Establish Fuelwood Plantations in Michigan
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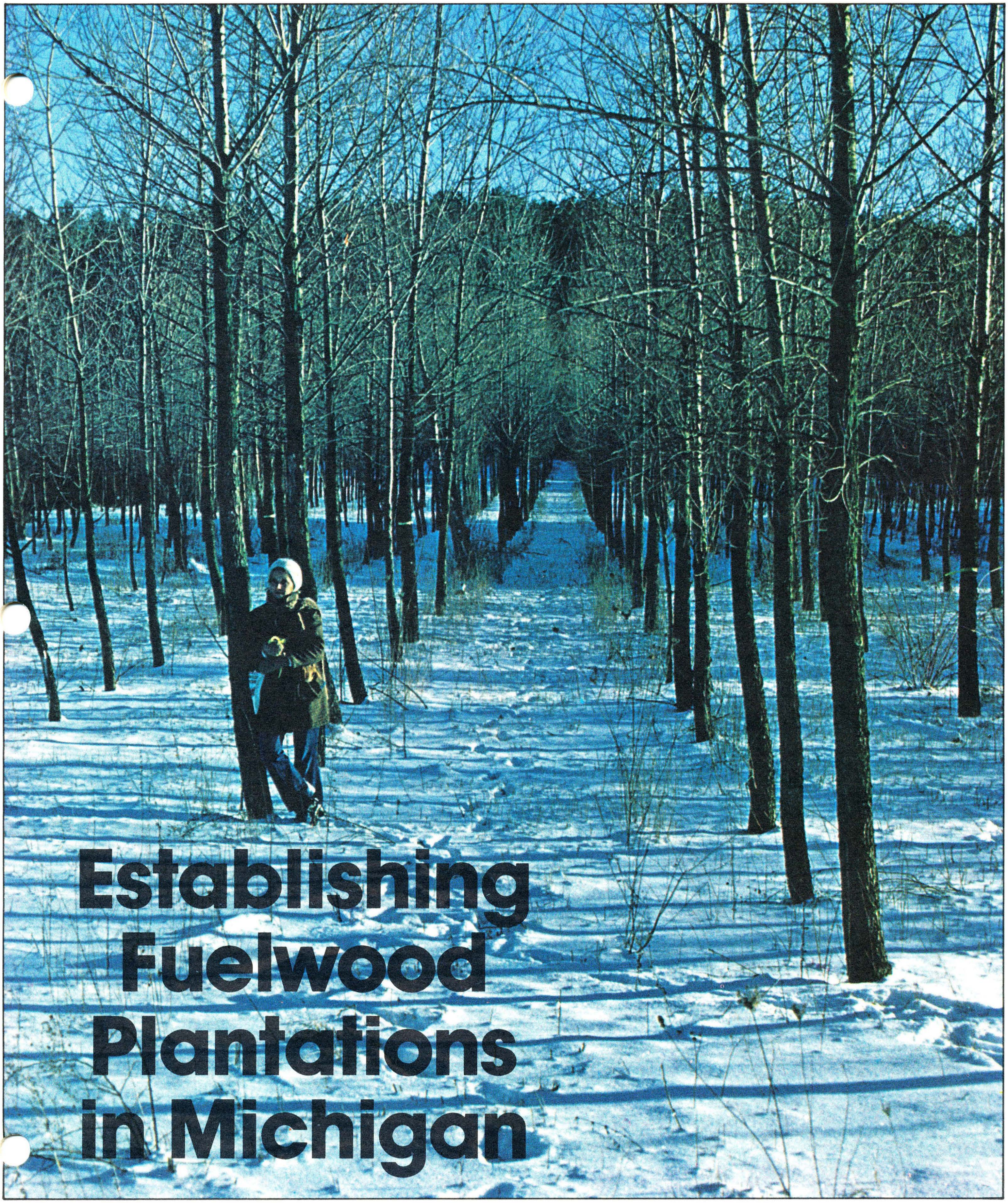

Establishing Fuelwood Plantations in Michigan

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Figure 1. Approximately 12 to 15 face cords of fuelwood are necessary to provide heat for an average-size home during a typical Michigan winter.

