both conifer and hardwood planting sites; can be applied to tolerant conifer and hardwood tree species (see supplemental label for tolerant species) anytime during the season

Vanquish

Common Name: Dicamba—56.8%

Formulation: Water-soluble liquid (amine salt)

Signal Word: Caution

Toxicity: Slightly toxic; oral LD₅₀: 3,512 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, waterproof gloves, shoes, and socks

Carriers: Water, herbicidal oil, and emulsifier

Activity: Absorbed through foliage and root uptake

Mode of Action: Translocated through plant, causing targeted weeds to collapse

Selectivity: Nonselective, broad-spectrum control

Precautions: Not recommended for areas with permeable soils and shallow water table

Application Methods: Foliar spray, cut surface, basal bark, basal soil

Uses: Controls many annual and perennial broadleaf weeds, woody brush (including hardwoods and pines), and vines; used for forest site preparation prior to planting; also used to control multiflora rose during the dormant season

Velpar DF

Common Name: Hexazinone—75%

Formulation: Water-dispersible, dry, flowable granule

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 1,310 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, protective eyewear, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and root uptake

Mode of Action: Has both pre- and postemergence activity; sufficient soil moisture and rainfall are required for activation

Selectivity: Most conifer species show some resistance

Precautions: Causes irreversible eye damage; not recommended for use on highly permeable soils or on areas with shallow water tables; if applied within root zone, desirable trees and shrubs may be affected

Application Methods: Foliar spray, basal soil

Uses: Used to control most annual, biennial, and perennial weeds and woody vegetation for conifer planting site preparation and release

Velpar L

Common Name: Hexazinone—25%

Formulation: Water-dispersible liquid

Signal Word: Danger

Toxicity: Slightly toxic; oral LD₅₀: 1,200 mg/kg

Use Classification: General use

Minimum Required Personal Protective Equipment: Long-sleeved shirt, long pants, protective eyewear, shoes, and socks

Carriers: Water

Activity: Absorbed through foliage and root uptake

Mode of Action: Has both pre- and postemergence activity; sufficient soil moisture is required for activation

Selectivity: Most conifer species and yellow poplar show some resistance

Precautions: Causes irreversible eye damage; not recommended for use on highly permeable soils or on areas with shallow water tables; if applied within root zone, desirable trees and shrubs may be affected

Application Methods: Foliar spray, basal soil

Uses: Used to control most annual, biennial, and perennial weeds and woody vegetation for conifer planting site preparation and release; recommended for controlling herbaceous weeds in the establishment of yellow poplar plantations when applied prior to seedling bud break

Table 4. Trees, Shrubs, Vines, and Ferns Controlled by Commonly Used Forestry Herbicides Registered for Use in Pennsylvania.

This table reflects plant species listed on respective product labels. Federal and state law permits herbicide applications to control target plants not specified on the control of species not listed.

Plant	Accord	Arsenal AC	Chopper	DMA 4 IVM	Escort XP	Forest-ers'	Garlon 3A	Garlon 4	Krenite S	One Step	Oust Extra
Alder	x	x	x	x		x	x	x	x	x	
Arrowwood	x						x	x		x	
Ash (green, white)	x	x	x	x	x	x	x	x	x	x	
Aspen	x	x	x	x	x	x	x	x	x		
Basswood	x						x	x	x		
Beech (American)	x	x	x				x	x		x	
Birch (white, yellow, black)	x	x	x	x		x	x	x	x	x	
Blackberry	x				x	x	x	x	x		x
Blackgum	x	x	x				x	x	x	x	
Blueberry	x	x	x				x	x			
Boxelder	x	x	x					x		x	
Cedar (red)					x						
Cherry (black, pin, choke)	x	x	x		x	x	x	x	x	x	
Chinquapin		x	x				x	x		x	
Cottonwood		x	x		x		x	x	x	x	
Dewberry	x				x	x					x
Dogwood	x	x	x	x		x	x	x	x	x	
Elderberry	x					x	x	x			
Elm	x			x	x	x	x	x	x		
Fern	x					x			x		x
Grape (wild)	x	x	x		x		x	x	x	x	
Hackberry											
Hawthorn	x	x	x		x	x	x	x	x	x	
Hazel	x			x		x	x	x			
Hemlock											
Hickory	x	x	x	x		x	x	x	x	x	
Honeysuckle	x	x	x		x	x				x	x
Hornbeam (American)	x					x	x	x			
Huckleberry	x	x	x				x	x		x	
Kudzu	x				x		x	x			
Locust (black, honey)	x				x	x	x	x	x		
Mountain laurel								x			
Maple (red, sugar, striped)	x	x	x	x	x	x	x	x	x	x	
Mulberry		x	x		x		x	x		x	
Oak (black, red, white)	x	x	x	x	x	x	x	x	x	x	

the label, provided the target plant is found on a site specifically listed on the label. You may also want to check with herbicide manufacturer representatives for

