

Matching Species to Site – Some Considerations

(Part 2 of 2)

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In the last issue of the *Great Lakes Christmas Tree Journal* (Volume 17, #2), I had the opportunity to identify the concept of site as applicable to the production of Christmas trees. Site was defined as the composite expression of several variables related to climatic, topographic, and soil conditions which influence the capacity and potential of a given area (location) to produce Christmas trees. Specific aspects considered ranged from temperature and elevation extremes to both physical and chemical characteristics of soils. To illustrate the importance of site with respect to growing plants (trees), the reason banana plants can not be grown in northeastern North America is due to an unfavorable site characteristic related to extended periods of below freezing temperatures. Other climatic factors may be a contributing factor as well.

This article is obviously not concerned with banana production but rather with the production of commercial Christmas tree species in the northeastern United States and adjacent Canada. While there are many components of site that are equally favorable throughout the region, there are some components that will limit or prevent the growth and production of all species throughout all locations within the region.

Common Species Cultivated For Christmas Tree Production

Commercial Christmas tree production throughout the region is generally limited to species in four main genera. These are: *Abies sp.*, the true firs, *Picea sp.*, spruce, *Pinus sp.*, pines and *Pseudotsuga sp.*, Douglas fir. All genera with the exception of Douglas fir, include more than one species that are planted and cultivated as Christmas trees. Some characteristics of each of these genera, together with the specific species most commonly planted as Christmas trees in the region, will be considered.

Abies sp. – true firs

Nine species of true firs are native to North America. All native species are indigenous to northern latitudes or to alpine locations. Firs typically grow where average daily summer high

temperatures are relatively cool. Most are not highly tolerant of drought and prefer locations where summer precipitation is adequate. Most true firs are very tolerant of below freezing winter temperatures and thrive in mountainous regions where a heavy snowpack is common. The most common species of true fir grown in eastern North America for Christmas trees include Balsam fir, Canaan fir, a sub-species of Balsam, Concolor or white fir which is native to the Rocky Mountains in the western United States and Canada, and Fraser fir, a species native to the southern Appalachian Mountains in the United States.

Picea sp. – spruce

Of the 7 species of spruce native to North America only two or three are planted as Christmas trees. These include Colorado blue spruce, native to the Rocky Mountain region, white spruce, native to much of Canada and the upper Midwest including the Lake States, and Black Hills spruce, a sub-species of white spruce native to the Black Hills region of South Dakota. Norway spruce, a species native to Europe is occasionally planted by smaller choose-and-cut producers due to location related site issues that limit the ability to grow other more popular Christmas tree species.

Pinus sp. – pines

Some 49 different species of pine are native to North America. However, only one native species, eastern white pine, is planted for commercial Christmas tree production. The pine species most widely planted is Scotch pine (*Pinus sylvestris*), a species native to Europe and parts of Asia. Plantings of Scotch pine have decreased in the past several years due to the increasing popularity of true firs. A few choose-and-cut growers may plant a couple of other pine species such as native red or Norway pine (*Pinus resinosa*), and Austrian pine (*Pinus nigra*), although markets for these long-needed species are limited.

Pseudotsuga sp. – Douglas fir

Native to the Pacific coastal region of the United States and adjacent Canada, and to the Rocky Mountain region of the United States, Douglas-fir is a monotypic genus. This means there is only one recognized specie. Douglas-fir was discovered by David Douglas and has been known by several different names. At various times it has been called a pine, a hemlock or even a spruce. Additionally, it is not a true fir (*Abies sp.*). The Latin name of the genus, *Pseudotsuga*, actually means false hemlock. Douglas-fir was recognized as a distinct species in 1867.

Figure 1. Five-year-old stand of Canaan fir growing well on site with clay loam soil. The soil is too heavy for Fraser fir.

There are three recognized varieties of Douglas-fir that are native to North America. These are coastal Douglas-fir (variety *menziesii*), which grows generally west of the Cascade Mountains in the United States and in British Columbia. The variety (*glauca*) grows in the Rocky Mountains from eastern British Columbia south to northern Arizona. The variety *lindleyana* grows in the mountains of central Mexico. In the northeastern United States and adjacent Canada, only trees of Rocky Mountain seed origin are hardy.

Characteristics of Individual Species as Related to Site Considerations

Of the several species identified in this article as suitable for Christmas tree production, there are only a few which can be produced in all locations in the northeastern United States and adjacent Canada. The remaining species have one or more requirements related to site that restricts or limits production. The previously identified species will be

considered alphabetically on an individual basis by genera.

