Maple Syrup Digest

Vol. 63, No. 3 September 2023

Quailty From Tree to Table
2023 International Maple Conference

The Newsletter of the North American Maple Syrup Council

MAPLE SYRUP DIGEST

Official publication of the North American Maple Syrup Council
www.northamericanmaple.org
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2546 Homestead Dr., De Pere, WI 54115
Published four times a year (Mar., June, Sep., Dec.)

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NAMSC's Vision is for all sugarmakers to consistently and sustainably produce high quality maple products.

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President's Note

Greetings maple folks,

It's fair season! Where did the summer go? Maple sales at Boyden Bros. Maple, are growing by the week now as fall approaches and those jugs purchased in the spring are getting empty. Also, the seasonal markets are opening for harvest sales, and that causes a spike in sales.

For Jeanne and I this starts a season of high-candy and cream sales. I made 95 pounds of cream over the weekend. Not much time to do other stuff!

For us in the Northeast, we had a late "deep" frost that set back the maples and spurred on a very heavy "mast year". The leaves are also very small. I hope that the trees have something left for us in February and March! (Or even January for you early tappers)

The conference is shaping up well! The trade show promises to be a good one, and participants are signing up. Please get your registration in to us ASAP so that we can accommodate you.

We have an interesting bunch of speakers, covering most things maple!

The Maple Syrup and Confections contest will be open to all participants. Bring your best and maybe take home some bragging rights! All entries will have confidential comments from the judges so you will know what they thought of your product. These comments over the years have helped Jeanne and I dial in our process to make the best product that we can. Just please check your density and grade before entering. It would be a shame to be disqualified before it is ever tasted.

As this is my last message as president of NAMSC, I thank you all for your support and wish you great sugaring going forward!

Let's all make sure that we work to, "Make Maple a Staple"!

Howard Boyden

President, NAMSC

Quality from Tree to Table

2023 International Maple Conference

October 26-28 • Sturbridge, MA

More information on page 37 and at

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In this issue...

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Nonconductive Wood Associated with Taphole Wounds in Sugar Maple

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The tree's response to the taphole wound is a dynamic and complex process to "wall-off" or compartmentalize the affected area, in order to limit the spread of pathogens in wood tissues and preserve the integrity of the tree's water transport (vascular) system (Shigo 1984). To accomplish this, living cells in the sapwood generate compounds to plug vessels in order to impede movement of pathogens and air vertically (Morris 2018). These cells also produce compounds that inhibit the growth or movement of microorganisms and that reinforce the strength of existing physical barriers which together restrict movement laterally and toward the tree's center (Morris 2018). The cambium (the layer of cells just underneath the bark which generates new wood each year) also generates a "barrier zone" comprised of specialized cells reinforced with movement- and growth-inhibiting compounds to prevent the spread of pathogens to new wood generated after the wound is made (Morris 2018). The outcome of this process is that the portion of wood which is walled off is no longer functional – it no longer conducts water (or sap for sap collection) or stores carbohydrates. Visually, most of this compartmentalized area is characterized by darker-colored wood than the surrounding sapwood. This has been termed "wound-associated staining". We will refer to this zone as "nonconductive wood" (NCW), to reflect the practical reality that visibly stained wood is typically no longer conductive to water or sap.

Compartmentalization and the development of NCW relate directly to the long-term sustainability of tapping trees for sap collection, in terms of both sap yields and tree health. Tapholes drilled into stained, NCW will yield significantly less sap than those drilled into clear sapwood (Isselhardt 2022). The accumulation of NCW in a tree from tapping not only increases the chances of reduced yields by increasing the probability that a new taphole drilled will encounter existing NCW, but also affects the functionality of the tree's water transport system, and can increase its susceptibility to the development of internal decay.

