

MAY 2014

Shearings

The Quarterly Newsletter of the Massachusetts Christmas Tree Association



Twilight time....do your trees have winter injury or something else?

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Calendar

June	Wed.	4	MCTA Twilight Meeting Vandervalk's Farm & Winery Mendon, MA
June	Sat.	14	MCTA Twilight Meeting Crane Neck Tree Farm West Newbury, MA
June	Wed.	18	MCTA Twilight Meeting Clara Belle Tree Farm Shrewsbury, MA
June	Thurs.	19	CTCTGA Twilight Meeting Paproski's Tree Farm Newtown, CT
June		28	NH/VT CTGA Summer Meeting Bryan Blundell Farm East Hardwick, VT
July		17-19	CTFA of NY Annual Summer Meeting Critz Farm Cazenovia, NY
July		18-19	PA- CTGA Summer Meeting Mahantongo Valley Farm Pitman, PA
July		22	CTCTGA Twilight Meeting Valley Laboratory Windsor, CT
July		25-26	Michigan/Midwest Meeting Peterson's Riverview Nursery Allegan, MI
August		20	CTCGTA Twilight Meeting Oak Ridge Tree Farm Middletown, CT
August		23	MCTA Annual Meeting Cranston's Tree Farm Ashfield, MA
September		5 & 6	North Carolina CTA Semi-Annual Meeting & Tour Jackson County, NC
September		20	Fall Annual Meeting Angevine Family Farm Warren, CT

*On the Cover: Balsam fir trees damage in early spring.
 Credits: Steven Katovich, USDA Forest Service,
 Bugwood.org. (NE Wisconsin. #1398021)*



ORGANIZATION & INDUSTRY NEWS

Let the hard work begin. It seemed as if spring would never arrive and now it is here. Or is it summer already? The snow piles have finally disappeared, and hopefully so have the flakes and bitter cold with it. We can only hope and pray the frost holds off to give us and our crop a fighting chance to catch up in short order. Cabin fever is cured! For anyone that taps Maple, the extended cold was a bonus for flow, creating a productive season, (even if you had to shovel your way to each tree to put in the taps). Hopefully, most of us survived this harsh winter, unscathed and recovered from 2013 injuries. Time comes when we will need every bone and muscle in our body to perform the much needed tasks ahead.

The MCTA has a busy spring and summer ahead of us. We have three (3) Twilight Meetings scheduled in June. One eastern MA and two in central MA, on three well established farms with plenty of interesting things to gain insight and knowledge of current problems facing us. Whether you're a new farmer, old farmer, or farmer that has more troubles than you can count, a twilight meeting is always a good time to give and receive help to our fellow growers. Our association members have a lot of experience with many challenges over the years. Just think of what you learned at the last meeting. Sharing these things together, make us what we are at the MCTA. Give yourself permission to take a few hours off from your hectic spring schedule to take a twilight tour, you'll never know what you'll come away with. As you will note on the "Calendar", there are several meetings scheduled in neighboring state associations to attend as well.

Our annual meeting will be at Cranston's Tree Farm in Ashfield, Ma. As long term tree farmers, Tom and Cynthia Cranston bring a wealth of knowledge and expertise to our Association long time participants. Their full time commitment to the diverse landscape creates many challenges and obstacles when trying produce retail and wholesale trees. They do a great deal of research, experimentation, and try to keep up with the latest methods in managing a full scale Christmas tree farm. This is a meeting you won't want to miss as there will be something for everyone to participate in. An alternative program will be offered for those wanting to use their creative skills, and three pesticide credits for attendees. Wouldn't it be nice to get away for a weekend to the Berkshires and enjoy a tour, home-cooked food and sightseeing and, just maybe some spouse time too?

Please note time is running out to get your great tree farm photos for the 2015 Ag Calendar. Submission deadline is June 1, 2014.

Go to <http://www.mass.gov/eea/docs/agr/markets/photo-contest-entry-form.pdf>

Is it Winter Injury or Needlecast Disease?

This winter was certainly a one for the record books. Not only was it cold and snowy, but the wind seemed much more prevalent. It's not surprising to see conifers beginning to show the classic symptoms of winter injury.

Winter injury can affect most Christmas tree species and other conifers. Growers are reporting that they are seeing damage on many species. It is more common in Fraser fir, Concolor fir, Douglas fir, Scotch pine, Austrian pine, White pine, and Norway spruce.

The most obvious symptom of winter injury is browning needles, especially on the south side of the tree or above the snow line.

The first type of damage we see is often called winter drying. Drying occurs when the soil is frozen and the roots cannot easily replace water therefore, the trees lose moisture in the winter due to windy or sunny conditions.

The second type is referred to as winter burn. This happens when needles or buds are damaged after rapid temperature changes. This most often occurs on the south side of the tree where the sun reflects on the snow and warms the tree during the day and then at night the temperatures drop. In a winter like this, growers may be experiencing both winter drying and burn.

Cold wind damage occurs on the west to north-west side of the tree, above the snow line. It is more common around the perimeter of a tree block. Needles will show discoloration from the tips of the needles to the back. On closer inspection, needles have a stippled effect.

To complicate matters, we also see browning on Douglas fir from Swiss needlecast, or on Austrian pine, due to *Dothistroma* needlecast. Needlecast diseases such as *Rhabdocline* and Swiss needlecast in Douglas fir has become a larger problem throughout the U.S due to an increase of Douglas fir used as landscape specimens.

In addition to needlecast diseases, some trees may have died over the winter from compromised root systems caused by *Phytophthora* root rot in Fraser fir or root collar weevil on several pine species. Once you get into the field, it's a good idea to look closely at the trees to determine the true cause of the symptoms you are observing.

And more importantly, low temperatures and an above average snow cover made food sources scarce for animals. There has been many reports of winter damage on trees and shrubs of what appears to be animal damage. Damage to landscape plants are mostly small mammals and deer. Mice, rabbits, squirrels and voles desperate for food cause damage mainly by gnawing on trunks and branches. Despite their small size, these animals can kill trees by removing bark and underlying tissue around the circumference of a tree trunk, a process referred to as "girdling." Deer will defoliate landscape plants as well as

Once you get out into the field, it's a good idea to look closely at the trees to determine what the true cause is of the symptoms you are observing. A pad of white paper, a plastic bag and a camera will come in handy. Take samples, write down what you see as you walk around. Were the needles yellow, then did they turn brown with the onset of warm weather? The most obvious signs of winter injury to buds is damage above the snow line (if you can remember where that was!) This can be more severe on the south to southwest side of a tree, because it receives the most direct sunlight and wind.

Are the affected needles brown from the tip down? Is the brown solid, stippled or banded? Is it above or below the snow line? Do you see dead fruiting bodies? Is the bark or trunk damaged above or below the snow line?

Severely affected needles that turn completely brown and will fall off. Snow cover protects the bottom of the tree from some types of winter injury, which is the exact opposite pattern of needlecasts. Above the snow line, trees will be completely brown.

Damage can vary from year to year, site to site. The long term impact depends on whether or not buds were killed. It is possible to see needle browning without bud kill. If the buds are injured, it will take longer for trees to recover.

And lastly, low temperatures and an above average snow cover made food sources scarce for animals. There has been many reports of winter damage on trees and shrubs what appears to be animal damage. Several animals can damage landscape plants but the most common are small mammals and deer. Small mammals such as mice, rabbits, squirrels and voles desperate for food cause damage mainly by gnawing on trunks and branches. Despite their small size, these animals can kill trees by removing bark and underlying tissue around

continued

Winter injury continued

the circumference of a tree trunk, a process referred to as "girdling." Rabbits and rodents usually clip stems neatly, at a 45° angle. The damage occurs, from ground level to about 6"-12", below or above snow line.

