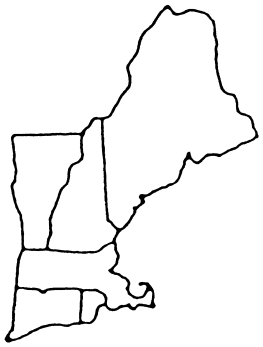
2007 New England Guide To Chemical Weed and Brush Control in Christmas Trees



This publication was coordinated and edited by **J.F. Ahrens**, Connecticut Agricultural Experiment Station, Windsor CT with assistance provided by the University of New Hampshire Cooperative Extension.

All pesticides listed in this publication are registered and cleared for suggested uses according to federal registrations and state laws in effect as of December 2006.

The pesticides listed herein may be classified for restricted use only in accordance with federal and state regulations. Persons using restricted use pesticides must be certified in each state where they are applying such pesticides. In addition, most states require licensing. Check with your Cooperative Extension agent regarding certification, licensing and reciprocity.

NOTICE

It is unlawful to use any pesticide for other than the registered use. Read and follow the label. The user assumes all responsibilities for use inconsistent with the label on the product container.

WARNING

Pesticides are poisonous. Read and follow all directions and safety precautions on labels. Handle and store in original labeled containers, out of reach of children, pets, and livestock. Dispose of empty containers at once, in a safe manner and place. Do not contaminate forage, streams, or ponds.

A BASIC WEED MANAGEMENT PROGRAM

1. Identify the problem weeds on your farm and evaluate control strategies. Monitor weeds before bud break in the spring and in July and August to help make those decisions.
2. Calibrate application equipment or plan on spot treatments. Select proper rates using this guide and labels. Read and follow label directions and precautions, including mixing, loading, storage and reentry periods.
3. Consider site preparation with herbicides the season before planting. (See Site Preparation on page 10.)
4. Apply preemergence herbicides in the early spring after planting but before conifer bud break. Combine herbicides if necessary to control the spectrum of weeds on your sites.
5. Following a June evaluation, consider whether additional treatments are needed for problem weeds; for example: Vetch, or other uncontrolled weeds.
6. Plan on a fall treatment with Roundup or Garlon to control perennial weeds, ferns and brush.
7. Keep good records of equipment calibration, products used and dosages and dates applied.

Trade names are used in this publication for identification.
No product endorsement is implied, nor is discrimination intended against similar materials.

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UNIVERSITY of NEW HAMPSHIRE COOPERATIVE EXTENSION

GENERAL CONSIDERATIONS

Select seedbed and transplant bed sites that are well drained with access to water for irrigation. Treat perennial weeds with glyphosate (Roundup, etc.) one or more times the year before planting. Organic mulches such as wood chips, or pine needles conserve moisture and control many weeds alone, or can be used in addition to preemergence herbicides.

Seedling trees less than four years old are more susceptible to injury from certain herbicides than older trees. That is one reason why seedling and transplant bed treatments differ from treatments for field-grown stock. Four-year transplants or plugs plus one of spruces and firs are recommended for field planting. Certain herbicides are safely sprayed directly over the trees (Princep, Goal, Devrinol, Surflan), whereas others must be applied as directed sprays, where contact with conifer foliage is minimized or avoided entirely (Roundup, Garlon, etc.). Field planting in pre-killed sod is faster and herbicides applied after planting are used at lower rates. In the year of field planting weed control is essential, but complete control (bare ground) is not necessary. Band treatments require less herbicide per acre of trees, save money, and also prevent soil erosion on slopes. Bands 24 to 30 inches wide are satisfactory for two years, but as the trees grow, the treated bands should be widened. Spring-applied herbicides are usually required each year until the trees are large, but dosages may be reduced after the second or third year. Spraying of brush or resistant weeds is done only as needed. Soils higher in organic matter require higher rates of preemergence herbicide than sandy or gravelly soils low in organic matter. Avoid applications of preemergence herbicides on snow or frozen soil.

Consult labels for specific guidelines for each compound. Ask your pesticide supplier for labels, or get them from the internet website: www.cdms.net .

Semi-Directed Sprays are applied so that only the basal 8 - 12 inches of the conifers are contacted. Application is usually with the use of off-center nozzles or wide-angle nozzles mounted low.

Fully-Directed Sprays are applied in ways that avoid contact with conifer foliage such as the attachment of an 8 inch funnel to the nozzle of knapsack sprayers, or using shields on tractor-mounted sprayers.

CAUTION:

Spray solutions of Roundup should be mixed, stored, and applied only in stainless steel, aluminum, fiberglass, plastic, and plastic-lined steel containers. **Do not mix, store, or apply this product or spray solutions of this product in galvanized steel or unlined steel (except stainless steel) containers or spray tanks.** This product or spray solutions of this product react with steel to produce hydrogen gas which is highly combustible. Roundup is corrosive to iron. Leaving Roundup solutions overnight in cast iron spray pumps can accelerate pump wear.

GROUNDWATER PROTECTION

Chemicals, including herbicides, are indispensable to agriculture; but some can leach through the soil to groundwater. Herbicides applied to the soil are subjected to physical, chemical, and biological processes that affect their movement through soil and their potential for groundwater contamination. Consideration of these factors when selecting and applying herbicides can minimize the threat to groundwater.

I. Soil Characteristics

Soil texture and organic matter content play major roles in herbicide performance and persistence. Chemicals tend to leach more readily in coarse-textured soils with low organic matter content. In contrast, fine-textured soils with high organic matter are highly adsorptive and therefore have low leaching potential.

II. Herbicide Characteristics

A. Adsorption: Some herbicides bind strongly (adsorb) to soils and therefore are not easily removed. Clay minerals and organic matter favor strong adsorption. Use soil analysis information on organic matter content when selecting herbicide application rates for your weed management program.

B. Solubility: Some herbicides are highly soluble in water, which can increase their leaching potential. However, leaching of a herbicide can be minimized by herbicide dosage and by the timing and method of application. Choose the proper herbicide and rate for your situation.

C. Persistence: The rate of degradation by natural processes is highly dependent on herbicide chemistry and environmental factors. Sunlight, temperature, soil pH, microbial activity, and other soil characteristics affect the breakdown of herbicides. Some herbicides break down slowly, and therefore have a greater potential for leaching, whereas short lived herbicides may be degraded before any leaching occurs. Choosing a short-lived herbicide can minimize leaching potential.

