Maple Syrup Digest

Vol. 55, No. 1 February 2016

March is Maple Month
Vacuum Research
Sap Beverage Research

The Newsletter of the North American Maple Syrup Council


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MAPLE SYRUP DIGEST

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Greetings from your President

As I begin to transition between the hectic schedule of maple schools, annual meetings, and the increasingly hectic preparation for the sap season, I am becoming evermore aware of the loss of unbiased field and production information pertaining to our maple industry. Fresh from the expansive schedule of programs at the 21st New York Maple Producers Winter Conference at Verona and just back from the Michigan Maple Syrup Association annual meeting, I am reminded that most of our commodity information is now coming from manufacturers' representatives rather than from research programs at land grant institutions, universities or institutional research centers.

While I don't wish for a moment to minimize the importance or the impact of industry input or support, I am acutely concerned by the dwindling number of researchers working on unbiased institutionally supported research programs. One simply has to review the list of the 19 contributors who provided chapters or information for the most recent *North American Maple Syrup Producers Manual* (2006) and realize that only seven of them are still engaged in some capacity for the industry. Many of their positions have simply been lost through retirement, institutional fiscal realignment, or changes in priority or focus. We all need to work cooperatively to garner state, provincial, and federal support to enhance research opportunities, professional and technical expertise and educational opportunities for information transfer within our economically progressive agricultural specialty crop.

My message for producers from all sectors of the sixteen states and provinces represented by this Council is to reach out for expanded support for maple research and development. With this we need to institute mechanisms geared to provide shared information with neighboring regions where expertise is lacking. The NAMSC Education Committee is embarking on a program to provide information, expertise and technical assistance to areas with documented need and lack of professional support. The Council has budgeted initial funding to begin matching expertise with areas of need. This industry is far too valuable to be lost in the shadows of larger, better lobbied commodities, and it's up to us to raise the visibility of our products and what we do.

My best to all fellow producers as we prepare to balance our desire for "the best maple season ever" with the reality of the climatic throttle under which we all must cope. Good sugaring….

Kind regards,
Eric Randall, NAMSC President

In this issue...

Cover photo: Wisconsin Sugarmaker Lee Krueger writes: "This is an 1890 picture of my great grandfather August Richter helping at his mother's family's evaporator "shack" near West Bend, Wisconsin. August is on the left. His brother-in-law, Charles Hoppe, is in the doorway. An unknown helper is on the right."

Contribute to the Maple Syrup Digest!

This is **<u>your</u>** newsletter. We are always interested in receiving:

- News from your business or association.
- Event announcements.
- Photos of your sugarmaking operation.
- Ideas for articles.

Send your contributions to editor@maplesyrupdigest.org.

Help Spread the Word

March is Maple Month

Sugarmakers can help grow the industry

NAMSC and IMSI have teamed up to launch a website and reach out to press, bloggers, and other influencers in the culinary world to promote the events that happen in maple producing states and provinces during the sugaring season. This campaign will bring more attention to maple products, and more visitors to sugarhouses. There are many ways you can help spread the word.

Participate: Open up your sugarhouse to visitors, so they can see how maple syrup is made and learn about why it's so great. If your state or province has a Maple Weekend, join in! See the article on page 20 about how to improve visitors' experiences.

Press: If you have connections with local media, share the press release on the following page with them.

Social Media: Use your personal and business Facebook pages, Twitter accounts, and Instgram accounts to spread the word about the website, at www.maplemonth.org.

Promote: With everything you do, let people know about why maple products are so great, and how versatile they are. For instance, consider Having some cookbooks, like the ones mentioned in the article below, for sale alongside your syrup, so that customers know that they need to buy more so they can use it in all of their cooking.

Save the Date: 2016 International Maple Meetings

The 2016 NAMSC/IMSI annual meetings, and International Maple Conference and Tradeshow, will be held October 26-28 in Burlington, VT. This event features panel discussions with industry experts, a tradeshow with vendors from across the maple belt, presentations on the newest research and products, and tours of local sugarhouses.

More information will be posted as it becomes available at http://vermontmaple.org/2016.

Maple Cookbooks

"Maple Syrup Cookbook" by Ken Haedrich (Storey, $14.95), whose website is thepieacademy.com, first covered maple syrup in 1989. This new edition includes more than 100 recipes as well as more info on maple history, sugaring tips and profiles of farmers. "Maple," by Katie Weber (Quirk, $22.95), sorts some recipes into vegan and gluten-free options, along with other inventive uses for maple syrup, such as pizza dough. Minnesota author Teresa Marrone's "Modern Maple" (Northern Plate, $16.95) explores sweet and savory uses from Ojibwe and Dakota cultures through modern uses such as on grilled radicchio, and has 75 recipes and a tutorial on backyard syruping.

Minneapolis Star Tribine, 12/23/15

Find Your Sweet Spot: Visit a Maple Sugarhouse

March is Maple Month in the U.S. and Canada

www.maplemonth.com

As the sap starts to flow and sugarmakers begin making this year's crop of pure maple syrup, visitors are being welcomed at thousands of maple sugarhouses in the U.S. and Canada. Now there's a new resource at www.maplemonth.com to help people Find their Sweet Spot.

Every spring, thousands of maple syrup producers in the Northern United States and Canada harvest sap from the region's maple trees as they begin to thaw and boil the sap down to make pure maple syrup. This is the only region in the world where maple syrup is produced. Sugarmakers combine modern equipment with techniques that are hundreds of years old to make one of the region's sweetest and tastiest foods. Sugarmakers use sustainable management practices, carefully stewarding hundreds of thousands of acres of North American forest so that each maple tree they tap will yield pure, unadulterated maple sap – the only ingredient in pure maple products – for many generations.

Many sugarmakers welcome visitors during the sugaring season, allowing people to learn about how maple syrup is made, and taste and purchase pure maple syrup, maple candy, maple cream, and other delicious products. The new website, www.maplemonth.com, helps consumers find sugarhouses to visit, as well as events taking place throughout the sugaring season.

While most people know maple syrup as a breakfast topping, cooks and consumers alike are discovering the versatility of maple syrup, using it in baking, marinades, dressings, and even cocktails. The www.maplemonth.com website contains links to many recipes that feature the distinctive taste of maple syrup.

Pure maple syrup is fat-free, allergen-free, and is lower in calories than most other sweeteners. Recent research has revealed that pure maple syrup not only has a lower glycemic index than other sweeteners but also contains important antioxidants, vitamins, minerals, and amino acids.

The www.maplemonth.com website is the result of the joint effort between the North American Maple Syrup Council (www.namsc.org) and the International Maple Syrup Institute (www.internationalmaplesyrupinstitute.com), two associations dedicated to providing assistance to the thousands of sugarmakers in the U.S. and Canada.


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A Summary of Research to Improve Vacuum in Maple Tubing Systems

T.D. Perkins[1], M.L. Isselhardt[1], T.R. Wilmot[2] and B. Stowe[1]
[1]University of Vermont Proctor Maple Research Center
[2]University of Vermont Maple Extension

Sap exudation from maple trees is driven by the gradient in pressure from the inside to the outside of the tree. Under certain weather conditions (fluctuations above and below the freezing point of water) a dynamic period of tree pressure can be observed (Heiligmann *et al.* 2006, Chapeskie and Staats 2006). In most cases, the greater the difference in pressure, the greater the volume of flow produced. It has long been recognized that lowering the pressure in tubing by using vacuum pumps will increase sap yield (Laing *et al.* 1962, Blum and Koelling 1968). For every additional inch of mercury (Hg) difference in vacuum, there is a corresponding increase in yield of approximately 5-7% (Wilmot *et al.* 2007, Perkins *et al.* 2012), with no significant change in sap chemistry or tree wounding (Wilmot *et al.* 2007). Therefore maple producers generally attempt to reduce the pressure in their tubing system as much as possible, and strive to quickly detect and fix leaks to maintain the vacuum at these high levels.

A problem in maple tubing systems that affects achieving maximum vacuum at the taphole is commonly thought of as a lack of "vacuum transfer." In actuality, the opposite is true. The difficulty is caused by the inability to move air (originating from leaks or from gases produced by trees) out of the system rapidly. During flow, the tubing system contains a combination of liquid (sap) and gases. When separate, air and liquid will each flow at very different rates, with air moving much faster than liquid. Liquids are largely incompressible, whereas gases in the tubing system can expand or contract depending upon the pressures involved. Because of this property, air cannot be transferred optimally through mixed gas/liquid systems. The slow movement of air out of the tubing system increases pressure locally within the tubing system, resulting in reduced (less negative) vacuum levels, and consequentially, lower sap yields. In addition, junctions (tee and wye fittings), sags, leaks, slope changes, ice and debris build-up, and other factors impart friction and turbulence or blockages which affect the smooth flow of air and liquid in mainline, however these problems are either transient or controllable to some degree. Proper design, layout, installation, and maintenance of tubing systems can help ensure that liquid can move freely along the bottom of the mainline pipe and air is evacuated rapidly across the top, greatly minimizing most negative consequences in mainlines. However the internal diameter of 5/16" lateral line systems is small enough that slugs of air and sap are intermingled, which results in poor (slower) air removal. In addition, the small diameter of fittings in 5/16" lines (compared to mainline) results in higher internal friction affecting both air and liquid movement.

To combat these problems, dual-conductor systems were developed to separate air and liquid in mainlines.

Vacuum: continued on page 12


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Vacuum: continued from page 11

This improved air transfer and allowed good vacuum levels to be achieved to the ends of the mainline system, but didn't address the vacuum transfer limitations of the lateral/drop line system. The result was that producers moved towards shorter lateral lines with fewer taps per lateral. Although this improved vacuum transfer and sap yield to some degree, it did not address the inherent limitations of the smaller tubing system containing both liquid and gases.

The following research program was conducted at the University of Vermont Proctor Maple Research Center over several years to explore a variety of methods to potentially increase sap yields from tubing systems through modifications of the lateral/dropline portion of the sap collection system.

