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Recommended Species for Christmas Tree Plantings In the North Central United States  
Michigan State University Agricultural Experiment Station and Cooperative Extension  
Service

Research Report

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# Recommended Species for Christmas Tree Plantings

## In the North Central United States



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Christmas trees are an important agroforestry crop in the North Central states, with approximately 15 million trees harvested annually in the region. Many of these trees are sold within the state in which they are grown. A sizable proportion are sold outside the area, principally to retailers in the southern and eastern sections of the country. While Christmas trees are grown in every state in the region, the greatest production occurs in states bordering the Great Lakes. In recent years, Christmas tree production and marketing have become increasingly competitive. The market for low-quality trees has shrunk; in many areas it is nonexistent. Successful Christmas tree growers must produce high-quality tree Critical to the production of high quality trees is the selection of the proper species and variety to grow - one that will produce a quality marketable tree in an acceptable period of time on

the site where it is planted. Most importantly, there must be a market for the species/variety grown. Many tree characteristics which affect tree quality and the cost of production (e.g., length of production, winter color, stem straightness and pest resistance) vary by species and variety. Selection of the wrong species or variety commonly results in higher production costs and/or lower sale income, resulting in substantially lower profit. At the extreme, inappropriate species or variety selection can result in few or no marketable trees. Successful species and varietal selection for localized areas within the region must also recognize soil, climatic and topographic differences.

Potential planting sites in

the North Central United States are extremely diverse. Soils in the region vary from coarse sands to heavy clays, from very well drained to poorly drained and from extremely deep to very

shallow. Climatic factors such as temperature and precipitation vary throughout the region. Local growing conditions are often modified by topography or the presence of a large body of water.

Such a diversity of planting conditions make it possible to commercially produce a variety of Christmas tree species. However, such diversity requires that the planting conditions at a particular site be evaluated and a suitable species and variety be planted.

As an example, balsam fir is well adapted to moderately well-drained soils in cool, more northerly portions of the North Central region, but will not thrive in the western or southern portions. Similar geographic specificity exists for other species including concolor fir, Douglas fir and Fraser fir. Sensitivity to environmental factors also exists within individual species. Scotch pine is well adapted to all states within the North Central region. However, some

varieties of Scotch pine, such as those originating in Spain (Spanish seed sources), grow well in more southerly locations but can experience severe winter injury when planted in the northern part of the region.

As another example, Douglas fir is susceptible to late spring frost because of its tendency to break dormancy early. However, there is considerable genetic variation in this characteristic and frost damage can be minimized by proper seed source selection.

All of the Christmas trees commercially produced in the North Central region come from one of four main species groups: pine, spruce, fir and Douglas fir. Species commonly planted within each group are listed in Table I. The physical characteristics of each of these species that affect their attractiveness as Christmas trees are presented in Table II.

This publication provides additional information about the major Christmas tree species grown in the North Central region, including varietal characteristics and factors such as growth rate, form, density, color and environmental tolerances. The grower should evaluate all of the factors to determine the species and variety to be planted on particular sites, and the decisions should relate to the grower's entire Christmas tree operation.

## *Pines*

Pines are the most common species group planted for Christmas trees in the North Central United States. They are characterized by a fast rate of growth and adaptation to a wide variety of soils and sites.

**Table I. Species Suitable For Use In Commercial Christmas Tree Plantations In All Or Part Of The North Central Region**

Pine	Spruce	Fir	Douglas fir
Austrian (Black) pine	Colorado blue spruce	Balsam fir	Douglas fir
Eastern white pine	Norway spruce	Fraser fir	
Red pine	White spruce	Concolor (white) fir	
Scotch pine			
Southwestern white pine			

All recommended species are hardy throughout the region. They are easy to establish in plantations; two- or three-yearold seedlings or transplants are commonly used for planting. For the most part, they respond well to cultural practices necessary to produce marketable trees and produce salable trees in the shortest time period (Table IV, p. 11). Foliage density for pines is greater than for most other species, due to needle and branch arrangement and needle length.

