HERBICIDE PRACTICES IN HARDWOOD PLANTINGS

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Abstract.—Control of competing vegetation is an important early cultural practice that can improve survival and vigor in hardwood tree plantings. The type of program used depends on landowner objectives, species of weeds present, equipment available, and types of herbicides available. Pre-planting planning can greatly increase effectiveness of an herbicide program for the first several critical years. Basic knowledge of weed species, herbicide modes of action, calibration of equipment, and herbicides available is essential to having an effective program. Although there have been few changes in the types of herbicide available in recent years, a couple of new labels have expanded the options for controlling weeds in hardwood tree plantings.

INTRODUCTION

Early success in hardwood tree plantings is often attributed to vegetation control. Weed control is especially needed on well-drained, fertile soils like those favored by black walnut (Siefert 1996). The options for weed control include mowing, shallow tillage, desirable ground covers, mulching, chemical control, and combinations of these (Van Sambeek and Garrett 2004). Control of competing weeds right next to the tree's root zone and beyond is more important in establishment than making sure the weeds between the rows are maintained. Keeping the immediate area around the tree roots absolutely weed free year round or just keeping it moderately clean for the spring and early summer depends on the landowner's objectives and his or her willingness to invest in a weed control program.

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VEGETATION DIFFERENCES

Determine what type of weed species you have and which ones are known to negatively affect hardwood tree growth. Weeds compete with planted trees for sunlight, water, and nutrients and some compete by excreting chemicals into the soil that will reduce hardwood tree growth. Identifying a plant as an annual grass or a choking perennial can help guide decisions on what type of weed control is needed and what type of herbicide to use. If biennials such as thistle are present, there are optimal times to kill that plant. Knowing the difference between sedges and grasses is also important as sedges can be harder to control using herbicides specific to grasses. Glyphosate mixed at 2 percent or less will only temporarily stunt sedges.

Some weed species have allelopathic characteristics and produce phytotoxic chemicals in the root zone that slow tree growth. Tall fescue and goldenrod are allelopathic to hardwood trees. Various vines such as field bind weed and morning need to be controlled as they will grow the trunk of trees and wrap around branches causing crooked and deformed stems or even death if they cover and shade out young trees. Once vines are out of control, they can be costly to control and usually require a rescue type of action (Stringer et al. 2009).

PRE-PLANTING PLANNING

A successful weed-control program starts before planting the trees, especially on sites with known competitive weeds. Following an agronomic crop like soybeans makes for a great site preparation to plant trees into but in reality many tree plantings go on old pasture, fallow land, or unproductive portions of fields. Getting rid of unwanted vegetation like tall fescue will greatly increase the effectiveness of the post planting weed control. Methods for site preparation can include chemical burndown (glyphosate) with and without tillage (Seifert and Woeste 2002). Some sites, especially on heavier soils, have plow pans and if possible, deep tillage to break that up can help with root penetration as well as drainage (McKenna and Farlee, this proceedings). The fall before planting is the best time to prepare the site for spring planting (Fig. 1). Also, a cover crop may be seeded as well to help suppress broadleaf species.

EQUIPMENT CONSIDERATIONS

The type of equipment used to deliver herbicide depends on the size of the planting, management objectives, and the landowner's budget. Band spraying is the most common form of spraying hardwood plantings and the ability to minimize the number of passes while maintaining accuracy of the spray is important, especially on larger scale plantings (Fig. 2). Backpack sprayers and ATV-mounted sprayers are great for smaller jobs with each having advantages and disadvantages. For smaller plantings, these two combinations are typically used for spraying.

Figure 1.—Fall site preparation to eliminate perennial vegetation and spring tillage has left this new planting weed free and ready for application of a pre-emergent herbicide to control weed competition through the first growing season. (Photo by Brian B. Beheler, Purdue University)

Figure 2.—Two nozzle tractor- or ATV-mounted boom for strip spraying young hardwood planting where height is adjusted so spray pattern of flat; fan nozzles are directed at base of tree seedlings and just barely overlap. (Photo by J.W. Van Sambeek, U.S. Forest Service)

Tractor-mounted sprayers are more expensive but are extremely effective and provide limitless possibilities for setting up booms and the best means of controlling application rates.

When setting up sprayers and tanks, make sure there is recirculating agitation in the tank, especially when using many pre-emergent chemicals which will otherwise settle at the bottom of the tank and spray out too dilute to begin with and too strong at the end. Other important considerations are having a sufficient sized pump, a pressure gauge, a means of adjusting pressure, and easy shut-off by the operator.

The nozzle type is equally important. Flat fan type nozzles have proven to be most effective and larger angles (i.e., 110 degrees vs. 80 degrees) allow for lowering the boom and reducing drift. The control droplet applicator (CDA) used in the fruit and vineyard industry makes a mist of concentrated solution that is sprayed over the target area and shields the stems and branches of the young trees (Fig. 3). There are various sizes CDA sprayers which have a shield allowing for spraying glyphosate after leaf out of tree seedlings even in windier conditions.