Microbial degradation occurs when fungi, bacteria, and other soil microorganisms use herbicides as a food source. High organic matter, along with other properties such as optimum moisture, aeration, temperature, and soil pH, can enhance microbial degradation. In addition, chemical degradation of herbicides can occur by reaction with water, oxygen, and other chemicals.

In general, herbicides that are highly water-soluble, relatively persistent, and not readily adsorbed to soil have the greatest potential for leaching.

III. Water Table

High water tables are especially vulnerable to contamination by agricultural pesticides and fertilizers due to the relatively short distance between the soil surface and groundwater. The potential for groundwater contamination is great in areas with coarse-textured soils and high water tables.

IV. Herbicide Use Patterns

Applying the same herbicide at high rates on the same land each year increases the likelihood of herbicide leaching to groundwater. Applying minimal rates and alternating herbicides whenever possible reduces leaching potential. Banding the herbicides over the rows rather than broadcast applications can greatly reduce the amounts applied, reducing the leaching potential. Care in mixing and loading to avoid spills is also extremely important.

Specific application information for each herbicide is contained in the herbicide label. Careful adherence to application and disposal directions, combined with proper equipment calibration, provide the best methods of preventing groundwater contamination.

CHARACTERISTICS OF HERBICIDES AND FORMULATIONS

ATRAZINE products (Aatrex, 4L, Nine-O, and Atrazine 4L and 90DF) are closely related to simazine, but atrazine is more soluble in water, more active in controlling perennial weeds, but also potentially more injurious to conifers than simazine, especially during active growth. Combinations of simazine and atrazine are suggested for plantation-grown conifers in northern New England, where perennial grass sods are a major problem. Once the perennial grasses are under control, it is usually better to use simazine alone, or simazine plus a preemergence "grass herbicide," which gives longer residual control than atrazine. However, substituting as little as one pound of atrazine for one pound of simazine can improve control of emerged annual weeds. Neither simazine nor atrazine controls broomsedge, orchardgrass, milkweed, or woody plants. Atrazine products now are restricted because of ground and surface water concerns. New label restrictions cover mixing and loading and applications near streams or other waters.

After many years of continuous use of the triazine herbicides (atrazine and simazine), biotypes of certain weeds, including lambsquarters, pigweeds, horseweed and others are resistant to and no longer controlled by these herbicides. The surviving resistant biotypes reproduce and become increasing troublesome, requiring new management strategies. See section E-Established Stands.

BARRICADE, DEVRINOL, PENNANT, PENDULUM, SURFLAN, and **TREFLAN** all control some broadleaf weeds, but are primarily effective in controlling annual grasses. For broad spectrum preemergence control these herbicides are often combined with broadleaf herbicides such as Princep, Gallery, or Goal. See individual descriptions.

BARRICADE, formerly FACTOR (prodiamine, 65 WDG) is a long-residual preemergence herbicide for field grown conifers. It is similar to Surflan in chemistry and spectrum of weeds controlled. Barricade should not be used in seed beds or transplant beds.

BASAGRAN T/O (bentazon) is a contact postemergence herbicide that controls yellow nutsedge, Canada thistle, musk thistle and certain seedling broadleaf weeds such as ragweed, velvetleaf, dayflower and purslane at 1.5 to 2 pints per acre plus a crop oil concentrate at 1 quart per acre. White pine has tolerated over-the-top sprays in experiments but fully directed sprays are needed to prevent foliar injury to most conifers.

DEVRINOL 50W OR 5G (napropamide) is a long-residual preemergence herbicide that can be used in conifer seedbeds and transplant beds. It controls some types of nutsedge and partially controls quackgrass. It controls most annual grasses and many broadleaf weeds, but not yellow woodsorrel, spurge, nightshade, or horseweed. To prevent surface losses, rain or irrigation should follow within 24 hours of application, except in early spring.

FUSILADE II OR DX, ORNAMEC (formulations of fluazifop-P), VANTAGE (sethoxydim) and PRISM or ENVOY (clethodim) are systemic postemergence grass herbicides that kill or suppress grasses with little or no effect on broadleaf plants and sedges, and have little or no residual activity in the soil. Therefore, to provide continued weed control, they should be followed by other herbicides. Spray volumes of 30 gallons per acre or less have been effective. Rainfall within one hour after application may reduce control. Grasses may take three to four weeks to die. Immature grasses are most susceptible. All offer alternatives for suppression of perennial sod grasses in old fields when sprayed over conifers and combined with or followed by simazine. Summer tank mixes of either with Goal have also been effective, but tank mixes with other herbicides may injure conifers. Rates of these postemergence grass herbicides and needed surfactants differ widely. Follow label directions. Vantage is a formulation of sethoxydim that contains the necessary additives. It is effective at 36 to 60 fluid ounces per acre. Envoy is the only one that controls annual bluegrass.

GALLERY 75DF (isoxaben) is a preemergence herbicide that controls most annual broadleaf weeds and suppresses annual grasses. It controls weeds for 3 to 4 months or longer by root activity and can be sprayed over-the-top of labeled conifers. It does not control emerged weeds. For broad spectrum control of annual weeds it can be combined with preemergence grass herbicides such as Surflan, Devrinol, or Pennant and the postemergence herbicides Goal or Stinger. It is a potential alternative to simazine on freshly tilled sites or on sites where Roundup is used to kill established weeds. Use in plantations but not in seedbeds or transplant beds. Gallery could substitute for simazine for reduced leaching potential in aquifers..