### *Scotch Pine*

Scotch Pine (*Pinus sylvestris*), a two-needle pine native to Europe and Asia, is the most widely planted of all conifers grown for Christmas trees (Figure 1). It will grow on a wide variety of soil types but performs particularly well on well-drained sandy loam soils. Most sources of planting stock are hardy throughout the region, but there are exceptions. Southern European sources will generally not grow rapidly or develop into high-quality trees when planted in more northerly areas. Seedlings of several different seed sources are available; needle length, winter foliage color, stem straightness

and growth rate vary considerably. The species responds well to plantation culture including shearing, although considerable effort and attention is required to produce high-quality trees. The popularity of Scotch pine as a Christmas tree has declined. Increased insect and disease problems, a tendency for crookedness in some varieties and changing consumer preference for shorter needled species have all led to decline in the numbers of Scotch pine planted. Nevertheless, its ease of harvesting and excellent shipping and marketing characteristics continue to make it the major species in the wholesale and choose-and-cut market. A number of Scotch pine varieties are available. Distinct differences among the varieties should be considered when selecting the variety or varieties to plant (Table III). For example:

- No matter where they are planted in the North Central region, varieties of Scotch pine from northern Europe generally grow very slowly and have yellow foliage during the winter.
- Southern European varieties of Scotch pine will generally

**Table II. Selected Characteristics of Species Used For Christmas Tree Production**

Species	Fragrance	Color	Stiffness of Twig	Shipping Qualities	Freedom from Pests	Needle Retention
Scotch pine	Good	Excellent to very poor	Excellent	Good	Very poor	Excellent
Eastern white pine	Excellent	Very good	Fair	Good	Fair	Excellent
Southwestern white pine	Excellent	Excellent	Fair	Good	Good	Excellent
Austrian pine	Good	Good to very good	Excellent	Very poor	Fair	Excellent
Red pine	Good	Good	Good	Good	Good	Excellent
Colorado blue spruce	Good	Excellent	Excellent	Fair	Fair	Good
Norway spruce	Good	Good	Good	Very good	Fair	Poor
White spruce	Poor	Very good	Very good	Good	Good	Fair to poor
Fraser fir	Excellent	Excellent	Good	Excellent	Very good	Excellent
Balsam fir	Very good	Very good	Fair	Excellent	Very good	Very good
Concolor fir	Very good	Very good	Good	Excellent	Very good	Very good
Douglas fir	Very good	Excellent	Fair	Excellent	Very good	Very good

not grow rapidly or develop into high-quality trees when planted in more northerly areas.

- A number of Scotch pine varieties produce crooked stems, an undesirable characteristic in a Christmas tree. Such varieties would not normally be selected unless they have other desirable characteristics for marketing purposes, such as short needles.

- There are distinctive characteristics of different Scotch pine varieties, such as needle length, color and overall appearance, that appeal to a grower's individual

preference or have marketing appeal.

Often, the selection of a particular variety of Scotch pine to plant is a compromise' selecting the variety with the desired characteristics that has the fewest undesirable traits. When purchasing seed and/or seedlings from seed distributors or nurseries, it is essential that the authenticity of the source (varieties) be established. In recent years, much seed has been sold which misrepresents the original geographic origin of the species. Efforts to correct this situation have been made

by some nurseries, and seedling stock of certified seed origin is now available.

In addition to the geographic origins identified in Table III, some nurseries offer seedlings of "local origin" or proprietary varieties. Some of these named varieties represent original European sources that have been renamed by local nurseries. Others are seedlings produced from a particular "local" seed orchard. Still others are specific selections that have been based on genetic and tree improvement research. Some proprietary varieties are excellent; others, because of the original seed

