Shearings

February 2014

Precocious Coning in Fraser Firs -
What can we do?

Massachusetts Christmas Tree Association
www.christmas–trees.org

Calendar

February	7 – 16	Salem Chocolate & Ice Sculpture Festival Salem, MA
February	22 & 23	1st Annual Maple Weekend
March	1	CTGA ANNUAL MEETING Middletown, CT
March	12-16	Boston Flower & Garden Show` Seaport World Trade Center Boston, MA
March	13 & 14	Ash Borer ID Training Orono & Bar Harbor, ME
March	26	Ag Day at the MA state House Boston, MA
April	9	MCTA Director's Meeting Chicopee, MA
April	19	Earth Day
April	25	Arbor Day

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ORGANIZATION & INDUSTRY NEWS

It was called “Green Weekend”. Black Friday turns blue. How nice it was to experience the meaning of “Christmas Rush” the day after Thanksgiving. Could it be real trees are back in style? A roundtable discussion of the 2013 season among the locals (MCTA growers) and National growers throughout the US, revealed a significant increase in sales, in some cases as much as 40% from 2012, on the 3-day weekend. Contributing facts include a late Thanksgiving and a shorten season. And, sales remained very strong through the weekend of December 8th. The unfavorable weather in New England on the third weekend appeared to extend sales into the last weekend before Christmas, for farms that were still open. Farms, retail lots and stands continued to have better-than-normal sales late into the season. (*without check-off program being implemented*). Ancillary sales, such as wreaths and fresh green products were also strong. NCTA did a good job dispelling the media blitz of a “MOLD” problem with Christmas trees, as it faded away quickly, with little or no impact.

The MCTA, Rick Leblanc and the Commissioner of the Dept. of Agricultural Resources would like to send a special “Thank you” to James Brackbill , owner of Crane Neck Tree Farm of West Newbury for hosting the 2013 tree cutting ceremony, in his newly opened field of Douglas fir.

Many of us are aware of the upcoming changes in the tax laws for 2014-2015. With them come more financial challenges in the operation and succession planning of our farms. An increase in health insurance rates; a potential increase of the minimum wage from $8.00 to $11.00 per hour in Massachusetts (which will be tied to inflation) ; the expansion of the bottle bill ; the increase in gas tax ; and many exemptions we have had in the past may go away permanently, and will surely affect the financial decisions needed to be made.

Now’s a good time to bundle up by the fire and reflect on the three “R’s” . Record, Review, and Report; as well as thawing out in between storms. Gathering a summary of 2013 of what worked and what didn’t can always be a chore. But reviewing the information gives us opportunity to make improvements for next year. Weed control , disease and pest control begins with a good plan and ends with healthy trees. Although, Mother Nature never fails to throw off the best laid plans with a surprise weather event. Recording your financials; file pesticide applications, MSDS sheets; and “notes to self” seem like busy work but identifying unusual events or failed energies might help tackle that hard-to-do/ “put-it off-til’-later ” lists. It looks good on paper and even more productive on implementation. Let’s keep our farms operational for another successful year and beyond.

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NATIONAL NEWS

The White House Christmas Tree: The 18 ½ ft. by 11 ft. wide Douglas fir arrived by horse drawn carriage to the White house on November 29th. The tree was presented to the First Lady by the Botek family, growers of this year's tree, and the Wyckoff family, winners of the NCTA National Christmas Tree contest. The Boteks are 2nd generation Christmas Tree farmers from Crystal Spring Tree Farm in Lehighton, PA.The Wyckoff farm has been family owned for six generations since 1839.

AG Census : Another round of the Ag Census was sent out in early January. The deadline for submission was February 4. A second mailing was sent out to farms who did not respond to give to give them another opportunity to reply. This is not a mandatory filing and only for a general census survey purposes.

NCTA Check-Off Program: After 5 years, the farm bill finally passed in Congress. The check-off program will move forward. Christmas tree producers should expect to learn more about the future of their check off in the next six to eight weeks. Christmas tree growers who sell or import fewer than 500 trees are exempt, and after three years, those subject to the assessment will vote on whether or not to continue the program. If approved and moves forward, the program will be effective for the 2014 season and could provide many more promotional grants to the industry.

This year Trees for Troops® 2013 provided 17,051 free, real Christmas trees to military families and troops, bringing the total since inception of the program to more than 139,000 trees. This year's trees were delivered by FedEx to 62 military bases in the U.S. and Middle East, covering every branch of the armed services.

TREES FOR TROOPS
www.TreesForTroops.org

Precocious Coining of Fraser Firs What can we do?

Reprinted from Quarterly Journal October 2013 in " Early Coning of Fraser Fir " Brent Crain[1] and Bert Cregg[2] with combined references from "Precocious cone Production in Fraser Fir" 2003 Bert Cregg [2] Jill O'Donnell [3] and Mel Koelling[4] (see references at end of article)

Precocious coning (early coning before normal maturity) is one of the biggest issues with growing Fraser fir in the Great Lakes region. Most fir trees don't reach reproductive maturity until age 15 years or later, yet growers often see cones in 6 and 7 year old Fraser fir trees. One of the most important things to remember when discussing cone formation is that developing cones that growers see in late spring and early summer are the end result of a two-year cycle.

As current year (2013) shoots are growing and expanding, they begin to produce buds for next year's (2014) growth. Initially, buds are undifferentiated; that is, they may become vegetative buds or reproductive buds that produce male pollen or female cone buds. When the current year's lateral growth is nearly complete, usually around mid- to late-June, buds differentiate into either vegetative or reproductive buds. Therefore, the cones that growers pick off are the result of conditions that occurred almost a year earlier.

Temperature and Water Stress

So what factors cause buds to become reproductive? Tree stress is certainly the biggest factor. Both temperature and water stress affect cone development. It is often difficult to separate the two effects since warm years are frequently drier. A common response of many plants under water stress is to increase reproduction.

High temperate plays a role as well. A study in the Pacific Northwest demonstrated that warming fir trees by placing small plastic tents around them can dramatically increase cone production. Air temperatures inside the tents increased up to 8º above ambient. Placing the tents over the trees increased the average number of cones per tree from 3-8 to 22-24 compared to related treatments without tents.