Generally speaking, larger tapholes produce more sap, but also result in the development of more NCW. The choice of taphole diameter and depth thus represents a tradeoff between short-term yields and the maintenance of high sap yields and tree health in the long-term. Quantification of the magnitude of these factors – the amount of sap and NCW generated for a taphole

of a given size – allows estimation of the potential net outcomes, and thus facilitates decision making that is more data-based. Very few data exist on the volume of NCW generated in response to tapholes, although findings have generally shown the volume to be proportional to the volume of the hole (Renaud 1998, Wilmot et al. 2007a,b, Wilmot 2016, Wilmot, T.R., unpublished data; van den Berg, A.K., unpublished data). To help increase the amount of quantitative data available, we conducted a study to quantify the volume of NCW generated in response to taphole wounds in sugar maple trees.

Materials and Methods

In the summer and fall of 2017, producers at each of 10 maple operations in Vermont identified 10-20 sugar maple trees for inclusion in the study. Trees were healthy (North American Maple Project Crown Vigor Rating = 1) and part of the producers' current maple operations. During the production season of 2018, producers were instructed to place a single taphole in each tree using the same spout diameter and depth they would use for a tree of that size in their operations, and to remove the spout as usual at the end of the season. All spouts used were either 5/16" or 19/64" in diameter. After leaf-drop in the fall of 2018, the diameter at breast height of each tree was measured, and the location of diameter measurement and the study taphole were marked. Trees were then felled, and portions of the stem that contained each taphole and associated NCW were cut and brought back to the Proctor Maple Research Center in Underhill, Vermont. The portion of the slab containing the taphole wound was removed tangentially with a chainsaw, then each was subsequently cut with a circular saw into 2"-wide segments beginning at the center of the taphole and moving up and down the stem until stain from the taphole was no longer visible. Each of these segments was then photographed with a scale using a digital camera. ImageJ image analysis software (https://imagej.nih.gov/ij/) was used to measure the area of NCW in the image of each segment of each tree. These data were then used with the segment widths to calculate the total volume of NCW generated in response to each taphole in each tree. The volume of taphole wounds was calculated from producer-reported taphole depth and drill bit diameter. It should be noted that there is some inherent lack of precision in this calculation, since actual depth or diameter can vary due to bark thickness or other factors. Total NCW volume was used with taphole volume to calculate the NCW volume in proportion to the volume of the taphole for each tree – this enables NCW volume to be compared between tapholes of different depths and diameters.

For each tree, the cross-section collected from the height at which tree diameter was measured was retained and used to measure its radial growth rate. These cross-sections were air-dried and prepared for analysis by sanding to enhance the visibility of annual rings. Thirteen of the cross-sections had defects rendering them unsuitable for growth ring analyses, leaving a sample size of 50 cross-sections. Using a dissecting microscope, the widths of

each cross-section's annual rings were measured to the nearest 0.001-mm using a digital micrometer linked to an electronic measuring sledge. Two transects perpendicular to the direction of growth were measured for each cross-section, one each 1 to 2" from the left and right of the taphole location to avoid any unusual growth caused by the wound (Speer 2010). Areas of unusual growth or defects (branch scars, etc.) were avoided. These data were used with the trees' diameters to calculate the mean annual basal area increment (BAI) over the previous 5, 10, 15, 25, and 25 years for each for each transect using standard formulas (Long et al. 2009). The average of these two measurements was calculated to approximate the radial growth rate of the tree in the location of the taphole wound. The growth rate was also calculated for the portion of wood the taphole wound actually intersected (e.g. from the growth ring at maximum taphole depth).

Results and Discussion

One hundred fifty-five trees were initially selected and tapped for the study. Of these, 124 were felled, with some trees excluded due to producer choice, safety of felling, or other considerations. One hundred one of these were suitable for photography of NCW columns after trees were slabbed and cross-sections cut (3 slabs cut off a portion of the NCW column from the taphole, and tapholes from one site (n = 20 trees) were determined to have been made prior to 2018, and thus were excluded from the analysis). Of the 101 NCW columns photographed, 38 were removed from analysis because the stain intersected or or interacted with either the tree's central column of non-conductive wood (Figure 1), or other pre-existing NCW within the tree (Figure 2) (tapholes from previous years, branch scars, etc.). Thus, ultimately 63 NCW columns from 9 sites were included in analyses.