Methods

All of the research described was conducted in the "Martin Block" sugarbush section (encompassing approximately 24 acres) at the UVM Proctor Maple Research Center in Underhill Center, Vermont, in the sap flow seasons from 2010 to 2015. A light thinning was performed in the summer prior to the first tapping. Trees averaged 14.2" in diameter at breast height (dbh) at the beginning of the study and had not been previously tapped. Average slope was 20.4%. The sugarbush was divided into twelve plots containing approximately 65-70 trees each, for a total of about 820 trees in the study. This allowed the study of four different experimental treatments (including the control) most years with three replicate plots for each treatment. The specific treatments examined varied by year and are detailed below. Each plot was serviced by a ¾" mainline connected to a Busch vacuum pump through a custom releaser equipped with a counter, which was calibrated to record the sap volume each time it dumped. Releaser tallies were recorded once or twice daily during every flow period over each season, standardized to sap yield (gallons sap per tap) for each plot, then averaged by treatment. Analysis of variance was used to assess differences by treatment. Due to the low sample size (three replicates), these results should only be viewed as screening studies to identify treatments showing promise.

All trees in all treatments were tapped within the same week each year. Only one tap per tree was used regardless of tree size. New spouts were used each year. If new tubing was installed for one treatment, new drops were placed in all other treatments to maintain a similar level of sanitation across all treatments. Droplines were the same length across all treatments each year.

Treatments

Treatments used during the five years of study are shown in Table 1. From 2010-2014, four treatments were examined each year with three replicate plots per treatment. In 2015, two treatments were compared, with six replicate plots per treatment.

Treatment A was designed to represent a standard "best practices" (Control) tubing installation (Heiligmann et al. 2006), with standard 5/16" laterals and droplines averaging five taps per lateral. All remaining treatments were experimental. The specific treatments examined varied by year. Treatment B was very similar to the control treatment, except that each 5/16" lateral line serviced only one tree (one tap per lateral with a 5/16" tubing system).

Vacuum: continued on page 14

Vacuum: continued from page 13

Treatment C was similar to Treatment B, with the exception that there was no lateral line. Instead, ¾" mainline was run to each tree, a ¾" saddle and the 30" of 5/16" tubing served as the dropline. Treatment D (Figure 1A) utilized a custom-made stub-spout combination made of ½" PVC mated to a clear-straight polycarbonate spout that would allow sap or gases to flow out of the spout into the large open space of the chamber, thereby allowing better separation of liquid and gases temporarily. Treatment E (Figure 1B) utilized custom-extruded ½" polyethylene tubing and nylon fittings (tees and stubby) for both lateral and droplines in an attempt to allow sap to run across the bottom of the tubing and gases to flow across the top, similar to what should occur in the typical mainline. Treatment F (Figure 1C) utilized a custom extruded dual-conductor 5/16" line connected to a customized stubby. One conductor of the dual-line had a tactile ridge molded in so that the wet and dry line could always be identified correctly. The top line was used as a dry-line with the bottom serving as a wet-line. The internal configuration of the custom-built stubby allowed air to flow predominantly to the rear of the stubby and out the dry-line, while sap would flow chiefly though the wet-line. Treatment G consisted of commercially-made 3/16" lateral line and 3/16" droplines. No effort was made to optimally re-tube the plots specifically for the 3/16" system. The treatment consisted only of simply replacing the previous lateral lines with 3/16" lines regardless of slope or number of taps on a lateral line.

In most years, vacuum was continuously measured and recorded at the ends of the last lateral lines (next to spouts) on each experimental plot using Keller-Druck LEO recording vacuum gauges (2010-2013) or the Smartrek wireless vacuum monitoring system (2014-2015). In general, the changes in sap yields closely reflected differences in vacuum achieved, so these results are not presented.

Results

All treatments produced good sap yields each year of the project, with a low of 19.7 gal sap/tap across all treatments in 2012 and a high of 35.1 gal sap/tap, averaging 27.1 gal sap/tap for

Treatment	2010	2011	2012	2013	2014	2015	Average Change[3]
A. CONTROL 5 Taps per Lateral	31.5	27.4	18.1	33.6	23.6	23.3	na
B. 1 Tap per Lateral	32.1	28.1	18.4	34.1	24.8		2.5%
C. Mainline to Each Tree	30.7	25.6	20.4	34.3	25.7		3.0%
D. Chamber Stubby	29.1						-7.6%
E. 1/2" Lines		27.1					-1.1%
F. Dual-5/16" Conductors			21.9[a]	38.5[a]	27.7[a]		17.7%
G. 3/16" Lines						25.5	9.4%
Annual Average Sap Yield	30.9	27.1	19.7	35.1	25.5	24.4	na

[3] Average % change from Treatment A – Control.

Table 1. Experimental treatments and sap yields (gallons of sap per tap) in Martin Block section in Underhill Center from 2010 2015. Direct yield comparisons should only be made within a given sap flow year (column). Average change in sap yield due to each treatment is shown in the right-most column. Letters after sap yields indicate a significant difference in yield compared to the control treatment.

the six seasons of study.

Table 1 provides sap yields for each treatment within each year. Because each sap flow season was different, only values within a single column (year) should be directly compared. In general, most treatments showed only minor, non-significant effects on sap yield. Over the five years tested (2010-2014), Treatment B (*one tap per lateral*) produced a 2.5% increase in sap yield compared to Treatment A (*five taps per lateral – Control*). Similarly, Treatment C (*Mainline to each tree*) produced a 3.0% increase over the control during the same time period. Treatment D (*Chamber Stubby*) was tested only in 2010 and produced 7.6% less sap than the control, mostly due to an inability to get a leak-tight seal between the polycarbonate straight-through spout and the bushing used to mate the spout to the ½″ PVC chamber. Thus this was not a good test of the concept, but more of a problem in translating the concept to a workable, functional prototype. Treatment E (*½″ lateral lines*) appeared to be a very promising candidate in our modeling studies, however the approach proved to be very problematic in the field, producing slightly (-1.1%) less than the control treatment during the one year (2011) it was tested, providing a good illustration of the importance of field testing ideas. Dual-conductor lateral and drop lines (Treatment F) produced significant increases in sap yield averaging 17.7% over each of the three years of study (2012-2014), which included a poor year, a very good season, and an average yield season. Treatment G (*3/16″ Laterals and Drops*), which was tested only in the 2015 season, produced a 9.4% improvement in sap yield.

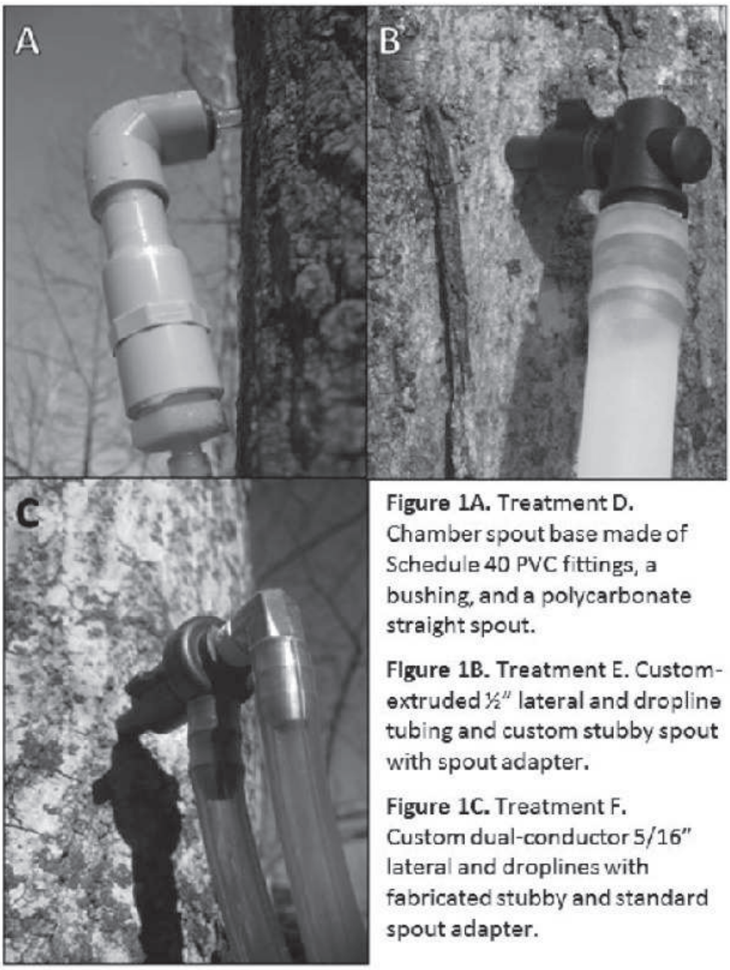

Figure 1A. Treatment D. Chamber spout base made of Schedule 40 PVC fittings, a bushing, and a polycarbonate straight spout.

Figure 1B. Treatment E. Custom-extruded ½″ lateral and dropline tubing and custom stubby spout with spout adapter.

Figure 1C. Treatment F. Custom dual-conductor 5/16″ lateral and droplines with fabricated stubby and standard spout adapter.

Discussion

Simple changes such as installing only one tap per lateral or running mainline to each tree can result in slight increases in sap yield, however the additional cost of implementing these strategies is prohibitive.

Due to problems in implementation, it is impossible to judge whether separating the liquid and gas using a chamber-type stubby or spout design would be worthwhile, although it most likely

Vacuum: continued on page 16

Vacuum: continued from page 15

would not result in substantial changes because any effect would be transient, and air and liquid would eventually both have to transit the same small diameter line.

The use of ½″ lateral lines showed promise in the lab, but in the woods, the increased weight of sap in the ½″ laterals caused the lines to sag when full of sap, thus providing areas for the sap to pool and reduce effective gas transfer. When these areas subsequently froze, they blocked all transfer of air or sap until those areas melted. Melting took longer because of the larger diameter of the ice dam created and because the tubing was a light, translucent white color and likely did not absorb as much solar radiation compared to the blue 5/16″ line in the other treatments. Had the tubing been suspended on wire like mainline, it may have shown better results, however this would raise the cost of installation tremendously, rendering the approach unviable.