Moreover, the tent treatments designed to increase tree temperature also increase transpiration resulting in water stress. Water stress and root pruning have been used to enhance flowering in conifers (Ross 1991). Observations suggest that drought stress and elevated temperatures during the period of bud differentiation increased seed cone production in *Picea glauca*. (Daoust et al. (1995)

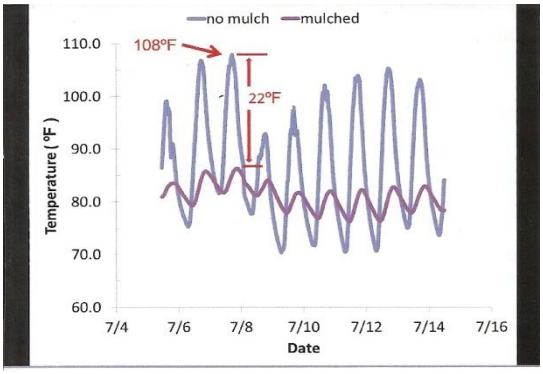


Chart 1: Temperature Data

Nutrition

Flowering generally increases with increased plant nutrition developed DRIS indices for populations of high cone yielding and low cone yielding Fraser fir trees. DRIS analysis indicated phosphorus most consistently limited cone development.(Owen 1995) Nitrogen was the second limiting element of cone production based on DRIS. Flower production in Douglas-fir increased with nitrogen fertilization up to 800 lbs/acre. The form of nitrogen fertilizer is also important. Nitrate fertilizers may increase flower production up to ten-fold compared to ammonium sources (Ebell, 1972; Ebell and McMullan 1970).

Tree age/ size

The age at which conifers become reproductive varies widely among species. *continued on page 6*

Precocious coning continued

However most conifers, do not produce significant cone crops until age 15-45 years (Owens 1995).

Among North American firs, Fraser fir and balsam fir are considered the earliest to flower. In a test plantation near East Lansing, Michigan we observed cones on trees three years after planting as 2-3 seedlings (i.e., 8 years from seed). We also observed extremely early (<8 years) flowering in Korean fir and Korean x Balsam hybrids in our exotic fir test plots. Cone production also increases with tree size. Seki (1994) found that cone production in *Abies mariesii* increased as an exponential function of trunk diameter.

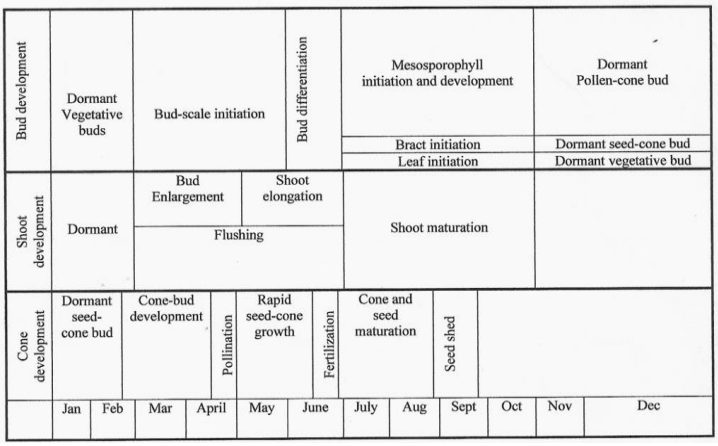
Endogenous Patterns

In addition to environmental factors, internal factors within trees can also affect coning frequency. This is called the endogenous pattern. In native forests many conifers experience an alternate-bearing cycle which results in a biennial pattern of heavy cone year alternating with lighter cone years. These cycles are driven by the carbohydrate balance within the tree. During heavy cone years, trees allocate photosynthates to cones resulting in less shoot and needle growth. The following year, reduced needle area results, in less total carbohydrates available to produce cones.

Most temperate confers do not produce heavy cone crops every year. Intervals between heavy cone crops vary from 2 to 7 years for temperate members of the Pinaceae family. I examined cone crop loads of several conifers in forest stands in California.

Abies concolor produced the most infrequent cone crops compared with Douglas-fir, ponderosa pine, and sugar pine; producing cone crops in only 6 of 23 years studied, *Abies balsamea* displayed a consistent trend of biennial cone production. Powell proposed that the biennial pattern was the result of altered source-sink relations. In heavy cone years, developing cones provide strong sinks for photosynthates (a compound formed by photosynthesis) Developing shoots (including the next year's buds) receive less photosynthate, produce shorter shoots with short needles and the developing buds remain vegetative. In the subsequent year few cones develop resulting in greater allocation of photosynthate to developing shoots and buds and increased differentiation to reproductive buds. This alternate bearing cycle is interrupted by tree growers who pick the cones off each year.

Table 1. Bud development in true firs (Abies)



Hormones

All plants have contain plant hormones. In conifers, Gibberellins (gibberillic acid) are the hormones most consistently associated with flower production. Application of gibberellins (GA) would increase flower cone production in a number of conifer species. According to the study by Owens and Blake (1985), GA 4/7 increased the number of cone flowers of Douglas-fir from 9.2 per tree to 59 compared to root-pruned only treatments and increased the percent of trees with flowers. In studies it also reported that application of GA 4/7 increased the percent of trees with flowers. Although the mechanism of the effect of GA on flowering is not clear, application appears to cause a shift towards reproductive development during bud differentiation.(Eysteinssson & Greenwood 1995)

In Fraser fir Christmas tree plantations in Michigan, we have observed a related trend. When cone buds are not picked, the needles and shoots that develop the current year are much shorter than on those on which the cones are picked. *Continued on page 7*

Precocious Coning continued

How does it relate to growers*?* Growers need to remember that Fraser fir is an exotic species in the Michigan and the Great Lakes region. Fraser fir is native to the southern Appalachians where high temperatures during the summer are typically 5°F - 6°F cooler and rainfall is more abundant than in the Upper Midwest. This is probably one of the main reasons why precocious coning is common when grown off-site in the Great Lakes region, but relatively rare in North Carolina. It is possible that our northern latitude, which increase day length by one hour in mid-June compared to western North Carolina, may affect coning when Fraser fir is move to the Upper Midwest. Improving fertility and increasing foliar nutrient concentration can also increase coning.

So, what can be done to prevent cone production? Stress clearly plays a major role, given the vast increase in precocious coning of Fraser fir in Michigan compared to the species' native range. Irrigation can reduce tree moisture stress, yet many growers that irrigate still report heavy coning. Part to this may relate to timing. As noted, newly formed buds differentiate into reproductive or vegetative buds fairly in the season –about the time the current year's lateral growth flush is fully elongated. Note that this is based on lateral growth, which ceases well before the terminal leader growth is complete. In Michigan, this usually occurs in mid-late June, or around 1400-1800 GGD. (base 41°).

Table 2. Reported ages for first cone crop of North American fir species

Species	Age of first cone crop (years)
A. amabilis	20-30
A. balsamea	15
A. concolor	40
A. grandis	20
A. lasiocarpa	20
A. bifolia	50
A. magnifica	35-45
A. magnifica var. *shastensis*	30-40
A. procera	20
A. fraseri	15

This is earlier in the season than many growers typically irrigate. Growers should consider irrigating during this time if they aren't already. One half inch of water every four days is ideal.