GARLON (Refer to Triclopyr)

GLYPHOSATE Products (Roundup Original, Glyfos, Glystar, Credit, Clear Out 41 Plus, Glyphosate 4, Mirage, Roundup Original Max, etc.). Over 40 different products contain glyphosate but not all are registered for Christmas trees. They vary in glyphosate concentrations and types of salts and surfactant which can affect their potential injury to conifers when sprays contact their foliage. If sprays do not contact conifer foliage (fully-directed sprays), all registered glyphosate products are safe to use. In this publication we consider Roundup Original (41% glyphosate as an isopropylamine salt) as the standard. Glyphos, Glystar, Credit, Clear Out 41 Plus, Glyphosate 4 and Mirage are others that are represented as containing the same ingredients as Roundup Original. Roundup Original Max is one of the more concentrated products that we have found to be suitable in Christmas trees. Follow label directions and note that 1 quart (32 fluid ounces) of the 41% glyphosate formulations mentioned above is equivalent to only 22 fluid ounces of Roundup Original Max. **Read the discussion below before using glyphosate in Christmas trees!**

Glyphosate is a foliar-absorbed systemic herbicide that is rapidly inactivated in soil and controls most weed and brush species with the right doses and timing. Quackgrass must be actively growing and over 6 inches tall, and perennial weeds should be in flower bud or later stages at treatment. Woody brush, poison ivy and brambles are best controlled in August or September, before frost. To provide residual control of weeds from seed, glyphosate must be followed or combined with a preemergence herbicide. Commonly, Roundup Original is applied in the fall and preemergence herbicides are applied in the early spring. However, spring applications before conifer bud break may be used to control emerged winter annuals and some green perennials. To prevent winter annuals from invading in the fall it is common to add simazine (Princep, Sim-Trol) at 1 to 1.5 lbs. active ingredients per acre or SureGuard at 4 to 6 ounces per acre to the fall Roundup sprays. Glyphosate sprays can injure the foliage of conifers. Conifers are most resistant to semi-directed basal sprays (where only the basal branches of conifers are sprayed) of Roundup Original, or equivalent late in the season (late August, September) or in early spring before bud break and most susceptible during active growth. Douglas fir and white pine are more susceptible to injury than spruces or true firs (Abies spp.) Avoid spraying basal foliage of white pine or Douglas fir until trees are at least 2 feet tall. Adding surfactants or emulsifiable formulations of herbicides such as Goal or Pennant to Roundup Original increases injury potential on conifer foliage. At sub-lethal dosages Roundup also is used for weed suppression rather than

total kill. Weeds not usually controlled with glyphosate include perennial vetch and Asiatic dayflower.

Adding 17 pounds of spray grade ammonium sulfate per 100 gallons (5 tablespoons per gallon) can enhance efficacy of glyphosate sprays where the water source is hard.

KERB (pronamide) is a postemergence herbicide with moderate preemergence activity. Because of volatility, it is effective only during the cold seasons. Late fall or winter applications control established perennial grasses such as quackgrass, orchardgrass, and bluegrass, certain winter annual grasses and members of the mustard family and chickweed, but many annual weeds may invade in June or later unless other preemergence herbicides are applied in the spring. Dandelions, clovers, other legumes and many broadleaf perennial and annual weeds are not controlled.

Oxyfluorfen Products (Goal 2XL, Galigan 2E, GoalTender) are preemergence and postemergence herbicides useful for annual weed control in seedbeds, transplant beds, and Christmas trees. GoalTender is a more concentrated and less volatile form of oxyfluorfen. Dosages vary with the size of the conifers and the length of control desired. Preemergence control of broadleaf weeds lasts longer than control of grasses. Depending on the dosage, oxyfluorfen causes contact injury on spruces and true firs during rapid growth. Avoid applications of Goal 2XL over one pint per acre on those conifers during the 5 to 6 week period following bud break. Emerged chickweeds, spurge and annual grasses are tolerant, but seedlings of purslane, carpetweed, pigweeds and several other weeds are controlled. Adding a surfactant at 0.25% by volume can improve postemergence control with GoalTender. Oxyfluorfen could substitute for simazine for reduced leaching potential in aquifers.

PENDULUM 60% WDG, 3.3EC, 3.8 AQUA CAP, HURDLE 3.8 ACS (pendimenthalin) is chemically related to Surflan. The AQUA CAP and HURDLE formulations are microencapsulated, sprayable forms. While these are registered for several Christmas tree species, there may be a risk of injury to young seedlings. The water dispersible granule (WDG) formulation is preferred after conifer bud break.

PENNANT MAGNUM (s-metolachlor) is a preemergence herbicide. Applied in early spring before bud break, it controls yellow nutsedge and annual grasses in transplant beds or field-grown conifers. White pine is injured when sprayed with Pennant during active growth. Pennant combines well with simazine or Goal for broad-spectrum control, but is not safely used in seedbeds. A second application may be needed for season-long control of nutsedge.

PRINCEP (Refer to Simazine)

RONSTAR 2G (oxadiazon) controls a broad spectrum of weeds and grasses from seed. Chickweeds are resistant. A single application at 3 to 4 pounds active ingredient per acre lasts for a full season. It is a useful granular preemergence herbicide for transplant beds.

ROUNDUP (Refer to Glyphosate)

SIMAZINE products (Princep 4L, Princep Caliber 90, Simazine, Sim-Trol) are broad-spectrum pre-emergence herbicides. At low rates they fail to control annual grasses, but at high rates they control certain established perennial grasses when applied before growth starts in the spring. Both sprays and granules are safely applied over the tops of tolerant plants. Simazine combines well with preemergence "grass herbicides" such as oryzalin, metolachlor or pendimethalin to provide broad-spectrum preemergence control. Conifer tolerance varies with the species and age. Therefore, lower rates are used in transplant beds and on field-grown spruce than on firs or pines. Only the rates for the liquid formulations are given in this guide. See Atrazine products for a discussion on Triazine resistant weeds (weeds resistant to Simazine and Atrazine).

STINGER (clopyralid) is a systemic herbicide useful in the control of vetch, other legumes, thistles, Canada thistle, horseweed and certain other broadleaf weeds in the aster and smartweed families. It has no effect on grasses, sedges, or most woody brush and can be safely sprayed over established conifers. A surfactant is not needed. It has been effective alone or combined with Goal over-the-top in early summer or combined with fall semi-directed sprays of Roundup to control perennial vetch. Applications on actively growing, newly-planted conifers in transplant beds may cause twisting and growth reduction if over applied.