Despite the positive and consistent increase in sap yield resulting from the use of dual-line 5/16″ tubing, the additional anticipated expense makes this approach profitable only when yields are 0.5 gal/tap or better AND bulk syrup value is high or a producer is selling directly into the retail syrup market or making value-added products from the syrup produced. Given the recent drop in bulk syrup prices, this approach is not likely to be adopted despite the high yields achieved.

Although the treatment did not achieve statistical significance due to low sample size, the use of commercially available 3/16″ tubing and fittings produced a 9.4% increase in sap yield.

Four things are critically important to consider in determining the proper strategy to pursue. The vacuum level in the mainline was already very high due to the pump, averaging about 25.5″ Hg. This left very little room for improvement due to natural gravity vacuum. Second, the installation of 3/16″ tubing was not optimized in any way, but was installed merely as a replacement for the 5/16″ tubing that was previously installed in this area. Even a slight level of optimization (running the tubing further downhill, adding more taps per lateral) would likely increase the vacuum level even further. Third, the low cost of implementation of 3/16″ tubing compared to the other approaches in this study was very attractive. Using 3/16″ tubing is no more expensive than using 5/16″ tubing. In a normal 3/16″ tubing installation, less mainline is used, thus the approach is likely to be even less expensive, making the net profit per gallon of sap higher than other approaches. Finally, the other methods examined all involve new products or methods that would require some (or considerable) adjustment on the part of maple producers. Using 3/16″ tubing is a very easy transition to make for those used to 5/16″ vacuum tubing (Wilmot 2014).

In summary, only the dual-line experimental treatment and the 3/16″ tubing treatments show any reasonable amount of promise as approaches to increasing yield. While the dual-line system produced higher net yields, the 3/16″ tubing method is considerably more economical in terms of producing a reasonable net profit for the cost of achieving the added sap yield.

Although on the surface it might seem paradoxical that we can solve the problem of poor vacuum transfer by using a smaller tubing line, the answer lies in the fact that 3/16″ tubing generates vacuum not by allowing the passage of air out of the system quickly, but by using the weight of the sap in the small diameter line to generate vacuum within the 3/16″ lines themselves. Therefore, the additive effect of pumped vacuum in the mainline system and natural gravity vacuum in the 3/16″ lines means that we achieve the highest vacuum in the area we want it the most – at the taphole.

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Vacuum: continued on page 19

Vacuum: continued from page 17

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Isselhardt Appointed UVM Extension Specialist

Mark Isselhardt has been appointed to the position of University of Vermont (UVM) Extension Maple Specialist. Mark will be based at the UVM Proctor Maple Research Center in Underhill Center, where he has been employed for the past 12 years, first as a maple research technician and for the last three as a research specialist. At the Proctor Center, Mark has worked on research to increase sap yields as well as what impact modern methods have on trees or the finished product. He succeeds Tim Wilmot, who retired in November after 29 years at the University.

His connection to the Proctor Maple Research Center goes back 20 years, to when he started as a work study student while earning his Bachelor of Science degree in Forestry Management from UVM. He later received his Master's Degree in Plant Biology from UVM.

Isselhardt lives in Elmore with his wife and two children. He can be reached at (802) 899-9926 or by e-mail at Mark.Isselhardt@uvm.edu.

WMSPA Hires New Executive Director

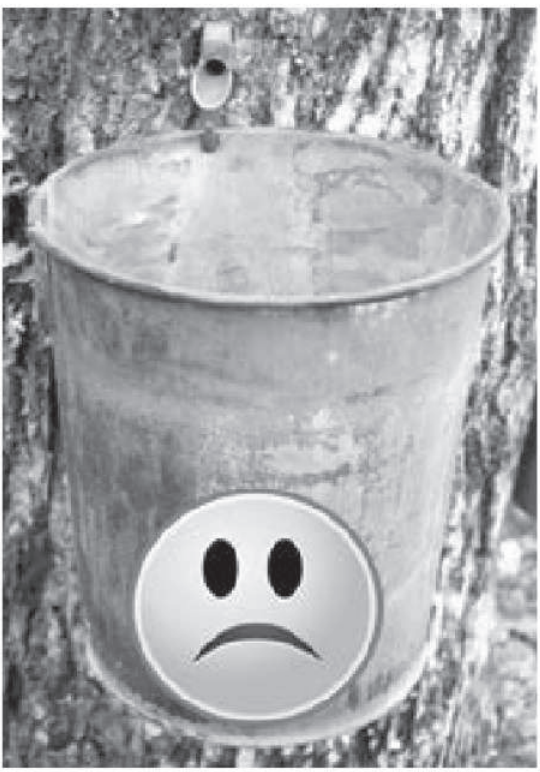
The Wisconsin Maple Syrup Producers Association has announced the hiring of Theresa Baroun as its new Executive Director. Theresa has been involved in the maple syrup industry since she was a child, helping her grandparents, and then parents, make pure maple syrup every spring. Now she, her husband Jon, and their two children are in the process of taking over the family maple operation, looking to upgrade things to make it more efficient and less labor intensive.

Theresa has been involved with the WMSPA through working at the Wisconsin State Fair, where the Association sells syrup and educates the public. As Executive Director, Theresa hopes to keep the organization working together and moving forward by bringing in new membership of all ages. The Association feels that she will bring new insight and energy to the association, and that her experience in the maple syrup industry through the years will allow her to be a good spokesperson for the WMSPA.

Sugarhouse Aesthetics: What The Public Sees

Gary Graham, Ph.D., Ohio State University Extension

Aesthetics is defined as "concerned with notions such as beautiful and the ugly" related to emotion, sensation, and simply how something looks. As sugarmakers, we have a great responsibility to produce a quality product. We produce a luxury gourmet food that consumers choose to purchase. Some producers are also willing to open up their sugarhouse doors to show the buying public how we make the sweet treat. Repeat customers know the quality of product produced, but for many consumers the operation's aesthetics are critical to their purchasing habits.



The fastest growing sector within the food industry continues to be locally grown food. Consumers today are more aware of and educated about the values of foods, and they want to know where the food comes from and how it's made. Agritourism, defined as "any agriculturally based operation or activity that brings visitors to a farm," is growing rapidly due to interest in locally grown food interests. With the growing disconnect between consumers and agriculture and growing interest in locally grown food, sugarmakers have a great opportunity to increase sales by bringing the customers to us.

Maple weekends and tours have done a great service to all producers as they bring customers out to see us and potentially buy our pure maple products. Unfortunately they can also be an opportunity to turn customers off from buying our products, not just from you but from any maple producer, due to what they may encounter during their visit. And there's the additional risk of bad word-of-mouth: how many people will a dissatisfied customer tell about their bad experience, influencing their friends and families to not purchase maple products?

You may have heard the saying "don't judge a book by its cover," meaning don't assume that something or someone is the same inside as what is presented on the outside. People do judge food by how it looks and the conditions of where it's made, though. If you're traveling somewhere and are hungry would you stop by the diner that was clean inside and out or at the diner that looks like a dog couldn't find a clean place to lie down? Firefighters are the only people I know who are willing to run into buildings the rest of us avoid. The public tastes with their eyes and nose as much as they do with their mouth. If the sugarhouse looks dirty and smells bad they are going to assume that the product inside the container is dirty and tastes bad too. If jugs of syrup for sale are dirty they will assume that the syrup inside is dirty too.

Consumers have been trained by the commercial grocery industry which spends billions on marketing so we buy more products. Grocers understand that if shoppers are provided a safe, clean, comfortable environment they will stay longer and buy more. I'm not saying your sugarhouse needs to look like your local grocery store, but it does need to be clean and brightly lit and smell like you are making the luxury gourmet food product they have come to buy. To the public, if they see a clean operation it equals a clean product. If they see an operation that is dirty and messy, they will assume the product is dirty as well. Right or wrong, visual aesthetics directly relates to consumers' purchasing decisions.

Judgment of the quality of your syrup literally starts at the end of the driveway. If coming to visit you in a $50,000 car, do you think a customer will pull off the pavement into a driveway that looks like it hosted the mud bog competition for the local 4-wheel drive club the night before? If they have to get out of the car and walk through mud or around unstacked firewood or barrels of syrup covered in mud they may never get out of the car. If the sugarhouse looks like nothing a quart of gas and a match wouldn't fix do you think they will go inside?

If you have put down gravel to keep a clean entry into the sugarhouse what do you think is the next thing of interest to the consumer? It's not buying syrup. Consumer research shows that restrooms rank as the #1 most important issue to customer satisfaction. They have traveled to see you and like most of us when we travel and make a stop, the restroom is the first thing sought out. Research shows that if the restroom experience is good consumers are more likely to stay longer and buy more. If the restrooms are dirty and unpleasant research shows the visit is shorter and shopping is less. This does not mean you must have multi-stall, separate gender restrooms – having one clean restroom will do. Even an outhouse will do fine if it is clean, well lit, and hopefully heated. Remember, first impressions are lasting impressions.

In any sugarhouse the activity revolves around the evaporator. To consumers that is the food processing center. It is up to us to welcome visitors and educate them as to how and what is happening. Having educational displays goes a long way. I often walk in sugarhouses and see great displays of vintage or antique equipment from the past, however it's often not labeled as such. Consumers not familiar with the industry may think that the old rusty stuff is still being used, rather than an opportunity to learn about the history of our industry alongside all the modernizations that assure we are making

Aesthetics continued on page 23

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Aesthetics: continued from page 21

a high quality, clean product for their enjoyment. You are setting impressions on the experience, but more importantly, the impression of your product. We know the display has nothing to do with the quality of product, yet to the consumer it does have an impact, especially with their discretionary income. Don't have Grandpa's old, rusty, dented, lead-based bucket and tap hanging on a tree outside the sugarhouse so they can watch the sap drip into it. Hang a new food grade metal or plastic bucket and tap for this purpose. Encourage them to look in it so they see that the syrup comes from the sap the tree provides us. It connects them to the process and understanding of how natural and pure our industry is.