Overall, the average volume of NCW was 50.9 times the volume of the taphole (Figure 3). There was a large amount of variation (±3.6), with values ranging from 11.4 to 153.5 times the volume of the taphole (Figure 3). This is very similar to results observed in previous work at UVM PMRC, which found an average taphole to NCW ratio of 49.2 (±5.1), and ranged from 14.7 to 197.6 (Figure 4) (Wilmot, T.R., unpublished data; van den Berg, A.K., unpublished data). Finding similar results in a study of different trees at different sites is indicative that, despite the high level of variation, the average proportion of NCW that develops in response to tapholes drilled into clear sugar maple sapwood is fairly consistent. This confirms that these estimates are reasonable to use in models and calculations to estimate the potential accumulation of NCW in the tapping zone over time (van den Berg et al. 2016). It should be noted that the trees in this study were felled and dissected one growing season after wounding. Previous work has shown that the volume of stained wood can continue to increase slightly after the first growing season following tapping, at least up to four years after the initial taphole wound is made (Houston and Fagan 1997). Thus, the volume of NCW after only one growin

Thus, the volume of NCW after only one growing season could somewhat underestimate the ultimate volume that will develop. This might be the cause for the observation by Wilmot (2005) that the nonconductive wood extended to an area 50 to 100% greater than the area of visibly stained wood, since the trees in that study were examined in the months immediately after wounding. Current models which estimate the development of NCW over time incorporate this in their calculations (van den Berg and Perkins 2013).

It has sometimes been speculated that the efficiency of a tree's compartmentalization of taphole wounds might be related to its growth rate, and thus that differences in growth rates might explain some of the variation between trees observed in the development of NCW. However there was no significant linear relationship observed between the volume of NCW and radial growth rates in this study (Figure 5). The linear regression of NCW volume on growth rates over the prior 20 years is shown in Figure 5 as an example; similar results were observed for growth rates over the previous 5, 10, 15, and 25-year periods ($p < 0.7953$, $p < 0.6911$, $p < 0.6449$, $p < 0.4576$). Likewise, there was no linear relationship between the volume of NCW and the growth rates in the portion of wood into which the taphole was drilled in each tree ($p < 0.2438$). It should be noted, however, that the relatively small sample size precludes drawing any strong conclusions from this analysis. Controlled experiments with much larger sample sizes would be needed to address this question more adequately.

One peripheral/auxiliary finding of note is with respect to the 32 trees in which the taphole interacted with the central column of discolored wood (CCDW). This interaction can occur even if the taphole wound doesn't directly intercept the CCDW (Figure 1), and results in the generation of considerably more NCW than tapholes drilled into clear sapwood. All but 3 of these 32 trees were smaller than 9" in diameter, and 26 were smaller than 8". Although this study was not designed to investigate the relationship between tree diameter and the likelihood of interactions with the CCDW, the results suggest that with smaller-diameter trees there is a heightened risk of tapholes interacting with the CCDW, with the resulting formation of larger amounts of NCW. With all else equal (growth rates, etc.), NCW inherently accumulates more rapidly in smaller trees than larger trees due to the smaller volume of wood in the tapping zone; if an increased risk of interaction with the CCDW also exists, this could magnify this effect. The relationship between tree size and CCDW interaction with wounds should be more directly examined to help elucidate a better understanding of these factors and ultimately facilitate provide additional guidance minimum tapping diameter to promote maximum sustainability of tapping over the long-term.

This study adds to the quantitative data available on the volume of NCW developed in response to taphole wounds in sugar maple, which ultimately facilitates data-based choices of taphole diameter and depth to balance the trade-off in sap yields and NCW

to effectively optimize both yields and tree health over the long-term. There remain numerous questions to answer with respect to factors which affect the development of NCW in response to taphole wounds, including the effects of tree age, growth rate, wood anatomy, and carbohydrate status (tree health and "stress"), as well as the time of year and temperature when the wound is made and subsequently compartmentalized.