**Table III. Selected Characteristics of Scotch Pine From Different Geographic Seed Origin**

Ecotype - Variety	Growth Rate	Needle Length	Winter Color	Stem Straightness	Winter Burning Sensitivity	Insect Disease Susceptibility	Other Comments
<b>Scandinavian - Baltic Siberia</b>							
- Northern Finland, Northwestern Siberia	Extremely slow	Short	Very yellow	Excellent	None	Average	Very hardy
- North Central Scandinavia	Slow	Medium	Yellow	Excellent	None	Average	Very hardy
- Southern Norway, South Central Sweden, Finland	Slow	Medium	Yellow	Excellent	None	Average	Very hardy
- Southern Sweden, Latvia	Moderate	Medium	Yellow	Excellent	None	Average	Includes the common variety "Riga"
- Southern & Western Siberia	Slow	Medium	Very yellow	Very Good	None	Average	
<b>Central Europe</b>							
- Northeastern Poland	Moderate	Medium	Yellowish	Good	None	Average	
- Eastern Germany, Czechoslovakia, Romania		Medium	Slightly yellow	Average	None	Average	Trunk sweep is common
- Western Germany, Northeastern France, Belgium, Western Hungary, Northern Italy	Rapid	Medium	Generally to long	Slightly green	Slight crooked	Average	Most rapid growth - tops difficult to control
- Surrey, England	Moderate	Medium	Generally green	Average	None	Average	Includes the common variety E. Anglia
<b>Southeast Europe</b>							
- Greece, Bulgaria, Georgia, Former Soviet Union, Turkey	Moderate	Short to medium	Green	Somewhat crooked	None	Average	Trees generally are coarse textured - green color
<b>Western Europe</b>							
- Scotland	Moderate	Medium	Green	Good	None	Average	Slight tendency for terminal forking
- Central Massif of France	Somewhat slow	Short	Green	Poor	Slight	Average to high	Bluish foliage color - large stems
- Northern Spain	Moderate	Short	Green	Good	High	High	High needlecast susceptibility

source, produce low-quality trees even with the best of cultural practices.

## Eastern White Pine

Eastern white pine (*Pinus strobis*) is a five-needled pine native to southeastern Canada, the Lake States and northeastern United States south along the Appalachian mountains and plateau to northern Georgia (Figure 2). In recent years, plantings of eastern white pine for Christmas tree production have increased in response to increased consumer demand and as a marketing alternative to Scotch pine.

Eastern white pine is noted for its rich green to blue-green color (depending on seed source) and fragrant aroma. Branches are relatively weak and do not support numerous or very heavy ornaments. It responds well to shearing, although timing is more critical than with other conifers, and at maturity can be a very attractive, full tree. It holds its needles well and is quite resistant to premature drying.

Eastern white pine will grow on a wide range of sites, but best growth will occur on moist, well-drained soils (Table IV). It will not tolerate as droughty a site as Scotch pine. It has traditionally been considered the pine most suited for sites with seasonally wet, heavier soils. It is still suited for such sites in areas of the North Central region where white pine root decline (*Verticicladiella*) is not a problem. Where root decline is a problem, eastern white pine should not be planted on seasonally wet sites (the wet end of soils classified as somewhat poorly drained or wetter).

Available nursery stock usually is grown from seed collected either in the Lake States or the Southern Appalachian region. Trees produced from Southern Appalachian seed sources generally have longer, bluer needles; better second year, needle retention; more drooping (pendant) foliage and faster growth than Lake States sources. "Typical" Southern Appalachian seed source eastern white pine has a very distinct look; some growers and consumers like it, others do not. Lake States seed sources in general are hardier and less vulnerable to winter drying, especially important in northern parts of the region. Growers in some areas of the North Central region have observed that at least some Southern Appalachian sources set fewer buds, have "wilder" tops and are more difficult to shear into a quality tree.

## Southwestern White Pine

Southwestern white pine (*Pinus strobiformis*), also called border pine, is a native of the mountainous regions of Arizona and New Mexico (Figure 3). It can be found in some choose-and-cut plantations in the region, but it is not a major species in the wholesale industry.

Southwestern white pine is a five-needle pine very similar to eastern white pine except its needles are usually shorter, darker and bluer. Its branches are somewhat stiffer and it grows slightly more slowly. Its site requirements are similar to eastern white pine, although it seems to prefer a slightly better drained soil (Table 4).

Southwestern white pine does not respond nearly as well to shearing as eastern white pine,

i ~ and  
it is often difficult to produce a quality tree with uniform density and full foliage.

