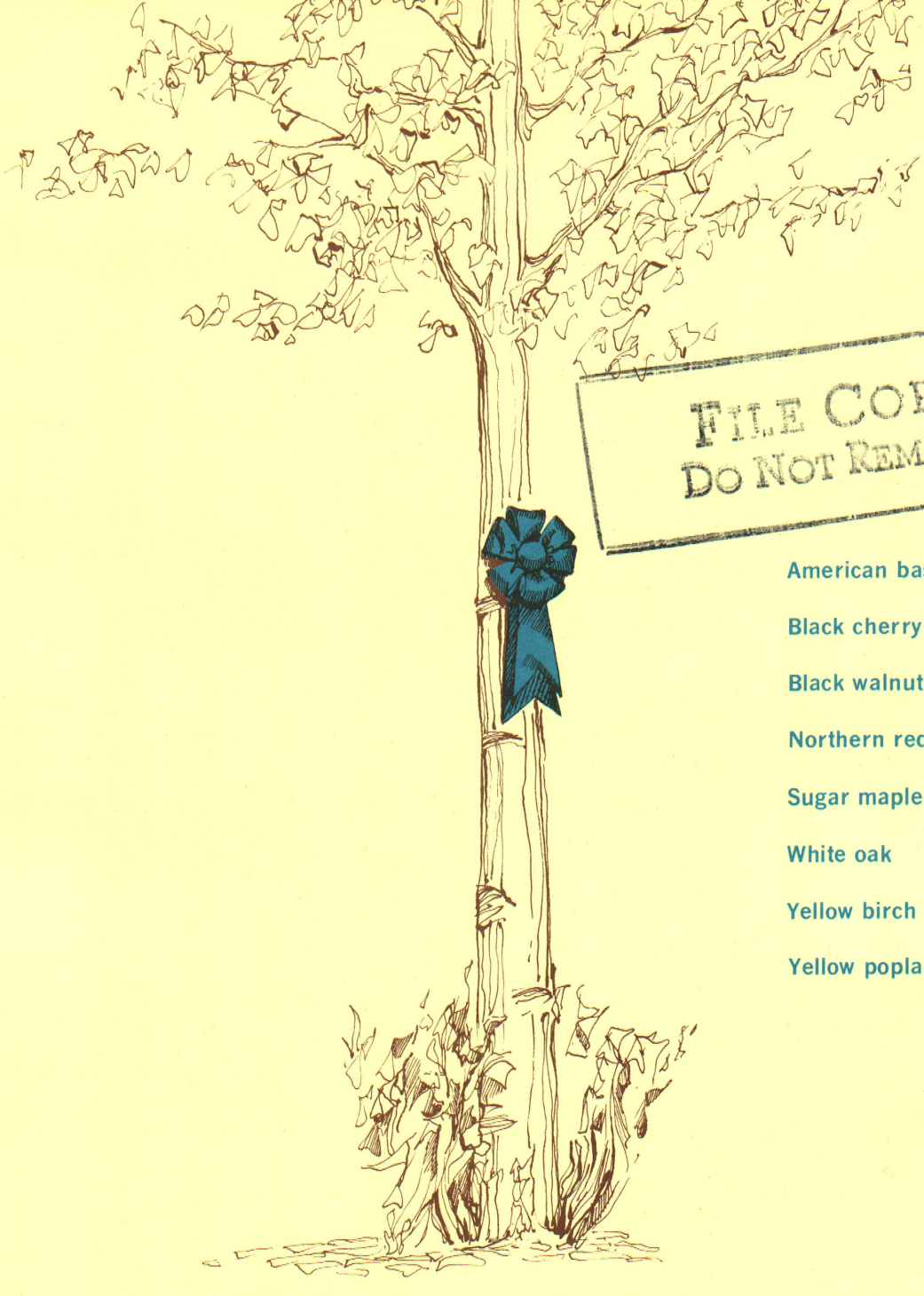


American basswood

Black cherry

Black walnut

Northern red oak

Sugar maple

White oak

Yellow birch

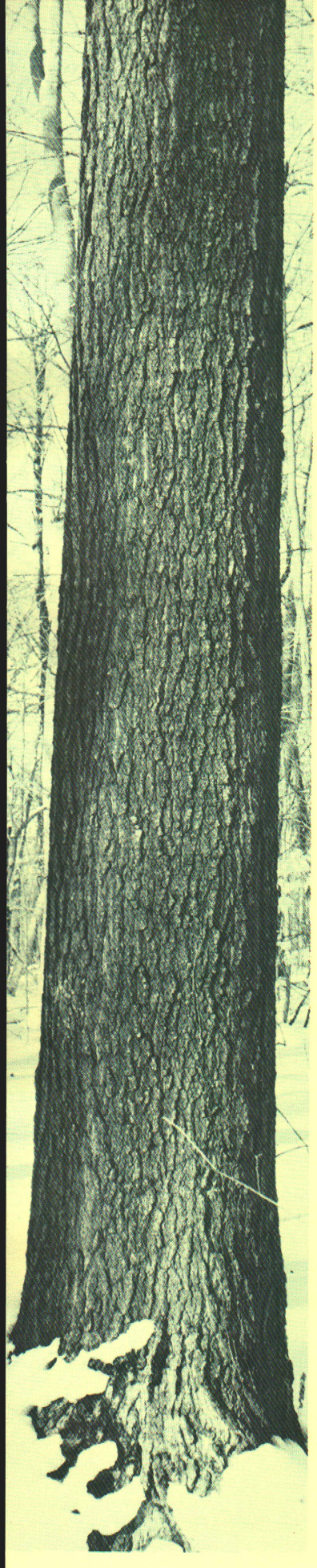
Yellow poplar

"LET'S ACCELERATE SOME"

BLUE RIBBON HARDWOODS

No. 4 of a Series

Extension Bulletin E 623
Natural Resources Series December 1968
Cooperative Extension Service
Michigan State University



Let's Accelerate Some

BLUE RIBBON HARDWOODS

By Lester E. Bell, Melvin R. Koelling and Donald P. White

Figure 1 — High quality Blue Ribbon tree. The butt-log of this tree will produce many square feet of high value veneer for furniture, door faces or panel boards.

Demand for quality hardwood lumber continues to increase despite the availability and acceptability of synthetic wood products. Furniture, paneling, and veneer industries are offering wider selections of wood materials with more intricate design and pattern configurations.

Quality hardwood logs usable for today's veneer and lumber demands are becoming increasingly difficult to obtain (Fig. 1). Naturally established stands are nearly depleted and younger second-growth trees are still relatively small and slow-growing.

Many young forest stands contain potentially valuable hardwood trees. Both quality and growth rates of these trees must be improved if they are to provide for future supplies of quality hardwood lumber.