High soil temperatures also stress trees. Soil temperature can greatly exceed air temperature in plantations managed for total weed control. During the July 2012 heat wave, growers in Michigan recorded soild temperatures as high as 108°F (and 18° F hotter than the air temperature) at 2" depth under bare ground. Soil temperatures were as much as 22°F cooler under a 2" layer of mulch a few feet away. (see figure 3) . Growers who plan for total weed control may want to consider using cover crops or mulches to reduce water loss due to evaporation and runoff, while moderating soil temperatures. (soil composition can contribute to temperature variations as well)

Nevertheless, it is likely that factors we can't control such as air temperature and day length will still contribute to cone development. In theory, growers could exploit the alternate-bearing phenomenon and not pick cones the year prior to harvest in hopes this will reduce coning in the harvest year. However, this strategy would impact growth and unsightly cone stalks will still persist form the previous year, reducing tree visual quality.

RESEARCH APPROACHES TO REDUCING FLOWERING

Based on the developmental patterns of cones, we at Department of Horticulture and Department of Forestry at the University of Michigan are investigating two approaches to eliminating cone production.

First, we are evaluating the use of flower thinning agents that are commonly used in the tree fruit industry. These are caustic chemicals that cause fruit tree flowers to abort. "Wilthin" and ammonium thiosulfate are two products are presently on the market for flower thinning fruit trees. In the spring of 2001 we initiated trials to evaluate the effectiveness of "Wilthin" to thin Fraser fir cones.

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Precocious coning continued from page 8

Results from an on-farm trial Ingham County, Michigan indicated that Wilthin at a high rate (8%) stopped the development of over 60% of the cones on the trees that were treated (Fig. 3). A second on-farm trial Oceana County, Michigan yielded similar results in 2001. In 2002 and 2003 the experiments were repeated at the on-farm site in Ingham County. In the subsequent trials Wilthin and ammonium thiosulfate did not stop cone development and we observed significant needle phytoxicity.

A second approach to eliminating cone production is to disrupt the internal chemical signals that causes some of the undifferentiated buds on the current year's shoot to become next year's cone buds. From research on promoting flowering in seed orchards, we know that a hormone, gibberillic acid (GA), increases cone production in many conifers, including true firs. Several plant growth retardants used in the floriculture trade are GA inhibitors (Grossman, 1990; Rademacher 1991). These compounds retard growth of greenhouse crops by inhibiting GA synthesis or GA translocation. In the spring of 2003, we treated 50 trees each with one of five PGR's. The trees were treated three times on a bi-weekly basis beginning when current year's short growth was nearly complete. The trees will be scored in the spring of 2004 for cone production.

Plant growth retardants (PGR'S) applied in current cone reduction research

Trade Name	Active Ingredient	Rates
B-Nine®	Daminozide	5000 ppm
Bonzi ®	Paclobutrazol	60 ppm
Sumagic®	Uniconazole	15 ppm
Cycocel®	Chlormequat	1500 ppm
A-rest®	Ancymidol	100 ppm

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M.C.T.A. MEETING HIGHLIGHTS

January 8, 2014

Chicopee, MA: Attendance: Rob Leab, Dan and Kathy Pierce, Joe Meichelbeck, James Colburn, Scott Dwinell, Rick LeBlanc, Greg Davagian, Larry Flaccus, Joyce Leitl, Peter Sweet, Seth Cranston, Carol Nims and Susan Lopes.

President Rob Leab: The minutes of the October 2013 meeting were approved as printed.

Treasurer 's Report: Joe Meichelbeck reported YTD spending against the 2014 budget was on target. He noted budget receipts are based on the membership roster at the end of FY'13.

Secretary's Report: Jim Colburn, reported the Association currently has 119 members. At the end of the last fiscal year, there were 121 members. This year there are 4 new member farms and 6 non-renewals. The most recent new membership was in January 2014. A discussion on the fairness of the full $60 fee for this member for the remaining 7 months of the year ensued, especially now that the selling season was over and the benefit of the website listing was diminished. It was noted that the Board had discussed this issue a number of times in recent years and at one point voted to pro-rate dues based on the timing of new memberships. The Board asked the Secretary to prepare a draft of a By-Law change for the next meeting for further discussion.

Department of Agricultural Resources – Rick LeBlanc reported the annual tree cutting ceremony took place on Friday, November 29th at the Crane Neck Tree Farm of West Newbury and the official press release was picked up by the AP and enjoyed good coverage.

Rick reviewed the calendar of events ahead for the year and noted that another round of farm viability grants would be offered in the spring.

Committees – Rob Leab noted there will be a full slate of open Officer positions this year. Carol Nims 2nd Board term will be expiring and the 1st terms for Seth Cranston and Larry Flaccus will be expiring.

Annual/Twilight Meetings – There were 3 farms mentioned as possible hosts for twilight meetings this year. A joint meeting with Connecticut was still a possibility. A Saturday evening meeting was considered. The schedule will be fixed at the April Board meeting. Seth Cranston indicated the Cranston Family would be interested in hosting the Association's annual meeting this year at the Cranston Tree Farm in Ashfield.

New Business - Ag Day at the Statehouse is scheduled for March 26, 2014. Dave Butt and Jim Colburn volunteered to represent the Association at the event.
Peter Sweet spoke about expanding the distribution of information he receives from Dr. Elizabeth Lamb. Board members agreed that the IPM Newsletter and various other Christmas tree business items were interesting and would likely be useful to most of the Association members. To protect the privacy of our members it was decided to use the mass email process maintained by Dave Morin. Peter agreed to forward emails to the Secretary who would then forward to Dave.

Larry Flaccus spoke about a recent Pesticide Field Audit at his farm. Most important is to have a good system to file and store application manuals, Material Safety Data sheets (MSDS) and chemical label information. He noted that the USDA recordkeeping format for restricted pesticides was a good form to follow or use. He stores his chemicals under lock and key. Farms with employees should be aware of the "worker protection standards bulletin." It's available on the internet.
The Board thanks Susan Lopes for hosting the meeting. The next meeting is scheduled for April 9, 2014, in Chicopee.

Respectfully submitted , Jim Colburn, Secretary

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Suggestions for growers:

Cone flowering in *Abies* is a complex process controlled by a variety of potentially interacting factors. Some standard practices in Christmas tree culture may contribute to increased flowering. For example, growers typically maintain a high level of fertility, which may promote flowering. At present, it seems unlikely that a single approach will completely eliminate flowering. However, growers may consider modifying cultural practices to reduce flowering.

Recommendations:

- Use ammonium sources of nitrogen rather than nitrate
- Irrigate trees to reduce moisture stress when buds are differentiating (current year's hoots are 50% to 100% elongated)
- Overhead irrigation, if available, to used for cooling on days when buds are differentiating
- Pruning: reduces the number of cones per tree by reducing shoot length but does not affect cones per length of shoot

Precocious Coning Sources: Quarterly Journal October 2013 Vol. 28, Number 3;" Early Coning of Fraser Fir- What we Have Learned in Michigan" Brent Crain and Bert Cregg. Department of Horticulture, Michigan State University: "Precocious Cone Production in Fraser Fir" 2003

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For additional literature cited go to www.hrt.**msu**.edu/assets/Faculty-Photos/**Cregg** Bert/**Precocious**-**Cone**.pdf

Cultural and Pest Management Update for Christmas Tree Plantations November 2013

About the color green

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Reprinted by from T. Rathier and CT CTGA The Real Tree Line Newsletter November 2013 Vol. 53-#4

Green is the most prominent color associated with Christmas. Red may be a close competitor but green figures in everything related to the season. Much of green's prominence is due to the wide use of broadleaf plants like holly and laurel and conifers. Natural decorations used in the northeast include roping, wreaths, sprays, blankets and most importantly, Christmas trees.