If a large portion of trunk circumference has been girdled, trees are unable to move energy reserves between roots and shoots, growth will be stunted and disfigured, and will eventually die. Deer can cause extensive damage to trees and shrubs due to feeding and also through rubbing their antlers. Deer feeding is often indicated by a "browse line" based on how high deer can reach. Deer rubbing can cause major deformation to trunks and can even kill trees by girdling. Deer rub on small flexible saplings, tree trunks and limbs and damage can be quite severe on small trees.

It's a good idea to take a walk through your fields and look closely at the trees to determine what the true cause of the symptoms you are observing. Damage can vary from year to year and site to site. The long term impact depends on whether or not the buds are killed. We can often see needle browning without bud-kill. If buds are injured or missing, it will take longer for trees to recover and will require adjustments in how we shear the trees. To help trees recover, try to minimize any additional stresses this growing season through proper nutrient management, weed control, pest control and irrigation.



One healthy tree next to damaged tree caused by Rhabdocline and Swiss Needlecast; brown winter injury

Rhabdocline	Swiss Needlecast	Winter Injury
Infected needles have purplish-brown transverse bands. The bands have a distinct margin.	Infected needles turn yellow, then brown	Brown tips. The bands don't always have distinct margins
Fruiting bodies are orange blisters, found on the underside of needle in May-July, open during wet weather	Infects newly expanding needles, but doesn't kill them until they are 2-3 years old	No fruiting bodies
More severe in lower branches	More severe on lower branches	Needles on bottom of tree injured to a lesser extent
Occurs on all sides of tree, regardless of direction	Occurs on all sides of tree, regardless of direction	Most noticeable on south to southwest side of tree
Cause: Rhabdocline weirii	Cause: Phaeocryptopus gaeumanni	Cause: Winter weather

Resources: Wisconsin Christmas Tree Journal, April 2014; Michigan State University Extension Service; www.msue.msu.edu.; University of Maryland Extension Service Fact sheet 655; Branching Out IPM Newsletter for Trees and Shrubs; O'Brien & Hudler; Dept. of Plant Pathology, Cornell University; Penn State University, IPM for Christmas Tree Production (Manual).

Understanding Glyphosate To Increase Performance

Reprinted from *Glyphosate, Weeds and Crops Group Publications with weeds scientists: Bob Hartzler, Iowa State Univ.; Chris Boerboom, Univ. of Wisconsin; Glenn Nice, Purdue Univ. Peter Sikkema, Univ. of Guelph* : 12/06

Glyphosate and Roundup Ready® crops are popular because they provide consistent, broad spectrum weed control with minimal risk of crop injury. On occasion, however, growers experience poor weed control with glyphosate, generally because of application or weather-related factors. This publication examines the factors that affect glyphosate performance and offers management strategies to minimize fluctuations in its effectiveness.

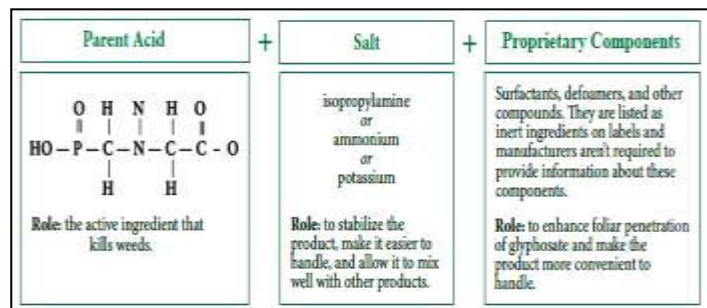
Product Formulations

If you look at any glyphosate product label, you'll notice the ingredient statement. For example, the Roundup Ultra® label states its active ingredient as "Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt." Glyphosate is the common name of the active ingredient, and the rest of the information describes the chemical's structure.

Regardless of the product, the active ingredient that actually kills weeds — glyphosate — is the same. Glyphosate products vary only in the type of salt and proprietary products included in the formulated products. Manufacturers add these components to create products that are convenient to handle, mix well with other agricultural products, or facilitate movement of the active ingredient into plants. The differences in performance among glyphosate products are due to the types and amounts of proprietary compounds included in the formulation.

Figure 1. Components of a Glyphosate Product.

Every glyphosate product is composed of three parts: the parent acid, salt, and proprietary components.



Manufacturers are not required to reveal these components, and they are listed as inert ingredients on the label, stated in terms of pounds of acid equivalent (ae) per gallon. A formulation's acid equivalent is just a measure of the parent acid — the component that kills weeds (glyphosate).

Several newer product formulations contain higher concentrations of glyphosate, or a different salt than the original Roundup® formulations. On each product label's ingredient statement, the glyphosate concentration is stated in terms of pounds of acid equivalent (ae) per gallon. A formulation's acid equivalent is just a measure of the parent acid — the component that kills weeds (glyphosate).

Glyphosate, Weeds, and Crops

Many labels also state the quantity of active ingredient (ai), which includes both the glyphosate and the salt present in the formulation. Do not use the active ingredient concentration to compare formulations that use different salts of glyphosate. When comparing the performance and cost of different products, compare them based on acid equivalent, not product rate or cost per gallon. The following formula is a simple way to fairly compare the costs of different glyphosate products:

cost (\$) per lb. of glyphosate

$$\text{Equals} = \frac{\text{price (\$) per gallon}}{\text{Lbs./acre per gallon}}$$

Glyphosate products differ primarily in the surfactants and concentration of acid equivalent they contain. Surfactants enhance the movement of the herbicide from the leaf surface into the plant tissue. Although the blends and amount of surfactants vary among the many glyphosate products, Purdue University researchers found no significant differences in the performance of six glyphosate formulations (see Table 2)

Understanding glyphosate continued on page 7

Similar results have been found at other universities throughout the Midwest. Differences in performance occasionally occur, especially when below-labeled rates are used. However, these differences are inconsistent and do not support any one being superior to others.

Table 1. Composition of Selected Glyphosate Formulations.

Shows the relationship between the ae concentration and amount of product required to apply equivalent amounts of glyphosate.

Formulation	Salt	Active Ingredient (ai)/Gallon	Acid Equivalent (ae)/Gallon	Product to apply 0.75 ae/A
Roundup Original®/ Glyphomax®/GlyStar Plus®, etc.	isopropylamine	4 lbs.	3 lbs.	32 oz./A
Roundup UltraMax®	isopropylamine	5 lbs.	3.7 lbs.	26 oz./A
Roundup UltraMax II®/ Roundup WeatherMax®	potassium	5.5 lbs.	4.5 lbs.	21.3 oz./A
Touchdown®	diammonium	3.7 lbs.	3 lbs.	32 oz./A
Touchdown HiTech®	potassium	6.2 lbs.	5 lbs.	19.2 oz./A

When glyphosate fails to control weeds, use of an inappropriate rate for the specific weed species or size is frequently the reason. Weed species differ in their sensitivity to glyphosate. And generally, the bigger the weed, the higher the rate required for control. For example, to control waterhemp, nearly twice the rate of Roundup WeatherMax® was required at a late post emergence application as for an early one (Table 3). In other words, the rate of any product used on a field should be based on both the species and size of weed found in the area to be sprayed.

Table 2. Performance of Selected Glyphosate Formulations.