Size of operation does not influence consumers as much as cleanliness. Whether you are high-tech or low-tech you have a great opportunity to educate potentially new customers who may become the repeat customers, as long as they aren't scared off by what they taste with their eyes and nose without even letting a spoon full of pure liquid gold electrify the taste buds of their mouth. Look at your sugaring operation inside and out from a consumer's viewpoint, just like you would when you go to spend your hard earned dollars. You will see things you can do to enhance their experience and the chance they will return, simply by improving the aesthetics of heir visit.

Do Not Use Isopropyl Alcohol as a Maple Sanitizer in the U.S.

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Increased attention to spout and tubing sanitization has led to rising sap yields for maple producers. Cleaning and replacement (use of new spouts, use of check-valve spouts or adapters, or replacing spouts and droplines) strategies have different effects on sap yields, and each carry their own costs in terms of supplies and labor to implement the various approaches, and thus each has a different net profit. This topic has been extensively studied, and an on-going study by researchers at the University of Vermont and Cornell University has verified the effectiveness and net profit of each of the major ways of achieving good sanitization in maple operations. A report detailing these findings and a computer-based tool to help producers determine the optimal sanitization approach to use in their operation is expected to be available later in 2016.

Many people may simply assume that the use of isopropyl alcohol (IPA) would be governed by the U.S. Department of Agriculture. That is not the case. In the United States, chemicals used to clean and sanitize spouts and tubing in maple operations are regulated by the Environmental Protection Agency (EPA). Some Federal Drug Adminstration (FDA) regulations under Title 21 may also pertain. IPA, like many sanitizers, is considered to be a pesticide. The mode of action of these substances is to remove or kill microbes existing in the system and to prevent regrowth, thus protecting the tubing and the materials passing through the tubing from the harmful effects of microbial growth. To be legal to use in the U.S., sanitizers must be registered for use with the EPA after they have undergone a review process to document their efficacy and safety, and labels must include certain precautions and specific instructions for the type of use for which they are to be employed.

Most sanitizers used in maple operations are registered sanitizers, and include statements for use on surfaces such as maple tubing. Producers using these sanitizers should carefully read the label to understand any hazards associated with their use, and follow instructions on the application of the sanitizer, any rinsing requirement (often satisfied by allowing the first sap of the season to run on the ground) and the safe disposal of any residues.

Isopropyl alcohol (IPA) is a commonly used maple spout and tubing sanitizer in Quebec. IPA is registered for use in maple tubing systems in Quebec and throughout Canada, and publications are available in both French

IPA continued on page 26

IPA: continued from page 25

and English detailing how IPA should be used there. When used according to instructions, IPA does appear to have some level of effectiveness against some types of microbes occurring in maple tubing systems. The labeling on at least some of the IPA products that are available are unclear or contradictory, stating "No-Rinse" in some places, but requiring producers to "…dispose of maple sap collected until alcohol has been eliminated from the system," although there are no instructions advising how to determine that point. In addition, the instructions of one product state on one part of the label to, "Spray product directly on hands" as a sanitizing hand dip, but the precautions say to "Avoid contamination with skin…," "Wear impervious gloves," and to "Wash contaminated skin with soap and water" in other sections. At best, this is highly confusing and doesn't meet U.S. pesticide labeling requirements.

It has come to our attention that some maple equipment companies in the U.S. are offering IPA in their catalogs and in their stores, are selling the equipment to dispense IPA in tubing, and are providing instructions in its use in maple operations. We have also spoken with several U.S. producers who have asked about, already tried, or are currently using IPA. Using this product is illegal.

Regardless of the availability and guidance provided, maple producers should clearly understand that **THE USE OF ISOPROPYL ALCOHOL IN MAPLE TUBING SYSTEMS ANYWHERE IN THE UNITED STATES IS A VIOLATION OF FEDERAL LAW.** Syrup produced from tubing systems in the U.S. employing IPA could therefore be considered contaminated according to U.S. E.P.A. regulations. Any syrup produced with IPA in the U.S. could be seized and destroyed by Federal or State regulators.

The availability of IPA by maple equipment vendors in the U.S. and the acceptance of IPA by Canadian authorities does not convey any regulatory protection for maple producers using IPA in the U.S. **Therefore, we strongly encourage maple equipment and supply companies in the U.S. to cease making IPA available to U.S. producers, and for maple producers using or considering using IPA as a sanitizer to refrain from doing so until such time as IPA is registered with the E.P.A. for use in maple tubing systems.**

Researchers identify molecule with anti-inflammatory properties in maple syrup

Arthritis and other inflammatory diseases could someday be treated with medication containing a molecule from maple syrup. Université Laval researchers demonstrated in a recent study that quebecol, a molecule found in maple syrup, has interesting properties for fighting the body's inflammatory response.

Discovered in 2011, quebecol is the result of chemical reactions during the syrup-making process that transform the naturally occurring polyphenols in maple sap. Daniel Grenier of the Université Laval Faculty of Dentistry, who developed an in vitro model for determining the anti-inflammatory potential of natural molecules, explained: "We take blood cells called macrophages and put them with bacterial toxins. Macrophages usually react by triggering an inflammatory response. But if the culture medium contains an anti-inflammatory molecule, this response is blocked." The researchers carried out tests that showed quebecol curbs the inflammatory response of macrophages, and some derivatives are even more effective than the original molecule.

The study, coauthored by Sébastien Cardinal, Jabrane Azelmat, Daniel Grenier, and Normand Voyer, was published in a recent issue of the journal *Bioorganic & Medicinal Chemistry Letters*.

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Evaluating Processing Methods to Produce Safe, Shelf Stable Maple Sap Beverages for Small Operations

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Abstract

In order for sugarmakers to take advantage of the newfound interest in maple sap beverages, processes must be developed that would allow small scale producers to process and package maple sap safely, efficiently, and economically. We investigated several methods that might be employed for seasonal markets during the harvest season of January-April. This study showed that maple sap might be only a marginally suitable alternative seasonal beverage, with a short shelf life for small producers. Due to the short shelf life, we would not recommend maple beverages be produced on a small scale until more research has been completed. Production of perishable maple beverages would most likely not be allowed in typical sugar operations due to federal, state or provincial regulations. Producers considering pursuing seasonal sap beverages should check their local regulations before investing time and funds producing beverage products.

Afin de profiter de l'intérêt nouveau pour la sève d'érable comme breuvage, des procédés doivent être élaborées pour permettre aux producteurs à petite échelle de traiter et d'emballer la sève d'érable de façon sécuritaire, efficace et économique. Nous avons étudié plusieurs méthodes qui pourraient être utilisées durant la saison de récolte du sirop d'érable, du mois de janvier au mois d'avril, visant un marché saisonnier de produits stables à température ambiante. Cette étude a démontré que la sève d'érable en tant que boisson saisonnière à courte durée de conservation à température ambiante ne pourrait être qu'une alternative acceptable marginale pour les producteurs à échelle réduite. En raison de la difficulté d'acidification de la sève et de risques relatifs aux niveaux du pH, nous ne recommanderions pas que de telles boissons de sève d'érable soient produites à petite échelle. La production de boissons de sève d'érable périssables par les opérations typiques de produits de l'érable ne serait fort probablement pas permise compte tenu de la réglementation fédérale, des états et des provinces. Les producteurs visant la production de sève d'érable saisonnière en tant que boisson devraient vérifier la réglementation locale qui s'applique avant d'investir temps et argent pour produire de tels breuvages.

Introduction

Consumers are attracted to beverages that are minimally processed and contain beneficial nutrients, similar to coconut water. However, little research has been conducted to evaluate if sap beverages are considered safe for consumers, while utilizing techniques available to small-scale operations.

Although maple syrup begins as sap, maple sap and syrup are two different types of products with distinct Brix and water activity properties. Maple sap has an extremely low Brix level (2% soluble solids), and during the boiling process, water is evaporated and sugars are concentrated in the finished syrup. Maple syrup typically has a final Brix between 66 and 68.9. Syrup is bottled hot and the heat and sugars help preserve the syrup as a shelf-stable and low risk food. Because sap contains a high moisture level and other nutrients, such as sugars, amino acids, and minerals, sap can promote rapid microbial growth and is not considered shelf-stable. The shelf life of sap is typically two days or less, depending on the storage temperature; therefore, sap by itself is considered quite perishable.

The FDA defines perishable products as potentially hazardous foods because of high pH and water activity levels that support the rapid growth of pathogenic bacteria, which can cause foodborne illness. Shelf stable foods can be safely stored at room temperature and are considered non-perishable foods.

Products can be made shelf stable typically by reducing the pH below 4.60 or reducing the water activity below 0.850. Other technologies can be utilized to produce shelf stable and commercially sterile foods, such as steam retorts or aseptic processing. Foods that cannot be made shelf stable by these processes can be pasteurized to lower the microbial load, and then stored at frozen or refrigerated temperatures to extend the shelf life.

The popular, functional maple beverages on the market are currently produced by either Ultra High Temperature pasteurization (UHT) combined with aseptic packaging techniques allowing a shelf life of 12-18 months or the use of High Pressure Processing (HPP) allowing a shelf life or 30-60 days to create a shelf stable product. Both of these technologies are prohibitively expensive for small producers considering creating a seasonal, local product for their customers.

This research project investigated whether small producers could create a quality refrigerated sap beverage product using pasteurization techniques with standard household utensils. We conducted a shelf life study with four treatments and an untreated sap control with two replications each. This was a preliminary study to establish baseline data on maple sap beverages to determine if producers might be able to offer maple sap beverages as a viable and safe additional product to consumers.

Objectives

1) To determine if pasteurization (heat treatments) and acidification of maple sap would extend the shelf life of sap which is extremely perishable even at refrigerated temperatures.

2) To help establish guidance for small maple producers interested in producing sap beverages on a small-scale.

Sap: continued on page 33

Sap: continued from page 31

Materials and Methods

Twenty-five gallons of sap were collected at one sugarhouse in Somerset County, Maine and transported in cleaned and sanitized (100ppm bleach) food-grade plastic buckets to the University of Maine (UMaine) School of Food & Agriculture's Commercial Kitchen. Sap was processed using the following treatments in duplicate and a shelf-life study was conducted on these samples.

