Weed Control in Southern Hardwood Nurseries

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Abstract—In the South, most nursery managers have relied on methyl bromide for weed control in hardwood seedbeds. When methyl bromide is no longer available, handweeding times will likely increase unless management regimes adapt to the change. Some nursery managers will increase use of both sanitation practices and herbicides. Although several herbicides are registered for use on hardwoods, some can injure seedlings when applied to seedbeds. Grasses can be effectively controlled with selective herbicides. Many small seeded broadleaf weeds can be suppressed with preemergence herbicides. Information on registered herbicides for hardwoods is provided.

Keywords: herbicides, fumigation, integrated pest management.

INTRODUCTION

Hardwoods are a small proportion of the seedlings grown in forest tree nurseries. In the South, they represent less than 2% of the total seedling production. Less than half the forest tree nurseries grow hardwoods. In 1992, total production from 10 nurseries was less than 10 million seedlings (Table 1). Developing an efficient weed management program for individual species can be difficult when so few seedlings are produced (Stone 1991). For these reasons, weed control research in seedbeds has concentrated on *Pinus*

Table 1. Hardwood seedling production from ten nurseries in 1992. (Nurseries include Miller, International Paper, Scott Paper (Alabama), Flint River (Georgia), Champion, Piedmont, Westvaco (South Carolina), Pinson (Tennessee) and Indian Mound (Texas).

Group	Production	Acres
unspecified	3,498,000	8.0
oaks	1,500,750	5.6
sycamore	1,397,400	5.0
lespedeza	1,194,000	2.2
dogwood	662,700	3.4
sweetgum	430,950	1.6
maple	258,100	0.5
green ash	167,050	0.7
yellow poplar	90,000	0.1
black walnut	49,000	0.1
mulberry	39,030	0.1
persimmon	24,500	0.04
crab apple	17,300	0.04
Total	9,329,050	25.0

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species. However, weed diversity and numbers are often higher in hardwood seedbeds due to higher soil alkalinity and greater irrigation and fertilization. Without herbicides, handweeding often exceeds 200 hours/acre. Although a nursery may only grow about 2.5 acres of hardwoods, handweeding times for this area may exceed that for the entire conifer crop. For example, an acre of untreated hardwoods at the Norman Nursery in Oklahoma exceeded 1,600 hours of handweeding in 1981 (Abrahamson 1987).

Efficient weed management systems for hardwoods involve a combination of methods which often include fumigation, herbicides, and various nonchemical techniques. Inefficient systems usually rely on just one or two methods of weed management.

SOIL FUMIGATION

Nursery managers have often relied on methyl bromide fumigation to reduce weed populations in their hardwood seedbeds. A main advantage of methyl bromide is that it can be used prior to sowing many hardwood species. However, after the year 2001, methyl bromide will no longer be available. Some managers will switch to fumigants that are weak on weeds. Possible alternatives include chloropicrin and dazomet. Although both can control certain soil borne pests, neither is effective in controlling nutsedge. Most other annual weeds can be controlled with herbicides (South and Gjerstad 1980; Garrett et al. 1991).

Few hardwood nurseries have problems growing endomycorrhizal crops when fumigating with 98% methyl bromide (Campbell 1992). However, fumigation with 300 lbs/acre of chloropicrin may retard growth of certain endomycorrhizal hardwoods. In the past, fumigation that included chloropicrin at 115 to 150 lbs/acre reduced growth of some species (e.g. sweetgum and dogwood). This resulted due to a lack of viable endomycorrhizal spores (South et al. 1980). In fact, in 1994, one nursery in Georgia had stunted corn due to effective fumigation with 33% chloropicrin and 66% methyl bromide. Some managers may use other fumigants such as dazomet or 1,3-dichloropropene for beds to be sown with dogwood or sweetgum.

HERBICIDES

To control weeds without injuring hardwood seedlings, either the herbicide must be totally selective such as fluaziflop-butyl (see Table 2 for common names) or the herbicide must be applied in a suitable manner. Selectivity is based on physiological or morphological differences between crop and weed. For example, a physiological difference between broadleaves and grasses is the basis of selectivity for sethoxydim and fluaziflop-butyl. As a result, handweeding grasses should no longer be necessary.