The green color of all plant foliage is due primarily of the presence of the pigment chlorophyll is the principal energy acquisition agent and thus a major participant in photosynthesis. The process works because chlorophyll absorbs energy from light which the plant then, in the presence of water, uses that energy to convert carbon dioxide to simple sugars, which are the building blocks for the more complex compounds that make up the bulk of the plants. Most of the light absorbed by chlorophyll is from red and blue portions of the spectrum but not from the green portion, which is why foliage appears green. Annual and perennial herbaceous plants and deciduous woody plants experience a decline in photosynthetic activities as the end of the growing season approaches. This is reflected in a loss of chlorophyll and their green color. Ultimately, all of the foliage falls off. The same basic process occurs with evergreen plants except not all foliage falls off each year.

In addition to the natural chlorophyll/photosynthesis cycle, many problems that plants encounter involve some level of breakdown of photosynthesis, reflecting a shortage of chlorophyll which often involves the loss of at least some of the green color, and possibly, actual foliage. Throughout this past growing season, conifers growing on many of our tree farms showed several different problems that involve chlorophyll loss.

Premature loss of older needles

No conifer keeps all of its needles forever. Each year, some needles - usually the oldest- slow down or stop their photosynthetic activity. When this happens, those needles gradually turn yellow, then brown and eventually fall off. In some years, growing conditions are more stressful and more than just the oldest needles are affected. The most common example of this is the way the native white pines in Connecticut behave. Each year, around mid-September, older needles on pines yellow and fall off –usually in a pretty rapid fashion. In some years, the pines are more stressed and ore needles fall which was the case this year. I usually can expect more calls about needles loss from growers when this occurs.

As it happens, my first call came from a local town's tree warden asking me to visit the town's new Christmas tree they had planted back in April. The concern that the 10 foot tall nursery grown Concolor fir, while still looking great, had 2 years work of older needles (out of 4 years total) that were yellowing and beginning to fall. The tree was planted in the same location as its predecessor, a 35 foot Concolor that had declined enough in recent years to warrant replacement. The soil site had been reconditioned and was quite fertile and well drained.

Individual declining needles had dark blotches and were varying shades of light green/yellow. The tree warden was fearful that the new tree had a rapidly developing needle disease that would lead to a quick death. We took some of the needles

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to culture but my guess was that, since most needle diseases begin on young needles, which were healthy on this tree, the needle loss was an accelerated case of natural needle loss (senescence

Even the most conscientiously grown and dug 10 foot tall conifer is bound to experience some decline when it's transplanted into even the best prepared planting site. Add to that stress, a dry April and May, a very rainy June, a hot July and august and it wasn't surprising that the new tree had lost so many needles.

Barely a week later, I was visiting a Christmas tree farm and noticed a field of very successful Concolor firs exhibiting the same symptoms on their oldest needles, confirming my observation that 2013 was a good year but not so good that there wasn't going to be some loss of older needles. I was pleased to pass that information onto the tree warden but it occurred to me that many of our tree farms were likely to see amplified discoloring of and loss of older needles to the extent that it could affect the appearance of trees for the 2013 harvest.

With this in mind, at some farms, it may be necessary to use blowers to hasten the drop of those needles prior to the sales season. At the very least, having a good shaker may at least keep the needle drop on harvested trees at the farm and not in the customers' houses.

Needle diseases

The common needle disease we see in plantations, needle rusts of spruces and needlecast of spruces and Douglas firs, all affect young needle tissue, thus interfere with chlorophyll availability and ultimately result in the loss of green to some extent. Most of the needle diseases infect young needles that develop in the spring and result in a barely noticeable loss of green color during that first season that often progresses to yellow in the spring of the following year when spores emerge to infect the next set of new needles.

The dry to very dry conditions of this past April and May posed significant waster need problems for both newly planted and established trees in the field. One beneficial effect was that needle diseases were likely less prominent. We may not see as much disease related interference of chlorophyll activity next year but we should still be watching for it.

Insect and mite activity

As with needle diseases, any physical interference of the normal health of needles by sucking or rasping arthropods will likely affect chlorophyll activity result in some loss of green. The sucking activity of aphids and armored scales remove sugary sap from needle tissue, disrupting photosynthesis and ultimately, chlorophyll content resulting in yellowing around the wounded area. If insect populations are large, then overall yellowed look develops on whole needles and eventually whole twigs and branches. Similarly, mite infestation involves a rasping activity on needle surfaces which also disrupts chlorophyll activity resulting in a similar loss of green. Because spray management attempts for these sorts of arthropod pests can be hampered by under pressurized or poorly directed spray attempts, yellowing due to their activity is often found on older needles.

Nutrient related color problems

As tough as management of disease and insect problems seems to be, at least there are some well defined protocols to follow to help solve them. Losses of green due to nutritional concerns are often so poorly understood that it is difficult to be specific regarding remedies. There are two syndromes that we've been confident about; mid to late season yellowing of secondary and tertiary lateral growth on Fraser firs; and late season growth of spruce needles the yellowing of

secondary and tertiary laterals of Frasers begins when soil temperatures extend beyond 90^0 F as happens in most years in Connecticut. Typically, the vertical leader and continued from page

primary laterals (the first to grow each season) are green and vigorous in contrast to lighter colored and tertiary growth. At first glance, there is a tendency to presume a nutrient deficiency but when the pattern is often repeated in subsequent years it's hard to believe that nutrients are only available at certain times.

A more logical explanation would be that, as the soil heats up, Fraser fir roots become less functional and not enough available nutrients are taken up to keep the later maturing growth colorful. When we have a cooler than normal summer, this problem is less severe and maybe not even noticeable. Since other true firs (Canaan and Balsam) do not have this problem, growers do have the option to avoid planting Frasers in soils where they have seen this problem. It may also be the case that other root related problems such as insects and diseases can cause this same problem.

Late season loss of green by needles of healthy spruces is most likely a non-surplus of certain plant nutrients and is related to the natural physiology of conifers. All conifers turn somewhat off color in the winter. We see it in the wild and in landscapes where trees prepare for cold weather by relocating some nutrients from needles to twigs and stems, resulting in a diminished supply of visible chlorophyll. Come springtime, those nutrients are restored to needles and the green color intensifies.