SUREGUARD 51.1% WDG is a broad-spectrum preemergence herbicide. We have tested it in Christmas tree plantations and transplant beds over the past seven seasons. It controls several of the triazine-resistant annual weeds and also Asiatic dayflower and chickweeds. Treatments before bud break or in dormant firs in the fall have been safe but newly flushing firs are injured. It is not safe for use in seedbeds. It combines well with Roundup Original where weeds are emerged at treatment but, when applied alone, has little effect on established perennial grasses, nutsedge and a number of perennial

broadleaf weeds. At 12 ounces of product per acre it has given equal or better control of annual weeds than combinations of simazine with oryzalin.

Label rates of SureGuard 51WDG are 8 to 12 ounces (by weight) per acre. One ounce of SureGuard (by weight) is 1.75 fluid ounces; therefore, 8 ounces of SureGuard is 14 fluid ounces and 12 ounces of SureGuard is 21 fluid ounces.

SURFLAN AS OR ORYZALIN AS (oryzalin) is a long-residual preemergence herbicide for field-grown conifers. It controls annual grasses and some broadleaf weeds, but does not control sedges or perennial weeds. Douglas fir and Fraser fir seedlings in transplant beds have been injured, but 3 or 4-year-old plants have been tolerant. It should not be used in seedbeds or transplant beds!

TREFLAN 5G OR 4E (trifluralin) is related to Surflan but is volatile and requires incorporation by tillage or irrigation. It can be incorporated into the soil ahead of transplanting or applied at higher rates on the soil surface after planting. It is not safely used in conifer seedbeds.

TRICLOPYR products (Crossbow, Garlon 3A, Garlon 4) are systemic weed and brush herbicides, useful in site preparation or around conifers in late August or September, before leaf drop of target weeds (Garlon 3A). They can be applied in water during the growing season or in oil for basal applications on brush during the dormant season (Garlon 4 or Crossbow). Garlon 4 can produce vapors that injure actively growing conifers during hot summer weather. Triclopyr controls vetch, other legumes, goldenrod, bedstraw, brambles, many other broadleaf weeds and brush, but not grasses or sedges. It is especially useful to control susceptible broadleaf weeds such as brambles, bedstraw and poison ivy in row middles where grass cover is desirable. It also is more effective than Roundup in controlling oriental bittersweet in early fall. Conifers established for three full years tolerate semidirected basal sprays of triclopyr in September. Crossbow is a combination of 2,4-D and triclopyr, useful in spot treatments (fully directed sprays) for woody vines and brush.

VAPAM (metham), BASAMID and DOWFUME MC-2 (methyl bromide) are soil fumigants that are toxic to plants but are used to kill weed seeds, underground plant parts, nematodes, and disease organisms before planting. Fumigation is only practical in seedbeds, transplant beds, and other high value crops. Attention must be given to soil temperature, time between treating and planting, and to safe application. Basamid is a granular product; Vapam is a liquid and Dowfume is a gas that must be released under a tightly enclosed cover.

WESTAR (0.65% sulfometuron methyl and 6.8% hexazinone) is a new herbicide combining two active ingredients for control of a broad spectrum of perennial, annual and winter annual weeds including quackgrass, ragweed, lambsquarters, yellow nutsedge, horseweed and many others. We have evaluated it during the last three growing seasons. It is safely applied on dormant trees before bud break but applications after bud break will injure conifers. Because it is new, trial use in Christmas trees is suggested in 2007, comparing it with standard herbicide programs. Use the lowest labeled rate in newly planted trees because of their greater susceptibility to injury. Adding a surfactant is unnecessary. Adding Roundup Original at 1 quart/acre to Westar before bud break in established plantations can improve control of brambles or bedstraw. Westar should be applied with properly calibrated equipment. It is not safely used for uncalibrated spot treatments where dosage ranges are often too wide and tree injury is likely, or for use in seedbeds or transplant beds.

Symbols following names of commercial products indicate the manufacturer's designation.

W or WP = wettable powder	G = granular
E or EC = emulsifiable concentrate	DF or WDG = water dispersible granule

Efficacy of foliar systemic herbicides such as glyphosate formulations (Roundup, etc.), Garlon and the postemergence grass herbicides (Envoy, Fusilade, Vantage) may be reduced when sprayed on wet foliage or when rain follows soon after application. Therefore, applications of these herbicides on weeds that are wet with heavy dew or rainfall should be avoided. Glyphosate formulations also are most effective at spray volumes of 20 gallons per acre or less.

Preemergence herbicides require rainfall or irrigation within a few days following application to activate them. Dry conditions following application may result in reduced control of weeds.

Calibrating a Knapsack Sprayer For Precise Applications

A knapsack sprayer has a hand pump lever that enables you to maintain constant pressure as you walk. It can do all of your herbicide spraying if equipped with the proper nozzle and a pressure gauge or pressure regulator.[1]

1. Select the nozzle and swath width that you want to spray.

2. Select a comfortable walking speed and practice walking it. For example:

   4 ft./sec. = 40 ft. in 10 seconds: 4.5 ft/sec. = 45 ft in 10 seconds.

3. Measure the nozzle output in fluid ounces per minute at a pressure you can comfortably maintain. Record the pressure.

4. Compute the gallons per acre applied, using the following formula.

$$\text{Gal. applied per sprayed acre} = \frac{\text{nozzle output in oz./min. x 5.7}}{\text{walking speed in ft./sec. x swath width in ft.}}$$

5. Add the desired acre rate of herbicide to the gallons applied per acre, or in that proportion.

6. Use the same walking speed, pump pressure and swath width in actual treatments as in calibration.

EXAMPLE:

Suppose you wish to apply Princep 4L at 4 qts./A; your nozzle applies 38 oz./min. and you want to spray a 2-ft. band, at a walking speed of 4 ft./sec.

$$\text{Gal. applied per sprayed acre} = \frac{\text{38 oz./min. x 5.7}}{\text{4 ft./sec. x 2 ft.}}$$

Gallon applied per sprayed acre = 27

You would therefore add 4 qts. of Princep 4L to water and make it up to 27 gallons. This would spray 1 acre of bands 2 ft. wide, or 21,780 ft. of row:

$$\frac{\text{43,560 sq. ft./A}}{\text{2 ft.}} = 21{,}780 \text{ ft.}$$

How much would you add per 3 gal. spray tank? Answer: 14.2 fluid ounces

3/27 x 4 quarts = 0.44 quarts = 14.2 fluid ounces

This would be enough to spray 2420 feet of row 2 feet wide. (3/27 x 21780 ft.= 2420 ft.)