Acknowledgements

We wish to recognize the valuable and important contribution made by the maple producers who participated in this study. We are sincerely grateful to them for giving generously of their time, and allowing access to their properties and removal of their trees for the advancement of the science in our field. Funding for this project was made possible through the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture Organic Transitions Program grant 2016-51106-25717. This article's contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

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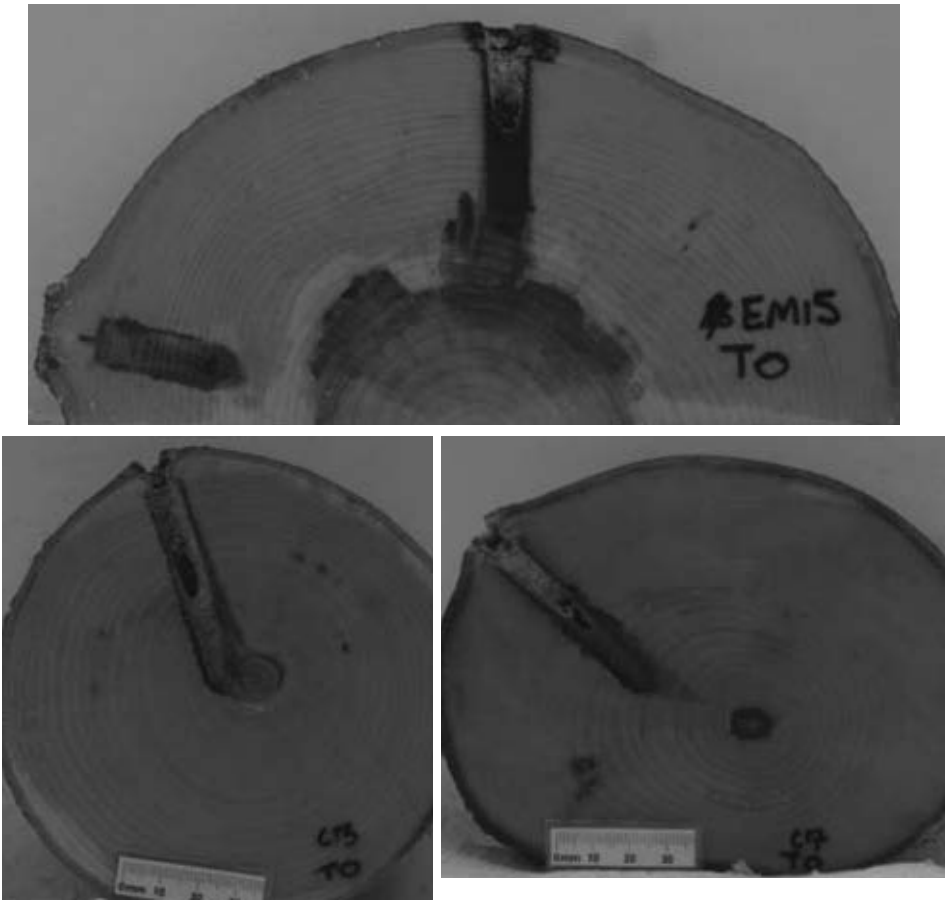

Figure 1. Examples where the response to the taphole wound has interacted with existing nonconductive wood (NCW) from previous wounds, and/or the central column of nonconductive wood (in maple, the stained area of wood in the central portion of the stem is referred to as the "central column of nonconductive wood", and it is not true heartwood as occurs in other species like walnut). Note that the wound does not have to physically intersect existing NCW for the response zones to interact, and when this occurs the result is often much more NCW than results from a wound in healthy sapwood.

