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# WEED MANAGEMENT

## LEARNING OBJECTIVES

After completely studying this chapter, you should be able to:

- Know the goals and objectives of vegetation management in forestry.
- Understand cultural, mechanical, and chemical weed control and how they are integrated for successful vegetation management.
- Know how to evaluate the results of a vegetation management program or practice.
- Know the objectives of weed management in Christmas tree plantations.
- Understand the basic characteristics of herbicides and how they are used to choose a herbicide for a particular weed management situation.
- Understand the factors that influence herbicide effectiveness.
- Understand the importance of weed resistance to herbicides, the practices that lead to it, and the steps that help to prevent it.

## FOREST WEED CONTROL

Weed control practices in forests are designed to favor the growth of the desired tree species, improve visibility along forest roads, control noxious weeds, and improve wildlife habitats. The goal is to manage timber species, ground vegetation, and wildlife so that each component is maximized yet balanced. Vegetation management is a primary means to achieve a productive forest.

Managers need to integrate the best cultural, mechanical, and chemical practices into appropriate and cost-effective management systems to minimize losses and detrimental effects due to weeds.

## Objectives of Forest Weed Management

A forester might undertake a weed management program with one or more of the following objectives in mind:

- Removing unwanted vegetation from planting sites to favor the planted trees.
- Releasing more desirable species from less desirable overtopping species.
- Thinning excess plants from a stand.
- Preventing disease movement through root grafts.
- Preventing invasion of herbaceous and/or woody vegetation into recreational areas and wildlife openings.
- Controlling vegetation along forest roads and around buildings and facilities.
- Eliminating poisonous plants from recreational areas.
- Controlling production-limiting weeds in a seed orchard or tree nursery.

When establishing a forest, relatively few seeds or seedlings are introduced into an environment in which an almost unlimited number of other plants exist or have the potential to become established. The immediate goal of the forest manager is species survival, which is achieved by reducing the competition from weeds. Site preparation and tree release are the procedures that minimize the density and reduce the vigor of the competing vegetation in the year of and in the years immediately

after planting. The type and intensity of management practices depend on the vigor of the desired (planted) species and the indigenous species.

## INTEGRATED CONTROL

Successful vegetation management plans incorporate the right package of practices into well planned programs that are executed on a timely basis. No single plan is best suited for each site, so careful analysis of each site is necessary. Routinely review the results obtained and modify the plans as needed to ensure satisfactory control.

### Cultural Control

Cultural weed control is simply carrying out those practices that favor the desired tree species and make them more competitive with weeds. Examples include the following:

- Select the best adapted species and varieties.
- Practice thorough site preparation.
- Plant vigorous, large, healthy seedlings.
- Plant seedlings at the appropriate spacing and replace those that die.
- Apply necessary insect, disease, and rodent control measures.
- Maintain optimum stocking levels for the site at each stage of stand development.

### Mechanical Control

Many specialized machines and attachments are used in forest vegetation management, including brush rakes, angle blades, shearing blades, rolling brush cutters, and shredders. Large offset disks and integral plows are sometimes used. In addition, chain saws, axes, brush hooks, powered brush cutters, hatchets, and other hand tools can be used in weeding operations.

On gentle slopes, mechanical means of site preparation and rehabilitation are generally sufficient to remove debris, control weeds, prepare seedbeds, reduce soil compaction caused by logging, and carry out minor land leveling operations.

Mechanical thinning is sometimes practiced, especially in very dense stands where clearing in regularly spaced strips is desired and no selection of individual trees is necessary. Mechanical thinning is not acceptable for release when desired small trees are hidden by taller, brushy trees or where individual tree selection is desired.

Mechanical control is not suited to all sites. The major obstacles to the use of mechanical vegetation management are unsuitable terrain, the likelihood of soil erosion, and relatively high operating costs.

Manual vegetation removal can be done in areas inaccessible to machines or to complement or replace the use of large equipment. Manual cutting is most effective when species to be cut are not too dense and do not resprout. Because conifers do not resprout, they are easily controlled by cutting. Many brush species, however, resprout readily from the trunk or established roots, and

this reduces the effectiveness of cutting. Manual cutting may not always be appropriate for site preparation or release, but it can be effectively combined with herbicide treatment of stumps to remove selected trees and prevent regrowth.



Figure 8.1. Woody plants may sprout from the base or roots.

### Chemical Control

Chemical control of weed species is normally practical only once or twice in the life of a forest stand. The benefits of herbicides applied during site preparation and release may be evident through the life of the stand if their use is supplemented by all the other principles of good forest management. Use of herbicides is only one step in a long-term production plan. Application of herbicides must be both necessary and compatible with all other phases of the plan.