All products were applied at 0.75 lb. ae/A (equivalent to 32 ounces of original Roundup®) to 4-inch weeds.

Formulation	Giant Foxtail	Ivyleaf Morningglory	Velvetleaf
	% Control		
Clearout 41 Plus®	97	86	99
Glyphomax Plus®	98	86	99
Roundup WeatherMax®	98	80	99
Touchdown Total®	97	84	99
Touchdown 4®	98	84	99
Roundup Original®	96	83	97

Source: Thomas Bauman, Mike White, David Hilger and Chad Dyer, 2003; Purdue University.

Increasing Reports of Resistance

The odds of selecting a weed with glyphosate resistance are probably less than the odds for selecting resistance to some other herbicide families. However, widespread and repeated glyphosate use without diversified weed management has increased the selection of resistant species.

Although the total number of glyphosate-resistant weed species is low, the number of species is increasing at an alarming rate (see Fig. A) important points. First, glyphosate-resistant weeds can occur even though the gene for resistance is rare.

Second, the number and geographic distribution of most glyphosate-resistant weeds is limited. This means that there is still time to adopt good management practices, limit the selection of additional glyphosate-resistant weeds, and extend the benefits of the products.

Certain weeds (such as yellow nutsedge, wild buckwheat, and Asiatic dayflower) are naturally tolerant to glyphosate. Acceptable control of tolerant weeds is unlikely regardless of application timing or rate. Including alternative herbicides in weed management programs will provide more consistent control of glyphosate tolerant weeds than programs relying solely on glyphosate.

Spray Additives

Most glyphosate products recommend adding ammonium sulfate (AMS) under certain conditions (see Water Quality below), but surfactant recommendations vary widely. That's because the amounts and types of surfactants included in formulated products also vary widely. Follow the product's recommendations for additional surfactants to optimize performance. Most studies have shown little benefit to adding extra surfactant to "fully loaded" formulations that do not specify the need for additional surfactant. Manufacturers of surfactants and other spray additives are not required to provide information on their products' active ingredients.

Thus, it is difficult to compare the numerous products available to find the optimum surfactant. The risk of obtaining a poor quality surfactant can be minimized by using products with a high concentration of active ingredients

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Understanding glyphosate continued

(typically greater than 80 percent), avoiding products that make unrealistic claims, and purchasing spray additives from the same location as the herbicide.

Water Quality

Glyphosate products are formulated to be mixed with water to facilitate application. Often, that water (whether it comes from a well or rural water association) contains large amounts of dissolved salts. Hardness is a measure of how much salt water contains. The harder the water, the higher the salt concentration.

Soil degradation and effects on micro-organisms and worms

Degradation pathway of glyphosate in the ground. When glyphosate comes into contact with the soil, it can be rapidly bound to soil particles and be inactivated. Unbound glyphosate can be degraded by bacteria. Glyphosate and its degradation product, aminomethylphosphonate (AMPA), residues are considered to be much more toxicologically and environmentally benign than most of the herbicides replaced by glyphosate.

In soils, half-lives vary from as little as three days at a site in Texas to 141 days at a site in Iowa.¹ In addition, the glyphosate metabolite aminomethylphosphonic acid has been found in Swedish forest soils up to two years after a glyphosate application. In this case the persistence of aminomethylphosphonic acid was attributed to the soil being frozen for most of the year. Glyphosate adsorption to soil, and later release from soil, varies depending on the kind of soil.

A 2009 study using a RoundUp formulation concluded that absorption into plants delays subsequent soil-degradation and can increase glyphosate persistence in soil from two to six times. A laboratory study published in 1992 indicated that glyphosate formulations could harm earthworms and beneficial insects.

However, the reported effect of glyphosate on earthworms has been criticized. The results conflict with results from field studies where no effects were noted for the number of nematodes, mites, or springtails after treatment with Roundup at 2 kilograms active ingredient per hectare.^[60]

It has been suggested that glyphosate can harm the bacterial ecology of soil and cause micronutrient deficiencies in plants including nitrogen-fixing bacteria.

A 2012 study on the effect of Roundup® (glyphosate with adjuvants) on three microorganisms used in dairy products found while the formulation had "a microbicide effect at lower concentrations than those recommended in agriculture", glyphosate alone "at these levels has no significant effect".

Glyphosate, Weeds, and Crops

These dissolved salts in hard water may reduce glyphosate’s effectiveness, particularly calcium and magnesium salts. These salts have a positive charge and may associate with the negatively charged glyphosate molecule, displacing the isopropylamine or other salt used in the formulated product. Plants absorb less glyphosate bound with calcium or magnesium salts than the formulated salt of glyphosate, thus reducing glyphosate activity.

Although specific recommendations vary, most glyphosate labels recommend adding AMS. The role of AMS is considerably different than the function of nonionic surfactants. Surfactants are active primarily on the leaf surface and improve herbicide absorption into plants. AMS, on the other hand, is active primarily in the spray tank where it prevents the antagonistic salts from interacting with glyphosate. AMS should always be added to the tank prior to glyphosate to prevent the formation of inactive complexes between glyphosate

and antagonistic cations. There are several products marketed as alternatives to AMS for reducing the antagonistic effects of hard water. Although these products may be more convenient to use than AMS, studies show many of them are less effective.

Weeds in the United States	Year First Reported	Location of Resistant Populations
Rigid Ryegrass	1998	California
Horseweed (marestail)	2000	14 states
Italian Ryegrass	2004	Oregon,
Common ragweed	2004	Missouri, Arkansas
Palmer amaranth	2005	Georgia, North Carolina, Tennessee
Water hemp	2005	Missouri

Figure A. Current Reports of Glyphosate-Resistant Weeds
Source: Univerity of Nebraska Haskell Ag Laboratory, Concord, NB

Spray Volume

Label recommendations for carrier volumes vary among products. For example, the Roundup WeatherMax® label recommends using a volume of 5 to 20 gallons of water per acre, and the Touchdown HiTech® label recommends 3 to 40 gallons of water per acre.

Spray Additives

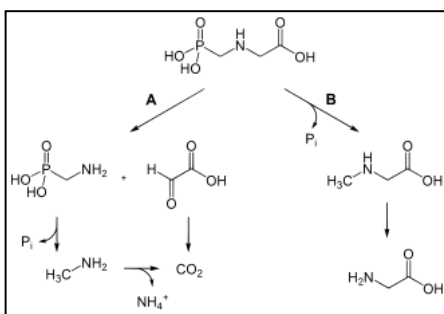
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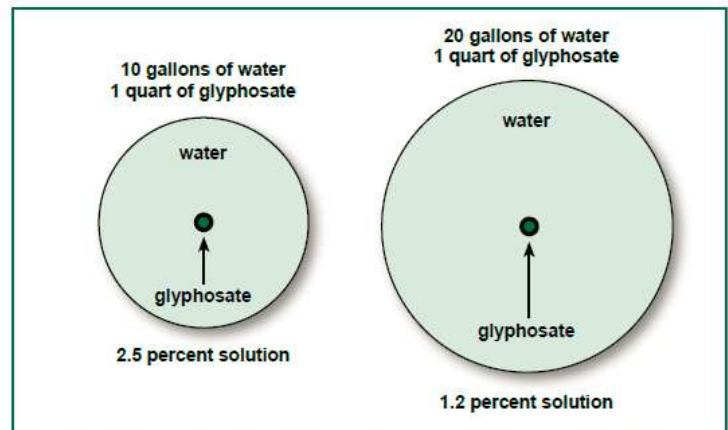


Figure 3: This figure shows the relationship between spray volume and glyphosate concentration. As the spray volume increases, the ratio of formulated glyphosate to water decreases.