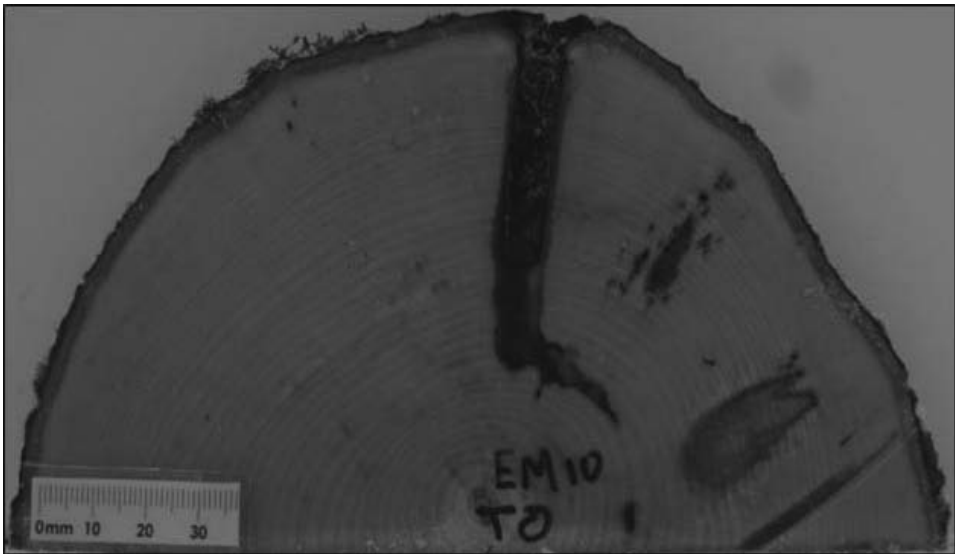

Figure 2. This image shows an instance where the wound response to the taphole has interacted with what is likely NCW from a previous year's taphole, and the stain from both are interacting with an area of stain (or decay) in the interior of the tree.

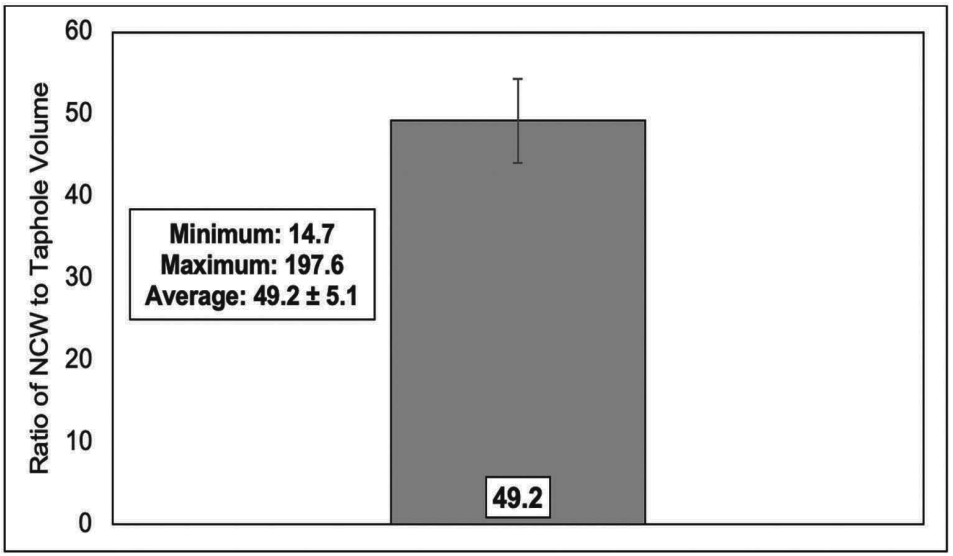

Figure 3. Overall mean (± standard error) ratio nonconductive wood (NCW) to taphole volume in 63 trees tapped with standard maple tapholes in spring 2018 and felled and dissected the following fall. Mean diameter at breast height = 8.9 inches (± 0.3), minimum = 5.1, maximum = 14.6.