Sap Treatments & Codes

1) Control (Con); fresh sap, no treatment
2) Low pasteurization temp (LSP) 191° F (88° C) for 1 sec.
3) High pasteurization temp (HSP) 212° F (100° C) for 0.01 sec.
4) Acidified low pasteurization temperature (AcLo)
5) Acidified high pasteurization temperature (AcHi)

The control sap was poured directly into clean and sanitized pint glass canning jars and immediately refrigerated at 3-4°C (37.4 - 39.2°F). Pasteurization temperatures were selected from the Food and Drug Administration's Pasteurized Milk Ordinance (PMO): http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM291757.pdf. The higher pasteurization temperatures were selected since they are more likely to reduce yeast and molds based on preliminary research findings. Sap was heated according to the selected temperature treatment and time in stainless steel kettles and then immediately poured into pint glass, canning jars. Acidified treatments were included in this study to determine if acidifying sap would extend the shelf life under refrigeration. The acidified treatment was determined through preliminary testing and lemon juice was selected as an acceptable acidifier for sap, as it did not negatively affect sap flavor. The sap was acidified to a pH of 4.20 with lemon juice and then heat treated according to the appropriate heating temperature and time, and then immediately bottled. All the heat-treated and acidified/heat treated sap samples were inverted for five minutes after capping to pasteurize the headspace. After cooling to room temperature, previously heated-treated samples were immediately stored at 3-4°C (37.4 - 39.2°F). Sap was tested initially and monitored for pH, Brix and also for initial aerobic plate counts (bacteria), yeast and molds using 3M™ Petrifilms™. Microbial testing occurred on days 0, 3, 7, 21, and 28.

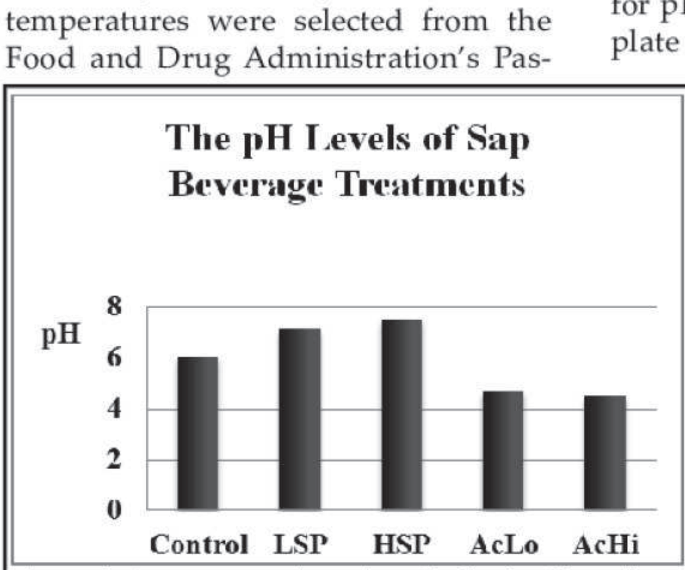

Figure 1: Averages are based on duplicate pH readings.

Results

When evaluating capped food products, pH is quite important, especially for acidified, shelf-stable food products. An acidified canned, shelf-stable food must have a pH level of 4.60 or lower in order to be considered shelf-stable to pre-

Sap continued on page 35

Sap: continued from page 33

vent the risk of Clostridium botulinum growth and botulinum toxin production. Figure 1 shows that the Control sap samples had a pH level that exceeded 4.60. When the sap was acidified to 4.20 with lemon juice, the sap appeared to have some buffering capacity, possibly due to the proteins and amino acids in the sap. The sap pH after acidification and heating exceeded a pH of 4.20, and in some instances above 4.60. If sap is packaged (capped) with pH levels above 4.60, and left at room temperature, this would present a botulism risk to consumers. Therefore, sap beverages would not be considered shelf-stable and would have to be stored under refrigeration at all times, unless properly processed using aseptic or HPP technologies. Therefore, labeling that the product must be kept refrigerated would be a critical factor to ensure the safety of the product and to avoid mishandling by the consumer.

As you can see from Table 1, the Control sap had a high bacterial load (approximately 1,000,000 viable bacterial cells per mL of sap) from these samples and continued to increase over time. All the heat treatments were effective in lowering microbial counts, but the Acidified High Pasteurization Temperature was the best treatment in reducing bacteria and appeared to reach a shelf life of at least 28 days under refrigeration. The

Sap: continued on page 36

Treatment	*Day 0*	*Day 3*	*Day 7*	*Day 21*	*Day 28*
Control	6.38	6.46	7.13	7.13	TNTC
LSP	2.85	2.84	3.59	4.04	5.48
HSP	1.33	1.36	1.29	2.0	4.07
AcLo	2.05	2.39	2.27	2.43	2.52
AcHi	ND	ND	ND	ND	<1.0

LSP = Low Pasteurization Temperature (191° F, 1 sec)
HSP = High Pasteurization Temperature (212° F, 0.01 sec)
AcLo = Acidified Low Pasteurization Temperature
AcHi = Acidified High Pasteurization Temperature
*(Acidified treatments were acidified with lemon juice concentrate prior to pasteurization)
After capping, heat treated containers were inverted for 5 min, cooled to room temp and stored at 3-4° C
ND = Not detectable (10 CFU/g)
TNTC = Too Numerous to Count
Averages n=4

Table 1: The Average Aerobic Bacterial Plate Counts (Log CFU/g) Over Time

Sap: continued from page 35

High Pasteurization Temperature treatment was also adequate, but the shelf life of this sample was approximately 21 days.

The graph in Figure 2 displays the trend of the bacterial counts over shelf life time. The Control (untreated sap) had high counts that kept increasing over time. However, the Acidified High Pasteurization Temperature samples remained quite low over time. The Acidified Low Pasteurization Temperature and Low Pasteurization Temperature treatments both had bacterial counts lower than the Control, but were still at high enough levels that they would not be considered safe for human consumption.

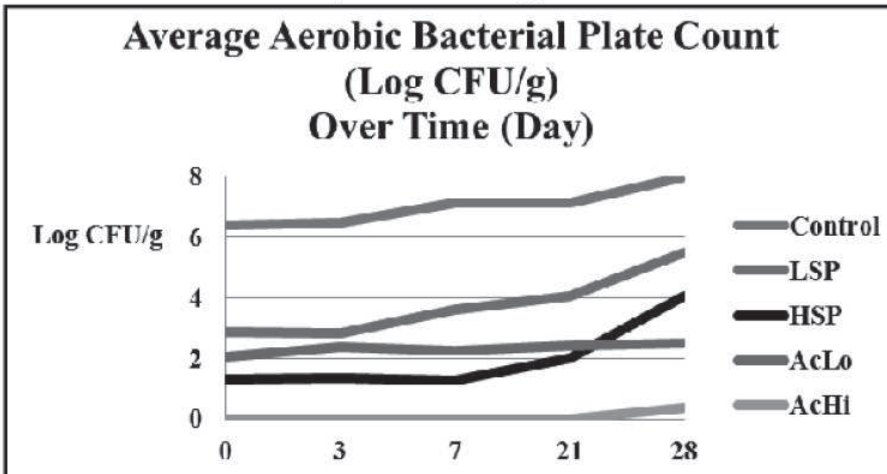

Figure 2: The Average Aerobic Bacterial Plate Count (Log CFU/g) Over Time. Averages are based on n=4

As expected, the Control sap samples contained yeast and molds. The yeast and mold counts were approximately 1,000

– 10,000 colonies/mL of sap (data not shown). All heat treatments appeared to be effective in destroying yeast and molds in the sap, as none were detected in all the heat-treated and also acidified/heat treated samples.

The day after processing, quality concerns arose as a cloudy precipitate formed at the bottom of all the sap samples, which tended to increase over storage time, especially in the untreated Control. These cloudy samples would most likely not be acceptable for consumers.

Discussion

Based on the microbial results, sap can carry a high microbial load of bacteria, yeast and molds and would require a pasteurization step in order to adequately reduce microbes of public health concern, such as bacterial pathogens. This preliminary research showed that heat, in combination with acidification, can lower microbial counts. A 28-day shelf life was obtained with acidifying the sap with lemon juice and heat-treating at a high temperature.

However, this preliminary research has raised more questions that should be further investigated before guidance can be provided to produce safe and acceptable maple sap beverages using only standard kitchen equipment. It is assumed that naturally occurring proteins and amino acids buffered the sap when the lemon juice was added, which caused the pH levels to increase after heating. Several other types of acidifiers could be investigated to determine if they are less affected by the buffering capacity of sap. However, sap has a subtle flavor and it would be important to select an acidifier that will not produce a chemical or acidic aftertaste in the sap. The white precipitate was most likely due to amino acids, proteins and possibly from the microbes within the sap, and the heat and/or acid treatments probably caused the proteins to precipitate out. A micron filter may help to prevent the precipitate, but the filter may exclude the beneficial sap nutrients, such as polyphenols and minerals, that are marketed in these maple sap beverages. However, Dr. Navindra Seeram et al. 2013, suggests that neither pasteurization nor sterilization appears to affect the constituents or health benefits of maple sap.

Worth noting, the University of Vermont Proctor Maple Research Center in 2014 conducted a sensory study on maple sap beverages and found sap beverage flavor ratings ranged from "objectionable" to "above neutral," but no samples achieved a "good rating" by their panelists. In addition, one beverage was cloudy or milky in appearance when poured into a glass and another sample had turned ropey. The sensory study evaluated a variety of different maple sap beverages, which included aseptic and HPP process products.

Conclusions

This study showed that maple sap can have a naturally high microbial load, high pH and water activity levels, placing it in the potentially hazardous food category because it is perishable. Sap may be a suitable alternative seasonal beverage, but has a short shelf life. Due to the difficulty with sap acidification, short shelf life, and white precipitate concerns, we would not recommend maple sap beverages be produced on a small scale at this time. Poor flavor and appearance of contamination have the potential to discourage consumers from purchasing sap beverage products.