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Within the past few years, Americans have become increasingly aware of the importance of energy in their daily lives. Potentially limited reserves of fossil fuels, continual price increases and the threat of an interrupted supply have led to conservation efforts and the development and use of alternative energy sources.

As a result of the "energy crisis" of the 70s, more and more homeowners decided to either replace or supplement their oil- or gas-fueled furnaces with wood-burning units. In 1972, before the OPEC oil embargo, fewer than 200,000 wood stoves were sold annually in the U.S.; in 1979, more than 1.5 million were sold to energy-conscious Americans.

The expanded use of wood for home heating, combined with an increase in industrial consumption of wood fuels, has increased the contribution of wood to the U.S. energy budget from next-to-nothing to nearly that of nuclear energy (1980 data). In addition, the swelling demand for wood stoves has influenced some people to return to a simpler lifestyle.

However, don't be overcome by the romance and nostalgia associated with wood stoves. While offering the potential for significant fuel savings, wood stoves require a lot of work and attention, and are messy, inconvenient and often inefficient. Unless safety precautions are observed, they can be fire hazards. Furthermore, there is concern over smoke-produced air pollution in certain localities.

The increasing cost of fuelwood is currently another concern of the wood stove owner. A wood-burning unit can consume a large amount of wood during the course of a Michigan winter, particularly if it is the only heat source used (Fig. 1). This means that several cords of wood must be purchased or produced annually. As a result, fuelwood supplies in some areas, while adequate, are becoming more expensive as buyer competition intensifies. This is true even in Michigan where wood has always been plentiful. Therefore, unless you own a woodlot, obtaining firewood at reasonable prices may become more difficult in the coming years.

To illustrate, the Michigan Department of Natural Resources issued approximately 1,000 permits for cutting firewood in state-owned forests in 1975; in 1980, more than 32,000 permits were issued. There has also been a significant increase in wood thefts from both publicly- and privately-owned forests.

An alternative to the purchase of high-priced firewood does exist. It is possible to plant and grow your own supplies on a few acres of land. In 10 to 20 years, or less, a plantation of fast-growing trees can produce enough wood to meet the annual needs of an average-sized wood stove or furnace.

Trees to Plant for Firewood

A major factor to consider when selecting trees for a fuelwood plantation is their potential rate of growth. Although nearly any wood can be burned acceptably, fast growing trees will produce the largest volume of wood (Fig. 2) in the shortest period of time. In addition to growth rate, con-