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[1] Note: Plans for broadcast and band sprayer attachments for knapsack application are available from your county Extension agent, county forester, and from J.F. Ahrens, Connecticut Agricultural Experiment Station, P.O. Box 248, Windsor CT 06095.

APPLYING HERBICIDES ON SMALL AREAS

(Such as Transplant Beds or Seedbeds)

Calibration of hand-held sprayers may be unnecessary for applying herbicides in small areas. An alternative is to measure out the required amount of herbicides for the area to be treated, dilute the spray formulations in water, and apply them uniformly over the area.

The following procedure is effective:

1) Decide on the herbicide and dosage per acre using the herbicide label and/or information in this bulletin.

2) Determine the area to be treated in hundreds of square feet.

3) Using the chart on page 9 (Weight and Volume Measurement of Herbicides for Application in Small Areas), calculate the volume of herbicide required to provide the selected dosage on the determined area.

4) Dilute the measured volume of herbicide in water and spray it uniformly over the area, making several complete passes until all of the diluted spray is applied. The amount of water is not critical with preemergence herbicides but it is convenient to apply 1 to 2 pints of diluted spray per 100 sq. ft. With a systemic herbicide such as Roundup, a satisfactory amount is 1/2 to 1 pint of diluted spray per 100 sq. ft. Granular herbicides may be spread directly with a hand-held rotary spreader or diluted with sand and spread by hand.

EXAMPLE:

Suppose you want to treat a transplant bed of 1,000 square feet with Goal 2XL at 2 quarts per acre. From the chart that follows you see that 1 quart (= 2 pints) per acre is equivalent to 2/5 teaspoon per 100 square feet or 2/5 x 10 = 4 teaspoons per 1,000 square feet. Two quarts per acre therefore is 8 teaspoons per 1,000 square feet. Dilute the 8 teaspoons in 10 quarts (2 ½ gallons) of water and spray in convenient swaths over the entire area uniformly, using a constant swath width, speed, and pressure until you have sprayed the entire 10 quarts on the area. Then add another quart of clean rinse water to the sprayer and spray it on the area.

Weight and Volume Measurement of Herbicides

For Applications In Small Areas (a,b)

Herbicide Name		Dosage Per Acre		Dosage of Commercial Product per 100 sq. feet			
				Weight (a)		Volume (b)	
Active Ingredient	Commercial Product	Active Ingredient lb./A	Commercial Product	English (oz.)	Metric (gms.)	English	Metric (ml)
simazine	Princep 80W (c)	1.0	1.25 lb	0.05	1.3	2/3 tsp	-
simazine	Princep Caliber 90	1.0	1.10 lb	0.04	1.1	2/5 tsp	-
simazine	Princep 4L	1.0	1.0 qt	-	-	2/5 tsp	2.2
simazine	Simazine 4G	1.0	25.00 lb	0.90	26.0	2 tbsp	-
clopyralid	Stinger 3 lb/gal	0.125	1/3 pt	-	-	.075 tsp	.36
DCPA	Dacthal 75W	9.0	12.00 lb	0.44	12.5	2 tbsp	-
DCPA	Dacthal 5G	9.0	180.00 lb	6.60	188.0	1 cup	-
isoxaben	Gallery 75DF	0.5	0.66 lb	0.02	0.7	1/3 tsp	-
oxadiazon	Ronstar 2G	4.0	200.00 lb	7.3	208.0	1-1/3 cup	-
napropamide	Devrinol 50W	4.0	8.00 lb	0.30	8.3	4-1/2 tsp	-
napropamide	Devrinol 5G	4.0	80.00 lb	2.94	83.4	1/2 cup	-
trifluralin	Treflan 4L	1.0	1.0 qt	-	-	2/5 tsp	2.2
trifluralin	Treflan 5G	1.0	20.00 lb	0.70	21.0	3-1/2 tsp	-
oxyfluorfen	Goal 1.6E (c)	0.25	1-1/4 pt	-	-	1/4 tsp	1.4
oxyfluorfen	Goal 1.6E (c)	1.0	2-1/2 qt	-	-	1 tsp	5.4
oxyfluorfen	Goal 2XL or Galigan 2E	.25	1.0 pt	-	-	1/5 tsp	1.1
glyphosate	Roundup 4 lb/gal	0.5	1.0 pt	-	-	1/5 tsp	1.1
glyphosate	Roundup 4 lb/gal	1.33	1-1/3 qt	-	-	3/5 tsp	2.9
glyphosate	Roundup 4 lb/gal	2.0	2.0 qt	-	-	9/10 tsp	4.3
flumioxazin	SureGuard 51WDG	0.75	12 oz	0.03	0.8	1/4 tsp	-
all liquid herb.			1.0 pt	-	-	1/5 tsp	1.1

a. 1 lb/A of any substance is equal to 1 gram per 96 sq. ft. This can be rounded to 1 gram per 100 sq. ft. with only minor error.

b. Volumes of dry materials are not determined with precision because they settle erratically. These values are approximations based on an average of 5 examples. Different formulation of dry materials can differ in their volume weights. Whenever possible, it is best to weigh out dry materials and to measure liquids by volumes:
tsp. = teaspoon; tbsp. = tablespoon.

c. Older formulations no longer on the market.

Volume Conversion Units

1 teaspoon (tsp) = 5 milliliters (ml)
3 tsp = 1 tablespoon (tbsp) = 1/2 fluid ounces = 15 milliliters
16 tbsp = 1 cup = 8 fluid ounces
2 cups = 1 pint (pt.) = 16 fluid ounces
2 pints = 1 quart (qt.) = 32 fluid ounces

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WEED CONTROL IN CHRISTMAS TREES - 2007