Oust XP	Path-finder II	Path way	Patriot	Razor	Spyder	Stalker	Tahoe 3A	Tahoe 4E	Tordon 101M	Tordon K	Trans-line	Van-quish	Velpar DF	Velpar L
	x	x		x		x	x	x	x			x		
	x	x					x	x	x	x				
	x	x	x	x		x	x	x				x	x	x
	x	x	x	x		x	x	x	x	x		x	x	x
	x	x							x	x		x		
	x	x		x		x	x	x	x	x		x		
	x	x		x		x	x	x	x	x		x	x	x
x	x		x	x	x		x	x	x	x		x	x	
	x	x		x		x	x	x	x	x		x	x	x
						x			x	x		x		
	x	x				x		x	x	x	x		x	
	x	x	x							x		x		
	x	x	x	x		x	x	x	x	x		x	x	x
						x	x	x				x		
	x	x	x			x	x	x	x	x		x		
			x	x					x					x
	x	x		x			x	x	x	x		x		
						x			x	x		x	x	x
x				x	x				x			x		
	x	x	x	x		x	x	x	x	x	x	x		
	x								x	x				
	x	x	x	x		x	x	x	x	x		x	x	x
			x			x	x	x	x	x				
	x	x	x	x		x	x	x	x	x			x	x

continued on next page

Table 4 continued.

Plant	Accord	Arsenal AC	Chopper	DMA 4 IVM	Escort XP	Foresters'	Garlon 3A	Garlon 4	Krenite S	One Step	Oust Extra
Olive (autumn, Russian)	x	x	x		x	x				x	
Persimmon	x	x	x			x	x	x	x	x	
Pine							x	x	x		
Poison ivy	x	x	x			x	x	x		x	
Privet		x	x				x	x		x	
Raspberry	x					x	x	x			
Redbud (eastern)	x					x		x			
Rose (multiflora, wild)	x	x	x		x	x	x	x	x	x	x
Sassafras	x	x	x			x	x	x	x	x	
Serviceberry	x						x	x			
Sourwood	x	x	x			x	x	x	x	x	
Spicebush											
Spruce					x						
Sumac (smooth, winged, poison)	x	x	x			x	x	x	x	x	
Sweetgum	x	x	x	x		x	x	x	x	x	
Sycamore	x	x	x				x	x	x	x	
Thimbleberry	x				x	x	x	x	x		
Tree of heaven	x	x	x		x		x	x	x	x	
Trumpet creeper	x	x	x			x				x	
Virginia creeper	x	x	x			x		x		x	
Walnut								x			
Willow	x	x	x	x	x	x	x	x	x	x	
Witchhazel											
Yellow poplar	x	x	x		x	x	x	x	x	x	

Trade names are used in this table only to give specific information. Penn State's College of Agricultural Sciences does not endorse or guarantee any product and does not specifically re

Oust XP	Path-finder II	Path way	Patriot	Razor	Spyder	Stalker	Tahoe 3A	Tahoe 4E	Tordon 101M	Tordon K	Trans-line	Van-quish	Velpar DF	Velpar L
	x	x		x		x			x	x		x		
	x	x		x		x	x	x	x	x	x	x		
	x			x			x	x	x	x		x		
	x			x		x	x	x	x	x		x		
						x			x	x				
				x					x	x			x	x
	x	x		x					x	x	x			
	x		x	x			x	x	x	x		x		
	x			x		x	x	x	x	x	x	x		
	x	x							x	x		x		
	x	x		x		x			x	x			x	x
												x		
									x	x		x		
	x			x		x	x	x	x	x		x	x	
	x	x		x		x	x	x	x	x		x	x	x
	x													
	x											x		
	x	x	x	x		x	x	x	x	x		x	x	x
												x		
	x	x	x	x		x	x	x	x	x		x		

Do not recommend any product. Before you apply any pesticide, be sure to read and follow the label. It is a legal document.