Seedlings produced from seed collected anywhere within the natural range of southwestern white pine appear equally suited for Christmas tree production. To date, research has not identified any individual seed source as "better suited." It is important, however, to be sure to obtain *Pinus strobi formis* seedlings.

## Other Pines

Several other pines are occasionally grown by producers. Two of the more common are red pine (*Pinus resinosa*) and Austrian or black pine (*Pinus nigra*). Red pine is a two-needle pine native to the northeastern United States and eastern Canada, where it is commonly found growing on the coarser well-drained to excessively well-drained soils. On fertile soils, red pine needles are a deep green and three to five inches long. Red pine is difficult to shear and shape into a quality, uniformly dense tree, and does not have wide consumer appeal. Most Christmas tree producers in the region will not find red pine a desirable species to plant. Some choose-and-cut operations, particularly in the northern part of the region, may wish to include a small number for variety.

Austrian pine, a native of northern Europe, is a twoneedle pine with dark green, very stiff needles which average four to six inches in length (Figure 4). Austrian pine is also difficult to shear and shape into a quality, uniformly dense tree, although less so than red pine.

Currently, Austrian pine does not have wide consumer appeal as a Christmas tree but is grown by some wholesalers for sale to the nursery and landscape industry and by some retailers for sale as a dug Christmas tree.

## Spruces

Spruces have commanded and continue to command an important portion of the Christmas tree market. Historically, white spruce and Norway spruce were the major species. Today Colorado spruce is more important. Characteristically, spruces are more site demanding and slower growing than most pines. Their short, single needle foliage is somewhat stiff; their thick, stout branches support heavy ornaments. While the needle retention of cut trees is not as good as for pines, their pleasing symmetry and appearance have helped maintain their popularity. They have been widely, planted throughout the region, reflecting their adaptation to several different sites and soil types. They respond well to plantation cultural practices necessary to produce high-quality trees.

## Colorado Blue Spruce

Colorado blue spruce (*Picea pungens*), also called Colorado spruce or blue spruce, is a Rocky Mountain species that has been widely planted throughout the eastern United States for ornamental as well as Christmas tree purposes (Figure 5). Its naturally pleasing symmetry and attractive blue foliage have

made it an increasingly popular Christmas tree. Needle retention by cut trees is the best of all spruces. In some seed sources, the stiff Y4 to 1Yinch long needles are powdery blue in color, while seed collected from other sources results in trees with colors ranging from dark green to light blue. The short, stiff foliage and rather rigid branching habit; which make for difficult handling, do not appear to decrease its popularity. Colorado blue spruce is thought of as a relatively slow growing, long-rotation Christmas tree species. Growth is usually slower than that of either Norway or white spruce: However, Colorado blue spruce can grow surprisingly fast when quality transplants are planted and plantations are properly managed and include effective weed control and fertilization. Although adaptable to a wide variety of sites, growth is usually most rapid on well drained sandy loam to silty barn soils (Table 4).

Colorado blue spruce will tolerate heavier and wetter soils than many other Christmas tree species. In some areas it may be the only high-quality single-needle conifer that will grow, on the lower, wetter sites with heavier soils. On many sites, including those with coarse, sandy soils, Colorado blue spruce will require fertilization to obtain the desired growth and color. Recommended seed sources include selected locations in Colorado, Arizona and New Mexico. Several origins have been identified because of a particularly desirable characteristic such as color. These origins are often named

to identify the desired trait, and are available and marketed through individual nurseries.

## Norway Spruce

Norway Spruce (*Picea abies*), a native of Europe, is best known for its prominence around farmsteads throughout the midwestern United States (Figure 6). Its dense, pendulous branches and foliage have made it a component of many windbreaks where it contributes to reducing winter winds and accumulated snow. It is also common in parks and cemeteries, due to its attractive shape and easy culture. Needles on Norway spruce are dark green and range from X to 1 inch in length. Trees achieve acceptable growth rates when planted on a wide variety of soils (Table 4). Like most spruces, growth in the first few years following planting is slow; once established, growth can be quite rapid.