THE TRUE FIRS. (*Abies sp.*)

Balsam fir (*Abies balsamea*) is widely planted throughout the region, although it is more popular with growers in New England, Quebec, and the Maritime provinces. Some site related observations about the species include:

- Breaks dormancy early in the spring thus should not be planted in locations prone to late frosts.
- Can tolerate a partially shaded location.
- Is a preferred species for deer antler rubbing.
- Can tolerate heavier and wetter soils than other true fir species.
- Does not grow well on drouthy soil.
- Not related to site, but it is quite susceptible to balsam twig aphid.

Canaan fir (*Abies balsamea* variety *phanerolepis*) is a relatively new species in the Christmas tree industry.

Although the sub-species has been identified for some time and is sometimes referred to as bracted balsam due to extended scales on the cones. However, Bracted Balsam fir is distributed throughout the natural range of Balsam fir from southern Quebec and the Maritime provinces to West Virginia.

All Bracted Balsam fir is NOT Canaan fir. Canaan fir is Bracted Balsam fir, the seed of which is collected from trees in the Canaan Valley of West Virginia, or from seed orchards of established trees that were started from seed collected from selected trees in the Canaan Valley. The climatic and topographic features of the Canaan Valley make it unique, thus the native vegetation has some unique characteristics. The elevation of the Valley is some 3200 feet above sea level. Average summer high temperatures are in the 70's F., and average winter snowfall is approximately 130 inches. The length of the typical growing season is approximately 95 days. It is from this region that



Figure 2. Concolor fir growing on a small hill in an otherwise mostly Fraser fir plantation. The small difference in elevation allows Concolor to avoid damage from late spring frosts.

authentic Canaan fir originates. Canaan fir is a unique sub-species that has allowed areas of the northeastern United States to grow a true fir species in locations where other species such as Fraser could not be grown (Figure 1). Observations about Canaan fir related to site include:

- Breaks dormancy late in the spring, thus is well suited where late spring frost is a concern.
- Tolerates heavier and wetter soils than Fraser fir.
- Tolerates soils with higher pH values better than Fraser fir.
- Can be grown in areas where average summer temperatures are relatively high.
- One of the fastest growing of all true fir species.
- Precocious cone production is less than on Fraser fir.
- Like all true firs, adequate precipitation is necessary during the growing season.

- May not be as attractive to deer browsing if Fraser fir is present at the same location.

Concolor fir (*Abies concolor*) also known as white fir, is native to the western mountainous region of the United States and Canada. Mature trees are an important source of construction lumber, and it is valued for producing dimension stock. When planted in the northeastern United States and adjacent Canada for Christmas trees, it grows well in plantations. It is more tolerant of locations characterized by higher average summer temperatures than many other true fir species. Site related characteristics applicable to growth in Christmas tree plantations include:

- Breaks dormancy early in the spring, thus should not be planted in low lying areas or frost pockets.
- Does not characteristically produce cones during a normal Christmas tree rotation.
- Tolerates soils with higher pH values than other true fir species.

- Responds well to annual shearing, but its appearance and form may be somewhat challenging in the first few years following planting.
- Will grow on heavier soils than most other true fir species (Figure 2).
- Tolerant of partial shaded locations.
- Increasingly popular as a landscape species.
- Not related to site, but the foliage has a desirable citrus-like fragrance.

Fraser fir (*Abies fraseri*) is the most popular Christmas tree species in the eastern United States and adjacent Canada. It is highly prized by consumers and for this reason is widely planted by growers. Quality trees are valued for their density, symmetry, and fragrance. However, one of the most desirable traits is its excellent needle retention during the display period. When planted for Christmas tree production, it is considered as one of the most site demanding species if maximum quality and productivity is to be realized. When site conditions are ideal it is easy to grow and trees of



Figure 3. Excellent stand of seven-year-old Fraser fir growing on a sandy loam soil.

excellent quality can be produced (Figure 3). Some site related concerns include:

- Will not grow well on soils with a pH value of 6.0 or more.
- Difficult to produce quality trees when planted on heavy textured soils.
- Will not tolerate wet, maybe even seasonally wet soils.
- Is susceptible to *Phytophthora sp.* root rot on soils with internal drainage issues (Figure 4).
- Is not tolerant of drought conditions.
- Productivity is much enhanced when soil fertility levels are high.
- Does not tolerate locations where prolonged periods of higher, above 85 degrees F., summer air temperatures are present.
- Is extremely attractive to late summer and fall antler rubbing and winter browsing by deer.
- Regardless of site has a precocious tendency to produce heavy cone crops, even when small.