Once the weed species to be controlled have been identified, the correct herbicide, formulation, rate, water volume, method of application, and time of treatment must be determined. Before using any pesticide, read the entire label.

### Evaluating the Results

After using any vegetation management practice, inspect the area to evaluate the results. Keep in mind the type and species of vegetation treated, the soil type, and weather conditions during and after application. Know the objectives of the control program when evaluating the results. In some cases, suppression of treated vegetation is sufficient; in others, selective control is desired. Initial herbicide activity and possible injury to adjacent desirable vegetation can be determined 2 to 4 weeks after application. The results of vegetation control treatments should be evaluated after about 2 months, at the end of the season, and then for several years. The effectiveness of brush and perennial weed control measures cannot be fully evaluated for at least 12 and sometimes 24 months after treatment.

Evaluation must be an on-going activity. It allows you to make adjustments in rates, products, and timing of herbicide applications, and to plan any additional control measures that may be needed.

# CHRISTMAS TREE PLANTATION WEED CONTROL

Christmas tree production has developed into an intensive agricultural operation designed to maximize the quantity and quality of trees per acre and minimize the number of years to harvest. An intensive management program focusing on the factors affecting tree growth, foliage quality, and general appearance is necessary. The effective use of herbicides is an essential part of this management program.

## Objectives of Weed Control

A Christmas tree plantation manager might undertake a weed management program with one or more of the following objectives in mind:

- Preparing the planting site.
- Increasing survival, nutrition, and growth of newly planted trees by eliminating competition.
- Reducing rodent damage.
- Developing better quality foliage on the lower parts of the trees by eliminating the shading effect of weed growth.
- Permitting easier and higher quality shearing.
- Reducing the probability of foliage diseases.

The Christmas tree plantation manager must also consider the impression that a clean, well managed plantation makes on potential buyers and on cut-your-own customers.

## HERBICIDE CHARACTERISTICS

Herbicides are chemicals that affect the germination, growth, and behavior of plants. To choose the appropriate herbicide for a particular situation, you need to understand some basic herbicide characteristics.

### Selectivity or Specificity

Herbicides are not equally effective on all types of vegetation. Selective herbicides are available that control grasses only, broadleaf plants only, or certain grasses and broadleaf plants. There are also non-selective herbicides that kill all vegetation that they come in contact with. Some herbicides are selective in Christmas tree plantations when applied during certain periods of the year, such as before the trees begin growing in the spring, after they have hardened off in the late summer, or when they are dormant.

### Mode of Action

Herbicides affect plants in different ways. Some are absorbed through the foliage; others are applied to the soil and are absorbed through the root systems of actively growing plants. A few herbicides kill only the portion of the plant to which they are applied. Other herbicides are applied to or incorporated in the soil to prevent the germination of weed and grass seeds.

## Residual Nature

Herbicide effects vary, in part because of their residual characteristics. A herbicide is considered to have residual effect if it prevents the regrowth of vegetation for a period of time after application. This time period varies from a few months to more than a year. Several residual herbicides exert *preemergent* control by continuing to kill weeds as their seeds germinate.

Application rate, soil texture (particularly clay content), soil organic matter content, soil moisture level and herbicide solubility affect a herbicide's residual properties. Many herbicides that are absorbed through foliage have little or no residual effect (*postemergent*), whereas those applied to the soil before plant growth usually have residual effect.

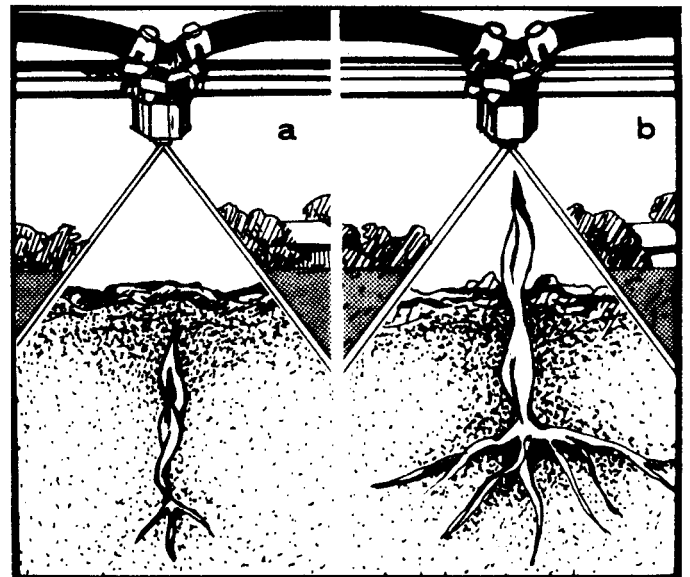


Figure 8.2. (a) Germinating weeds require preemergence herbicide; (b) postemergence herbicide is applied after weeds emerge.