The popularity of this species for Christmas tree production has declined considerably because of its coarse appearance and poor needle retention once cut. Aside from limited local markets, it is not recommended for commercial Christmas tree production. When Norway spruce is grown for a cut Christmas tree, harvesting should be done as late as possible.

## White Spruce

White Spruce (*Picea glauca*), native to the northern Lake States and southern Canada, has been widely planted for Christmas tree production in the past (Figure 7). Its attractive natural shape, short stiff needles ( X- to Y4- inch) and

# Recommended Species for Christmas Tree Plantings In the North Central United States



Characteristic Scotch pine  
needle/twig pattern.



Figure 1. Scotch pine represents the most widely planted species throughout the North Central region. When managed intensively, marketable trees can be produced within 7 to 8 years.

Figure 2. Eastern white pine responds well to shearing to produce an attractive tree with uniform foliage. Its soft foliage and symmetrical branching habit contribute to its pleasing shape and popularity.





Figure 3. Southwestern white pine is characterized by attractive blue-green foliage. It is not widely planted because of difficulty in developing trees with full, uniform foliage.



Figure 4. Austrian pine can be managed to produce an attractive Christmas tree. Its stiff foliage and strong branches make it particularly desirable for flocking.



Figure 5. Colorado blue spruce is widely planted throughout the region. Its attractive foliage and pleasing natural symmetry contribute to its increasing popularity as a Christmas tree.



Characteristic Colorado blue spruce needle/twig pattern



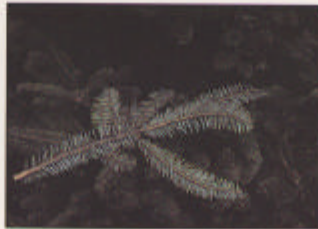
Figure 6. Norway spruce has been widely planted for ornamental purposes. Its popularity as a Christmas tree has declined due to poor needle retention.



Figure 7. White spruce has attractive foliage and a pleasing natural shape. While popular in some choose-and-cut operations, it is less commonly planted for the wholesale market.



Figure 8. Spartan spruce is new in the Christmas tree industry. This hybrid between Colorado blue spruce and white spruce is characterized by the bluish color of blue spruce and the soft foliage and faster growth rate of white spruce.



Characteristic Fraser fir needle/twig pattern.



Figure 9. Fraser fir has become an increasingly popular Christmas tree in the past several years. Its attractive foliage, fragrant aroma and excellent needle retention characteristics have contributed to increases in annual plantings.

Figure 10. Balsam fir has long been the traditional Christmas tree in northern areas of the United States. This native species grows well in plantations where management provides adequate fertility and freedom from competing vegetation.



Figure 11 Canaan fir has been successfully established in plantations in portions of the North Central region. It is well adapted to somewhat poorly drained soils and to areas where late spring frosts occur.



Figure 12. Concolor or white fir grows well in plantations if effective weed control is present. Its long, silvery-blue needles, combined with excellent fragrance, contribute to its increasing popularity.



Characteristic Concolor fir needle/twig pattern



Figure 13. Douglas fir of Rocky Mountain seed origins will grow satisfactorily in many areas of the North Central states. It is characterized as a symmetrically shaped tree which has soft, fragrant foliage.



Characteristic Douglas fir needle/twig pattern.

excellent blue-green to whitish blue-green color have undoubtedly contributed to its popularity. It is, however, not being planted as widely as in the past; primarily because of poor needle retention. Needle retention by white spruce is better than Norway spruce, but still not satisfactory for most consumers. White spruce will grow, on a fairly wide range of sites, including those with somewhat poorly drained soils, but develops best on well-drained upland loam to silt loam soils (Table IV). Although results from seed source trials are limited, plantings in the northern North Central region will probably be most successful using seedlings and transplants grown from southern Ontario sources. However, white spruce seedlings and transplants from identified seed sources are not common. As a result, growers generally plant and produce satisfactory trees from whatever planting stock is available. One common use source of white spruce is Black Hills spruce, named for the outlying white spruce population in western South Dakota.