For trees that need to look colorful at Christmas, one way we've shown to avoid color loss is to supply them with a surplus of nutrients like potassium, magnesium and possibly calcium (never nitrogen) either with ordinary fertilizer

timing or separately no later than early to mid June. Growers have had good luck with sulfate of potash/magnesium; (sul-po-mag, 1 oz – 3 oz per tree applied to the soil surface around each tree) .

Water/Moisture Related Color Problems

During rainy periods, especially during growing seasons, poorly drained soils can become water-logged to the exclusion of oxygen which is vital to root health. Likewise, during dry periods, excessively drained soils can become dry enough to limit water uptake by roots. In either case, a likely early symptom is a loss of chlorophyll and yellow needles.

Soil physical concerns may only be corrected with substantial mechanical attention to drainage improvement or, at least, choosing to plant tolerant species. Droughty soil can be dealt with by use of irrigation and mulching trees to limit loss of moisture to the atmosphere.

Green spruces

One aspect of conifer needle color is harder to assign importance to is the connection to genetic concerns and whether or not certain species or cultivars are better at responding to various inputs and physical conditions without loss of chlorophyll.

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Cultural Update continued

This past year, I've received several inquiries regarding the color and needle retention qualities of white spruce. Each inquiry went along the same line: "Why aren't the white spruces we grow currently like the ones we use to grow just ten or twelve years ago?

They used to be really green and their needle retention lasted longer. Now they're more grayish green and their needle retention is okay but not like the good old days." It seemed to me that these comments were probably describing genetic differences within the same species and that we might able to track down green spruces.

My first thought was, given that comments centered on the ten to twelve year absence, perhaps the old favorite white spruce was a product of the former Connecticut State Forest Nursery in Griswold. To get closer to the bottom of things, I contacted Pete Merrill, who spent a good portion of his professional career as a forestry at the nursery. According to Pete, all of the white spruce seedlings grown in the nursery began as seed collected from mature white spruces growing in two or three different locations in state forest in Southeastern Connecticut. This suggests that, while not native, the old favorite could at least be locally sourced.As it happens, there are two blocks of large white spruces that came from the old sate forest nursery growing in production at Allen Hill Farm, where our fall meeting was held this past September. Most of the folks at the meeting agreed that the trees were sturdy and definitely green. Any retro-introduction of transplants from this seed source would likely be difficult. It would probably require permission from an assortment of state agencies and it definitely would take some time. At any rate, it's something to think about over the winter.

For additional information on the topics discussed in this update or other aspects of producing Christmas trees is available by contacting Thomas Rathier at trathier@snetglobal.net

In The News 2013

Chemical Prices

by Steve Rosenthal, VP of TH Agri-Chemicals, Inc
Reprinted Wisconsin Quarterly , Nov. 2013

New Miticide

The Gowan company has received a label for it's new miticide product called "Magister" which is registered for Christmas tree plantations and is specific to Mites. The rate of application is 12-24 ounces per 100 gallons of water or per acre. Do not make more than one application per year and do not exceed 24 ounces per year.

Fertilizer prices have dropped dramatically in the fall of 2013. Hopefully, they will continue for 2014.

Glyphosate products continue to rise. A rise in prices from August to October (2013) on average was up $2.00/gallon .

According to major growers in the mid-west, other Herbicide pricing are projected to stay flat to slightly up, depending on what is in the product (active ingredient). "Anything with a new name is just a combination of products we already have. Remember to rotate herbicides to prevent resistance (i.e. Glyphosate). Where would we be if Roundup no longer worked?

"Artificial Christmas Tree Recall:"

(December 16, 2013, Associated Press)

Menards, a chain of home improvement stores based in Wisconsin and the Mid-west recalled over 1,800 pre-lit artificial 7 ½ foot Christmas trees due to lights that may overheat, start a fire or cause an electric shock.

Several reports of tree light strings overheating, melting or smoking were reported.

The artificial trees were sold for about $300 exclusively at Menards between September and November. The recall was for the Twinkling Pine by Enchanted Forest brand. They were made in China and imported by Seasonal Specialties LLC.

"Crazy Price Differences for Same Christmas Trees"

(ABC news, Dec. 12, 2013, by C. Curry)

Tree Stands 6 ft. high in California or Alabama, so why is the price so wildly different?

When you're rockin' around the Christmas tree, do you ever stop to wonder if you got swindled? Prices vary widely from tree to tree across the US and even within cities. Prices vary so much that we found differences of $40 to $70 within just a few blocks. In all, ABC News found that prices for a 6 to 7 ft. tree ranged from $8 (for cut your own) to $150 around the country.

Purveyors pointed out that certain types of trees go for more money, and of course, theirs is always the fine art of negotiating. "Come by and we'll do the dance, don't worry about it" replied one vendor to me.

Is it cheaper to buy from a big-box store, a family farm or to cut-your-own? Take a look at the results and decide for yourselves.

Birmingham, Alabama.:
$24.98 for a Douglas Fir,
$34.98 for a Fraser Fir at Lowes in Homewood
$61 for a Fraser Fir at Pine Hill Tree Farm in Tarrant
$33 for a tree at Beavers Christmas Tree Farm in Trafford

Cheyenne, Wyoming
$10 for a permit to cut your own tree at Medicine Bow-Routt National Forests
Chico, California
$28.77 at Karen Muellers Christmas Farm
$50 for a noble fir at Sierra Cascade Christmas Trees
Albuquerque, N.M.
$60 to $70 at Just Sprinklers
$25.98 at Home Depot

New York City, N.Y.
$30 for Balsam Pine, $60 for a Fraser pine at stand at 82nd St. and Amsterdam Ave.
$90 to $150 for a range of trees at stand at 81st St. and Columbus Ave.
$80 to $120 for trees at stand at 79th St. and Columbus Ave.

"Do you know where and if we can buy an un-sheared Christmas tree? An old fashioned one?" asks bbbbswetz@verizon.net on November 18,2013. Maybe we should make a path into the woods at the end of a field and price a few of wild stands afterall! Have we found a new market?

"Space-saving Christmas Trees fit in corners, squeeze against walls, says Saginaw County tree farmer" (*Dec. 16, 2013, Saginaw News/Bay City times by Heather Jordan)*
Swan Creek Township, MI: Nacy Puffer. Co-owner of Swan Creek Tree Farm, added a new variety to the Christmas trees for sale at her lot: space-saving "half-trees". Puffer sells pine, Douglas fir Norway, white, and Colorado Blue spruce. Sometimes trees don't look as appealing from all sides. Puffer's solution clears her farm of uneven or sparse trees while serving the needs of people with little living rooms.


This tree is just perfect!

She trims off what might not be good so that it can be put on a wall or in a corner. "Nobody can tell they're not a whole tree. "I've never done this before, but it saves space in your living room and has received positive feedback from her customers. Puffer said the trimmed trees, most of which sell for about $25 to $30, save space and money, as well as reducing waste on the farm. These space saving trees can be custom-trimmed to fit your space.