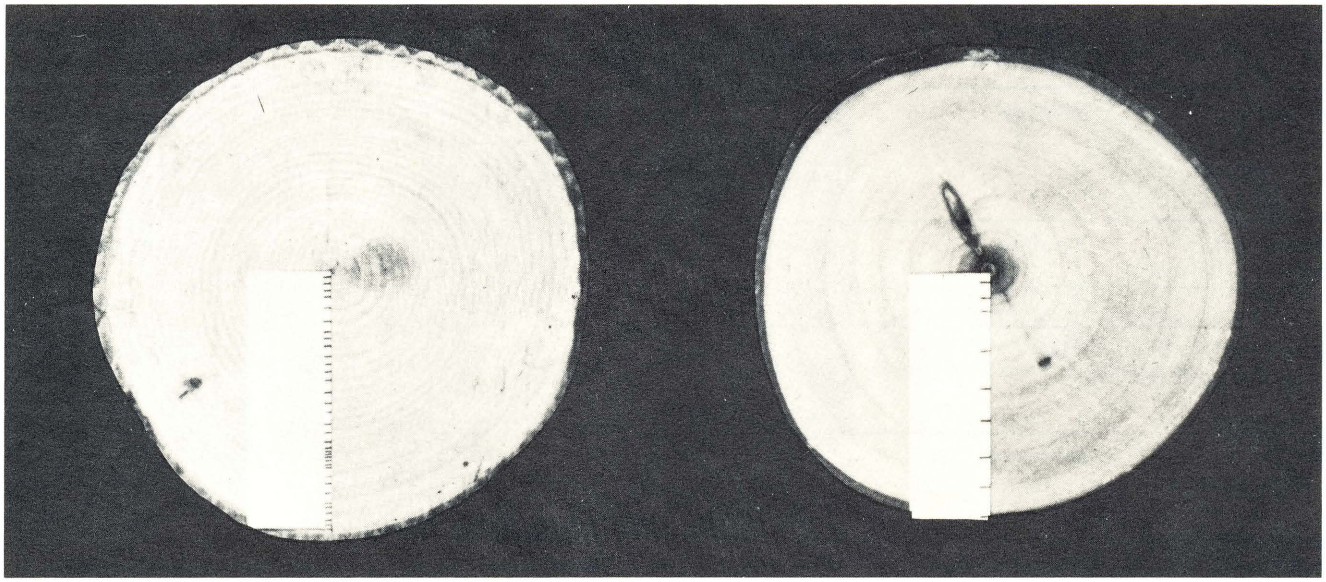

Figure 2. Although these trees were nearly equal in size, the faster growing tree on the right required 23 years less to produce the same amount of wood.

sider density of the wood. Oak or hickory are preferable over less dense woods since they contain more heat value (Btu's) per cord. Unfortunately, most trees that produce a dense wood are relatively slow-growing.

Another important factor to consider is the sprouting ability of the species. Species which sprout well eliminate the need for planting to reproduce the stand. This reduces re-establishment costs and produces more wood in a shorter period of time since sprouts grow very rapidly in the early stages of their life.

Select a species that is hardy and well suited for the planting location. Some trees grow better on certain types of soils than others. Planting the right tree in the wrong location can often ruin the plantation.

The characteristics of tree species suitable for establishing firewood plantations in Michigan are summarized in Table 1. The preferred species include hybrid poplar and cottonwood, both related to the native popple (aspen) (Fig. 3). The rapid growth rate of these trees compensates for their relatively low heat value per unit of volume. When planted on good soils and given proper care, fuelwood harvests can begin in eight years or less, depending on how small a tree you are willing to cut.

If hybrid poplars are planted, it is extremely important to choose the right cultivar or variety. Some of these selections, including "Lombardy," "Androscoggin" or "Kingston," are highly susceptible to canker diseases which will eventually kill the tree. In Lower Michigan, cultivars like "Carolina" (also known as "Norway" or "Eugenii"), "Robusta," "Raverdeau," "Wisconsin #5" or "Crandon" are recommended. In the Upper Peninsula, plant "Carolina," "Crandon," "Tristis #1," "Northwest" or "Balm-of-Gilead."

Figure 3. Five-year-old hybrid poplar plantation. Approximately 4.5 cords of fuelwood per acre is present.

Table 1. Some suggested tree species for fuelwood plantations and their characteristics.