SITUATIONS	COMMERCIAL MATERIAL AND RATE*	COMMENTS
A. SITE PREPARATION - Treatments for use before planting.		
1. To kill perennial grasses and other weeds before planting seedbeds, transplant beds, or field plantings.	a) Roundup (glyphosate) at 1-1/3 to 2 quarts in no more than 40 gallons water per acre as a broadcast spray. OR 1-1/3 to 2-1/2 fluid oz. per gallon water in hand or non-calibrated knapsack sprayers. Repeat after regrowth of perennial weeds.	Treat in summer for fall planting or in fall for spring planting. Apply to quackgrass when 8 inches in height. Use higher rate for milkweed, Canada thistle. Allow 3 or more days after application before tillage and planting. It will be necessary to apply a preemergence treatment after planting in the fall or spring. Apply Princep 4L at 1 to 1.5 qts. per acre or SureGuard at 4 to 6 ounces per acre after fall planting to prevent winter annual weeds from emerging.
2. To control brush the year before planting.	See Roundup and Garlon in Brush Control – Section G	
B. SEED BEDS		
1. Preplant treatment to control most weed seeds, weed seedlings, and perennial root stocks or tubers.	Use Vapam (metham), Basamid or Dowfume MC-2 (methyl bromide + chloropicrin) according to label directions.	Use of these materials may be restricted; consult your county forester, Extension Service or State Pesticide Division before use. Follow all label precautions. Clover seeds are resistant.
2. Seedling bed maintenance for seedling weeds only, first year or second year.	a) Devrinol 50WP (napropamide) at 4 to 6 lbs. per acre or Devrinol 5G at 40 to 60 lbs. per acre.	Apply to weed-free soil before or after conifer seedlings have emerged. Optimum weed control when followed by rain or irrigation.
	b) Goal XL or Galigan 2E at 1 to 2 pints per acre, or GoalTender at ½ to 1 pint per acre.	Apply higher rate after seeding labeled conifers: apply lower rate in 5 to 6 weeks after conifer emergence. Provides preemergence control of seedling weeds. Excellent in mid-June following earlier application of Devrinol.
	c) Fusilade II or DX at label rates or Ornamec at label rates + 0.25% non-ionic surfactant	To control emerged annual grasses only.
	d) Vantage at 36 oz. per acre.	As above (B 2c).
C. TRANSPLANT BEDS (2-year-old or older seedlings replanted into beds.)		
1. Post-planting treatments.	a) Mulch 1-2" with wood chips, pine needles, or other suitable organic materials. Apply preemergence herbicides before or after mulching as indicated below.	
	b) Devrinol 50W (napropamide) at 8 lbs. per acre or Devrinol 5G at 80 lbs. per acre.	See B 2a; for annual grasses and some broadleaf. Apply before any organic mulches.
	c) Treflan 5G (trifluralin) at 10 to 20 lbs. per acre if incorporated; at 30 to 50 lbs. per acre if surface applied.	Optimum weed control when followed by rainfall or irrigation within a few hours after treatment; for annual grasses and some broadleaf. Apply before any organic mulches.
	d) Ronstar 2G (oxadiazon) at 150 lbs. per acre	For annual weeds except chickweeds. Apply <u>after</u> organic mulches.

***** See product label for full details. Always read the label first; follow all precautions.

SITUATIONS	COMMERCIAL MATERIAL AND RATE*	COMMENTS
1. Post-planting treatments in Transplant Beds. (Continued)	e) Goal 1.6E (oxyfluorfen) at 1.3 to 2.2 quarts per acre or Goal 2XL or Galigan 2E at 1 to 2 quarts per acre, or GoalTender at 1 to 2 pints per acre.	Provides preemergence and postemergence control of seedling weeds. Avoid application during early flush of spruces or true firs. Apply after organic mulches. To control emerged grasses and broadleaf weeds combine Goal with Fusilade, Vantage or Envoy. (See F.7b)
	f) Combine or follow Devrinol or Treflan with Princep or Sim-Trol liquid at 1 qt. per acre or Goal 2E at 1 quart per acre, or Ronstar 2G at 100 lbs. per acre.	Provide excellent broad-spectrum weed control. Repeat, if needed, in mid-June or later. Avoid applications of Goal or Galigan during the early flush of spruces or true firs. Princep, Sim-Trol, Devrinol and Ronstar 2G are safe on the early flush.
	g) Pennant Magnum (s-metolachlor) at 2 to 2-1/2 pints per acre. Combine or follow with Princep, Goal, or Ronstar at above rates for broad-spectrum control.	Provides excellent control of nutsedge, annual grasses and Asiatic dayflower. A second application may be needed for seasonal control of nutsedge and dayflower. Apply Pennant before any organic mulches. If combined with Goal apply after mulching and then irrigate.
	h) SureGuard 51.1% WDG at 8 to 12 ounces per acre.	Apply on dormant conifers in the spring before bud break.
	i) Fusilade II or DX at 1 to 1.5 pints per acre or Ornamec or Envoy at label rates and 0.25% non-ionic surfactant.	Use lower rate for emerged annual grasses and higher rate for perennial grasses. Repeat at lower rate for perennial grasses in 14 to 21 days, if needed. Use Envoy if annual bluegrass is the problem.
	j) Vantage at 36 to 60 oz. per acre.	As above
	k) Stinger, 1/3 to 1/2 pints per acre.	Treat in summer for vetch and clover control or in the spring of the second year to control emerged legumes, horseweed, thistles, and other members of the aster family.

D. FIRST YEAR PLANTINGS - Broadcast or Banded Treatments over the Field Rows

1. To control annual weeds on freshly tilled soil or on sites treated with Roundup the previous fall.	a) Princep 4L (simazine) at 2 to 3 qts. per acre OR Princep liquid at 2 qts. per acre + Surflan AS (oryzalin) at 3 to 4 qts. per acre OR Pendulum EC (pendimethalin) at 2.4 to 4.8 qts. per acre OR Pendulum 60% WDG at 3.3 to 6.7 lbs. per acre OR Pennant Magnum (s-metolachlor) at 1 1/3 qts. per acre, or Barricade at 2.3 lbs. per acre.	In northern New England, where annual grasses are often not a problem, Princep alone is satisfactory, especially in the first few years. Surflan, Pennant, Barricade, or Pendulum provides added control of annual grasses. Pennant also controls nutsedge. If annual weeds have emerged, substitute 1 lb. per acre of atrazine for 1 lb. per acre of simazine in the mix. i.e. Aatrex 4L 1 qt./A plus Princep 4L 2 qts./A alone or with one of the preemergence grass herbicides at left.
	b) Gallery 75DF (isoxaben) at 0.66 to 1 lb. per acre plus Surflan, Pendulum, Pennant Magnum or Barricade at rates above (D1.a).	Apply on weed-free soil after planting or in fall or spring before weed emergence in established trees. Gallery plus Surflan or Barricade or Pendulum would be good choices for aquifer areas or other areas where leaching potentials must be minimized.
	c) Goal 1.6E (oxyfluorfen) at 3 to 4 qts. per acre or 2XL at 2 1/4 to 3 qts. per acre plus Surflan AS (oryzalin) at 3 - 4 qts. per acre OR Pennant Magnum (s-metolachlor) at 1 1/3 qts. per acre, or Barricade at 2.3 lbs. per acre.	Goal plus Surflan or Barricade or Pendulum would be good choices for aquifer areas or other areas where leaching potentials must be minimized.
	d) SureGuard 51.1% WDG at 10 to 12 oz. per acre.	Apply on weed-free soil after planting, before conifer bud break.
	e) Westar at 6 ounces per acre.	A followup treatment may be required in June to control escaped weeds. (See E5) For trial use in 2007.
	f) See F6 ESTABLISHED STANDS.	