Sap: continued on page 39

Sap: continued from page 37

Until further work is done on the pasteurization processes for maple sap, we would recommend bottling sap with a co-packer using high pressure processing (HPP) or Ultra High Temperature pasteurization (UHT) combined with aseptic packaging techniques. It is not likely that production of perishable beverages would be allowed in typical sugar operations due to state or provincial regulations, and producers considering pursuing seasonal sap beverages should check with their regulatory agency for applicable requirements before investing time and funds prior to producing beverage products. Beverages are typically bottled in commercial facilities or a dedicated beverage facility where sanitation is extremely well controlled.

Further research will be conducted in 2016 to determine if higher temperatures, longer heat treatment times or another type of acidifier, will create a higher quality, safe and appealing value-added product option for the small producer.

Acknowledgments

This work was supported by a grant from the North American Maple Syrup Council and in collaboration with the University of Maine School of Food and Agriculture and the University of Maine Cooperative Extension, and by the USDA National Institute of Food and Agriculture, RREA project 228285.

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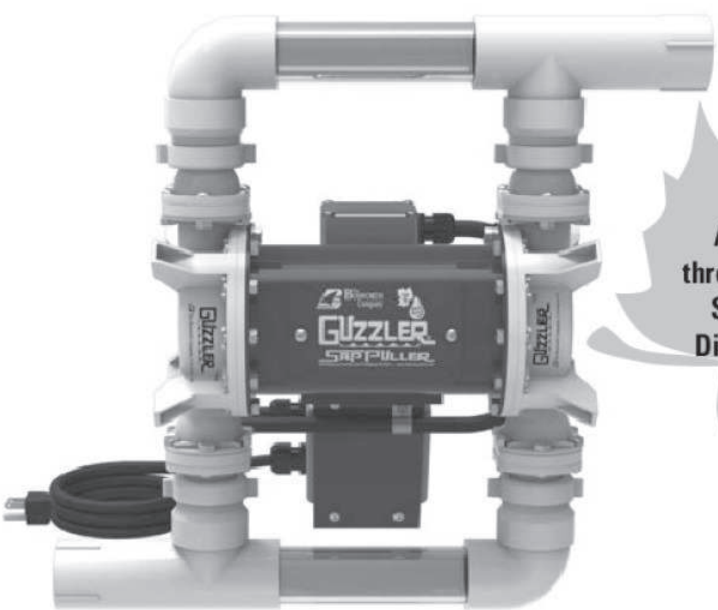

Taphole Injury in Red Maple

Timothy Wilmot, University of Vermont Extension

Cette étude a examiné les blessures de entaillage en érable rouge (Acer rubrum) en découpant les troncs d'arbres qui avaient été exploitées et la mesure du volume du bois teinté associé au trou de coulée. Dans la plupart des arbres, le volume de bois teint était similaire au volume de bois teinté associé avec des blessures d'entaillage à l'érable à sucre. Quelques exceptions ont été notées. Érables rouges plus petits que 18 cm de diamètre et d'érables rouges qui avaient été exploitées pendant de nombreuses années ont souvent un grand noyau central de bois décoloré et devraient être exploitées à moins de 5 cm de profondeur. Aussi, entailles ne doivent pas être placés au-dessus des blessures de l'exploitation forestière ou d'autres dommages qui est faible sur le tronc. Fissures dans l'écorce qui forment souvent au-dessus et au-dessous entailles étaient généralement superficielles et ne causent pas de décoloration dans le bois. Notre conclusion est que les lignes directrices de dérivation pour l'érable à sucre sont également appropriés pour l'érable rouge, avec les précautions décrites ici.

Introduction

One of the most common hardwoods of the northeastern forest, Acer rubrum, or red maple, is an important resource for the production of maple syrup. The number of red maples in the northeast large enough to be tapped for sap production is huge. According to the U.S. Forest Service Inventory and Analysis surveys taken in the late 1990's, Vermont has at least 40 million live red maple stems over 9" in diameter, and New York, Maine and Pennsylvania have far greater numbers of trees this size.[1] Many producers take advantage of this species; for example, in a 2010 survey of 200 mostly Vermont maple producers with a total of approximately 780,000 taps, almost one tap in six was in a red maple.[2] Despite the increasing use of this tree for sap production, far less information exists about the effects of tapping on the long term health of this species than exists for sugar maple.

Maple tapping guidelines, which specify the number of taps in relation to bole diameter, and the spacing and depth of tapholes, have been devised primarily using sugar maple wounding as a model. The narrow column of discolored wood that results from a taphole wound represents a portion of the trunk that is compartmentalized and no longer functional in terms of sap flow, and is therefore an area to be avoided until sufficient wood has regrown over the affected area. Producers will know when their drill bit has struck one of these stained compartments by the dark shavings coming from the hole, indicating a hole which will produce little sap. The predictable size of these compartments in sugar maple makes it possible to model their accumulation in a tree that has been tapped for many years. Along with knowledge of the typical growth rate of tapped sugar maples, this modeling has formed the basis of newly revised tapping guidelines for sugar maple currently being developed at the University of Vermont Proctor Maple Research Center (PMRC). With its importance

Red Maple: continued on page 42

Red Maple: continued from page 41

as a present and future resource for maple sap, it is critical that we extend our knowledge about taphole wounds to red maple so that, if necessary, these guidelines can be revised to include the proper and sustainable tapping of this species.

There is evidence in the scientific literature suggesting that taphole wounds in red maple may be larger in red maple compared to sugar maple. Shigo (1965) reported that discoloration and decay in young red maples advance more rapidly than in sugar maple.[3] Red maples are described as especially sensitive to mechanical injury, including increment boring.[4] Many people have observed that red maples with smooth bark, characteristic of some smaller (generally 12″ diameter at breast height (dbh) or less) stems, can develop long vertical cracks through the cambium when nails or spouts are driven into the trunk. All of this evidence points to the likelihood that tapholes in red maple could produce discolored, nonfunctional compartments in the trunk that are larger than those in sugar maple. This would mean that tapping with greater spacing and less intensity than in sugar maple would be required if the health of tapped red maple trees is to be sustained.

Methods and Materials

Several approaches were used in order to gain a better understanding of the volume of discolored (stained) wood associated with wounds in red maple. All trees in this study came from the PMRC (Underhill Center, VT) except for a few large stems collected at another northern Vermont site. In February 2013, 18 codominant red maples 7″-11″ dbh and never previously tapped, were drilled with a 5/16″ bit to a depth of 1.5″ below the bark and fitted with polycarbonate spouts. Most trunks were tapped on both sides, with the tapholes offset vertically by several feet. In February 2014, the process was repeated on eight of these same trees. None of the spouts were connected to tubing and the sap was allowed to drain onto the ground. In July 2014, all trees were felled, the trunks sectioned vertically into two long halves, and brought to the lab where each section was cut into 2″ thick slices above and below the taphole in order to measure the volume of stained wood associated with each taphole.

In July 2014, three additional 12″-15″ dbh red maples that had been tapped for several years for vacuum sap collection were also felled and dissected as described above. During the summer of 2015, several additional 16″-20″ dbh red maples from a neighboring stand that had been used for vacuum sap collection for at least a dozen years were felled and 2″ thick slices were cut to encompass most of the tapped portion of the trunks.

Finally, during the summer of 2015, 70 intact trees, some of which had been tapped for 2-3 years, were cored at breast height to a depth of approximately 3.5″ below the bark in order to measure the depth at which discolored wood was encountered. These cores were taken from trees with a variety of bark textures and stem conditions and many were not randomly located but instead taken to answer specific questions about internal staining.

Results and Discussion

In the following descriptions of the reaction of maples to wounding, "stain" refers to visibly discolored wood which is, at minimum, the area of non-functional wood created in the tree as a result of the wound. While the extent of the non-functional wood generated by a wound may extend beyond the boundary of the stain, the area where this applies is not easily defined. Therefore, all references in this article to the non-functional portion of the wood related to wounds, decay, or other processes, will be limited to what is visible in a sectioned stem.

The volume of wood excavated by a 5/16" diameter drill at a depth of 1.5" below the bark is 0.115 in3. The stained volume of wood associated with 34 tapholes in the first group of 7"-11" red maples ranged from 1.9 in3 to 6 in3, with an average of 3.2 in3 from 24 tapholes drilled in 2013 and 3.5 in3 from 10 tapholes drilled in 2014; therefore the average volume of the stained wood in these trees was about 30 times the volume of the hole. Previous research on taphole wounds in sugar maples conducted at the PRMC[5,6] showed that the average volume of the stain was between 40 and 50 times the volume of the hole, thus the stain volume seen in these red maples was surprisingly small. Among the 34 tapholes, the stain extended an average of 5.2" above and below the taphole and on average extended an equal distance above and below the hole. The longest stains extended 12" in either direction from the taphole.

Two additional tapholes from the 7"-11" dbh trees had taphole stains that were much larger and were not included in the averages shown above. In one case, a 7" dbh tree had a stained column of heartwood about 2" below the bark with which it merged, making a large and ill-defined taphole stain. In the second case, an old wound 24" below the taphole had created a large column of stained wood in the trunk, which again merged with the taphole wound. In a few of the other trees in this group, there were hidden stain columns from branch stubs or old injuries which did not intersect the taphole stain.

In the three 12"-15" dbh trees that had been tapped for 3-4 years with sap collected by vacuum, a total of five taphole wounds were analyzed; some other taphole stains were difficult to distinguish from each other and could not be properly measured. The ratio of the stain to the volume of the taphole in five holes analyzed was about 45:1, which was similar to our data from sugar maple wounds. This was larger than the discoloration observed in the smaller trees described above that were not subject to vacuum sap collection; however, given the small sample size it is premature to state that vacuum causes larger taphole stains in red maple. Previous work in sugar maple found no relationship between vacuum level and the volume of the taphole stain.[6]

The 16"-20" dbh trees tapped for many years each contained a central core of discolored wood, leaving a few inches of white sapwood below the bark. Several shallower tapholes (1.5" depth or less) had stain volumes that were small and confined to the sapwood. These stain compartments were similar in size to those seen in the 7"-11" dbh trees described above. Other deeper or older tapholes were associated with larger stains that merged with the central core or with stains from other tapholes. In one tree, a seam low on the trunk which was almost completely closed on the outside had created a long column of stained wood on that side of the tree. A taphole 30" above this wound had merged with the

Red Maple: continued on page 44

Red Maple: continued from page 43

stain column to create a large area of discoloration.