Morphological differences between crop seed and weed seed can also be used to provide some selectivity. Large seeded species such as oak, walnut, pecan, hickory tolerate preemergence herbicides that are toxic to small seeded species. For example, oxyfluorfen at 0.5 lb ai/acre can be applied after sowing without injury to walnut, pecan, hickory and oak. Although not currently labeled, this is potentially a useful treatment for several large seeded hardwoods.

Differences in plant size can also be used to achieve selectivity. Some herbicides (like trifluralin, oryzalin, prodiamine and napropamide) are active mainly on seed germination. These herbicides can be applied once hardwood seedlings have germinated and have developed a few true leaves. The herbicide is toxic to small hardwood seed such as sycamore if applied at time of seeding, but when applied after the seedlings are establish, the chance of injury is greatly reduced. Although these herbicides will not control emerged weeds, they will help

Table 2. Common and trade names of herbicides registered for hardwoods.

Trade name	Common name	Company
VERY SELECTIVE GRASS HERBICIDES		
Acclaim	fenoxaprop-ethyl	Hoeschst
Fusilade	fluaziflop-butyl	Zeneca
Vantage	sethoxydim	BASF
CAN BE SELECTIVE WHEN SPRAYED OVER ESTABLISHED HARDWOODS		
Barricade	prodiamine	Sandoz
Dacthal	DCPA	ISK Biotech
Devrinol 50-DF	napropamide	Zeneca
Treflan 4EC	trifluralin	Monterey
CAN BE SELECTIVE WHEN APPLIED AS GRANULES OVER ESTABLISHED HARDWOODS		
Eptam	EPTC	Zeneca
Chipco Ronstar G	oxadiazon	Grace-Sierra
Rout	oxyfluorfen+oryzalin	Grace-Sierra
Ornamental Herbicide 2	oxyfluorfen+pendimethalin	Scotts
Ornamental 5G	napropamide	Lesco
Southern Weedgrass Control	pendimethalin	Scotts
TO AVOID INJURY, DO NOT APPLY TO SEEDBEDS		
Casoron	dichlobenil	Uniroyal
Derby	metalachlor+simazine	Ciba
Gallery	isoxaben	DowElanco
Kerb	pronamide	Rohm and Haas
Pendulum	pendimethalin	Cyanamid
Pennant	metalachlor	Ciba
Princep	simazine	Ciba
Predict	norflurazone	Sandoz
Snapshot	oryzalin+benefin	DowElanco
Surflan	oryzalin	DowElanco
XL	oryzalin+benefin	DowElanco
NOT SELECTIVE BUT CAN BE DIRECTED		
Basagran T/O	bentazon	BASF
Lescogran	bentazon	Lesco
Finale	glufosinate - ammonium	Hoechst
Roundup	glyphosate	Monsanto

keep subsequent weed seed from germinating. This technique is used successfully by several nursery managers in the South.

With some herbicides, formulation will affect selectivity. Formulating herbicides as granules is a common practice to reduce the potential injury. When applied to dry foliage, herbicides granules of oxyfluorfen and oxadiazon may be less phytotoxic to foliage than liquid formulations. Herbicide injury still occurs if granules lodge in the foliage or are not completely washed off with irrigation. Therefore, it is important for most granules to be applied to dry foliage.

A final way to provide selectivity is to ensure the herbicide does not come in contact with crop foliage. This can be done with either directed applications by hand or by using shields to apply herbicides between drill rows. Most foliar active herbicides should be directed away from the crop and toward the weeds. A number of nursery managers have applied glyphosate to weeds between seedling drills.

WEED CONTROL TREATMENTS USED BY MANAGERS

Commonly used weed control practices were determined by surveying 17 hardwood nurseries. Methyl bromide fumigation was used at most (15) of the nurseries. To suppress hardwood diseases, 10 managers used methyl bromide with 33% chloropicrin.

Ten nursery managers used no herbicides at time of sowing. Some were afraid that herbicides could result in seedling injury. Trifluralin was the most popular preemergence herbicide and was used after sowing at 5 nurseries. Two nurseries had good results

when testing oxyfluorfen on large seeded species such as oaks, persimmons, and hickories. One applied EPTC as a pre-plant incorporated treatment.

Managers at 12 nurseries used postemergence herbicides (applied postemergence to the crop). Selective grass herbicides were the most popular. Sethoxydim was used at 9 nurseries and 3 others used fluaziflop-butyl. It was surprising that neither of these herbicides were used at 4 nurseries. Apparently some managers either do not mind handweeding grasses or they are afraid to use any herbicide on hardwoods. Two nurseries used granular herbicides (Rout® or OH-2®) to a limited extent.