This publication, the fourth in a series on Blue Ribbon Hardwoods discusses some of the problems involved in increasing the growth rate of young, high quality, hardwood trees in natural stands and plantations, and offers recommendation. (See Extension Bulletin 620, Let's Grow Some Blue Ribbon Hardwoods; E 621, Let's Meet Some Blue Ribbon Hardwoods, and E 622, Let's Plant Some Blue Ribbon Hardwoods).

FACTORS THAT REDUCE GROWTH

Current growth rates in young hardwood stands may be less than maximum for several reasons — inadequate number of trees per acre, woody and herbaceous plant competition, infertile or poorly drained and eroded soils. Improvement of any or all of these factors through the application of available cultural techniques can significantly improve growth rates and tree quality.

Stand Density

Inadequately or over-stocked young hardwood stands do not result in maximum high quality wood production (Fig. 2). In overstocked stands, competition for available sunlight, soil nutrients and moisture is severe. Competition for soil moisture is especially intense during prolonged drought periods. When young stands are allowed to develop to maturity in understocked conditions, much low value material will normally be produced. Excessive limbiness and poor form frequently characterize semi-open grown trees. Inferior or low value species are usually present in these stands. Permitted to grow to maturity these trees frequently yield very little economic return and represent inefficient utilization of the growing site.