It has been suggested that glyphosate can harm the bacterial ecology of soil and cause micronutrient deficiencies in plants,^[61] including [nitrogen-fixing bacteria](#).^{[62][63]} A 2012 study on the effect of Roundup® (glyphosate with adjuvants) on three microorganisms used in dairy products found while the formulation had "a microbicide effect at lower concentrations than those recommended in agriculture", glyphosate alone "at these levels has no significant effect".^[64]

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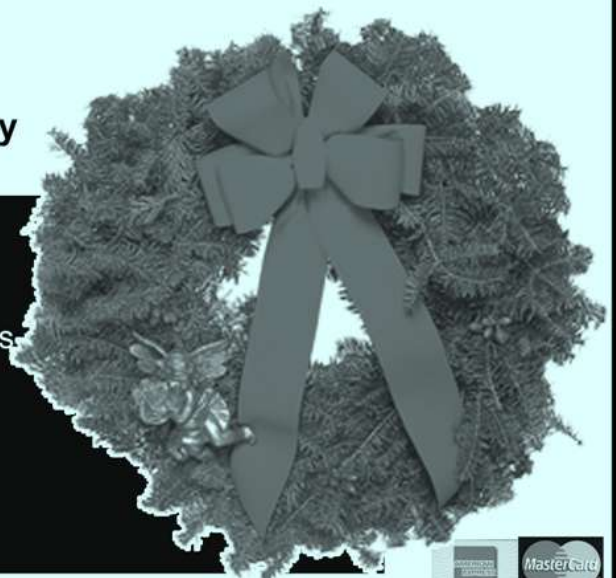
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Glyphosate, Weeds, and Crops

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and antagonistic cations. There are several products marketed as alternatives to AMS for reducing the antagonistic effects of hard water. Although these products may be more convenient to use than AMS, studies show many of them are less effective.

Spray Volume

Label recommendations for carrier volumes vary among products. For example, the Roundup WeatherMax® label recommends using a volume of 5 to 20 gallons of water per acre, and the Touchdown HiTech® label recommends 3 to 40 gallons of water per acre. Research has documented that glyphosate applied in water volumes less than 10 gallons per acre often performs better than when it is applied in water volumes of 20 or more gallons per acre.

There are two primary factors responsible for this response. First, as spray gallonage increases, the ratio of antagonistic salts to glyphosate increases. Thus, the potential for calcium or magnesium salts to inactivate glyphosate increases as spray volume increases. The second factor is a simple dilution effect. As spray volume increases, the ratio of formulated glyphosate to water decreases (Figure 3). The reduction in concentration of both the active ingredient and surfactant in the spray solution may reduce performance under certain situations.

(Increasing spray volume may improve control in areas with high weed density or fully developed crop canopies.)

Several factors should be considered when selecting a glyphosate spray volume. As carrier volume decreases, there may be an increased risk for spray drift and insufficient weed coverage. Relatively small spray droplets are required for uniform coverage at spray volumes less than 10 gallons per acre. Small droplets increase the likelihood of spray drift.

As spray volume is reduced, variability in spray droplet deposition increases and the likelihood that individual weeds may not receive a lethal dose of the herbicide is greater. The variability in spray deposition also increases as the plant canopy's density increases. For most agronomic situations, spray volumes of 10 to 15 gallons per acre minimize the negative effects on glyphosate performance while allowing adequate coverage of weeds present in corn and soybeans. Higher volumes (15 to 20 gallons per acre) may be beneficial in situations with dense weed infestations, well-developed crop canopies, or large weeds.

Spray Nozzle Type

Several new spray nozzles have been introduced that are designed to reduce the number of driftable droplets. While these nozzles may reduce the coverage of target plants by the herbicide solution, glyphosate's mobility within plants reduces the importance of spray coverage compared to other herbicides. Thus, nozzle selection for glyphosate application should be based primarily on managing droplet size and drift potential rather than optimizing spray coverage.

Environment

Plants are continuously responding to stressful environmental conditions (drought, heat, cold). For example, during dry or hot weather, plants conserve water through changes in both the composition and thickness of the cuticle on the leaf surface. These changes influence herbicide absorption and performance.

Most herbicide labels contain vague statements regarding environmental influences on herbicide performance. The Touchdown HiTech® label states, "Touchdown® requires actively growing green plant tissue to function." Most growing seasons contain short periods when temperature or

continued on page 12

Understanding Glyphosate continued

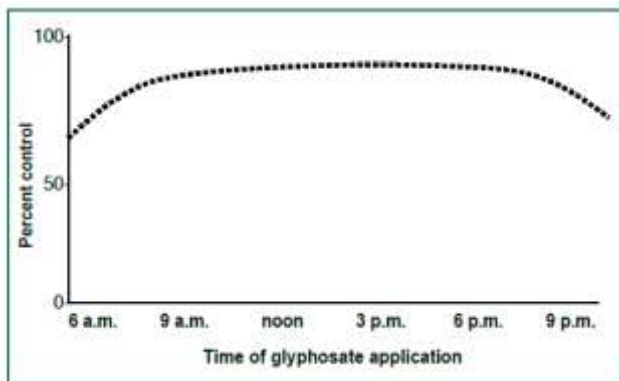
moisture extremes essentially cease plant growth. Herbicide applications made during these periods may provide ineffective control. Managing fluctuations in herbicide efficacy due to changing weather is one of the most difficult challenges in weed control.

Attempts to develop tools that determine the optimum herbicide rate or spray additive based on prevailing weather conditions have been largely unsuccessful. Increasing the glyphosate rate may help overcome the effects of adverse weather conditions that occur before or at application. Postponing applications until more favorable conditions return is another option if crop and/or weed size permit delayed action.

Time of Day

Soon after Roundup Ready® soybeans were introduced, control problems with evening applications of glyphosate were observed. Subsequent research confirmed that glyphosate activity can decline when applications are made early in the morning or in the evening (Figure 4).

Figure 4. This graph shows a hypothetical response activity to time of application



Rainfall

Glyphosate must penetrate the leaf surface to provide effective weed control. While absorption occurs relatively quickly, rain after an application can wash glyphosate off before it has a chance to enter the leaf.

The rain-free period required to prevent reduced activity is influenced by the susceptibility of the target weed and the glyphosate rate. Small weeds of a sensitive

species will require a shorter rain-free period than large or difficult to control weeds. A 30-

minute rain-free period may be adequate under ideal conditions. When spraying larger weeds, however, several hours between application and rain may be required to avoid reduced activity. Differences in rainfastness among glyphosate products are generally small. Adding more surfactant appears to have marginal benefits on the rain-free requirement.

Glyphosate, Weeds, and Crops

Dew

There is a wide range of views among growers about the influence of dew on herbicide performance. Some say they see the best herbicide performance when light dew covers the weeds' foliage. Others believe the presence of dew greatly reduces weed control. The few controlled studies investigating this factor have not found a consistent response to dew. A recent study reported reductions in glyphosate activity only with heavy dew and high spray volumes (48 gallons per acre) where the spray solution triggered runoff from plant leaves.

Dust and Tire Tracks

In glyphosate-treated fields, it is common to find weed escapes in the sprayer's tire tracks. Such failures are likely caused by the mechanical damage by tire traffic to the weeds, or by dust kicked up by the tires that intercept the spray solution.