Species	Relative Growth Rate	Million Btu's per Cord	Sprouting	Site Preference	Remarks
Hybrid poplar (*Populus* spp.)	Very Fast	18.7	Yes	Better upland soils, well-drained bottomlands.	The fastest-growing tree you can plant. Most are hardy anywhere in Michigan.
Cottonwood (*Populus deltoides*)	Very Fast	18.7	Yes	Same as hybrid poplar.	Plant in Lower Peninsula only. Use a local source if possible.
Black locust (*Robinia pseudoacacia*)	Fast	37.3	Yes	Will grow anywhere; a nitrogen-fixing tree.	Hardy only in southern Michigan. Locust borer may be a problem.
Red oak (*Quercus rubra*)	Moderately Fast	27.3	Yes	Better upland soils, well-drained bottomlands.	Fastest growing native oak. Hardy anywhere in Michigan. Easy to grow.
English oak (*Quercus robur*)	Moderately Fast	27.0	Yes	Same as red oak.	A very fast-growing oak. Hardy only in southern Michigan.
Sycamore (*Platanus occidentalis*)	Fast	23.5	Yes	Better upland soils and bottomlands.	Hardy only in southern Michigan.
Red or silver maple (*Acer rubrum* and *A. saccharinum*)	Moderately Fast	23.8	Yes	Same as sycamore.	The soft maples. Silver maple hardy only in southern Michigan.
Paper birch (*Betula papyrifera*)	Moderately Fast	20.0	Yes	Same as sycamore.	Hardy throughout Michigan. European white birch can also be used, but it is severely attacked by borers.
Tamarack (*Larix laricina*)	Moderate	23.6	No	Moist upland soils; will also tolerate wet sites.	The only native conifer suitable for fuelwood plantings.
European, Japanese and hybrid Larch (*Larix decidua, L. leptolepis, L. eurolepis*)	Moderately Fast	23.6	No	Better upland soils.	The fastest growing conifer you can plant. Hardy throughout Michigan.

Other recommended species are northern red and/or English oak. Although it will take twice as long to produce trees equal in size to hybrid poplar, the wood will have nearly twice the heat value per cord. English oak planting stock is more difficult to obtain than red oak, although it is available at several Michigan nurseries. The European species grows faster than any native oak, but is hardy only when planted in the southern part of the Lower Peninsula.

Black locust is another rapidly growing species good for fuelwood production. It is well suited for growing on poor soils because of its ability to "fix" atmospheric nitrogen. Black locust's characteristic of spreading rapidly by means of root suckers may make it undesirable, although, if controlled, can help reproduce the stand.

Establishing a Fuelwood Plantation

The first step in establishing a fuelwood planting is location (Fig. 4). You may have little or no choice; however, if you do have a choice, spend a little time reviewing available sites to consider soil and drainage patterns that will minimize future problems. As a general rule, locate plantings on cleared or fairly open land. If a natural stand of trees is present, it is better to manage this stand for continued production of fuelwood (See MSU Extension Bulletin No. E-1486 "Woodlot Management for Fuelwood," free).

Old fields and other abandoned agricultural lands are usually well suited for establishing forest plantations. Most

Figure 4. Choice of planting site is an important factor in establishing a fuelwood plantation. Productivity will be best on loamy textured well-drained soils.

fuelwood plantations do best on a well-drained, medium-textured (sandy loam to silt loam) soil. Avoid planting in a low area where water stands and frost pockets are present, or in deep, sandy soils and on dry ridge-tops. If these sites are all that is available, make certain the most appropriate species are used; e.g. cottonwood or tamarack for low-lying, wet areas, oaks for ridge tops, etc. In some very sandy sites it may be necessary to plant jack pine.

Preparation of the site before planting is essential (Fig. 5). In fact, many of the practices used to prepare soil for agricultural crops will benefit trees. Brush should first be cut and removed, or chemically treated to prevent sprouting. Following this, several alternatives can be followed. The site may be cultivated using farm equipment. On small tracts a garden rototiller is sufficient. Plowed areas should also be disked to further prepare the soil for planting. Several diskings or rototillings done periodically during the summer prior to planting (summer fallowing) will help control weeds.

A second alternative uses chemical herbicides to assist in preparing the site. Applications can vary from treatment of 3-foot diameter spots where individual trees will be planted, 3- to 4-foot wide strips sprayed at appropriate planting intervals across the planting site, or complete coverage of the area. There are advantages and disadvantages to each approach. Spraying spots or strips is more economical because it minimizes the amount of chemical used, can be done with a hand sprayer, and, once the weeds die, provides a distinct pattern that is a guide to later tree planting. On the other hand, if not controlled, weeds from adjacent unsprayed areas may spread rapidly into the treated spots or strips. Complete herbicide coverage reduces this problem, but is considerably more expensive. In addition, soil erosion may develop on steeply sloping sites where complete coverage is present.