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SITUATIONS	COMMERCIAL MATERIAL AND RATE*	COMMENTS
2. To suppress perennial sod grasses and prevent annual weeds, just after planting trees three years old or older on sites not treated with Roundup the previous fall.	a) Princep 4L (simazine) at 2 to 4 qts. per acre, or 50 to 100 lbs. Simazine 4G per acre. (1 teaspoon of Simazine 4G in a 2 ft. diameter spot or one level tablespoon per 3-ft. diameter spot).	Treat in early spring as soon as possible after planting. Use higher rate for quackgrass, lower rates for seedling trees. Orchardgrass and broomsedge are not controlled. See E 1b also.
	b) Westar at 6 ounces per acre.	For trial use in 2007. (See E5)
3. To control perennial sod grasses and prevent annual weeds after planting.	a) Fusilade II or DX, 1.5 pints per acre, or Ornamec, 3 quarts per acre or Envoy, 17 to 34 fluid oz. per acre plus 0.25% non-ionic surfactant, combined or followed by Princep 4L at 3 qts. per acre.	Apply when sod grasses are 6 to 8 inches tall. Avoid spraying new flush of true firs. Fusilade, Ornamec, Envoy and Vantage control grasses. Princep provides residual weed control.
	b) Vantage at 60 oz. per acre, combined or followed by Princep 4L at 3 qts. per acre.	As above (D 3a)

E. ESTABLISHED STANDS - (Trees growing in the field for one or more seasons.) Broadcast or Banded Treatments Over the Trees in Fall or Spring.

1. To control perennial sod grasses and prevent growth of annual weeds in established trees on sites not treated with Roundup the previous fall.	a) Princep 4L (simazine) at 3 to 4 qts. per acre, or Simazine 4G at 75 to 100 lbs. per acre. (one tsp. of granules per 2-ft. diameter spot or one level tablespoon per 3-ft. diameter spot.)	Apply in late fall or early spring. Spring treatment preferable for longer control of annual weeds, but fall treatments may provide better control of perennial grasses.
	b) Tank mix of Princep 4L (simazine) at 2 qts., plus Aatrex 4L at 2 qts. per acre.	High rate where canary or quackgrass predominates. Apply in early spring prior to bud-break. Do not use Aatrex repeatedly in spruce. Use low rate of Aatrex (1 quart per acre) for emerged winter annual weeds.
	c) Kerb 50W (pronamide) 3 to 4 lbs. per acre in late fall.	To provide longer residual control of annual weeds, combine with Princep 4L (simazine) at 2 to 3 qts. per acre, or apply Kerb in the fall and Princep in the spring.
	d) Westar at 10 to 12 ounces per acre.	For trial use in 2007.
2. To control annual grasses and weeds in areas treated the previous season with herbicides to control perennial weeds	a) Princep 4L (simazine), 2 to 4 qts. per acre OR Princep 4L at 2 qts. per acre + Surflan AS (oryzalin) at 3 to 4 quarts per acre OR Pendulum EC (pendimethalin) at 2.4 to 4.8 qts. per acre OR Pennant Magnum (s-metolachlor) at 1 1/3 qts. per acre, or Barricade at 2.3 lbs. per acre.	Treat early spring. See D 1a, b, c. To control triazine-resistant pigweed and lambsquarters use Princep and Surflan or SureGuard. Pendulum controls triazine-resistant lambsquarters. Goal at 1 quart per acre either added to one of the combinations at left or applied on seedling pigweeds and lambsquarters in June can also be effective
	b) SureGuard WDG 0.75 lb (12 oz) per acre.	SureGuard controls a broad spectrum of annual weeds. Add Roundup Original at 1 pint to 1 quart per acre if emerged green weeds are present.
	c) Westar at 10 to 12 ounces per acre.	For trial use in 2007.
3. To control vetch, alfalfa, Canada thistle, bull thistle and horseweed.	Stinger (clopyralid) 1/3 to 2/3 pt. per acre or 1/2 to 1 tsp. per gallon water for spot treatment.	Treat from late May to October. To control triazine resistant horseweed add Stinger at 5 oz. per acre to the spring preemergence herbicide mix. See E2 above.

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SITUATIONS	COMMERCIAL MATERIAL AND RATE*	COMMENTS
4. Spot treatment mix for controlling bindweed and vetch growing into conifers.	Stinger ½ tsp. per gallon plus Goal 2XL or Galigan 2E at 2/3 fluid ounces per gallon water.	Treat when vines are in trees but before they disfigure the tops - mid-June to early July. Spray lightly just to wet weed foliage.
5. Treatments in June to control seedling weeds that invade following spring treatments and to suppress perennial grasses.	Roundup Original at 4 fluid ounces per acre plus Goal 2XL at 16 fluid ounces per acre (or GoalTender at 8 fluid ounces per acre) plus Stinger 3 to 4 fluid ounces per acre. (See F.7b)	Most effective on immature weeds, approximately 4 to 10 inches tall.

F. ESTABLISHED STANDS - (Trees growing in the field for one or more seasons.) Semi-Directed or Fully-Directed Sprays Only.