Competition

Rate of growth of young hardwood trees may be seriously reduced by competition from woody (trees, shrubs and vines) and herbaceous (grass and weeds) growth (Fig. 3). Woody competition is usually a product of overstocked conditions. Correction necessitates removal of crooked, limby and defective trees of a desirable species as well as the undesirable species.

Since the foliage of trees is the biochemical factory which produces carbohydrates for new growth, the leaves of trees need sunlight. If stands are too dense, the removal of competing trees is often necessary to allow the crowns of selected crop trees access to sunlight.

Herbaceous and grass competition can have severe effects during the establishment period following germination or transplanting. Soil moisture, essential for seedling survival, can be sapped by heavy grass or weed growth. When essential soil nutrients are in short supply, newly planted seedlings are usually at the mercy of broad-leaved and grass plants. This is due to the greater foraging efficiency of the latter which have larger and better established root systems.

Growth and potential quality of young hardwood trees may also be reduced through poor form development. Dense and overtopping weed and grass growth can cause crooked and forked stems. Snow on heavy weed cover can mat down and deform young seedlings. Unless measures are taken to correct deformed or injured seedlings, the value of such trees at maturity may be greatly reduced. Heavy grass and weed growth also provide ideal winter cover for destructive rodents such as mice and rabbits.

Exposure

Poor growth may result when trees are grown on sites which are highly exposed to wind and sun conditions (Fig. 4). Reduced leaf surfaces, poor form and sun scald damage to the cambium layer will lower growth rates and create defects which will reduce wood quality. This type of injury can be avoided by placing new plantings in protected, non-exposed areas and providing artificial or natural wind breaks around the exposed edges of existing plantings.

Soil Conditions

Unfavorable soil conditions are probably capable of exerting more influence on tree growth than any other single site factor.

Soil moisture availability, fertility and the effects of soil texture and drainage on soil productivity influence many aspects of root and top growth. Poor survival and poor quality crop trees may result.

Soil textures cover a wide range of particle sizes from coarse to fine. Coarse textured soils such as those of a sandy or gravelly nature generally contain

Figure 2 — Over-stocked young (thicket) stand. Blue ribbon crop trees should be selected and others (crooked, defective, and low-valued species) removed or killed with herbicides.

Figure 3 — Black walnut seedling growing in competition with heavy grass and weed growth. Grasses and weeds rob the young tree of moisture and plant nutrients.

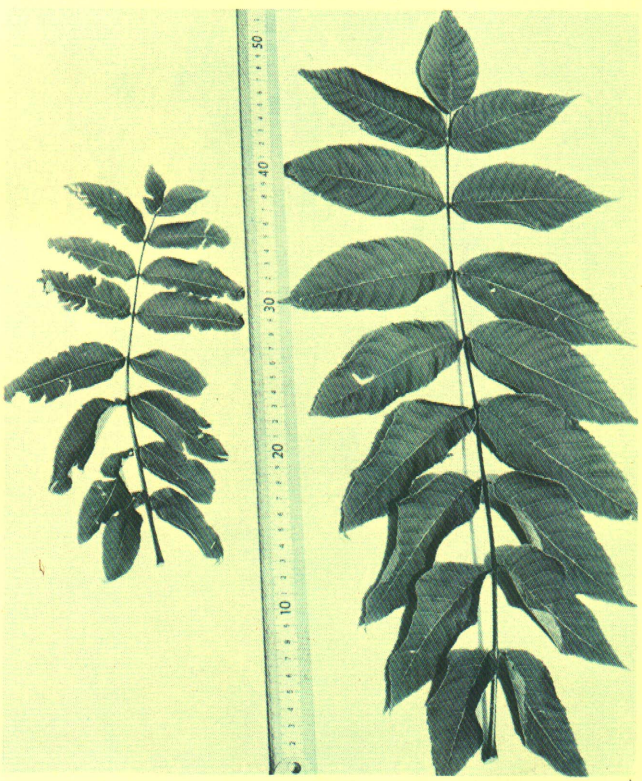
some desirable properties for rapid tree growth. Almost all of the moisture contained in coarse soils is available and lack of aeration is seldom a problem. However, such soils are often droughty during prolonged periods of dry weather. Rapid loss of moisture in the surface layers of coarse soils may be a deterrent in successfully establishing natural reproduction.