Napropamide and/or oryzalin were used at 4 nurseries. These herbicides can be applied to seedbeds after germination of hardwoods is complete (South 1984; Warmund et al. 1980). These herbicides do not have contact activity and therefore are not generally phytotoxic to emerged seedlings or weeds (Everest et al. 1989; Skroch 1994). However, since a nursery in New York sued the chemical company due to injury to Douglas-fir, nursery managers in the southern U.S. can no longer legally apply oryzalin to seedbeds. One sure way to reduce the number of registered herbicides is to file suits (or claim damages) against chemical companies. Fortunately, prodiamine is now registered and can be used in place of oryzalin (South 1992).

The following edited comments are from nine of the nursery managers:

#1 Either EPTC (pre-plant incorporated) or trifluralin (post sowing) is likely to damage chinese elm and river birch, but no problem with large seeded oaks and black walnut. No damage with fluziflop-butyl. Rout® (postemergence) does not hurt oaks.

#2 Trifluralin (applied just after sowing) caused some damage to sycamore.

#3 No problems with sethoxydim or trifluralin. Oryzalin slightly damaged dogwood, sycamore sweetgum and maple. OH-2® injured deciduous magnolias, maples, dogwood and sweetgum.

#4 Sethoxydim caused slight burn on shumard oak and mulberry.

#5 Wild cherry seedlings were burnt by sethoxydim.

#6 If sprayed early, dogwood seems sensitive to sethoxydim.

#7 Sethoxydim leaf burn was greater on white oaks than on red oaks.

#8 Do not use trifluralin (applied just after sowing) on sycamore; ground line lesions and root damage.

#9 Oxyfluorfen can be used on large seeded oaks, persimmons, and hickories. Use surfactant rather than oil when using sethoxydim or fluaziflop-butyl. Using a crop-oil can damage hardwoods. Shrub lespedaza can be treated with 2,4-D amine.

Several managers have observed foliar burn after using Poast®. In some cases, this resulted from the addition of a crop-oil. Under some environmental conditions, using a crop-oil concentrate injures newly emerged tissue. In fact, various brands of crop-oil were being used with Poast®. This is one reason why this product is no longer registered for ornamentals. Vantage® is a new formulation of sethodydim which is registered for hardwoods and already comes with its own surfactant. Therefore Vantage® does not require the addition of a crop-oil. The label for Fusilade 2000® states “do not use a crop oil concentrate.”

SUGGESTED HERBICIDE REGIME

As a general rule, granular fertilizers are more expensive than liquids or powders. For example, a pound of napropamide could cost $10 as a powder but $30 as a granular. Granular fertilizers that have been used in 1+0 seedbeds include Rout® (3%), Ronstar® (2%), OH-2® (3%), Treflan® (5%), Pennant® (5%) and Devrinol® (5%). A few other granular herbicides that are used on liner stock but seldom used on 1+0 seedbeds include Betasan® (7%), Casoron® (4%) and Lasso II® (15%). Although effective weed control can be obtained with granular herbicides (Reeder et al. 1992), some nursery managers choose not to use granular formulations due to the added expense.

Due to the numerous species involved, a single herbicide regime for all hardwood species is unlikely. However, the regime in Table 3 can be used for a variety of species. It should be used in conjunction with an effective sanitation program. The program relies on use of a grass herbicide (fenoxaprop-ethyl, fluaziflop-butyl, sethoxydim) in conjunction with a few other herbicides (napropamide, prodiamine, trifluralin) to control germination of small seeded broadleaf weeds. Emerged weeds are controlled with either handweeding or directed applications of glyphosate or glufosinate-ammonium.

Although DCPA has been approved for use in nurseries by the US Forest Service and is currently used in some hardwood nurseries (Garrett et al. 1991; Porterfield et al. 1993), the Auburn University Southern Forest Nursery Management Cooperative does not recommend using this herbicide. According to EPA, the acid metabolites of DCPA are the most commonly detected pesticide in drinking water wells. The metabolites were found in about 6.4% of community water systems and 2.5% of rural domestic wells. We believe nursery managers should be pro-active and not use DCPA, atrazine, alachlor, simazine, bentazon, and prometon (all have been found in well water). Nursery managers should restrict their use to herbicides that have little chance of leaching into groundwater. Such herbicides include oxyfluorfen, fluaziflop-butyl, glyphosate and prodiamine.