The third choice involves cultivation together with chemical weed control. This procedure is probably the most effective alternative. The site is sprayed with herbicides in late summer or early fall of the year prior to planting, either totally or in strips. After the herbicide takes

Figure 5. Tillage of the planting site before planting to remove competing brush, grass and other herbaceous growth will result in greater survival and rapid early growth of the trees.

Figure 6. Place individual cuttings in the soil so that approximately 1-inch of the cutting is above ground level.

effect, the sprayed area is plowed and disked, or rototilled. Not only are existing weeds killed, but soil benefits resulting from tillage are realized.

Several chemical herbicides are available for controlling grass and weed growth. Each has characteristics and requirements which influence its use. For current recommendations contact your local Cooperative Extension Office. Always follow label instructions when using any pesticide.

Planting is a critical stage in the production of a successful fuelwood plantation (See MSU Extension Bulletin No. E-771 "Tree Planting In Michigan"). Use only high quality planting stock (cuttings or seedlings). Hybrid poplars and cottonwood may be planted as either unrooted or rooted cuttings. Stemwood cuttings taken from established trees are suitable as planting stock and should produce large amounts of wood in a fairly short period of time.

To obtain cuttings which will root easily, use large vigorous branches or the lateral shoots of young trees, or take cuttings from young stump sprouts which develop following cutting of larger trees. Plant cuttings in late winter or early spring. Unrooted cuttings should be at least 8 inches long with a top diameter of not less than 1/4 inch. Long, unrooted cuttings up to 6 feet in length (sets) may also be successfully planted. Rooted cuttings which have been grown in a nursery for one year are more expensive but have higher survival rates and more rapid first-year growth.

Species other than poplars and cottonwood are planted as either bare-root or container seedlings. Hardwood seedlings should be at least 1/4 inch in diameter at the root collar, although 3/8- to 1/2-inch is even better. Avoid using smaller stock even if less expensive, since field plantings of smaller stock have resulted in low survival. If you have small stock, line it out in a corner of the garden for a year and provide adequate water and weed control. It will produce acceptable stock for planting the following year.

Seedlings or cuttings can be planted as soon as the soil is free of frost, but generally no later than May 15 in the Lower Peninsula or June 1 in the Upper Peninsula. As a rule, fall planting is not recommended, especially on heavier soil.

Plant seedlings, cuttings, or rooted cuttings by machine or by hand. The normal 8- to 12-inch poplar or cottonwood cutting should be placed in the soil so that no more than 1 inch of the cutting protrudes (Fig. 6). Make sure the cutting is placed in a vertical position with buds pointing upward. Plant rooted cuttings as deep as possible, even if some of the stem is in the ground. Seedlings require more careful handling than cuttings and should be positioned so that the soil level is just above the root collar. Planting in too shallow a hole can result in poor root development. Always firmly pack the soil around the planted cutting or seedling.

Deciding how far apart to plant trees in a fuelwood plantation depends on the eventual tree size desired. If 6- to 8-inch dbh (diameter at breast height) trees are the goal, plant at about an 8 x 8 foot or 8 x 10 foot spacing (680 and 544 trees per acre, respectively). The rectangular spacing allows ready access into the plantation for later cultural operations, including individual tree harvesting. Narrower spacings produce more, but smaller, trees on an acre; wider spacings yield larger diameter, low branched trees. Generally, spacings closer than 6 x 6 feet or wider than 12 x 12 feet are not recommended.

At narrower spacings, you can make a thinning before the final harvest to maintain rapid diameter growth and also yield some small-diameter cordwood. Delaying thinning too long, will substantially reduce the diameter growth of the trees.