Inherent fertility in coarse soils is usually not as good as in finer textured soils. Low organic matter content and lack of fine soil particles (silt and clay) are most commonly responsible. Addition and incorporation of organic matter — green manure, peat, sawdust, wood chips and crop residues into coarse textured soils is usually very beneficial.

On fine textured soils like silt deposits or heavy clays, lack of soil structure and excessive compaction can result in poor drainage or aeration and slow growth. These soil conditions restrict root growing space which increases vulnerability to long periods of drought.

Higher fertility in most fine textured soils creates even more favorable conditions for heavy grass and weed growth than in coarser soils. Unless controlled, competing weed growth can result in failure of newly planted or young hardwood stands. On highly fertile sites, some type of weed control is necessary for the successful establishment and rapid growth of hardwoods.

Figure 4 — Leaf damaged by wind-whipping. The leaf on the left was taken from a walnut seedling planted on an exposed site where wind-whipping damaged the tissue and reduced growth. The leaf on the right was taken from a seedling planted on a site well protected from damaging winds.



HOW TO IMPROVE CONDITIONS FOR GROWTH

Remove Inferior Species

High quality hardwood trees usually do not occur in pure stands, but rather as individuals in a stand made up of several kinds of trees in the "Blue Ribbon" category. Inferior or undesirable species are often present. These "weed" trees of little commercial value occupy growing space and compete with more desirable species for sunlight, soil moisture and nutrients. The quality of the stand should be upgraded by cutting, girdling or poisoning unwanted trees. (See chart on P. 8).

Where Blue Ribbon trees are sparsely stocked, it may be desirable to favor well formed specimens of a less desirable species to obtain complete utilization of the growing site.

Figure 5 — Removal of double forked yellow poplar at this early stage takes it out of competition thus releasing space, moisture, nutrients and sunlight to the better trees.

Figure 6 and 7 — Pelletized or granular herbicides can best be applied around individual trees with a hand-operated spreader (left). Back-pack sprayer application of liquid chemicals is recommended for herbicides spread in liquid form and when foliar contact is desired (right). More uniform spreading and precise control are usually attained with liquid application.

Thin Desirable Species

A favorable seed production year with good seedbed conditions often results in dense areas of naturally seeded hardwoods. Thinning such stands is necessary to provide growing space for the seedlings. Poorly shaped, diseased, and weak individuals should be removed and well formed, fast-growing seedlings favored (Fig. 5). Age and size of the trees will determine the correct amount of spacing for the remaining seedlings. It is generally better to make several gradual thinnings rather than one widely spaced cut. Too rapid opening of a young stand encourages sprouting and side branch development on the remaining trees.

Control Weeds

Mechanical

Traditionally, mowing and cultivation have been used to control heavy grass and weed growth. Mowing between the rows of planted seedlings or around naturally established seedlings to reduce the height of weeds and grass allows more sunlight to reach the surface of the leaves. This practice also lessens soil moisture loss since less water is transpired by the remaining vegetation. However, mowing cannot completely eliminate competition — all grasses and most weeds will resume growth after mowing.

Mowing grass and weeds within the planting row and around the base of each seedling is difficult, and damage to the base of young trees often occurs. Such injuries can lower the potential for developing a quality tree as well as facilitate entrance of disease organisms into the tree.

Cultivation may be partially successful in controlling weed growth, however, it is not completely satisfactory. It is a time consuming, expensive operation which must be repeated frequently. Often resulting in injury to the tree bole or root system, it may contribute to loss of soil moisture and induce erosion on some soils.

Initial growth of such vegetation may be reduced by planting in furrows, however, this practice is expensive, removes fertile topsoil and does not afford long term control of grass and weed growth.

Chemical

Chemical weed killers are effective for controlling undesirable vegetation (Fig. 6 and 7). Commonly used herbicides in tree plantations include *Simazine, Amitrol-T,* combinations of 2,4,5-T and 2,4-D (brush killers) *Casoron,* cacodylic acid, and *Paraquat.* These materials are suitable for preplanting weed control and around established hardwood seedlings (Fig. 8). The use of one or several of these materials must be evaluated for each planting situation. It will be influenced by availability of application equipment, terrain, area, spray cost, and tree species involved (Page 8).