## Other Spruces

Several other species of spruce which have been used for Christmas tree production; including black spruce (*Picea mariana*) and Serbian spruce (*Picea omorika*). Black spruce; native to the wetter sites in the northern Lake and New England States and Canada, resembles white spruce but has shorter needles and smaller cones. Black spruce was planted extensively for Christmas tree production at

one time, but little is planted today because of its slow growth rate and strong tendency to lose needles once, cut. Serbian spruce (*Picea omorika*), a native of southern Europe, is a well-shaped spruce with relatively soft needles which are green above and bluish below, somewhat limber branches, and often a slightly drooping appearance. It has been more widely planted for use as an ornamental than as a Christmas tree. Like most short-needled spruces, needle retention on cut trees is fair, to poor. Spartan spruce (*Picea glauca x pungens*), a hybrid between Colorado blue spruce and white spruce, is a recent introduction to the-Christmas tree industry (Figure 8): This hybrid combines the color and needle- retention of Colorado blue spruce with the growth rate, form and soft foliage of , white spruce. Although considerable variation within the hybrid exists, planting stock is available commercially and commercial Christmas tree plantations have been established.

## True Firs

All of the true firs planted for Christmas tree production in the North Central region. have soft, flattened (in crosssection) needles which are borne singly along the sides of twigs and branches. Firs are characterized by a pleasing fragrance and a natural; symmetrical, cone-shaped form. Needle length- varies with species, ranging from inch to 2 inches. Foliage color is variable by species and within some species, and

includes dark green and gray-, silver- or bluish-green. As a group, firs are well suited to moderately fertile to fertile, well-drained soils on upland sites. All species need relatively high soil fertility and may require fertilization to produce acceptable growth and quality. All species but balsam require a well-drained soil. Balsam (including Canaan) grow best on well-drained soil, but will perform reasonably well on moderately well drained and better drained to somewhat poorly drained soils. Most of the firs are also susceptible to late spring frosts and should not be planted where air drainage is poor or in "frost pockets."

## Fraser Fir

Fraser Fir (*Abies fraseri*), sometimes called southern balsam fir, is native to high elevations in the central and southern Appalachian mountains from Virginia to Tennessee (Figure 9). Typical needles are X- to Y4inch in length, dark green on the upper surface and silver to bluish on the lower surface (caused by the presence of two white bands): Branches are moderately stiff. Like balsam fir, Fraser fir produces a pleasant ".balsam" odor. Fraser fir can be successfully grown throughout much of the North Central region, although in the southern part of the region it may be limited to the cooler, moister northto-east-facing slopes. Site selection is critical for Fraser fir; it requires 'a well-drained soil (Table 4). It will not tolerate wet soil conditions, even for a short period of time. Similarly, it does not tolerate dry or droughty conditions

well. Plantings of Fraser fir should, therefore, be limited to sites which are not excessively exposed and which contain loam or heavier, well-drained soils. Fraser fir has excellent winter hardiness with a tendency to break dormancy late in the spring, thereby avoiding some of the frost problems associated with other firs.

Few variations in characteristics such as growth have been identified due to seed origin. Greater survival, better growth and higher quality trees will be produced if large transplants are used to establish plantations. Transplants should be at least 2-2 or 2-3, with good stem caliper and well-developed root systems.

## Balsam Fir

Balsam Fir (*Abies balsamea*) is native throughout much of Canada, the Lake states, Pennsylvania, New York and the New England states (Figure 10). In the northern portion of the region, it grows with white spruce in natural stands on upland sites. In southern portions of its natural range, it occurs around the edges of swamps and in river floodplains. Balsam fir resembles Fraser fir in appearance and form. The individual needles tend to be lighter in color, often with a blue cast on the upper surface, and they lack the distinct white banding on the underside (Figure 10).

Balsam fir has enjoyed widespread popularity as a traditional Christmas tree. In the past, many trees were harvested from natural stands.

Today it is an important plantation species, but is recommended only for the northern portions of the region: Balsam fir begins growth early in the spring. In the southern part of the region, it will repeatedly be killed back by late spring frosts.

Balsam fir growth and development is acceptable on well-drained and moderately well-drained soils. As with Fraser fir, large transplants (at least 2-2 of 2-3) should be planted. Balsam fir responds well to fertilization; effective weed control is essential for high-quality trees. .