Glyphosate binds very tightly to soil particles, thus any glyphosate that contacts dust in the air or on the leaf surface will be inactivated. Attempts to overcome these effects — by mounting booms on the front of sprayers, mounting extra nozzles behind the rear wheels, or placing larger nozzles in line with wheel tracks — have been inconsistent in resolving this problem. The best way to limit the problem is timely application to small weeds.

Summary

Glyphosate's performance is affected by many factors, and applicators have little or no control over many of them. The primary cause of weed control failures is a delay in application that allows weeds to reach sizes that are difficult to kill consistently. Timely application and using the proper rate for the specific situation minimizes the effects of factors outside of the applicator's control and reduces the likelihood of performance failures.



Twilight Meetings 2014

June 4 - Wednesday - 6:00 pm
Vanderwalk Tree Farm & Winery

Host: *Casey & Susan Vanderwalk*

25 Lovell St.

Mendon, MA

508 – 478-8733

Vanderwalk Tree Farm has been growing trees since 1984. They have a very active farm with year around ancillary businesses. They participated in some farmers markets during summer and fall as well. Their site is wet, rocky, hilly site with Balsam and Fraser firs. Casey has experimented with the use of raised beds in growing and harvesting his trees. There are insects and diseases scout as well. Casey invented a new Basal pruning design which will be demonstrated. Tour and discussion includes blueberry farm, winery and wine tasting. Food and beverages will be served.

For directions go to: <http://www.vandervalkfarm.com/>

Twilight Meeting

June 14 - Saturday 4:00 pm

Crane Neck Tree Farm

Host: *Jeb Brackbill*

114 Crane Neck Street

West Newbury, MA 01985

(978) 363-1272

Crane Neck tree Farm was founded by James Brackbill in 1968 and after a couple of transitions is now a second generation tree farm operated by Jeb Brackbill. The farm consists of about 20 acres at Crane Neck Street, all but 5 acres on leased property. Species grown include Douglas fir, Fraser fir, Canaan fir and a limited number of Norway spruce and Blue spruce (being phased out). Trees are sold choose and cut & pre-cuts are brought in to supplement inventory in some years

A second ten acre location in Groveland, MA about a five minute drive from Crane Neck Street is run with partner Bill Latham and opened for sales in November 2013. Both locations are enclosed with deer fencing. A 40-50 car parking lot provides easy access for customers at this site. Douglas fir, Canaan fir and Norway spruce are grown.

A third location of about 5 acres is under production on another leased site in West Newbury. It features Fraser fir, Canaan fir and about 500 Meyer spruce. This property is also fenced. These trees may be sold on site, harvested for pre-cuts, or both.

Fertilization has been lax in recent years but tree growth and color has been good. Scale is a concern, treatment for needlecast in Douglas fir is never skipped, band spray weed killing with glyphosate is consistent and deer pressure is constant. Emphasis for maintenance is on mechanical efficiency. A planter is used for planting, mowing is with Ventrac and weed killing is performed simultaneously when mowing once in the spring and once in the fall. A Jacto 400 is used for spray applications and a Rayco self-propelled stump grinder to eliminate stumps. Children Liza and Ben help keep mowing under control. At sales time wife Tammy, family and other relatives help out. Partner Bill Latham and wife run the Groveland location. Jack Jackson and the Essex County Tree Growers will provide sandwiches and soft drinks prior to the tour.

Go to website for directions. www.cranenecktree.com



Twilight Meeting
June 18 – Wednesday - 6:00 pm
Clara Belle Tree Farm

Hosts: *Alan & Cindy Bushey*

14 High Street

Shrewsbury, MA 01545

508 -845-9827

Clara Belle Tree Farm, formally known as Solar Plantation or Bushey's Tree farm was taken over by Bob Bushey's son, Alan and his wife Cindy. They are on a huge learning curve in terms of balancing the needs of the farm with the needs of our active young children. They have turned the glass greenhouse in a barn.

They have had lots of problems; root rot that is spreading (lost about 150 trees in the past year to this). Attempting to strengthen tree health by spraying ground and basal trunk sprays with phosphate. The cryptomeria is currently uncontrolled, largely because it went unchecked for a year, and they did not have a pesticide licenses. Trunks were sprayed last year with Safari with good results. Unfortunately, time was short and they were unable to spray the whole farm. Will continue this year but also need to basal prune to be able to successfully reach the trunks in a timely way. We also spray with onyx pro for the leader borers, and just finished that for this season. And, looking at the lower field this spring, it appears we have an emerging rust or fungus or something on the inner needles.

Bob's decided to inter plant baby trees (between the 5 foot plantings) and they are dealing with the results of young trees that are tall for their age and very thin. Their heads are spinning most days, but are encouraged by some success. And , will definitely have lots to see, discuss and are open for member's advice.

Directions to Clara Belle farm: <https://www.google.com/maps/place/14+High+St/@42.3038867,-71.6878578,12z/data=!4m2!3m1!1s0x89e3f61f9b07dea3:0x80f120a9e8b3bbe5?hl=en>



M.C.T.A Annual Meeting
Saturday - August 23, 2014
Cranston's Tree Farm

Hosts: *Tom and Cindy Cranston & Family*

372 Baptist Corner Rd.

Ashfield, MA 01330

(413) 628-3911

Guest Speaker: Dr. Nicholas J. Brazee, Extension Plant Pathologist, UMass Extension

(PESTICIDE CREDITS WILL BE OFFERED)

The Cranston Tree Farm is comprised of 170 scenic acres of which 40 acres are devoted to the cultivation of Christmas trees (Balsam, Concolor, and Fraser), 30 acres to hay land, and the remaining acreage to scenic woodland. Farm transitions are occurring as the younger generation takes on more responsibility. In fact, the annual meeting will be held at Seth and Maryellen's and our retail location. While there will be plenty of opportunities to view and discuss tree culture and see distress areas where phytophthora and armillaria root rot have been problems, we will also focus on our expanded retail operation. Partially because of flat wholesale prices, we have created an agri-tourism type of retail which includes caricatures Seth made, a FaceBook presence, and a credit card machine.

The alternative program will include a demonstration by Sara Delaney on the art and science of decorating a "real" Christmas tree. Cliff's Barbeque will cater the event with smoked pulled pork, barbeque chicken, potato, tossed, and fruit salads, and a real old-fashioned fudge sundae. Estimated cost: \$20. Per person

Christmas Tree Survey for New Phytophthora Root Rot Diseases

By Anette Phibbs, Susan Lueloff, DATCP Plant Industry Laboratory; and Reprinted from Wisconsin Christmas Tree Producers Association Quarterly Journal, April 2014 and pestsurvey.wi.gov/

DATCP inspectors surveyed for *Phytophthora* root rot disease during annual Christmas tree field inspections. This project was started in 2011 to look into the cause of tree losses observed by growers. It is funded with USDA Specialty Crop Block Grants and Wisconsin Christmas tree producers have the opportunity to participate through fall of 2014. In fields where patches of dying or declining conifers were found, inspectors carefully dug up affected trees and transported them to the DATCP's Plant Industry Laboratory for testing. Depending on tree size, two (2) to six (6) root rot symptomatic trees were combined into one sample per field.

Each survey year we try to add new farms, fields and counties to the survey, to assess the prevalence of root rot disease caused by *Phytophthora*. Table 1 lists the number of growers, fields and counties inspected and sampled each year. Over the last three years, 81 growers in 30 counties have been sampled. Four new counties were added in 2013.