Maximum effectiveness in weed control requires that proper equipment be used in applying herbicides. Spraying equipment or granular spreaders used for other agricultural crops can usually be adapted to prepare sites for planting or apply herbicides around hardwood seedlings.

Proper selection of nozzle sizes and calibration of equipment is essential. A low pressure, 20 to 30 psi (pounds per square inch) flat, fan spray is most suit-

able for herbicides. This type of spray can be obtained with a Tee-Jet 8004 nozzle. Types of equipment and instructions for calibration are contained in several recent publications (See References 2 and 3, page 7).

Preplanting weed control treatments which establish a weed-free strip before trees are planted in the spring can be made during October or November. Because the dead weeds are often not visible until after planting time, identification of the treated strips can be difficult. The use of Christmas tree paint or other colorants in the spray material can solve this problem.

Many otherwise successful plantations are heavily choked with weeds which compete heavily for soil moisture, and present a serious fire hazard. A fall application of *Simazine* (at 4 to 8 lbs. per acre) provides excellent control for the following season. Likewise, a fall or early spring application of granular *Casoron* at 6 lbs. per acre offers excellent control.

Control of established weeds during the growing season usually requires a spray material such as *Amitrol-T* or *Paraquat*, which directly affects the plant foliage. Use of either of these materials requires a carefully directed spray during periods of low wind so that drift is kept off tree foliage. These two herbicides may be safely used around hardwood seedlings in early spring or in the fall when the hardwood leaves have fallen but weeds are still green. They are not known to affect trees when contact is made only through the bark.

The outline of weed control recommendations on the back cover is based on MSU research of some common tree planting situations.

Manage Soil Fertility

Climate and the inherent fertility of the soil largely determine the kind of trees present and their growth pattern under natural forest conditions. Where natural stands of quality hardwood trees are found, the soils are usually highly productive. In the absence of recent destructive fire or heavy grazing, it is unlikely that supplemental additions of plant nutrients will greatly improve tree growth.

Figure 8 — With adequate weed control, this Blue Ribbon plantation is getting maximum use of available soil nutrients and moisture, yet the site is protected from surface run-off and severe erosion. Any plant food added will be available to the trees and not wasted on grass and weeds.

Figure 9 — Fertilizer placement can be easily controlled by hand spreader. Note excellent weed control in circular pattern in the root feeding area of this tree.

However, many forest soils have been depleted due to poor management in the past. Blue Ribbon species have frequently been planted on worn-out or depleted farm soils or on sites where they would not occur naturally. Symptoms of poor growing conditions are slow growth, sparse and "off color" foliage and early leaf fall. When these symptoms are not the result of disease or poor drainage, it is possible to significantly improve growth through the use of fertilizers. Nitrogen usually yields best growth response, however, applications of potassium and phosphorus have shown positive results. Traces of iron, zinc, copper and manganese may also result in improved growth on some sites.

Precise fertilizer formulations are difficult to recommend for trees. A good rule of thumb for quality hardwoods is maintenance of a level of available nutrients similar to that recommended for corn on the particular soil type. Soil testing of old farm fields now in tree production is useful, but this becomes much more difficult in natural forest stands and is generally not recommended. Although nitrogen is the element most likely to give the greatest response, it is better to use a balanced fertilizer with a NPK ratio of 2-1-1, such as 16-8-8. Applications of less than 100 pounds of nitrogen per acre will probably be of little value. For trees that show severe yellowing, applications of at

least 200 pounds of nitrogen per acre should be made with an additional supplement of 100 pounds of nitrogen 4 or 5 years after the initial treatment. Approximately 625 pounds of a 16-8-8 fertilizer are needed to supply 100 pounds of actual nitrogen per acre.

Fertilizer is not ordinarily spread over the entire planting but only around the selected crop trees (Fig. 9). The size of the area to be treated depends upon the size of the tree — treat a circular area approximately twice the height of the tree. For example a tree 10 feet tall should have a treated area approximately 20 feet in diameter. Spread the fertilizer uniformly over the ground in early fall or spring. Applications on snow or frozen ground are not recommended.