"A National Problem" Root Rot Attacking Christmas Trees: *(Dec. 2, 2012: NBC News)*

Oregon leads the nation in Christmas tree production. North Carolina is the No. 2 producer. One study estimated the potential losses to Oregon's nursery and Christmas industries of up to $304 million a year if Phytophthora is not properly contained. Douglas and Noble fir are the dominant holiday tree in the Pacific Northwest. Estimates it will cost farmers up to $6 million if the disease is not controlled.

"To date, no fungicide has proven effective to control Phytophthora on Christmas tree plantations. So once it's in the soil, that's it."

Jeff Pollard has been growing Fraser fir in western North Carolina for 40 years. He grows about 130,00 trees. Pollard said " Phytophthora set in after Hurricane Fran in 1996 and got worse following 2004's hurricane Ivan. He's lost a quarter of his trees over the past six seasons, and the state's mortality on some of his stands at up to 80%. Reduction due to loss may help the over supply in past years.

Researchers at Washington State and NC State are hoping to unlock the secrets to some species' rot resistance. Modifying native trees to have greater resistance remains the challenge. Katie McKeever, a PhD. Candidate in Chastagner's lab is working under a US Dept of Agriculture grant from Christmas trees to understand regional variations in pathogen populations. She commented that "The goal is to challenge various firs with different Phytophthora to determine mechanisms of resistance and ultimately develop genetic markers that can be used to identify trees that are resistant to the disease."

Since 2005, Oregon growers have planted an average of 500,000 Nordmann and Turkish fir per year. Studies have revealed these two fir are very resistant to phytophthora. Of course, Turkish fir is not bullet proof. It tends to bud out earlier than Fraser fir, making it more vulnerable to late-season frost, and deer find it much tastier than Fraser to snack on. Pollard harvest his first Turkish firs last year with good feedback from his customers.

Fraser Fir Plugs Revisited: Tomorrow's Seedlings

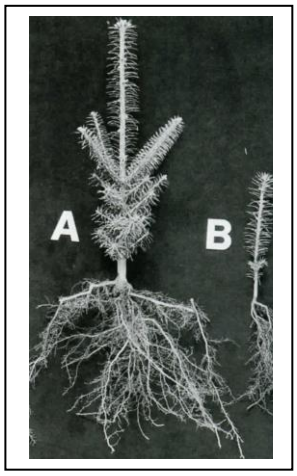
Reprinted from Limbs and Needles Fall 1997
Excerpts By Jeffery Owen Christmas Tree Extension Specialist and Eric Hinesley, NC State University

With increased concern about Phytophthora root rot, the traditional approach to planting field-grown Fraser fir seedling with good bud set and a good strong stem is no longer a sufficient measure of quality. Rather, a healthy, Phytophthora-free root system may be the most important measure of seedling quality. It not only determines the health of that tree but the long-term profitability of the field in which it is planted. Recognizing this, many growers are planting containerized seedlings. Several of the advantages and disadvantages to using plugs will be discussed.

The technology to produce containerized Fraser fir in the greenhouse has been available since the mid-1970. By artificially extending day length to eighteen hours and by optimizing water, nutrients and temperature, the equivalent of a 3-0 seedling can be produce in about a year under an accelerated greenhouse production system with longer days, the seedlings can produce three flushes of growth in one season before they need to go dormant in the fall.

The challenges of growing greenhouse plugs (containerized seedlings) arise in producing plants of uniform size that will break dormancy the following spring.

The NC forest Service was the first to produce Fraser fir in a greenhouse under accelerated growth conditions. Currently many, if not most commercial operations in the U.S. are producing conifer plugs.



A: Plug + 2 yr. transplant
B: 2-0 seed bed

Finding a guaranteed Phytophthora-free source of seedlings is the primary motivation for the current interest in Fraser fir plugs. All common sources of fungal contamination can be controlled in the greenhouse environment with proper management. The plugs are grown in a soil-less media, usually a sterile bark-peat mixture. Well water should be used for irrigation because ponds and streams are frequently contaminated with Phytophthora from nearby fields. Plug containers and the surface on which they rest (either gravel or floor or mesh table) are usually designed to eliminate any standing water or extended saturation of seedling roots. If these conditions are followed with good sanitation practices, the soil-borne phytophthora fungus can be eliminated from the seedling growing environment.

"Finding a guaranteed Phytophthora-free source of seedlings is the primary motivation for the interest in Fraser fir plugs"

There are several additional advantages to using containerized seedlings. Plugs have the potential to be larger than their bed-grown equivalent with the same number of flushes (2-0 or 3-0). The root

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systems of most Fraser firs plugs will be more substantial and compact than a bed grown seedling. Plugs can be transplanted without disturbing or damaging the root system, so transplant shock is minimal and can be planted much later in the spring as long as they are continually maintained. Frost is a limiting factor early in the season on actively growing plugs.

However, Fraser fir plugs do have several disadvantages. Any container plant including plugs will become pot-bound if they stay in place too long. In most round containers, the roots will coil around the inside of the container. Other plug trays or tubes guide roots to the bottom where they are air-pruned. In either case, the pot-bound root system tends to maintain its shape of the container with greatly reduced root function and even survival. It is vital to move the plugs out of their containers before this happens. When examining plugs, the roots on the outer surface should only be an inch or two long not twining around or down the length of the container. When planting, root pruning may be necessary if grown in containers with holes.

(It has been noted by some farmers that they will spread out/ loosen the root system on the plugs before planting for improved root growth.)

Containerize plants also have a greater requirement for water than seedlings in the ground or bare-rooted seedlings in cold storage. The plugs are actively transpiring and have a very limited reservoir from which to draw water. Even if they need daily watering. They can be the highest quality plant, but will be worthless if they dry out.

Phytophthora-free plugs will be more expensive but worth the cost. Even when a field-grown transplant may be clean, it is impossible to guarantee phytophthora-free stock. Soil contaminated with Phytophthora can be easily tracked, washed or carried into a nursery or seedbed or transplant field at any point during one to three years that the trees are there. Any field grown or plug must stand on its own merits and thorough root inspection for the symptoms of disease, before you plant is a must.

So, always grade your seedlings and transplants if you grow them or buy them and always practice good sanitation.

CHRISTMAS TREE RESOURCES

Massachusetts Dept of Agriculture:
www.mass.gov/agr
Umass Extension Service
www.extension.umass.edu/agriculture

Soil Testing Lab:
Soil and Plant Tissue Testing Lab
West Experiment Station
682 North Pleasant St.
UMass, Amherst, MA 01003

(413)545-2311 fax: (413)545-1931
soiltest@psis.umass.edu

UMass Plant Diagnostic Lab
101 University Drive, Suite A7
Amherst, MA 01002
(413) 545-3208 - fax (413) 545-4385
umassgreeninfo.org/
Landscape & Nursery Insects:
Bob Childs, (413) 545-1053,
rchilds@psis.umass.edu

Plant Diagnostic Specialists
Landscape & Nursery Diseases:
Nick J. Brazee
(413) 545-2826 Fax: (413) 545-4385
nbrazee@umass.edu

Landscape & Nursery Weeds:
Rick Harper
rharper@umass.edu

Fighting Phytophthora Root Rot

References and Credits to Jill R. Sidebottom, Extension Forestry; Department of Plant Pathology and Department of Forestry and Environmental Resources, NC State University, Fact Sheet Index, April 2007.