Other true fir species. On a world-wide basis there are more than 50 different *Abies* species. There is interest by some growers in cultivating one or more other fir species to determine

their suitability as Christmas trees. This interest is generally most intense where the more commonly planted fir species cannot be successfully grown. Some of the non-native or so-called exotic species include Corkbark fir, (*Abies lasiocarpa* var. *arizonica*), sub-alpine fir, (*Abies lasiocarpa*), Nordmann fir, (*Abies nordmanniana*), Turkish fir, (*Abies bornmuelleriana*), and perhaps a few others. Specific site considerations which can be generalized for most of these species are not well established. If growers are interested in these species, it is recommended that as much information about the habitat and environmental conditions of the areas where these species are native be obtained before undertaking wide scale planting. As an example, Corkbark fir is an alpine species which breaks dormancy early in the spring. When planted in non-alpine locations severe injury from late spring frosts can be expected.

SPRUCE. (*Picea sp.*)

In many locations throughout the Christmas tree producing region of the United States and adjacent Canada a couple of spruce species are grown. While they are less popular in the wholesale sector, they are common in most

choose-and-cut operations. They have traditionally been valued for their stiff branches and thus their ability to support heavy ornaments when displayed.

White spruce (*Picea glauca*) is native to the Lake States, the upper Midwest, and much of Canada. It is an important lumber producing species as well as a Christmas tree in many areas. It is characterized by relatively short needles and dense foliage when properly sheared. It responds well to plantation cultural practices and has an average growth rate. Specific characteristics of the species related to site include:

- Will grow on a variety of soil types.
- Can tolerate wetter soil conditions than most true firs.
- Will not grow well where prolonged periods of higher summer air temperatures (above 85 degrees F.) are present.
- In southern locations in the Midwest, should be planted on sites with north and east facing slopes.
- Prefers full sun for best foliage development.
- Can tolerate soils with higher soil pH values than true firs.



Figure 4. Localized *Phytophthora sp.* infection in Fraser fir. In the next rotation it is not recommended that any true fir be planted on this site.

Black Hills spruce (*Picea glauca* var. *densata*) is classified as a sub-species or variety of white spruce. It is produced from seed collected from mature trees in the Black Hills region of South Dakota. It has gained increased popularity in recent years and is valued both as a specimen landscape tree and as a Christmas tree. It develops dense foliage as a small tree and is valued for use as a “living Christmas tree” when sold in a potted container. Some attributes of the species as related to site include:

- Grows well on a variety of soil types.
- Has a reputation for being somewhat drought tolerant.
- Does not grow well in shaded locations.
- Tends to produce cones at an early age, however, these are considered attractive.
- Grows well in low-lying locations that are well drained.
- Breaks dormancy fairly early in the spring, thus avoid planting in frost pockets.
- Is considered hardy in USDA zones two through five.

Colorado blue spruce (*Picea pungens*) has traditionally been the most widely planted of all spruce species whether for Christmas trees or for landscape purposes. Native to the Rocky Mountains in the western United States and adjacent Canada, this species will grow well in many locations outside of its native range. It is considered hardy in USDA zones two through seven, although growth rates and overall health and vigor is better when planted in northern as opposed to southern locations. In recent years the popularity of the species has declined as a result of a couple of serious needlecast diseases. Where the objective is to grow spruce for the Christmas tree market, this species is largely being replaced by Black Hills spruce. Specific site related concerns include:

- Recommended to plant only in locations where air drainage is good.
- Generally does better in windy locations where needlecast issues may be less.
- Avoid planting in locations close to Douglas-fir due to the probability of increased Cooley spruce-gall problems.

- Will grow well on a variety of soil types including soils with high clay content, and high pH values.
- When planted on soils with high clay contents, frost heaving may be a problem in the first few years following planting.
- Expect serious needlecast problems when trees are planted close together as in typical Christmas tree plantations.
- Good species to plant where deer populations are a concern as deer tend to avoid the species.
- Regardless of location where planted, demand for this species as a landscape tree has decreased.

PINES (*Pinus* sp.)

When the commercial production of plantation grown Christmas trees began in the 1940's, the industry was dominated by Scotch pine. This species was the most popular Christmas tree species in the northeastern United States and adjacent Canadian provinces. The popularity of Scotch pine decreased considerably in the late 1980's and early 1990's as other species, most notably Fraser fir, became available and dominated



Figure 5. A good stand of Douglas fir growing on an upland site.

the retail market. Plantings of all pine species have decreased considerably; however, some choose-and-cut farms continue to grow a few pine species. Some demand at the wholesale level continues; however, not all wholesale growers continue to plant pines.

Eastern white pine (*Pinus strobis*), a species native to much of northeastern North America is probably the most commonly planted native pine species. The demand for white pine at the wholesale level is limited but it does find favor in choose-and-cut operations. Some site related characteristics include:

- Is considered extremely hardy from USDA hardiness zones two through seven.
- Will grow on a wide variety of soil types.
- Will not grow well in poorly drained soils.
- Does not grow well on soils with a pH value of 6.0 and above.
- May develop white pine blister rust when planted near woodlots where wild currant or gooseberries are present.