Among the 7"-11" dbh trees analyzed for this study, about half of the tapholes were accompanied by a vertical crack in the bark ranging in length from an inch to several feet above and below the hole. Long cracks were almost exclusively confined to tapholes in smooth bark. Sectioning through the cracked portions of the bole showed that for almost the entire length of the crack, it was superficial, penetrating only partway through the tissues commonly referred to as "bark," which are actually outer bark, phloem (the sugar transport system during the growing season), and the vascular cambium (where new wood cells are formed). While this study did not include a detailed analysis of which of these tissues was injured in the formation of the cracks, it was evident that the cracks rarely penetrated all the way to the wood. When a crack extended more than a few inches beyond the taphole, it was not accompanied by a stained area in the wood below the crack, indicating that the wood itself remained undamaged.

In cores taken from intact trees, a clear boundary between functional sapwood and non-functional stained wood was evident when the core intercepted a stained compartment. Cores offset horizontally from small and large trunk wounds often showed no stain to a depth of 3.5", but cores taken above a wound, or in some cases several feet above a small opening at the base of the tree showed evidence of stain columns that extended for a long distance in a vertical direction. Trees with very rough or very smooth bark were equally likely to have no evidence of stain at a depth of 3.5." In general, there was very little evidence of stain in any 3.5" core when close examination of the trunk revealed no old wound above or below the core, with the exception of smaller diameter trees. Cores from 13 trees averaging 8.5" dbh had a central stained heartwood core that averaged 3.5" in diameter; thus on average the white functional wood extended only 2.5" below the bark, and in some cases much less than this.

Summary

In most trees the volume of stained wood produced by taphole wounds in red maple appears to be similar to the stained volume produced by taphole wounds in sugar maple.

Some red maple trunks may have pre-existing stain columns from old wounds not related to tapping which extend several vertical feet from the wound. Tapholes that are placed above or below these wounds may intersect the stain column. Close examination of trees suspected of having an old trunk wound should allow the producer to avoid most of these hidden stain columns.

Smaller diameter red maple trees, for example trees less than 9" dbh, may have a heartwood core that could be intersected by the drill bit when deeper holes are drilled. Similarly, trees tapped for many years may have a large internal stain column from the accumulated taphole wounds. Shallower tapholes (e.g. 1.5" or less below the bark) are recommended when tapping these trees.

Cracks in smooth barked red maples, although unsightly, are usually superficial and do not produce stained wood below the crack, other than the stain associated with the actual hole. The cracks do not appear to interfere with normal taphole closure.

Bark texture in red maple does not appear to indicate the depth of the heartwood or internal stain column.

Conclusion: Based on the findings of this study, it is recommended that tapping guidelines developed for sugar maple are appropriate also for red maple, with the precautions outlined above.

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International Maple Syrup Institute News

The Board of Directors of the International Maple Syrup Institute (IMSI) met in Verona, New York on January 8, 2016. The IMSI currently has about 60 members in the United States and Canada representing state/provincial maple associations, maple packers, packer cooperatives, maple equipment manufacturers, vendors, some individual maple enterprises and maple researchers. There are currently 29 Directors and 5 Officers managing the affairs of the Institute. Mark Harran of Connecticut has entered his second term as President, Jeff Goulet of Lapierre and Pam Green of the Vermont are serving as 1st and 2nd Vice Presidents and David Campbell of New York State is serving as Treasurer. Dave Chapeskie will continue as the IMSI's Executive Director in 2016. The IMSI has a very busy agenda with discussions ranging from supply, demand and pricing of maple syrup to aspects of quality assurance.

Supply, Demand and Pricing of Maple

It was reported that at present there is a reasonably good balance between supply and demand for maple syrup. Sales of maple syrup remain strong and are increasing by as much as 5-10% per year in some quarters, while the sale of high fructose corn syrup and cane sugar are on the decline based on Nielsen data. Sales of value added maple products are also up in some markets by as much as 15%. It was reported that mail order sales from western states are strong. The supply of certified organic syrup is not adequate to meet current demand and there is currently a 17 cents per pound premium paid for bulk organic syrup.

The Federation of Quebec Maple Syrup Producers' representative reported that the Federation and the buyers of bulk syrup negotiated a price for the different classes of syrup to be applicable in 2016. The price of AA and A classes of syrup was increased by 3 cents/pound and the price of B class syrup was increased by 1 cent/pound while the price of Processing Grade Syrup did not change. It was reported that there are currently 62 million pounds of maple syrup in reserve in Quebec. Forty-two million pounds of this syrup is classified as table Grade syrup and the remainder is Processing Grade.

Marketing Strategy for Real Maple Products

In 2015 the Board of Directors of both the IMSI and the North American Maple Syrup Council endorsed a marketing strategy for maple syrup focused on North America. The IMSI is continuing work on the development of a generic marketing program based on a goal to double sales of maple syrup over the next seven years. Once the implementation plan is finalized, the IMSI will focus effort on identifying sustainable sources of financing to support implementation of the plan.

OMNI-IMSI Partnership Proposal

In the summer of 2015, OMNI Hotels, a chain of about 60 hotels located

IMSI: continued on page 49

North American Maple Syrup Council Research Fund

The NAMSC Research Fund funds research that supports and advances the maple industry. In recent years we have given tens of thousands of dollars to projects that have developed innovative practices and technologies, helped deepen our understanding of the science of sugarmaking, and promoted the products we all make.

You can make a difference!

Concerned about the future of the Maple Industry? Make a contribution to support the maple research we fund. One easy way is to pledge to send $.01 per container to the NAMSC Research Fund. Grant recipients are announced at NAMSC Convention each October.

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The NAMSC Research Fund is a non-profit, volunteer committee of the North American Maple Syrup Council, Inc.

IMSI: continued from page 47

in Canada and the United States, approached representatives of the maple industry to determine if there was interest in partnering with OMNI to promote maple over a three-month period in the summer of 2016. OMNI had already completed a successful promotional project for honey in partnership with the U.S. National Honey Board in 2015. The IMSI Board of Directors decided to enter into a partnership arrangement with OMNI to deliver a promotional effort for maple. A number of maple producer associations and packers of syrup from Canada and the United States have promised financial contributions to this project and more partner contributors are expected. IMSI representatives are currently working out project details with representatives of OMNI. Further information on the OMNI-IMSI Partnership Project can be obtained from the IMSI's Executive Director.

Labeling Recommendations for Maple (Sap) Water and Other Water Products

The IMSI finalized a series of recommendations advocating for uniform labeling of maple (sap) water and other water products such as RO permeate in the marketplace. An important consideration was that uniform labeling standards should be introduced now while the maple water industry is small, before un-uniform product labeling becomes firmly entrenched, potentially misleading consumers. These recommendations were finalized after consultation with IMSI members as well as companies currently involved in the production and distribution of these products. The IMSI's labeling recommendations have now been forwarded to the Canadian and United States federal governments as well as to the state and provincial regulatory authorities in jurisdictions administering maple specific regulations.

Standardized Maple Grades

The international classification and grading system recommended by the IMSI has now been endorsed by the federal governments in both Canada and the United States as well as by state governments with their own maple regulations including Maine, Vermont, New York, New Hampshire and Ohio. In December 2015 the Ontario government announced adoption of the IMSI's new grade standard. The Quebec government has been working on the maple grades regulatory amendments and an announcement is expected in the winter of 2016.

The IMSI will be working cooperatively with maple educators in Canada and the United States to prepare uniform contest rules for use by judges at the various contests in both Canada and the United States. Dave Chapeskie will coordinate this effort collaboratively with the maple educators in both countries. There is a need to ensure that the contest rules are consistent with the new international classification and grading system for maple syrup.

Maple Counts!

U.S. producers: Please be sure to participate in the annual NASS survey. An accurate picture of the maple industry is critical to ensuring our continued success. Sugarmakers in Indiana, Minnesota, and West Virginia will have their first opportunities to participate this year.

Quebec Federation Expands Storage Capacity

Though a warmer winter is threatening to take its toll on the world's largest maple syrup producer, Quebec's sugarbushes are preparing to endure the difficult weather and emerge stronger through the expansion of a Laurierville, Que. storage facility.

The $2 million warehouse expansion will allow the Federation of Quebec Maple Syrup Producers, an organization that represents 7,300 syrup businesses in Quebec, to greatly increase its capacity for storing the sweet, pricey commodity.

"With today's announcement of this $2 million investment… we'll have the capacity to respond to growing international demand for maple products and the steady increase in production," Serge Beaulieu, president of the FPAQ, said.

The larger stockpile will offset the "significant" impact annual production swings could have on prices, Beaulieu added.

The new facility will have the capacity to store 98 million pounds of maple syrup, or enough to fill 13 Olympic-sized swimming pools. The FPAQ, which currently produces more than two-thirds of the world's maple syrup, said the new warehouse will store the equivalent of an entire season's harvest. It is expected to enter into service at the end of the 2016 season—in time for the first barrels of the season's syrup.

Source: canadianmanufacturing.com

Sap prices

This table presents suggested prices per gallon for a maple producer to purchase sap. The variables that affect sap prices in this table are sap sugar content and bulk syrup price. It assumes that the sap buyer is paying the seller 50% of the bulk syrup price. You can download a customizable spreadsheet to calculate sap prices based on different variables at http://maple.dnr.cornell.edu/sapbuying.htm.