With the rapid increase in Fraser fir Christmas tree plantings, growers are facing a number of production issues. Most notably, *Phytophthora* species represent a serious limitation to the North Carolina Christmas tree market. Phytophthora root rot and stem canker, caused by several *Phytophthora* species, has been associated with significant damage to Fraser fir since the 1960s. *Phytophthora* is a fungus-like organism that inhabits the soil and infects many woody plants through the roots. It can lie dormant in the soil for several years, waiting for a susceptible host such as Fraser fir and the right environmental conditions, including warm soil temperatures (above 54°F) and saturated soils to infect plant roots.

Symptoms/Signs

The above-ground symptoms of Phytophthora root rot on Fraser fir include yellow-green needles, wilting, dead branches, and tree death. These dead needles typically turn cinnamon-brown and remain on the branches, eventually resulting in a bronze-colored tree. Roots of affected trees are cinnamon-red to black in color and lack white growing tips. The outer surface of the root can be pulled away from the inner core, also called 'root sloughing' and feeder roots are often absent. Cutting into the bark of the trunk of the tree may reveal butterscotch colored wood (Figure 2). Often these symptoms are initially present on only one side of the tree or on lower branches, since *Phytophthora* first infects a root and then colonizes the trunk on that side. Unfortunately, above-ground symptoms of the disease are often not apparent until the roots are heavily infected, after which death of the tree follows. Infected trees are usually found grouped together in a field or bed.

Causal Organism

Phytophthora root rot is caused by several species of *Phytophthora*, although in North Carolina, the most important species is *P. cinnamoni*. In addition, a few undescribed *Phytophthora* species have been recently isolated from symptomatic fir Christmas trees growing in seedling beds and plantations in multiple states. During the growing season when soils are warm and wet, mycelia or chlamydospores germinate and produce sporangia. These lemon-shaped structures cause new infections, either by germinating and colonizing roots, or by releasing zoospores (Figure 8) in water that have formed inside each sporangium. Zoospores are able to swim using their two flagella, and are capable of directional movement to host plants based on chemical attraction.

Disease Cycle

The disease is correlated with abnormally high soil moisture caused by frequent precipitation, flooding and poor soil drainage, as *Phytophthora* produces spores in response to near-saturated soils. *Phytophthora* species can spread by contaminated equipment, with infected nursery stock, or with water runoff from nearby infested sites. Transplanting infected nursery seedlings represents a major contribution to disease incidence in the field, yet there are no current standard methods for certifying seedlings as pathogen free. Due to the increase of *Phytophthora* species in seedling beds in North Carolina, growers have been purchasing field-ready transplants grown in other states such as Michigan, Oregon, Washington and Pennsylvania, to avoid purchasing infected seedlings. However, fir seedlings grown in other states also have the potential of being infected with their own regional *Phytophthora* species . Therefore, purchasing and transplanting seedlings from other states

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increases the potential for new introductions of exotic *Phytophthora* species. After disease develops in the field, growers have few options beyond harvesting as soon as possible, as the pathogen can survive extended periods of time as spores in the soil, in pieces of organic matter, or in roots of fir seedlings and trees. Due to this persistence, once *Phytophthora* becomes established on a site, the area is often no longer used for Fraser fir production.

Diagnostic Methods

If you start to see yellowing or dying seedlings or trees, contact your County Extension Agent to collect samples to determine if *Phytophthora* root rot is the cause. Root and/or soil samples should be sent to a Plant Disease and Insect Clinic (PDIC) to determine if *Phytophthora* species are present. This is best done after soil temperatures have warmed above 54°F. Root rot symptoms can also be caused by white grubs, transplant shock, drought, over-watering, fertilizer burn, and other problems. In the PDIC, root samples are washed, and suspicious root segments are collected, surface sterilized with a bleach solution, and plated onto selective media for *Phytophthora* isolation, known as PARPH. Although root samples are preferred by the PDIC, soil samples can also be baited for *Phytophthora*, by floating rhododendron leaves in water containing the soil for a few days. These leaves are then plated onto selective media for isolation of *Phytophthora*. Cultures growing on the selective media are identified by morphology using a microscope.

Disease Management

Managing Phytophthora root rot requires an Integrated Pest Management (IPM) approach. No single control strategy will prevent or control this

disease. As with most plant diseases, the best control is through healthy seedlings and transplants, and proper site selection. If trees become infected with *Phytophthora*, management should change to practices that reduce the spread of root rot and minimize financial loss. The steps outlined below will help reduce the risk of getting and spreading this disease.

First step: Obtain clean seedlings/transplants

Unfortunately, a transplant can appear healthy for several months after it has been infected. TO ENSURE THE CLEANEST TRANSPLANTS POSSIBLE, FOLLOW THESE STEPS:

1) Select the site for seedling or transplant beds where there has never been an incidence of Phytophthora root rot. Beds should be located in an area where they will not be flooded, where water will not drain through the beds, and where soil is not tight or high in clay.

2) Prepare raised beds that are 6-8 inches in height to increase water drainage. Soil should be carefully prepared to break up all clods and allow plant material to decay.

3) Fumigate the soil before sowing or planting with methyl bromide or some other labeled soil fumigant. This will reduce the amount of *Phytophthora* in the soil. Methyl bromide should only be applied when the soil temperature is above 50°F. For any treatment, label directions must be followed.

4) Irrigate seed beds and transplants with well water. Water from farm ponds, creeks and rivers may be contaminated with *Phytophthora* spores, which could infect plants.

5) Use Subdue MAXX fungicide in the spring and fall to prevent disease development. Apply 2 1/2 pints Subdue MAXX in at least 50 gallons of water per acre in seed beds and 5 pints Subdue MAXX in at least 50 gallons of water per acre in transplant beds.

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- Consider rotating with another fungicide such as Aliette. Aliette should be applied to the foliage until run-off using 5 lb of product per 100 gallons of water. (Note: waiting to use Subdue MAXX until after trees start dying from *Phytophthora* will only give you a false sense of security. Subdue MAXX will protect living tissue as long as the dosage remains in the plant. However, when it wears off, the plant is again at risk. Subdue MAXX will not eliminate *Phytophthora* from the soil or from dead roots. Once the trees are moved to the field and are no longer being treated with Subdue MAXX, *Phytophthora* will become active again and trees may start to die).

  6) Only purchase seedlings and transplants from a reputable dealer. Do not purchase plants grown in beds that have dead or dying plants.