Trees which have been planted to produce firewood do not necessarily have to be grown in large, solid blocks. Small clumps can be planted wherever land is available. Single or double lines of trees can be planted in fence rows, along lanes or roads, or through fields and pastures. If more than one line is planted, stagger the trees in adjacent lines and plant them about 8 feet apart.

Protection and Care of Fuelwood Plantations

After trees are planted, keep grass and weeds from around the tree to ensure maximum survival and growth (Fig. 7). Nearly all hardwood species, including those recommended in this publication, require protection from competing vegetation. If grass and weeds are not controlled, high yields will not be produced. Experience has shown that without intensive weed control, hardwood tree plantations generally fail. Control is most critical in the year of planting, although trees will benefit from continued

Figure 7. Control of competing vegetation using either mechanical, chemical or a combination of both is essential if maximum survival and growth is to be achieved.

weed control until their crowns begin to close or until they are at least 10 to 15 feet tall.

Several methods of weed control may be used, alone or in combination. It is best to use mechanical cultivation on sites that have been prepared for planting by plowing and disking or rototilling. Beginning *as soon as weeds reach 2 to 4 inches in height,* complete shallow cultivation with a hoe, disk, cultivator or rototiller, getting as close to the planted trees as possible without injuring them. Cultivate frequently throughout the summer to prevent weeds from taking over in the plantation. If done properly, mechanical weed control can be very effective, although it is expensive and requires considerable labor.

The use of herbicides is another alternative. This approach also begins with proper site preparation. Mechanical tillage or pre-planting application of a broad-spectrum herbicide should control weeds at the time of planting. The main objective is to maintain control with a residual herbicide which prevents weeds from becoming re-established.

Herbicides are available which provide satisfactory control if applied after tree planting but while the trees are still dormant. Usually it is best to delay application for a few days following planting to allow the soil to settle around the trees. Some materials can be sprayed on dormant trees without causing injury. Residual herbicides can be applied in spots around the tree by hand, in strips (banded) along the rows, or broadcast over the entire area. A single herbicide application at the correct rate should eliminate weeds for an entire growing season. If banding or spot treatment is used, periodically mow or plow under weeds in the untreated areas to reduce rodent problems.

Since species' tolerance to herbicides is variable, carefully read the label of any herbicide and follow all recommendations. Some plants, like unrooted poplar or cottonwood cuttings, are quite sensitive to herbicides but vary in their tolerance depending upon age. For all applications, be sure to use equipment calibrated to deliver the proper application rate.

If weeds have been successfully controlled the first year, subsequent weed management is easier. Basically, herbicide recommendations will be similar to those used the first year. If undesirable woody plants (e.g. briars) become established in the area, use materials specifically formulated to control such vegetation. After two to five years, cultivation or chemical applications can be discontinued. However, if you want a more manicured look, mow the undergrowth periodically.

For small plantings (a few acres or less), mulching effectively controls weeds during the first few years. Mulch can consist of perforated polyethylene plastic, shredded bark, wood chips, several layers of newspapers, or other materials.

In addition to grass and weeds, insects, diseases, rodents, deer, livestock and fire can also destroy young tree plantings. Many of these problems can be reduced through proper care. For example, good weed control will also reduce damage by certain insects, diseases, small rodents and fire. Deer can be partially discouraged with repellents, while livestock must be isolated with fencing. Treat insect pests with insecticides only if a severe outbreak occurs. Then, contact your local extension agent for advice on proper chemical treatment.

Fertilization is not recommended during the first year or two after planting because it will either increase weed and grass growth or be lost through runoff or leaching without really benefiting the trees. An exception to this rule is liming highly acid soils (less than pH 5.5) which should be done before planting.