Due to poorly established root systems, it is better not to fertilize newly planted hardwoods the first year, but rather concentrate on good planting techniques, site preparation and weed control. During the second to fourth seasons, ¼ pound of a complete fertilizer should be applied as described above. Avoid placing fertilizer within 6 inches of the stem. If only nitrogen fertilizer is applied, reduce the amount of dry fertilizer to 1 ounce of urea or other high nitrogen fertilizer for two year-old trees and 2 ounces for four year-old trees.

To be effective, fertilization of young trees should be accompanied with weed control. Without adequate weed control, fertilizer applications will result in overstimulation of competing vegetation and may actually harm the trees.

Fence-row or road side trees with good vigor, straight stems and high potential also deserve the added stimulus of good weed control and fertilizer.

Provide Good Drainage

All of the Blue Ribbon Hardwoods will normally grow best and obtain quality form development when growing on well-drained soils. River flood plains and land along streams make excellent hardwood planting sites. Soils on these areas are usually deep and fertile.

Poor drainage contributes to reduced growth rates of good trees and the encouragement of undesirable species. On wet sites the construction of drainage fields or ditches will benefit tree growth, however, this practice is normally not economically feasible.

The information given herein is supplied with the understanding that no discrimination is intended and no indorsement by the Michigan State University Cooperative Extension Service is implied.

Blue Ribbon Trees is a promotional and educational program sponsored by Michigan State University, the Michigan Department of Conservation and related forest industries to encourage commercial production of high quality hardwood trees.

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FOR ADDITIONAL ASSISTANCE

In working with Blue Ribbon hardwoods you may need additional help; if you do contact the following:

For educational assistance:
— Your local County Extension Agent, Cooperative Extension Service

For on-the-ground forestry advice:
— Your local District Forester, Michigan Department of Conservation

For soils work or site selection:
— Your local Soil Conservationist, County Soil Conservation District, U.S. Soil Conservation Service

For financial assistance:
— Your local county office of the Agricultural Stabilization Committee — Agricultural Conservation Program

For general information on forestry and tree farming:
— Extension Forester, Cooperative Extension Service, Michigan State University, East Lansing, Michigan 48823
— The American Forest Institute, 1835 K. Street, N.W., Washington, D.C. 20036
— The Fine Hardwoods Association, 666 North Lake Shore Drive, Chicago, Illinois 60611
— The American Walnut Manufacturers Association, 666 North Lake Shore Drive, Chicago, Illinois 60611