  7) Do not set transplants if roots are discolored and exhibit 'root sloughing'.

  If *Phytophthora* is diagnosed and diseased seedlings are isolated to one corner or section, you may be able to use plants in the rest of the bed or adjacent beds. However, remember that an apparently green and healthy transplant may be infected.

- Second step: Site selection and field clearing

  When temperatures are warm enough, soils only need to be saturated for several hours for *Phytophthora* to infect roots. Fraser fir should only be planted in fields where water drains quickly down through the soil and quickly off the field. Examine the potential field site for any areas where water collects or drains. Are there wet weather springs? Does a culvert drain onto the field? Be sure when establishing field roads that problems with water drainage aren't created. It may be necessary to go to a site during a heavy rain to observe water drainage.

  Examine the soil at potential field sites to determine how easily water will drain down through the soil profile. High clay content decreases water flow and holds water longer. Not only is clay in the topsoil a potential problem but also clay in the subsoil. Hardpans and shallow soils will slow water flow. Compacted soils also hold more water and slow water flow down through the soil.

  If fields are to be cleared of brush with heavy equipment, special care should be taken to reduce soil compaction and the loss of topsoil since this will increase the risk of Phytophthora root rot. Do not use heavy equipment when the soil is wet. Do not push topsoil off the site. Sow a cover crop in the field to help repair soil structure after clearing before trees are set.

  Phytophthora can infect several hundred species of plants including red bud, dogwood, rhododendrons, mountain laurel, white pines, and honeysuckle. There is a possibility that woodlands cleared for Fraser fir production already have *Phytophthora* in the soil. Also, growers setting Fraser fir in old apple orchards or where apple trees were growing in old pastures have had problems with *Phytophthora*. Grass and clover are not hosts and *Phytophthora* should not be present in old pastures where there were no apple trees.

Third step: Keep roots healthy.
Phytophthora is attracted to wounded roots.

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Phytophthora continued

- Keeping roots healthy may help reduce root rot development.

- THE FOLLOWING MEASURES SHOULD IMPROVE ROOT HEALTH:

  1. Do not set Fraser fir transplants deeper than 1 inch above the root collar. Forcing a large root system into a small planting hole will cause the roots to grow in the shape of a 'J', weakening root growth. Avoid excessive root pruning when planting.

  2. Spread fertilizer evenly. Piles of fertilizer on the ground will damage roots growing directly underneath.

  3. Limit use of Simazine. High rates of Simazine will damage roots.

  4. Allow ground covers to grow between trees to keep the soil cool. Fraser fir roots will grow closer to the surface of the soil where there is more oxygen and less water.

  Contact your county extension agent to learn more about ground cover management with the use of suppressive rates of post-emergent herbicides.

Fourth step: What to do if *Phytophthora* is found

Even with care, Phytophthora root rot can develop, especially after heavy rainfall or flooded conditions.

THE FOLLOWING STEPS MAY REDUCE DISEASE SPREAD AND TREE LOSS:

1. Quarantine areas of the field where trees are dying from *Phytophthora*. Soil from these infested areas can carry spores. When working in the field, visit infected areas last. Don't carry mud on boots or equipment to areas where trees are not dying. Wash soil off of boots or equipment with water and chlorine bleach when moving from contaminated to clean farms.
2. Keep a ground cover on quarantined areas to reduce the spread of infested soil and water runoff.

3. Early harvesting near affected areas may reduce financial losses. Selling smaller trees is better than leaving those trees to die before they can be harvested the following year.

4. Trees immediately surrounding diseased trees may be treated in the field with Subdue MAXX at the rate of 1 1/4 to 2 1/2 gallons per acre in a minimum of 50 gallons of water per acre, Subdue 2G applied at 125 to 250 pounds per acre spread evenly to infested areas, and/or Aliette applied to the foliage at 5 lb /100 gallons. Apply these products in the early spring and again in late summer. Application should be made 1 to 3 days before a predicted rain. Never apply Subdue MAXX to fir growing on bottom lands or poorly drained soils, or near surface water since it may contaminate streams. HOWEVER, these treatments are expensive and may not be cost effective if the trees are more than a year from harvest.

5. Do not replant Fraser fir on sites where Frasers have died from Phytophthora root rot. Alternative species may be used including Colorado blue spruce and Norway spruce. Although white pine and hemlock may also be cultivated in infested sites, they are a host to *Phytophthora*; if pathogen populations are high or the site is poor, they may die. Phytophthora root rot is becoming more of a problem in second and third rotations of Fraser fir in both beds and fields, as Fraser fir is HIGHLY susceptible to this disease, and continuous cultivation on the same site may promote disease development. At current, there is no natural resistance in Fraser fir to *Phytophthora*. However, research is currently being conducted to determine if Fraser fir grafted onto the roots of more resistant fir species can survive in areas

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Phytophthora continued

where Fraser fir has died.

The best way to control Phytophthora root rot is to never get it. Disease-free seedlings and transplants, and site selection continue to be the most important aspects of Phytophthora root rot management.

MASSACHUSETTS CHRISTMAS TREE ASSOCIATION
www.christmas-trees.org

2013 Growing Degree Days				
Region/Location	2 Week Gain	Total Accumulation for 2013	Soil Temp F° (at 4" depth)	Precipitation 1- Week Gain
Cape Cod	324	1160	78°	0.10"
Southeast	352	1164	78°	1.65"
East	346.5	1158.5	80°	1.46"
Metro West	370.5	1144	74°	0.60"
Central (Boylston)	336	1109	60°	0.77"
Central (Leicester)	360	1046	72°	1.09"
Pioneer Valley	392	1186	77°	1.06"
Berkshires	335	1025	75°	3.87"
AVERAGE	352	1124	74°	1.33"

*Reprinted from the UMass Extension Landscape Message # 16- 2013

Submission Deadlines

- Jan. 15 (February Issue)
- April 15 (May Issue)
- July 15 (August Issue)
- Oct. 15 (November Issue)

Other Publications & Resources

"Branching Out" : Cornell University IPM Newsletter Paper & on-line version available
Cost of *Branching Out* is $50 for the 2013 season
Cornell University "Branching Out
Department of Plant Pathology
Cornell University
PO Box 6699
Ithaca, NY 14851
email to: *ddo1@cornell.edu*

Cornell Pest Management Guide: to order
Http://psep.cce.cornell.edu/store/guidelines/

"Fraser Fir Pest Portal" (new from NC Cooperative Ext)
http://www.ces.ncsu.edu/fletcher/programs/ xmas/
Control/index.html

Integrated Pest Management for Christmas Tree Production:
(Penn State College of Ag Sciences)
http://pubs.cas.psu.edu/orders_CAS.asp"

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- Vertical	3.5"w x 10" h	48.00	90.00	172.00
1 /4 Page	3 5/8" w x 5" h	32.00	56.00	104.00
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