All samples from the new counties tested negative for *Phytophthora*. Nine samples from tree farms (see Figure 2) were infected with *Phytophthora* root rot in 2013. Trees that showed symptoms of root rot in the field were Fraser (*Abies fraseri*) and Balsam fir (*Abies balsamea* or *phanerolepis*), and Douglas fir (*Pseudotsuga mezesii*).

The infected trees displayed basal cankers with characteristic orange brown discolored cambium and xylem wood underneath the bark. All thirteen *Phytophthora* were identified to be one of two species. They are species that have only been described in

recent years: *Phytophthora sansomeana* (2009) and *Phytophthora europaea* (2002). All isolates were collected from declining or dead Fraser firs.

Figure 4 shows the survey distribution map. It's noteworthy that a high percentage of all trees examined, suffered from root compaction, J-shaped roots and secondary infections with *Pythium* of decaying fine roots. *Pythium* can cause root rot disease of seedlings but as plants mature they can outgrow infections and become more resistant.

Figure 1

Christmas Tree Program Statistics			
Year	2011	2012	2013
Collection Time frame	9/26-10/14	8/16-10/29	9/15-10/31
Growers Inspected	297	304	324
Grower's Samples	32	37 (26 new)	324
Fields inspected	689	702	767
Field samples	51 (7.4%)	58 (8.3%)	44 (5.7%)
Counties sampled	18	18 (8 new)	17 (4 new)

The identification of *Phytophthora* was based on observation of the pathogen's morphological features on three different media, followed by nucleic acid based detection techniques (PCR and sequencing). The use of molecular testing allowed us to compare DNA sequences, which was essential in identifying *Phytophthora* to species level.

In 2013, 20% of declining trees tested showed infections for *Phytophthora*, compared with 26% in 2012 and 27% in 2011. Other tree problems in 2013 were due to root compaction, *Armillaria* root rot, *Cytospora* and *Sirococcus* blight. The effects of 2012 drought also carried over into 2013.

Figure 2

Number of Samples Infected with <i>Phytophthora</i> Root Rot by Tree Species						
	2011		2012		2013	
Tree Species	Total Samples	Positive for <i>Phytophthora</i>	Total Samples	Positive for <i>Phytophthora</i>	Total Samples	Positive for <i>Phytophthora</i>
Balsam fir	10	0	8	2	19	5
Fraser fir	35	14	35	12	24	4
Cannan fir	1	0	2	1	0	0
Korean fir	1	0	0	0	0	0
Spruce	1	0	7	0	1	0
Pine	3	0	6	0	0	0
Grand Total	51	14 (27%)	58	15 (26%)	44	9 (20%)

Phytophthora Survey continued

Phytophthora Survey continued

The most frequently detected species of Phytophthora was *P. europaea* and *Phytophthora sansomeana*. These are two new species of

Phytophthora were first detected in Christmas trees in 2011. *P. sansomeana* is known to certain firs, especially Fraser fir but has been reported on Douglas fir in Oregon and infected several weed species in New York. It was also detected in Balsam fir in Marathon County, Wisconsin in 2013. The range of host crops is important to know when crop rotation is considered for disease management.

Figure 3

Phytophthora Species found in Wisconsin fir	2011	2012	2013
<i>P. europaea</i>	6	12	5
<i>P. sansomeana</i>	8	1	1
<i>P. plurivora</i>	0	1	1
<i>P. cactorum</i>		1	2
<i>P. sp. "kelmania"</i> (3 in 2010)	0	0	0
Total Number of Samples	51	58	44
Total Number of Samples with Phytophthora	14	15	9
Percent of Samples Infected w/ Phytophthora	27%	26%	20%
Percent of Fields Infected w/ Phytophthora	2.0%	2.1%	1.2%

In 2012 and 2013, we documented the better known root rot pathogen *Phytophthora cactorum* in Balsam fir, Canaan and Fraser fir. *Phytophthora plurivora* was found in Fraser fir in 2 other Wisconsin counties.

Phytophthora europaea was first found in European forest soils around oak trees. It has since been collected from soil samples in oak forests in Minnesota, West Virginia, Wisconsin and Pennsylvania (2006). It is considered a weak pathogen of oak. In our survey *P. europaea* infected Fraser firs displayed large areas of decaying wood tissue below the bark, (see photo 1) while the foliage only showed mild foliar discoloration. This may indicate that this species is a more aggressive acting pathogen of Fraser fir but more



Photo 1. Fraser fir trunk base infected with *Phytophthora europaea*. Outer bark removed to show orange-brown discolored wood tissue.

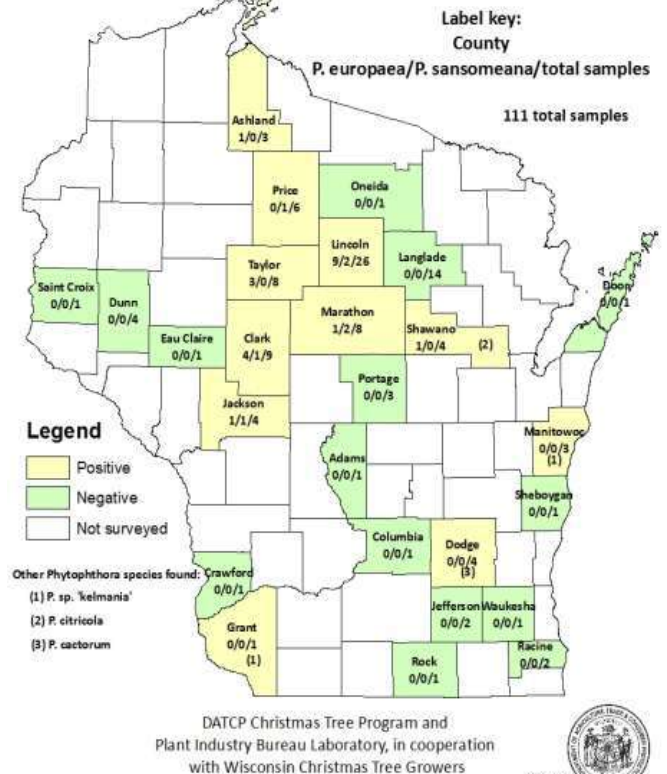
research is needed to evaluate Pathogenicity of *P. europaea* on firs and other conifers.

The first three years of survey for *Phytophthora* root rot revealed that some new species may be involved in causing root rot disease problems in Wisconsin. Although *Phytophthora* root rot only appeared in patches in localized fields in Wisconsin, it was present in most Christmas tree producing counties. A major concern about *Phytophthora* is its longevity in soils for many decades. During wet conditions outbreaks of disease can occur and decimate fields. More research is also needed to evaluate control treatment options of conifers in Wisconsin.

Growers are encouraged to participate in the survey because finding out the cause of tree diseases in each field and documenting the disease history is an important first step to managing tree health.

To learn more about the new species of *Phytophthora* DATCP Plant Industry Lab shared cultures with several researchers. Two researchers, Dr. Gary Chastagner along with Kathleen McKeever (his student) at Washington State University are focusing their research on finding more root rot resistant fir species for Christmas tree production.

Figure 4
2011-2012 DATCP Christmas Tree Phytophthora Survey



NATIONAL NEWS

July 2014

NCTA National Tree & Wreath Contest @ the Michigan/Midwest Regional Meeting July 25-26

Peterson's Riverview Nursery
873 26th Street, Allegan, MI 49010

Southern Christmas Tree Association Annual Meeting

August 1-3, 2014
Birmingham, AL area (specifics TBD)
Mike Buchart, Executive Secretary -
Sctaes@gmail.com
Phone: (225) 505-6335

Christmas Tree Check-Off Program Frequently Asked Questions

When will the collection of assessments begin?