## Formulation

Herbicides are available in several formulations:

- Solutions, which are completely soluble in water or other solvents, such as fuel oil.
- Emulsions, which are two unlike liquids mixed together.
- Wettable powders, which consist of finely divided solid particles that can be dispersed in a liquid.
- Granules, which contain crystals of the effective chemical bound together with an inert carrier.

Each formulation has advantages related to its manner of application and the targeted plants' susceptibility to the formulation used.

A herbicide mixture's effectiveness depends on the user's knowledge of the formulation characteristics. For example, soluble herbicides must be mixed with clean water because dirt will inactivate them. Combinations of emulsifiable compounds or wettable powders and water require spray tank agitation to maintain a uniform

suspension. Failure to agitate may result in erratic application rates.

## FACTORS INFLUENCING HERBICIDE EFFECTIVENESS

To successfully control vegetation, the manager must understand the factors that influence herbicide effectiveness. Effective control is related to:

### Application Rate

The amount of herbicide required per acre to obtain effective control depends on several variables, including herbicide formulation, soil type, and targeted vegetation. Specific application rates for various conditions are listed on the herbicide label. Follow these recommendations to obtain safe, economical, and effective results.

### Equipment Calibration

**Calibration** is the process of measuring and adjusting the amount of pesticide your equipment will apply to a specific area. Proper calibration of equipment is required to obtain good results when using herbicides. Calibrate equipment at least once each year. Once equipment is calibrated, it is essential that the same ground speed, pump pressure, and nozzle size are maintained during actual application.

### Application Method

For successful results, it is essential that coverage is uniform, regardless of method used for application. The equipment must be maintained and cleaned so that the herbicides will flow correctly. For herbicides that do not form true solutions, especially wettable powders, maintain agitation throughout the spray application. Failure to agitate can cause erratic application rates.

### Targeted Vegetation

Because of differences in anatomy and physiology, some plants are more affected by herbicides than others. Annual weeds and grasses are easily controlled with pre-emergent products, while perennial grasses and weeds, particularly those with deep root systems, are more difficult to control chemically. Some plants, such as horsetails and sedges, are very difficult to control. Because of such differences, two or more herbicides are often combined in the spray tank. Determine the compatibility of various herbicides before preparing tank mixes to avoid interactions that may make each compound less effective. There is also a danger that an improper tank mix could damage the plants you are trying to protect. Pesticide dealers provide charts that outline the compatibility of many herbicides.

### Soil-site Characteristics

Soils with high clay or organic matter contents require a heavier application rate of residual herbicide than coarse-textured sands or gravelly soils. If the amount of herbicide necessary for effective control on heavy soil is applied to a lighter textured soil, the herbicide may injure



Figure 8.3. Crabgrass is an annual grass that reproduces by seed.

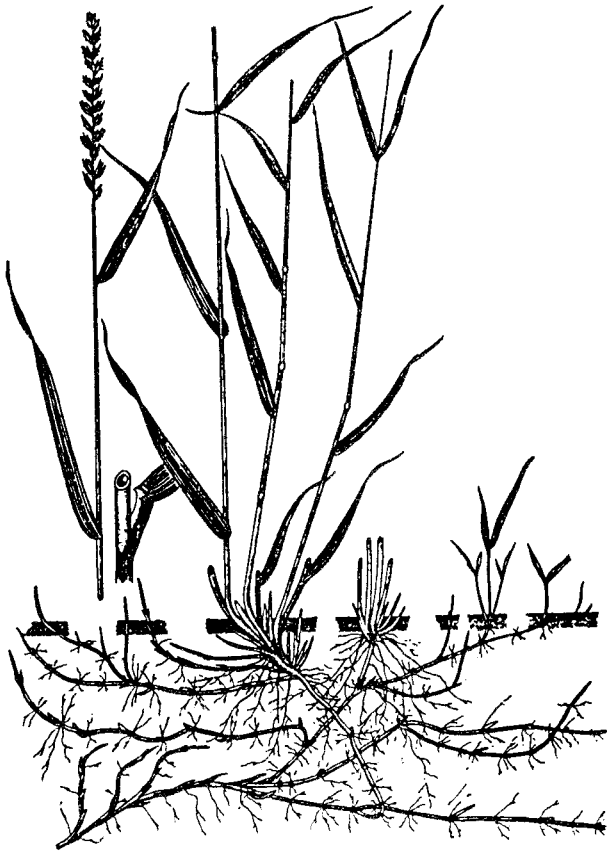
non-target plants. Further, residual herbicides persist longer on heavier soils because clay and organic particles adsorb more of the material.