Sap Sugar Content	Bulk Syrup Price ($/lb)										
	$ 2.00	$ 2.10	$ 2.20	$ 2.30	$ 2.40	$ 2.50	$ 2.60	$ 2.70	$ 2.80	$ 2.90	$ 3.00
1%	$ 0.13	$ 0.13	$ 0.14	$ 0.15	$ 0.15	$ 0.16	$ 0.17	$ 0.17	$ 0.18	$ 0.19	$ 0.19
1.1%	$ 0.14	$ 0.15	$ 0.15	$ 0.16	$ 0.17	$ 0.18	$ 0.18	$ 0.19	$ 0.20	$ 0.20	$ 0.21
1.2%	$ 0.15	$ 0.16	$ 0.17	$ 0.18	$ 0.18	$ 0.19	$ 0.20	$ 0.21	$ 0.21	$ 0.22	$ 0.23
1.3%	$ 0.17	$ 0.17	$ 0.18	$ 0.19	$ 0.20	$ 0.21	$ 0.22	$ 0.22	$ 0.23	$ 0.24	$ 0.25
1.4%	$ 0.18	$ 0.19	$ 0.20	$ 0.21	$ 0.21	$ 0.22	$ 0.23	$ 0.24	$ 0.25	$ 0.26	$ 0.27
1.5%	$ 0.19	$ 0.20	$ 0.21	$ 0.22	$ 0.23	$ 0.24	$ 0.25	$ 0.26	$ 0.27	$ 0.28	$ 0.29
1.6%	$ 0.20	$ 0.21	$ 0.23	$ 0.24	$ 0.25	$ 0.26	$ 0.27	$ 0.28	$ 0.29	$ 0.30	$ 0.31
1.7%	$ 0.22	$ 0.23	$ 0.24	$ 0.25	$ 0.26	$ 0.27	$ 0.28	$ 0.29	$ 0.30	$ 0.32	$ 0.33
1.8%	$ 0.23	$ 0.24	$ 0.25	$ 0.26	$ 0.28	$ 0.29	$ 0.30	$ 0.31	$ 0.32	$ 0.33	$ 0.35
1.9%	$ 0.24	$ 0.26	$ 0.27	$ 0.28	$ 0.29	$ 0.30	$ 0.32	$ 0.33	$ 0.34	$ 0.35	$ 0.36
2%	$ 0.26	$ 0.27	$ 0.28	$ 0.29	$ 0.31	$ 0.32	$ 0.33	$ 0.35	$ 0.36	$ 0.37	$ 0.38
2.1%	$ 0.27	$ 0.28	$ 0.30	$ 0.31	$ 0.32	$ 0.34	$ 0.35	$ 0.36	$ 0.38	$ 0.39	$ 0.40
2.2%	$ 0.28	$ 0.30	$ 0.31	$ 0.32	$ 0.34	$ 0.35	$ 0.37	$ 0.38	$ 0.39	$ 0.41	$ 0.42
2.3%	$ 0.29	$ 0.31	$ 0.32	$ 0.34	$ 0.35	$ 0.37	$ 0.38	$ 0.40	$ 0.41	$ 0.43	$ 0.44
2.4%	$ 0.31	$ 0.32	$ 0.34	$ 0.35	$ 0.37	$ 0.38	$ 0.40	$ 0.41	$ 0.43	$ 0.45	$ 0.46
2.5%	$ 0.32	$ 0.34	$ 0.35	$ 0.37	$ 0.38	$ 0.40	$ 0.42	$ 0.43	$ 0.45	$ 0.46	$ 0.48
2.6%	$ 0.33	$ 0.35	$ 0.37	$ 0.38	$ 0.40	$ 0.42	$ 0.43	$ 0.45	$ 0.47	$ 0.48	$ 0.50
2.7%	$ 0.35	$ 0.36	$ 0.38	$ 0.40	$ 0.41	$ 0.43	$ 0.45	$ 0.47	$ 0.48	$ 0.50	$ 0.52
2.8%	$ 0.36	$ 0.38	$ 0.39	$ 0.41	$ 0.43	$ 0.45	$ 0.47	$ 0.48	$ 0.50	$ 0.52	$ 0.54
2.9%	$ 0.37	$ 0.39	$ 0.41	$ 0.43	$ 0.45	$ 0.46	$ 0.48	$ 0.50	$ 0.52	$ 0.54	$ 0.56
3%	$ 0.38	$ 0.40	$ 0.42	$ 0.44	$ 0.46	$ 0.48	$ 0.50	$ 0.52	$ 0.54	$ 0.56	$ 0.58

Hillside Plastics, Maker of Sugarhill Jugs, Sold

Hillside Plastics, a company best known to sugarmakers for its Sugarhill maple syrup containers and that has been operating in Montague, Massachusetts for 22 years, has been sold to Carr Management Inc. (CMI), a New Hampshire-based company. Hillside President Peter Haas will continue in his role as president of the company while Kate (Haas) Colby, vice president of finance, will help for a period of time during the transition.

Beth Muscato, CEO of CMI, said the company plans to invest in Hillside's operations to service growing demand for its products. She said Hillside is an "outstanding fit" given its product offering, dedication to customer service and presence in growing end markets including food.

"My family is confident that the decision to sell the business will enable further success and growth for the company in Turners Falls," Peter Haas said in a news release.

IN Maple Syrup Association Holds Annual Meeting

A record-setting 149 members and guests attended the Indiana Maple Syrup Association's 25th Annual Meeting on December 5. Hosted by longtime Hoosier sugarmakers Becky and Art Harris, Carol and Ron Burnett, and Susan and Keith Ruble, in Greencastle, Ind., the meeting featured Leader Evaporator Vice President Bruce Gillilan, who discussed "little things to think about as you use your evaporator."

A third-generation sugar maker and Vermont native, Gillilan works with his family every spring in the sugar house his grandfather built in the early 1900's. Gillilan claims to have boiled in more sugarhouses than anyone, and stories from visits with sugar makers were part of his afternoon talk, which included a reminiscence about flames coming from the pan when he was a 10-year-old watching the evaporator. He used that to reinforce his first rule in the sugar house – to stay calm. It also was an example of the evaporator "talking" to the sugar maker, and that "conversation" was the focus of his presentation on making good syrup.

Health Committee Chair Art Harris reported on an upcoming meeting with the State Board of Health. "We're going to try to clarify Indiana's guidelines so anyone can understand them."

Keith Ruble, IMSA's delegate to the NAMSC, reported on the 2015 meeting in Pennsylvania. A master forester, Ruble also presented on "Maintaining a Healthy Sugar Bush," and guests learned "the taps will tell the story."

The report on IMSA's annual sugar shack at the Indiana State Fair revealed that 2,000 pounds of cream, 10,000 pieces of candy and 600 gallons of pure Indiana maple syrup were sold. To celebrate Indiana's 200th anniversary, IMSA is creating a bicentennial label for the 2016 State Fair syrup bottles.

More than a dozen vendors of maple-related products spoke, and Kim and Bill Owen, of Maple Acres, presented a workshop on making confections that included treats like chocolate covered maple creams, maple candy, coated nuts, maple jelly, maple taffy, fudge, and suckers.

Leader Evaporator's Kevin Lawyer talked about the science of RO machines, emphasizing how they save time, fuel, labor, and space.

A petition was circulated, asking member support for a maple syrup U.S. postage stamp, and the board capped the day with a meeting to plan for 2016.

The Indiana Maple Syrup Association has nearly 150 members in 42 counties. A nine-person board guides the organization, with David Hamilton as its president.

The 2016 New York State Maple Tour

Save the date now for the 2016 New York State Maple Tour scheduled for July 17-19, 2016 in central New York State. The tour will be centered at the Ramada Hotel and Conference Center in Cortland NY. Cortland is located in the beautiful eastern Finger Lakes region of New York. This tour will feature maple operations of various sizes and specialties. Information will be available soon at the nysmaple.com and cornellmaple.com sites.

In Memoriam: Maple Community Losses

"Hank" Peterson

Henry, "Hank" A. Peterson of Londonderry, passed away on December 23, 2015. He was born on June 15, 1932 in Hurley, Wisconsin, and he grew up there on the family farm. Hank was in the Wisconsin National Guard for 14 years, in the 725th Engineer Battalion.

Hank was very active in the New Hampshire Maple Producers Association, holding the position of secretary from 1988 to 2000, and running the maple booth at the Farm and Forest Expo in Manchester for 28 years. He manned promotional booths at both the Deerfield and the Hopkinton fairs and also spent time at New Hampshire's Big E booth in Springfield, MA. He was in charge of Ag in the Classroom Open Barn for Merrimack County for many years. At his sugarhouse Hank did many tours for local pre-school children.

Hank was New Hampshire's delegate to the North American Maple Syrup Council from 1988 to 2013. In 1997 he became Vice-President of the NAMSC and served as its President from 1999 to 2002, and he was also on the board of directors of the International Maple Syrup Institute from 1988 to 2014. Hank was inducted into the Maple Hall of Fame in 2005, and received the Lynn Reynold Leadership Award from IMSI in 2012.

Hank was also a member of the New Hampshire Farm Bureau and served on the Farm Bureau Forestry committee. He has was on the Board of Directors of the Farm and Forest Expo since 1999 and had been Master of the Londonderry Grange for 21 years.

Howard Mangold

Maple producer, Ohio Maple Producers Association member, and NE Ohio Maple Syrup Committee member Howard Mangold passed away in Randolph, Ohio on January 2, 2016. Howard ran a farm, made maple syrup, and raised a family in this small Portage County Community. Up until recent years, when his health failed him, Howard and his wife Carol were always present at every local maple function and most state and international maple meetings. Howard was especially fond of attending the NAMSC/IMSI meetings whenever possible. Along with maple, he had a keen interest in antique tractors and antique equipment.

Henry Brenneman

Henry Eli Brenneman, dairy farmer and owner and operator of Brenneman's Maple of Salisbury, PA for more than 40 years, passed away on September 18, 2015. Henry was held in high esteem by the maple community for being a link between the Amish and the 'English,' and for helping out many producers with advice, help in laying out pipeline systems, and answers to questions about maple equipment.

Jeff Mason

Jeffrey L. Mason, 66, of Worthington, Massachusetts passed away on January 13, 2016. Jeff was a longtime sugarmaker and was the owner/operator of The Red Bucket Sugar Shack, along with his wife LeAnn. He was an avid gardener and enjoyed camping with his family.

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Local author wishes to interview multi-generational (preferably 5 or more) sugar-producing families in New York State for an upcoming book. Please contact Dan Ladue at dladue12901@yahoo.com

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