Assessments will be collected this fall for imported Christmas trees and in February 2015 for domestic Christmas trees. The fiscal year under the program runs from August 1 thru July 31 of the following year.

Who will pay assessments and how much is it?

Domestic Christmas tree producers (wholesale & retail) who cut and sell for the holiday market 500 or more Christmas trees annually and importers who import to the United States 500 or more fresh-cut trees annually will pay an assessment of .15 cents per tree cut and sold for market or imported.

(ex. 650 trees = \$97.50 \$135.00; 1500 trees = \$225.00)

Who will collect the assessment?

The Christmas Tree Promotion Board will collect the assessments and administer the program with oversight by USDA. The Board will implement, with approval by USDA, projects and activities designed to help build demand for fresh-cut Christmas trees.

How will the Board be selected?

The Board will be appointed by the Secretary of Agriculture. The Board will be composed of 12 members: 11 domestic producers from 3 geographical U.S. regions and one importer.

Are small producers or importers exempt from paying assessments?

Yes, producers who cut and sell fewer than 500 Christmas trees annually and importers who import fewer than 500 fresh-cut Christmas trees annually will be exempt from paying assessments.

Why is USDA implementing this program?

The Christmas tree industry submitted a proposal to USDA for consideration and it was favored by a majority of comments received from Christmas tree producers, importers and interested persons.

Did the industry vote for the program?

Industry members will have an opportunity to vote in a referendum 3 years after the collection of assessments begin to determine whether the program continues. The program would continue if approved by a majority of producers and importers voting in the referendum.



**NOTICE to
M.C.T.A. Members**

**MAY 2014 is the last
“HARD COPY of “SHEARINGS”**
For more details refer to the MCTA
Board of Director’s April 9, 2014
highlights

How Fungicides Work

References By Erin Lizotte and Jill O'Donnell, MSUE: Reprinted from the Great Lakes Christmas Tree Journal, Spring 2014,

As we continually gain insight into the pesticide and pest interactions through research, we have the opportunity to greatly improve the efficacy of our management practices. In order to optimize environmental and economic sustainability we have to understand the lifecycle of the insects and pathogens in our Christmas tree fields and also the pesticides used to treat them.



To gain a better understanding of pesticides and how they work, we can look at their characteristics and how that affects their use and efficacy. For the purpose of this article we will focus on fungicides and three key fungicide characteristics; spectrum of activity, mode of action and mobility and explore how this information can help growers optimize Swiss Needlecast management.

A fungicides spectrum of activity is typically defined as single-site or multisite. Single-site fungicides act on a solitary chemical target within the pest and kill only plant pathogens that contain the chemical target. For example, strobilurin fungicides (e.g. Quadris) inhibit the production of energy within the pathogen cell by targeting a single point process.

Conversely, multisite fungicides affect general metabolic processes such as cell wall formation and often kill multiple species or groups of related pathogens. Multisite fungicides are general toxins, for example chlorothalonil based fungicides (e.g. Bravo, Echo) inhibit multiple substances and processes that are critical to spore germination and formation of the fungal cell wall. Understanding the spectrum of activity is critical to understanding the effect of an application on non-target pests and the implications for pesticide resistance management. Single-site fungicides are more prone to resistance development due to their associated modes of action and have less potential for suppressing secondary pathogens of concern.

Multisite fungicides are critical to pesticide resistance management and are often used in rotation or as tank-mix partners with single-site fungicides to prevent or slow resistance development. This is based

on research showing that genetic mutations are the most prevalent cause of pesticide resistance and exist naturally at very low frequencies within a given pest population. Over repetitive single-site fungicide applications resistant

genetic mutants survive treatment and increase disproportionately to normal population structure, eventually leading to field resistance or a readily detectable loss of disease control (see Figure 1). Conversely, a multisite fungicide like chlorothalonil affects numerous targets and processes within a pathogen that are controlled by multiple genes and affect many processes critical to the pathogens survival. All of the target sites in the pathogen that are affected by chlorothalonil would have to change simultaneously (within one individual) in order to stop a broad spectrum fungicide from working. The chances of these numerous genetic changes happening simultaneously are slight, and would likely cause the organism to become nonviable or noninfectious. That being said, there is still a risk of eventual resistance development to broad spectrum pesticides, it just typically takes many more pest generations to occur.

Mode of Action

Mode of action is a characteristic that defines how a fungicide affects the pathogen and is critical to understanding when to make an application (.g. before spore germination, after infection, when it rains) as well as how to properly rotate pesticides to prevent or delay resistance development. Luckily, it is easy to determine mode of action as almost all pesticide labels now contain a code that denotes the mode of activity. On fungicide labels these codes are

Fungicides continued on page 20

defined by the Fungicide Resistance Action Committee, and are meant to assist growers in easily identifying pesticides with like modes of action. Most commonly, we talk about pesticides by their label or trade names (e.g. Bravo, Echo) but these names do not communicate any information about the chemical class (chlorothalonil) or mode of action classification. For example, chlorothalonil is a multisite fungicide and acts as general enzyme inhibitor, affecting numerous target sites controlled by multiple genes and affecting general biological processes eventually leading to fungal cell death. Chlorothalonil is classified as an M5 fungicide, a code which is readily visible on many labels. All other fungicides labeled a M5 will have the same mode of action.

Mobility

The last characteristic we will address in this article is mobility. Pesticide mobility falls into three main categories; contact, translaminar, or systemic and defines where the pesticide is located on or in the plant. Contact pesticides remain only on leaf surface and do not absorb into or move within the plant tissue. Contact pesticides are highly susceptible to rain wash off and UV-light degradation and typically have shorter residual activity when compared to those with translaminar or systemic properties. Translaminar pesticides are capable of moving through the cuticle and into leaf tissue allowing for added protection from rain wash off and UV degradation, increasing the average residual activity of the product. True systemic fungicides are taken up by the xylem or phloem tissue of the plant and moved to new tissue. Most of the systemic materials available are translocated upward via the water-conducting tissues of the plant and are typically applied as root or soil drench. Systemic materials generally have the longest residual life compared to contact or translaminar pesticides.

Table 1 lists fungicide products labeled for use in by Michigan Christmas tree producers along with their

associated characteristics for grower reference. January 2014.

Case Study – Swiss Needlecast management

Now that we have defined three key characteristics of pesticides; spectrum, mode of action and mobility, let's discuss the real world implications of this information on management of Swiss needlecast (SN) with chlorothalonil. SN is caused by the fungus *Phaeocryptopus gaumannii* and primarily affects Douglas fir. Symptoms include yellow-brown needles and needle shed. Signs of fungi include black fruiting bodies growing out from the pores on the underside of needles. These fruiting bodies appear as two parallel rows of tiny, black spheres on the underside of the needle. (Photo 2)

Spores of the Swiss needlecast fungus infect through respiration pores on the underside of needles during the spring and early summer. The fungus then grows within the needle tissue and produces small black reproductive structures which become visible in early winter. These reproductive structures greatly inhibit the movement of water and gas through the stomata eventually causing death of the needle. The fungi overwinters in these reproductive structures and doesn't fully mature until bud break. Spores are then released and dispersed to new tissue by water (rain, dew, high humidity) or wind where they germinate and infect new needles starting the cycle again. New infection sites are primarily on tender new needles but can include last years' growth as well.