### Weather Conditions

Weather factors at the time of and following application can heavily influence herbicide effectiveness. Cool and cloudy weather following application of foliar herbicides will reduce their effectiveness. Lack of rain following soil application of herbicides may allow weeds to grow and germinate before the herbicide moves into the soil solution. Heavy rain, however, may leach the herbicide from the upper soil or wash it to low-lying areas. In both cases, the herbicide is less effective and may damage non-target plants. Weather conditions are one of the most common reasons why herbicide applications fail to control weeds.

## RESISTANCE TO HERBICIDES

Weed resistance to herbicides is being discovered in the major agricultural areas of the United States. It is important to monitor the results of weed control applications carefully and follow guidelines to avoid resistance.



**Figure 8.4.** Quackgrass is a perennial grass that reproduces by seed and rhizomes.

Triazine-resistant common lamb's-quarters has been confirmed in sites throughout most of the corn production regions of Michigan. In addition, resistance has been confirmed in pigweed species, common ragweed,

common groundsel, and mare's tail (horseweed). The occurrence of triazine resistance is generally associated with cropping systems where triazine (i.e., atrazine, simazine, and others) herbicides have been frequently used for weed control. Triazine-resistant biotypes of several other species have been identified in other states and countries.

Concern is growing about resistance to other classes of herbicides. Resistance to other types of herbicides has not yet been observed in Michigan but has become a serious problem in western U.S. crop growing regions and has been recently confirmed in many sites throughout the north central region of the United States.

An understanding of the practices that lead to herbicide resistance is important because prevention is the best approach. Use weed control practices that delay or prevent the development of herbicide resistance. The following practices were modified from a list developed by the North Central Weed Science Society Herbicide Resistance Committee:

- Scout regularly and identify weeds present.
- Combine mechanical control practices such as cultivation with herbicide treatments.
- Rotate herbicides using herbicides with differing modes of action. Do not make more than two consecutive applications of herbicides with the same mode of action against the same weed unless other effective control practices are also included in the management system.
- Apply herbicides in tank-mixed, prepackaged, or sequential mixtures that include multiple modes of action. Combining herbicides with different modes of action and similar persistence in soil will help prevent herbicide resistance.

2. List five objectives of forest weed management.

**CHAPTER**  
**8**

## Review Questions

### Chapter 8: Weed Management

Write the answers to the following questions and then check your answers with those in the back of the manual.

1. What is the primary goal of forest weed management?

3-7. Match the following types of weed control to the appropriate description.

- A. Cultural control
- B. Mechanical control
- C. Chemical control

- \_\_\_\_\_ 3. Plant seedlings at the appropriate spacing and replace those that die.
- \_\_\_\_\_ 4. Manual cutting of species that are not too dense and do not resprout.
- \_\_\_\_\_ 5. Use of herbicides during site preparation.
- \_\_\_\_\_ 6. Select the best adapted species and varieties for planting.
- \_\_\_\_\_ 7. Preparing or rehabilitating the site with specialized equipment.

8. Mechanical control is suitable to use in each case of vegetation management.

- A. True
- B. False

9. Where is mechanical thinning best practiced?

- A. Where desired small trees are hidden by taller, brushy trees.
- B. Where individual tree selection is desired.
- C. In dense stands where clearing in strips is desired and no individual selection is necessary.
- D. In stands of low density.

10. Chemical control of weed species is normally practical only once or twice in the life of a forest stand.

- A. True
- B. False

11. Which is NOT true about the evaluation of a vegetation management practice?

- A. You must know the objectives of the control program to evaluate the results.
- B. Initial herbicide activity and possible injury to desirable vegetation can be determined 2 to 4 weeks after application.
- C. The results of vegetation control treatments should be evaluated after about 2 months, at the end of the season, and then for several years.
- D. The effectiveness of brush and perennial weed control measures cannot be fully evaluated for at least 6 months.

12. Why must evaluation of vegetation management practices be an on-going activity?

13. List four to five objectives of a Christmas tree plantation weed control program.

14-17. Match the following herbicide characteristics to the appropriate description.

- A. Selectivity or specificity
- B. Mode of action
- C. Residual nature
- D. Formulation

- \_\_\_\_\_ 14. The length of time the herbicide prevents the regrowth of vegetation after application.
- \_\_\_\_\_ 15. Examples include being absorbed through the foliage or through the root system, killing only portions of the plant with which the herbicide has direct contact, etc.
- \_\_\_\_\_ 16. Examples include solutions, emulsions, wettable powders, and granules.
- \_\_\_\_\_ 17. The range of plants that the herbicide controls—examples are grasses only, broadleaf plants only, etc.