Table 3. A sample herbicide regime for fall sown hardwoods.

Time of Application	Chemical	Comments
Fall		Sow species that can be sown in the fall. This results in quicker canopy closure in the spring and gives hardwoods a jump on the weeds.
Fall	Barricade	Apply after sowing to large seeded hardwoods.
	or	
	Treflan	Apply after sowing small seeded hardwoods but before mulching. Mulch soon after application and irrigate to reduce volatilization. Do not apply to sycamore.
March	Treflan	Handweed winter weeds and apply soon after weeding. Apply 1/2 inch of irrigation after application to reduce volatilization.
Spring	Vantage or Fusilade or Acclaim	Apply after grasses have emerged. Use of crop-oil may cause foliar injury.
April	Devrinol	Handweed prior to application. Apply after complete emergence of hardwood seedlings.
Spring	Roundup or Finale	Use directed applications to perennial weeds.
May	Barricade or Devrinol	Apply one month after April treatment. Handweed prior to application.
June	Devrinol	Apply one month after May treatment. Handweed prior to application.
Summer	Vantage or Fusilade or Acclaim	Apply as needed to control grasses.

For Devrinol 50WP, use 3 pounds product/acre/application
For Barricade CFG, use 1 pound product/acre/application
For Vantage, use 2.25 pints/acre/application
For Fusilade 2000, use 2.5 pints/acre/application
For Acclaim, use 1.5 pints/acre/application
For Treflan 4E, use 1 quart/acre/application

LITERATURE CITED

Abrahamson, L.P. 1987. Forest tree nursery herbicide studies at the Oklahoma forest regeneration center. P. 49-57 in Proc. Intermountain Forest Nursery Association, Oklahoma City. USDA Forest Service, General Technical Report RM-151.

Campbell, S.J., Jr. 1992. Hardwood culture. P. 91-95 in Proc. Southern Forest Nursery Association. Pine Mountain, Georgia. Georgia Forestry Commission, Macon, GA.

Everest, J.W., C.H. Gilliam, and K. Tilt. 1989. Weed control for commercial nurseries. Alabama Cooperative Extension Service, Auburn University Alabama. Circular ANR-465. 13 p.

Garrett, H.E., R.C. Stenberg, Jr., G.S. Cox, R.J. Mitchell, and W.G. Young. 1991. A case for herbicidal weed control in forest nurseries. CP. 83-101 in Chemical Vegetation Management, J.E. Kaufman and H.E. Westerdahl (eds.) Plant Growth Regulator Society of America.

Porterfield, J.D., J.D. Odell, and G.R. Huffman. 1993. Effects of a DCPA/napropamide herbicide tank mix on germinants of seven hardwood species in tree nursery beds. Tree Planters' Notes 44:149-153.

Reeder, J.A., C.H. Gilliam, G.R. Wehtje, and D.B. South. 1992. The effects of selected herbicides on propagation of chestnut oaks in containers. P. 325-329. in Proc. International Plant Propagators Society. Ocean City, MD.

Skroch, W.A. 1994. Weed control suggestions for christmas trees, woody ornamentals, and flowers. NCSU. North Carolina Cooperative Extension Service. 100 p.

South, D.B. 1984. Chemical weed control in southern hardwood nurseries. South. J. Appl. For. 8:16-22.

South, D.B. 1992. Prodiamine: a herbicide for pine and hardwood nurseries. South. J. Appl. For. 16:142-146.

South, D.B. and D.H. Gjerstad. 1980. Nursery weed control with herbicides or fumigation an economic evaluation. South. J. Appl. For. 4:40-45.

South, D.B., D.H. Gjerstad, and S.J. Campbell. 1980. Comparison of methyl bromide and herbicide effects on endomycorrhizal formation, seedling production, and weed control in sweetgum seedbeds. European Journal of Forest Pathology 10(6):371-377.

Stone, J.M. 1991. Hardwood pest problems weeds, grasses, and herbicide controls. P. 17-21 in Proc. Nursery Pest Management Workshop. Athens, Tennessee. USDA Forest Service, Region 8, Atlanta, GA.

Warmund, M.R., C.E. Long, and W.A. Geyer. 1980. Preemergent herbicides for seeded nursery crops. HortScience 15:825-826.