Scotch pine (*Pinus sylvestris*) is a non-native species that continues to

be planted by some wholesale producers and cut-your-own-operators. For choose-and-cut operations it is more commonly planted where true fir species cannot be grown due to significant site limitations. Site characteristics related to Scotch pine include:

- Can be grown on nearly all types of soil.
- Will tolerate both acidic and alkaline soils.
- Is considered quite tolerant of drought.
- Will grow on soils of low fertility, thus fertilization is not considered necessary.
- Will not develop good form if grown under partial shade such as alongside woodlots.
- Not necessarily related to site but is susceptible to several serious insect and disease pests.

Other pines (*Pinus species*) A couple of other pines, Norway or red pine (*Pinus resinosa*) and Austrian or black pine (*Pinus nigra*) may occasionally be planted by smaller choose-and-cut operators. These species are generally not grown by wholesale producers for retail markets. Both species are

characterized by long needles and rather stiff branches. Some site considerations include:

- Will grow on several different types of soil.
- Do not require high fertility soils for maximum growth.
- Both are quite hardy throughout the northeast United States and adjacent Canada.
- Not necessarily related to site, but Austrian pine is susceptible to many of the same insect and disease problems that affect Scotch pine.

DOUGLAS-FIR (*Pseudotsuga menziesii*)

Douglas-fir of Rocky Mountain origin (variety *glauca*) has been widely planted in much of the northeastern United States. In recent years popularity of the species has decreased among growers due to two widespread needlecast diseases. These are identified as Rhabdocline and Swiss needlecast. With some difficulty, these diseases can be controlled through annual repeated applications of effective fungicides. Because popularity of the species among consumers continues in some areas of the Christmas tree region, it continues to be planted by some



Figure 6. Black Hills spruce in the foreground growing on a low-lying but well drained site. In the background are Concolor fir growing on an upland area of clay-loam soil.

wholesale and choose-and-cut operators. Site related concerns related to production include:

- Plantations should be established on uphill locations.
- Do not establish plantations in low-lying areas or on down-slope locations.
- Avoid planting close to Colorado blue spruce plantations because of likely increased problems with Cooley spruce gall aphids.
- Will grow best on soils that are slightly acidic (6.5 and below) as opposed to soils that are alkaline.

- If planted in low-lying areas injury from winter kill and late spring frosts can be expected.
- Avoid planting near woodlots where partial shade may be present.
- In areas where prolonged heavy winter snow cover is present, expect annual deer damage.
- Plantings sites near the Great Lakes or on high elevation sites are preferred over lower-lying inland locations. (Figure 5)

Annual growth will be less when planted on soils with a heavy texture.

Conclusions

This article has attempted to identify the most commonly planted species for Christmas trees in the northeastern United States and adjacent Canada. Additionally, it has endeavored to identify some of the most important site related considerations that should be noted and considered before a particular species is selected for planting. Because the planted species will occupy the selected location for a period of eight to ten years or more, it is important to plant a particular species where the opportunity for success is the greatest (Figure 6). Every Christmas tree farm



Figure 7. A single Canaan fir planted in a block of Black Hills spruce to evaluate its potential for planting on this site in the next rotation; obviously, Canaan fir will not be planted on this site next time.

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operator should attempt to gain as much information about the selected species as well as the location where the planting will be established. Unfortunately, all information is not necessarily known before the planting is established. In this regard experienced growers who have planted one or more crops of trees on the same location are at a distinct

advantage over a new grower who is just beginning.

Undoubtedly all individual species characteristics have not been identified. Likewise, all possible site variations have not been described. Growers are advised to evaluate the suitability of a particular site for a different species, by planting a few trees of the new species at various

locations in a planting of a species that is known to grow well on that site. In essence a few small “test plots” (Figure 7) will assist growers in putting the right species on the right site.

Finally, in locations where considerable variations in site quality exist over short distances it is recommended to mix similar species even within the same planting block to accommodate changes in site characteristics (Figure 8).


Combining true fir species such as Canaan, Concolor, and Fraser in the same planting block will not only expand species availability, but will also result in increased productivity in areas where a single species may not be well suited for the entire planting site. Such site conditions as soil type, soil chemistry, slope, and local topographic variations are among those conditions which should be considered. 



Figure 8. Changing species in the same row to accommodate a change in site. Due to slight changes in elevation and soil type, Concolor fir has been planted in place of Fraser fir since it is better adapted to the change in site.

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