After trees are well established, apply 100 to 200 pounds per acre equivalent of a complete high nitrogen fertilizer (e.g. 12-8-8), especially on soil depleted by previous agricultural cropping. If deficiencies are not indicated by soil analysis, do not fertilize. When fertilizers are necessary, one application during a fuelwood rotation will usually be sufficient, since trees effectively conserve and recycle nutrients. As an alternative to chemical fertilizers, you can plant nitrogen-fixing cover crops (e.g. birdsfoot trefoil, lupine, lespedeza or clover) or shrubs (e.g. autumn olive or alder) between the rows *after* the trees are well-established. This practice greatly stimulates tree growth in some hardwood plantings.

Expected Fuelwood Yields

The production of cordwood from a plantation depends on several factors, including: climate, site quality, tree species, how well the planting has been cared for, and age and size at harvest. Because of the number of factors involved, it is difficult to predict what yields will be obtained from any given situation.

Once a plantation has been established, don't be impatient and harvest too early. Yearly wood growth (called mean annual increment — MAI) increases rapidly early in the life of the stand and then levels off. To obtain maximum production from a plantation, it is best to wait until MAI approaches a maximum. For example, recent studies have indicated that the best hybrid poplar cultivars growing on a good site will have an MAI of about 1 standard cord[1] per acre per year at 7 years of age. However, if left to grow for an additional 5 years, MAI rises to about 4 cords per acre per year, giving a total production of about 48 cords per acre. By waiting 5 years, an additional 41 cords per acre are gained. Not all sites will give this level of production, but the same principle will still apply.

Two hypothetical examples of projected yields from fuelwood plantations will give some additional indications of expected production levels.

Example A: *Hybrid poplar is planted on a medium-quality site. Assume a yearly consumption of 5 standard cords of poplar wood (15 face cords) to fuel an air-tight stove, and the MAI is 1.8 standard cords per acre per year on a 10-year rotation. After 10 years, 1 acre will yield 18 cords. Therefore, by planting ⅓-acre each year for 10 years (3.3 acres total, allowing a little extra land for cushion) and allowing the trees to grow for 10 years, ⅓-acre can be harvested each year which will supply more than the amount of wood required.*

Example B: *Northern red oak is planted on a good-quality site. Assume a yearly consumption of 3 standard cords of red oak wood (9 face cords) to fuel an air-tight stove, and an MAI of 1.4 standard cords per acre per year on a 15-year rotation. After 15 years, 1 acre will yield 21 cords. Therefore, by planting 0.2 acres each year for 15 years (3 acres total, again allow a little extra for cushion), and allowing the trees to grow for 15 years, 0.2 acres can be harvested each year, which will supply plenty of fuelwood.*

These figures are hypothetical and are subject to change with each individual situation. Generally you should be conservative in estimating future yields of fuelwood. In addition, spread plantings out over several years to divide planting costs and create a uniform yearly harvest. However, you may establish larger plantations in one planting and remove wood as needed. With large plantings it is also possible to combine fuelwood production with the growth of trees for sawtimber, veneer or other products. Fuelwood can be produced in the periodic thinnings necessary in such stands.

It is also possible to combine fuelwood production with Christmas tree plantations or agricultural crops. The plantation format is entirely dependent upon the needs and imagination of the individual landowner. To produce high yields, it is most important to plant the right trees on the proper site and provide adequate care.

Conclusion

You have done everything correctly. The trees in your plantation have responded with vigorous growth and, after an appropriate time interval, you have gone to work with your chain saw and splitting maul. Now it is time to stoke the fire and sit back to contemplate the fruits of your labor. Not only are the trees that you planted and nurtured now providing warmth for you and your family, they are also providing you a degree of energy independence from the outside world. That is something OPEC or the oil and gas companies can never take away from you.

[1]*A standard cord is a stack of wood 4 feet wide, 4 feet high and 8 feet long.*

Cover Photo: Production of fuelwood will vary depending on several factors. This 6-year-old plantation of hybrid poplar contains approximately 8 cords per acre.

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