1. To control quackgrass, orchardgrass, canarygrass, thistle, milk weed, ferns and other perennial weeds and woody plants in established trees. Retreatment may be required. Fall or spring treatments on dormant conifers.	Roundup (glyphosate) at 1-1/3 to 1.5 quarts in no more than 40 gallons water per acre. Or 1 to 2 fluid ounces per gallon water for non-calibrated hand or knapsack sprayers. Coarse sprays preferred.	Fall applications are most effective in controlling perennials, ferns and brush (before frost) as SEMI-DIRECTED SPRAYS. See Glyphosate on page 4. In spring apply on actively growing weeds as a SEMI-DIRECTED OR SHIELDED SPRAY ONLY toward the base of established true fir or spruce species before bud break. With hand sprayers, apply on a spray-to-wet basis, NOT to point of runoff, FULLY DIRECTED.
2. To kill sod perennial grasses and prevent growth of annual and perennial weeds in established trees.	a) Princep 4L or Simazine 4G as above (D1); preceded by or followed up with a directed spray of Roundup 1-1/3 to 2 qts. in no more than 40 gallons water per acre for resistant weeds. b) Tank mix of Princep liquid at 2.5 to 3 qts. plus Roundup at 1 to 1.5 quarts per acre. c) Tank mix of SureGuard WDG at 0.5 to 0.75 lb per acre + Roundup Original at 1 qt. per acre. d) Westar at 10 to 12 ounces per acre.	Apply Roundup in late summer or early fall and Princep in early spring. Princep may be sprayed over trees; apply Roundup as a SEMI-DIRECTED SPRAY ONLY on dormant trees. Apply in May - June; as a FULLY-DIRECTED SPRAY ONLY. Any conifer foliage that is contacted will be seriously injured or killed. Apply as a SEMI-DIRECTED SPRAY before bud break of spruces and true firs in spring where established winter annual weeds are present. For trial use in 2007.
3. To control vetch, other legumes, poison ivy, oriental bittersweet, Virginia creeper and suppress bindweed in conifers over 2 feet tall.	Garlon 3A (triclopyr) at 1quart per acre or 1/3 fluid ounce per gallon of water for spot sprays.	Apply in late August or September as a SEMI-DIRECTED SPRAY to contact lower 8 inches or less of conifer foliage. Sprayed conifer foliage may be injured unless conifers are dormant. Early summer sprays must be fully directed to avoid conifer injury.
4. To control perennial bedstraw in grassy row middles or in rows of conifers	Garlon 3A at 11 to 22 fluid oz. per acre.	Apply in fall or early spring before conifer bud break, on dry weed foliage.
5. To control yellow nutsedge, Canada thistle and certain seedling broadleaf weeds such as seedling dayflower and velvet leaf.	Basagran T/O at 1 quart per acre plus oil concentrate at 1 quart per acre.	Apply on emerged weeds as a FULLY DIRECTED SPRAY, avoiding conifer foliage.

***** See product label for full details. Always read the label first; follow all precautions.

SITUATIONS	COMMERCIAL MATERIAL AND RATE*	COMMENTS
6. General use non-calibrated (spot treatment) mix for knapsack applications.	Tank mix per 3 gallons of water - Princep 4L, 3 fluid ounces plus Roundup 3 to 4 fluid ounces. Add Surflan or Oryzalin at 3 fluid ounces where annual grasses are expected.	Apply as a light, fully directed spray, only to wet the weeds. A funnel shield and cone nozzle is useful to prevent conifer injury. Best results are obtained if applied before weed growth exceeds 6" - 8". Taller weeds can be stepped on and sprayed to avoid conifer contact and injury. Woody plants including vines are most susceptible to Roundup in late August or early September, before a killing frost.
7. To suppress weeds and perennial grasses between rows with sequential semi-directed sprays. Use flooding nozzle such as Teejet TK-2 or TF-2 held low.	a) Roundup Original • 1st application (12 oz. per acre) • 2nd application (8 oz. per acre). Add Stinger at 4 oz per acre to control vetch. • 3rd application (12-16 oz. per acre) b) Tank mix of Roundup Original at 4 fluid ounces per acre plus Goal 2XL at 16 fluid ounces per acre plus Stinger at 3 to 4 fluid ounces per acre. For calibrated backpack applications GoalTender at 8 fluid ounces per acre is preferred in place of Goal 2XL because of lower odor. If seedling grasses are most prevalent, Roundup plus Goal or GoalTender can suffice.	Just before conifer bud break. Mid-June to Early July. Mid to late August. First application before bud break, 2nd in June and 3rd as needed. This combination may also be used in mid-June to early July to control seedling weeds that invade following spring preemergence treatments. (See E5)

G. BRUSH CONTROL

1. For control of woody weeds in Christmas tree stands; conifer release in natural stands.	a) Roundup. See F 1 b) Garlon 3A or Garlon 4 (triclopyr) at labeled rates.	Fall applications before frost are most effective. See F 1. Apply semi-directed foliar spray of Garlon 3A in water in late summer or early fall or directed basal spray of Garlon 4 in oil during the dormant season.
2. For selective control of larger, hard-to-kill, undesirable brush and tree species.	a) Garlon 3A as a frilling or stump treatment. b) Roundup as a treatment on freshly cut stumps to prevent resprouting.	Apply undiluted to cambium of freshly cut stumps or 1 to 1 with water in frills except during heavy sap flows. Apply 1 to 1 with water to the cambium area of freshly cut stumps.

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Note: To get copies of herbicide labels contact your pesticide supplier or get them from the Crop Data Management System's website at www.cdms.net . Single copies of this guide are available from the New England University Extension Foresters and can also be downloaded from the UNH Cooperative Extension website at http://extension.unh.edu/Forestry/Docs/NEGTWC.pdf .

Recommended Publications

Southern New England Christmas Tree Growers' Manual. A complete manual on Christmas trees with a chapter on weed control. Available at UMass Extension Bookstore: 1-413-545-2717 (In Massachusetts 1-877-862-7798) code NC-CTGM. Cost $7.00 plus shipping, http://www.umassextension.org/ .

Weeds of the Northeast. This is an excellent, well-illustrated weed identification reference. Available from bookstores and Cornell University (1-607-277-2211) or http://www.cornellpress.cornell.edu/ . Cost: about $30.00 plus shipping.