Based on the lifecycle of fungi that causes SN, growers utilizing chlorothalonil or other broad spectrum, contact fungicides such as mancozeb should consider that application prior to bud break will not be effective because the overwintering fungi is still protected in the reproductive structures. Until temperatures warm in the spring, the fungi is protected by both the reproductive structure and the needle itself and is not susceptible to treatment by contact fungicides.

Fungicides continued on page 22



M.C.T.A. MEETING HIGHLIGHTS

April 9, 2014

Chicopee, MA: Attendance: Dan Pierce, Joe Meichelbeck, Scott Dwinell, Larry Flaccus, Carol Nims, Kathy Pierce, Susan Lopes, Casey Vanderwalk, Tom and Cindy Cranston, Jim Colburn.

Vice President Dan Pierce: The minutes of the January 2014 meeting were approved as corrected.

Treasurer's Report: Joe Meichelbeck, reported YTD spending against the 2014 budget. Due to the timing of some expenses from last year's Annual Meeting, the meeting expense line will be over budget but overall spending should be on target by year end

Secretary's Report: Jim Colburn noted we added one new membership since the last meeting. The Association's supply of the Southern NE Christmas Tree Growers Manual is depleted and no longer distributed to new members. There is an electronic version viewable on our website under **Publications**. The Association currently has 120 members. At the end of the last fiscal year, there were 121 members. So far this year there are 5 new member farms and 6 non-renewals. Dave Butt and Jim Colburn represented the Association at the recent Ag Day at the Statehouse event.

Annual Dues – A discussion on annual dues focused on the fairness of charging new members the full amount especially for those joining the Association after the selling season. The Board reviewed the wording of the current membership article in the By-Laws. *Section 2: Each application for membership shall be accompanied by one year's dues. Those whose applications for membership are received after June 1 shall be considered paid in full through the next fiscal year.* Casey Vandervalk suggested the wording be changed from "after June 1" to "after January 1." A draft of the change will be reviewed at the July meeting prior to a members vote at the annual meeting. Membership renewal forms will be going out in late June, along with more details of the Annual Meeting in August.

Association Website: Gloria Ellsworth reported that the webilizer was removed from the Association website when Mouseworks installed a new server and it would require Board approval to be replaced. After discussion of the merits of this statistical data, Tom Cranston offered a motion to add the Webilizer to our website at a cost not to exceed \$100.

Shearings: Mass communications with Association members via the Internet has continued to increase with the recent addition of pest alerts, IPM newsletters and messages from UMass Extension. The effort is spearheaded by Pete Sweet and coordinated by Dave Morin. It was noted that we now have electronic issues of all newsletters from May 2012 forward available on the Association website. There was discussion on the costs of both the on-line and printed versions of the newsletter and most importantly the time and effort to produce both versions. Printing and postage costs continue to increase and this small job printing process is not efficient. The production and distribution of Shearings is essentially a one person effort. The Secretary noted that there were a few longtime members that did not have email addresses and have not been able to participate in any mass email communications or receive the on-line version of Shearings after the May 2014 issue. Motion was seconded and approved by vote that subsequent newsletters would be emailed to all members. Noted that this version can easily be printed with a personal computer and home printer. To accommodate those few members without email addresses a second motion was made. The Association will continue postal mailing to members without a registered email address. The motion was seconded and approved. The Secretary agreed to perform this administrative task each quarter.

Twilight Meetings: Have been set for 3 days in June. Wednesday, June 4th in Mendon; Saturday, June 14th in West Newbury, and Wednesday, June 18th in Shrewsbury. Details posted in May Shearings.

Annual Meeting: Saturday, August 23, 2014 is the date schedule for the annual meeting. The Cranston family will host the event at their farm in Ashfield, Ma. Cynthia outlined the drafted plans to the board. The speaker will be from UMass Extension with a potential of 3 pesticide credits offered. An alternative program for spouses is in the development. A 50/50 raffle will be held as well.

*Thank you to Susan Lopes and The Paul Bunyan Farm and Nursery.
Respectfully submitted, Jim Colburn, Secretary*

Fungicides continued

Contact fungicides do not penetrate the cuticle of the leaf nor the tissue of the overwintering reproductive structure making early sprays, wasted sprays.

Both chlorothalonil and mancozeb remain on the surface of the plant and should be used as a protestant barrier for when spores dispersal begins. Spores landing on needles treated with these fungicides fail to germinate, thus protecting the tissue from infection. Of course, we know that contact pesticides have a relatively short residual life and are highly susceptible to rain wash off and UV-light degradation. Reapplication instructions are label and rate dependent, but in general growers start applying when trees break dormancy in the spring and reapply every 10-14 days as long as conducive environment conditions are present. Growers are encouraged to review label carefully as reapplication intervals and rates significantly by product. Lastly, growers should




consider the implications of multiple fungicide applications in terms of resistance management.

Multiple applications of broad spectrum fungicide, like chlorothalonil are unlikely to cause resistance development, particularly given that the fungi that causes SN has only one reproductive cycle annually providing very few opportunities for natural mutation to resistance (consider this in contrast to a bacterium which might have thousands of generations in a season).


Utilizing all the information we have at our disposal regarding pesticides and pest can help in making educated management decisions that optimize the environmental and economic components of our production systems .

Continued on page 23 with reference table



*Vigorous plants from selected seed source
Can make all the difference...*

Larry & Marlene
1860, Spring Road, Cookshire Eaton (Quebec) J0B 1M0



DOWNEY
tree farm & nursery

Tel. 819 566.0319

www.downeynursery.com
Access Website for price list

How fungicides work continued

Table 1: Fungicides registered for use on Christmas trees in Massachusetts and Michigan
(with the exception of Kaolin clay in MA, unknown in other states please refer to current state registrations all fungicide products)

Active Ingredient	Trade Name	Spectrum	Mode of Action	Mobility	Risk of Resistance	FRAC code
Chlorothalonil	Echo, Bravo, Armor Tech, Quali-Pro Chlorothalonil, Daconil, Docket, Ensign, Equus, Initiate, Legend, Lesco, Mainsail, Pegasus, Thalonil	Multisite	Multisite contact	Surface contact	Low	M5
Kaolin Clay	Surround	Multisite	Physical barrier	Surface contact	Low	Not classified
Mancozeb	Dithane, Fore, Lesco, PenncoZeb, Wingman, Pentathlon	Multisite	Multisite contact	Surface contact	Low	M3
Thiophanate-methyl	Nufarm T-Methyl	Single-site	Affects mitosis and cell division	Systemic	High	1
Copper Hydroxide	CuPro, Kocide	Multisite	Multisite contact	Surface contact	Low	M1
Azoxystrobin	Quadris, Heritage	Single-site	Q01 affecting cell respiration	Translaminar and systemic	High	11

Figure A: Details action of most common fungicides

1. Risk of resistance as defined by the Fungicide Action Committee. High risk fungicides are defined as those with any of the following characteristics: cross resistance with existing fungicides; laboratory studies have shown resistant mutants with the population; the active ingredient is known for practice of repetitive use or sustained treatments; the active ingredient is known to have an extensive use; and, the target plant pathogens are known to have large populations with rapid multiplications.
2. Technically, Kaolin clay based fungicides form a particle film so the term multisite is not a perfect description as it is typically used to indicate activity against multiple chemical or cellular targets within a pathogen. However, given the multiple mutations that would have likely occur within a pathogen to overcome a particle film it is labeled as multisite for the purpose of this article.

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