WEED CONTROL FOR HARDWOOD TREE PLANTINGS

SITE CONDITIONS	CONTROL MEASURES	REMARKS
1. New plantings in annual weeds and grasses, when established vegetation has been deadened or clean-tilled; also when trees are planted in furrows or scalps.	Use 4-8 lb. per acre of active *Simazine*[1] in 50-100 gal. of water. (Five lb. of *Simazine 80W* has 4 lb. of active *Simazine*.) Use higher rate on silt to clay-loam soils. If vegetation has been killed with *Simazine* **do not** apply any more herbicide at planting time.	Apply with flat fan nozzle using coarse, low pressure, (20-30 psi) water spray in 24 to 30-in. band over planted trees immediately after planting. **For example:** Five pounds of *80W* should treat 3 acres at the 4 lb. acre rate when rows are 6 ft. apart. Not necesary to keep spray off trees.
2. Same conditions as above with weed trees and shrubs.	Before planting, cut woody brush. If large numbers of multiple stems make cutting impractical, thoroughly wet root collar zone with a low volatile ester of *2,4,5-T*, 3 parts concentrate in 100 parts of diesel oil. Use this also as a stump spray. After planting, apply *Simazine* treatment as in Control 1.	This can be done after planting but only during dormant season (Oct. to Mar.) **Avoid getting spray on new trees.** Individual trees may be killed by stem injection with cacodylic acid *(Silvisar)* at a rate of 1 cc per inch of diameter. Some woody species are best controlled with 2,4,5-T, plus 2,4-D (brush killer).
3. New plantings on heavy sod. (When no weed control has been practiced the preceding fall.)	Mow planting rows. Wait for 4 in. of new growth. Treat proposed planting strips with 2 gal. per acre of *Amitrole*[2] in 50-100 gal. of water. Wait 7 to 10 days before planting. Use of furrows should not be necessary. After planting, use 4 lb. of *Simazine* per acre as in control 1. Repeat *Simazine* treatment the following spring if new weeds appear. Mow between rows when necessary. **Alternative:** Mow field strips just before planting. Plant in silt or hole without turning sod. Wait until rain refirms soil around roots. Use directed spray of *Simazine-Amitrole* combination (see control 5).	*Amitrole* is most effective in spring when weeds are actively growing (4-6 in. tall). Thoroughly wet foliage. Use coarse, low pressure (20-30 psi) spray. When new planting areas contain blackberries, fern, sedges or other hard to kill vegetation, use *Paraquat*[4] (4 pt./acre) plus *Simazine* (4 lb./acre) in band spray before planting. Plant as soon as strips are visible without turning soil. Retreat with directed spray of *Amitrol-T* (2 gal./acre) when weeds start to reinvade rows.
4. Projected plantings for following season in heavy sod, particularly quack grass.	Mow proposed planting strips in late summer. After 3-6 in. of new seed growth appears, treat planned planting strips with 4-8 lb./acre of active *Simazine* or 4 lb./acre of *Casoron*[3] in strips 24 to 30 inches wide. Plant following spring in strip. Repeat *Simazine* treatment in fall if weeds start to grow in planted strip.	See No. 1. Mowing may be necessary to control grass between rows. Directed spray of *Amitrole* may be used during growing season as needed. **Keep drift off trees.**
5. Established plantings. Heavy weeds and grasses around trees seriously affecting growth.	Mow, if possible. When weed regrowth begins, use directed spray of *Simazine-Amitrole* combination at rate of 4 lb./acre *Simazine* and 2 gal./acre *Amitrole*. Fall application of 4-8 lb./acre of *Simazine* or 6 lb./acre *Casoron* should clean out row during following season (use high rate on fine textured soils). Wet weed and grass foliage. **For spot treatment:** One cup each of *Simazine 80W* and *Amitrol-T* in 4 gal. water should treat about 1,200 sq. ft. with 8004 *Tee-Jet* nozzle at 30 psi. A non-directed spray of *Amitrole* or *Amitrole-Simazine* combination may be used on hardwoods in spring before buds break dormancy. For growing-season knockdown, use directed spray of *Paraquat* at 4 pt./acre. Add a small amount of liquid detergent (20 drops per gal.) to improve wetting of foliage by *Paraquat*.	**Keep spray containing Amitrole off foliage.** Leaves may turn white and then drop off. Use coarse spray working close to ground and up to stem of trees. Avoid drift. Don't use *Amitrole* on ash. Weed understory in established walnut may be eliminated with dormant season application of 6 lbs./acre *Casoron*. To eliminate water sprouts, lateral branches and basal sprouts, spray with *Paraquat* when they first appear.

[1] *Simazine 80W* (Simazine) is absorbed through root system. It persists in upper layer of soil. **Do not** disturb soil surface after treatment.

[2] *Amitrole* (Amino-triazole) is absorbed mainly through the foliage. It works best when weeds are in young, succulent stage. The effect shows up first as a whitening of foliage (destruction of chlorophyll). Acts slowly — may be a week before reaction is noticed. Commercial concentrates of Amitrol-T contain 21% Amino-triazole.

[3] *Casoron* (Dichlobenil) should be used in granular (4%) form. Four pounds per acre rate requires 100 pounds of granules.

[4] *Paraquat* (Paraquat dichloride) is a contact herbicide. It is absorbed by green foliage, but not translocated throughout plant. There is no active residue, but the concentrated material is toxic and cautions on product label should be carefully observed.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U. S. Department of Agriculture. George S. McIntyre, Director, Cooperative Extension Service, Michigan State University, E. Lansing, Mich.

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