CHOOSING HERBICIDES

Knowledge of herbicide properties and mode of action helps in selecting an herbicide. Pre-emergent herbicides are applied before weed seeds germinate. Post-emergent are applied to plants that are actively growing. Some chemicals translocate, which means they move within the plant; these are known as systemic herbicides. Other chemicals only affect what they touch; these are known as contact herbicides. Chemicals like glyphosate are non-selective, meaning they are not specific to any species and will kill trees if applied incorrectly. Selective herbicides affect only some plant types or species—some just kill grasses, some only kill broadleaved plants. The label will help identify how the specific chemical works, how and when it should be applied, and what conditions to avoid to prevent damage to your trees.

Another important factor to consider is the chemical's persistence in the soil. Some chemicals have both pre- and post-emergent activity. Clopyralid, sold under the trade names of Transline™ and Stinger™, recently changed to be labeled for use in hardwood plantings, is effective for managing some problematic broadleaves late in the growing season (June-July). Clopyralid is selective on some specific broadleaves like ragweed and thistle, but safe for most trees except leguminous trees such as locust or red bud.

Figure 3.—Tractor-mounted control drop applicator with shield to control drift; this system is suitable for application of nonselective post-emergent herbicide. (Photo by J.W. Van Sambeek, U.S. Forest Service)

There is no silver bullet yet to knock out broadleaf weeds completely, although selectivity is improving. There are challenges when dealing with broadleaf weeds and hardwood trees since trees are broadleaves as well (Stringer et al. 2009). When choosing a herbicide or mix of herbicides, pay attention to species controlled, mode of herbicide action, timing, and how the chemical is labeled for use (i.e., hardwood tree plantings, CRP, and industrial sites), and toxicity (i.e., Caution, Warning, and Danger) that may indicate if it is restricted to use only by licensed applicators. One helpful resource is Crop Data Management Systems, Inc. (Crop Data Management Systems 2013). Type in a chemical name or brand and the Website will display all the labels and MSDS sheets. Cost also can play a role when purchasing a chemical. Table 1 lists common herbicides (and brand names) registered for use in hardwood plantings, recommended rates (which vary depending on vegetation and soils), and average cost in 2011 at a dealer in Indiana, using the highest recommended application rates to entirely cover 1 acre. Read and follow all directions as they are legal documents and based on extensive testing and research. Failure to follow the instructions and directions on a label will void any warranty from company. The applicator is also responsible if problems occur that can be traced back to application and directly linked to noncompliance with the label.

RATES AND CALIBRATION

Once herbicides have been selected, it is important to use a properly calibrated sprayer to get the correct amount of product to the target. Information on how to calibrate sprayers is available on the Internet, local agriculture co-ops, and university extension programs. It is important to make sure the correct measuring tool is used for the specific product type (Fig. 4). Some herbicides such as sulfometuron are effective at very small concentrations (0.5 to 1 ounce per treated acre)

Table 1.—Registered herbicide products for hardwood plantations.

Type of Herbicide	Chemical	Common trade names	Rate per treated acre	Cost per unit	Cost per treated acre (high rate)
Post-emergent (grass and broadleaves)	Glyphosate	Various names, i.e., Roundup	20-64 ounces	$20-40/gallon	$7-$12
Post-emergent (only certain broadleaves)	Clopyralid	Transline, Stinger	4-21 ounces	$200-$270/gallon	$30-$45
Post-emergent (grass only)	Clethodim	Envoy, Envoy Plus	17-34 ounces	$110-$135/gallon	$20-$40
Pre-emergent	Simazine	Princep, Caliper	2-4.4 pounds	$4-$5/pound	$20-$25
Pre-emergent	Pendimethalin	Pendulum, Aquacap	2-4.2 quarts	$50-$70/gallon	$60-$85
Pre-emergent	Oryzalin	Surflan	2-4 quarts	$70-$80/gallon	$70-$80
Pre-emergent, Post-emergent	Flumioxazin	SureGuard	8-12 oz	$115-125/pound	$85-95
Pre-emergent, Post-emergent	Sulfometuron	Oust XP	0.5-1.0 oz	$96/pound	$6

Figure 4.—Measuring amount of herbicide discharged from a flat fan nozzle for a minute as part of calibration to determine area covered when tractor is driven 3 to 4 miles per hour. (Photos by James R. McKenna, U.S. Forest Service)

and if applied too strongly, can significantly damage or kill hardwood seedlings. Water pH, turbidity (muddy water), or hardness can also reduce the effectiveness of certain herbicides and carefully reading the label will inform you of water quality considerations (see pages 8-17 in Whitford et al. [2009]). The rate of chemical to use for post-emergent herbicides (given as a range on labels) depends on the growth stage of weeds. For pre-emergents, the rate will be based on the soil type and the desired length of time to be effective. Unsatisfactory results can occur with lower rates for many chemicals, especially with pre-emergents. Also beware that when spraying over existing vegetation or thick thatch, some chemical will get bound up and not make it to the soil or target, reducing effectiveness. Increasing the amount-per-acre of liquid sprayed can help with increasing effectiveness in these situations.

RECORD KEEPING

Finally, record what was sprayed, how much, the date, and which weeds were present, so effectiveness can be compared from year to year. If in the next 2 months after spraying there are major weed issues, then the applicator can determine what did not work and plan on how to deal with the problem. Successful hardwood plantation establishment typically requires weed control for 3 or more years to get tree seedlings above the competing vegetation.

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