Stock that has been produced from local sources is recommended. Selections reflecting needle configuration, color and natural form are available. Most of these selections have resulted from species improvement work in New England and adjacent areas of Canada, but this stock is adapted to North Central region conditions.

## Canaan Fir

Canaan fir-1 (*Abies balsamea* var. *phanerolepis*), also sometimes called West Virginia fir, is found in the mountains of West Virginia and Virginia (Figure 11). There is evidence to suggest that, during the last glacial period (Pleistocene), a continuous fir population existed from Canada south along the Appalachian, mountains to Tennessee and North Carolina. As the climate warmed, firs in the Appalachian mountains were replaced by other species at the lower elevations, isolating

balsam fir to the north; Fraser fir at higher elevations in parts of Virginia, Tennessee and North Carolina; and Canaan fir at higher elevations in parts of Virginia and West Virginia. As would be expected, Canaan fir is quite similar in appearance to balsam and Fraser fir. Some trees look very much like balsam fir, while others look like Fraser. Most have characteristics that grade between balsam and Fraser. In general, the needles of Canaan fir are bluer and often somewhat longer than those of Fraser fir.

Canaan fir has two extremely important characteristics. It will tolerate wetter soils than Fraser fir and it appears to be more resistant to spring frost injury than either balsam or Fraser fir. Research and grower experience suggest that Canaan fir can be grown on well-drained, moderately well-drained and imperfectly drained soils. These two characteristics make Canaan fir a possible species for planting on the less than well-drained soils in the southern North Central region - soils too wet for Fraser fir and where balsam fir is repeatedly damaged by spring frost.

## Concolor Fir

Concolor or white fir (*Abies concolor*), native to the mountainous and northern regions of the western United States, is characterized by long silver-blue needles (lid to 2X inches long) which grow in an upswept position along the twigs and branches (Figure 12). Needle retention, natural tree form and fragrance are excellent, contributing to the

reputation of concolor fir as a premier Christmas tree species. Concolor fir will grow best in the northern parts of the region, although it will survive and grow in other areas. Although growth rates are thought of as slow, this often reflects poor site selection or inadequate cultural practices rather than inherent characteristics of the species. Like other firs, concolor fir grows best on fertile, well-drained soils. Its tendency to break dormancy early in the spring makes it susceptible to late frosts. Areas with poor air drainage and low frost pockets should be avoided when planting concolor fir.

For plantings in the region, transplants (2-2 or 2-3) grown from seed from central Arizona sources have been shown to develop into quality trees. These trees tend to grow faster than trees from other regions and are less susceptible to winter injury than trees from more southerly sources. Trees from more northern sources have not grown as rapidly when planted in the eastern United States.

## Other Firs

Several other true fir species suit Christmas tree production on the better sites in the region. They include noble fir (*Abies procera*) and grand fir (*Abies grandis*) from the western United States, Nordmann fir (*Abies nordmanniana*) from Asia Minor and Nikko fir (*Abies homolepis*) from Japan. Acceptable planting stock is not readily available for these species, but a few nurseries offer limited amounts of stock. Growers are advised to

evaluate these species on a small scale before undertaking the establishment of large plantations.

## Douglas Fir

Douglas fir (*Pseudotsuga menziesii*), is not a true fir, but a fir-like species native to a broad geographic area in the western United States and Canada. In the North Central United States, when grown on good sites with intensive management, Douglas fir can develop into a premier Christmas tree with very high consumer appeal. Its Y4- to 134inch flattened, flexible needles are borne singly along the slender twigs and tend to be dark green above and pale green to bluish on the underside (Figure 13). Needle retention by cut trees is excellent. Prominent, pointed, reddish-brown terminal buds assist in identification. When grown in the North Central region, Douglas fir is a very site demanding species and one of the most challenging to grow. Best survival and growth will be obtained on medium textured, well-drained soils (sandy loam to silt loam) with moderate to high fertility. While Douglas fir can be grown successfully on some sites with soils classified as somewhat excessively drained, it does not tolerate either excessively wet or dry soils, nor does it perform well when planted in heavy soils. Under most conditions, moderately well-drained soils will be too wet for acceptable performance.

Douglas fir is sensitive to late spring frost injury and should not be planted in frost pockets or areas with poor air drainage.

"Orchard-type" sites are ideal, with north- to east-facing slopes preferred. Successful plantations have been grown on other slopes.

Intensive management is necessary to grow quality Douglas fir Christmas trees. Good weed control is essential. Fertilization prior to planting may be necessary on some sites. Fertilization to improve growth, color and density may also be necessary or desirable on many sites. Douglas fir responds well to shearing. They are well formed with densities in excess of ninety percent. Improper management will result in poor survival, slow growth and very low-quality trees. Few tree species penalize growers for lack of proper management as much as Douglas fir.

Geographic seed origin is extremely important when selecting Douglas fir planting stock. Seedlings grown from seed collected from the West Coast are unsuited to conditions in the North Central region. Among interior sources there is considerable variation in growth rate and susceptibility to spring frost. Seedlings grown from seed collected in southern Colorado, Arizona and New Mexico are generally suited to the region. Many of these southerly seed sources are named after national forests. In the northern part of the region, seedlings grown from seed collected in northern Idaho and British Columbia grow almost as fast and are less susceptible to frost injury. With all of these seed sources, rotations of 7 to 9 years are possible, whereas rotations approaching 20 years may be necessary using other seed sources. It is

**Table IV. Site And Cultural Aspects Which Should Be Considered When Selecting Species For Christmas Tree Plantings**

Species	Site Characteristics (Requirements)					Average Length of Rotation (yrs)
	Soil Type	Soil Drainage	Air Drainage	Drought Tolerance	Fertility Requirements	
Scotch Pine	Sand to Loams	Moderate	Moderate	Good	Low	7-9
Eastern White Pine	Sandy Loam to Clay Loam	Moderate	Moderate	Fair to Good	Moderate	7-8
Southwestern White Pine	Sandy Loam to Clay Loam	Good	Moderate	Fair to Good	Moderate	8-10
Austrian Pine	Sand to Loams	Good	Moderate	Good	Moderate	7-9
Red Pine	Sand to Sandy Loam	Good	Moderate	Good	Moderate	7-9
Colorado blue Spruce	Sandy Loam to Clay Loam	Moderate	Moderate	Good	High	8-12
Norway Spruce	Sandy Loam to Clay Loam	Moderate	Moderate	Good	Moderate	8-10
White Spruce	Loam to Clay Loam	Moderate	Good	Good	Moderate	8-11
Spartan Spruce	Sandy Loam to Clay Loam	Good	Good	Good	High	8-10
Fraser Fir	Sandy Loam to Clay Loam	Excellent	Moderate	Poor	High	8-12
Balsam Fir (including Canaan fir)	Sandy Loam to Clay Loam	Moderate	Good	Poor	High	8-12
Concolor Fir	Sandy Loam to Clay Loam	Moderate	Excellent	Poor	High	8-12
Douglas Fir	Sandy Loam to Clay Loam	Excellent	Excellent	Poor	High	8-12

recommended that transplant stock (2-1 or 2-2), rather than seedlings, be used when establishing Douglas fir for Christmas trees.

## A Final Word

The species discussed in this publication offer the Christmas tree grower in the North Central region a large selection from which to choose. While individual species characteristics should be considered for marketability and consumer demand, it is most important that growers match individual species

and/or varieties with the sites and soils available. If more than one species is adaptable to a particular site, species characteristics can determine which should be planted. The information in Table IV provides general guidelines to species:site relationships. Although a particular species can be grown on sites other than those identified,- under most circumstances, the survival, growth and/or tree quality will be diminished. Growers are encouraged to experiment to determine suitable property sites for producing a particular species.

Sites with characteristics just outside the recommended range are sometimes suitable. Such experimentation, however, should be done on a small area. To remain competitive in the natural Christmas tree industry, it is essential that growers produce trees of the highest quality. Correctly matching species and/or variety to site characteristics is an important step in achieving this objective.



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