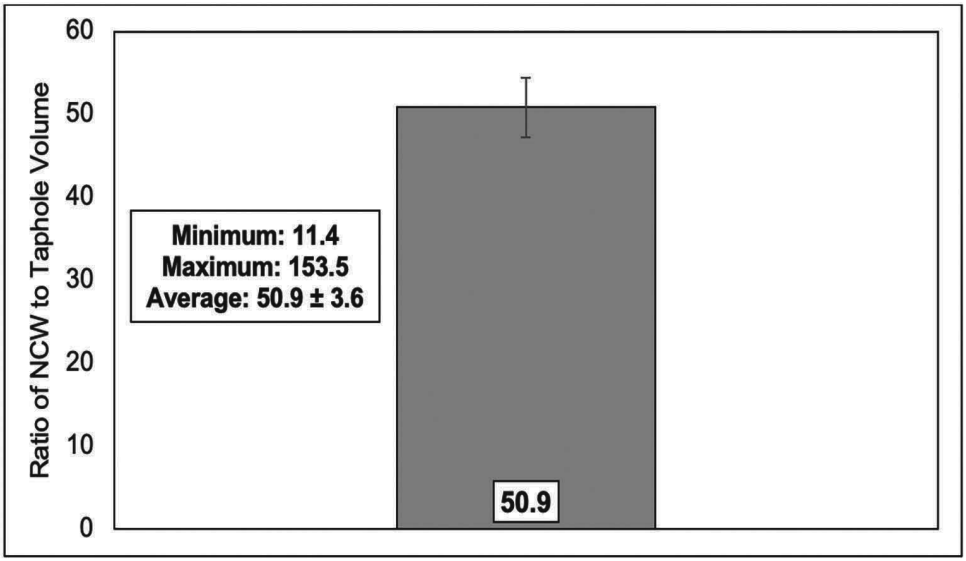

Figure 4. Overall mean (± standard error) ratio nonconductive wood (NCW) to taphole volume in 45 trees tapped with standard maple tapholes (5/16" or 19/64"-diameter) in various previous studies at UVM PMRC (Wilmot, T.R., unpublished data; van den Berg, A.K., unpublished data).

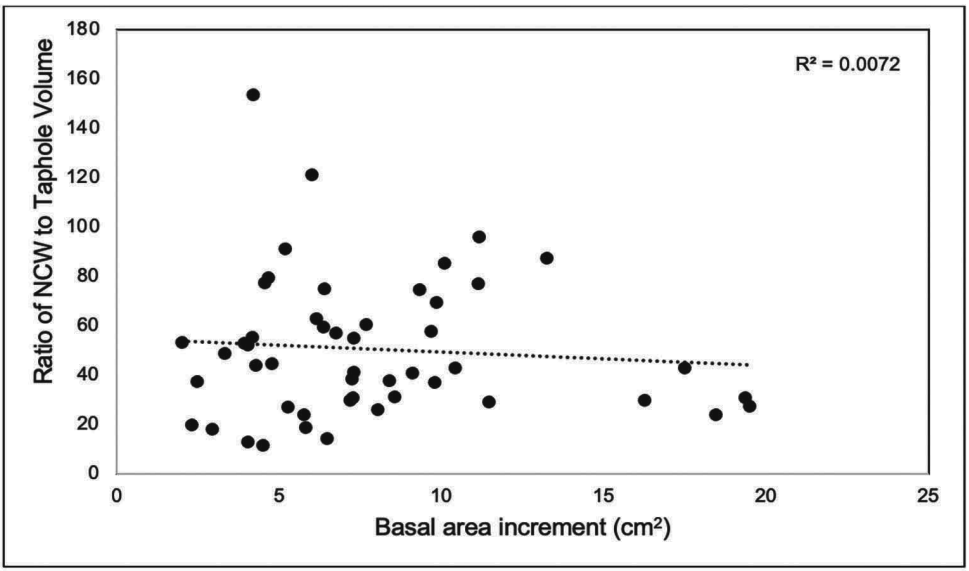

Figure 5. Linear regression of the volume of nonconductive wood (NCW) associated with tapholes (expressed as the volume of NCW in proportion to the volume of the taphole) versus the tree's growth rate (basal area increment in cm2) over the past 20 years (2008-2018). n = 50 trees

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Register now for the International Maple Conference hosted by the Massachusetts Maple Producers Association and the North American Maple Syrup Council, the 2023 International Maple Conference – "Quality from Tree to Table"

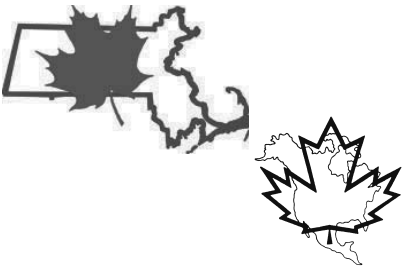
Will be held October 26-28 in Sturbridge, MA. Hundreds of maple producers from the US and Canada will gather for the industry's largest and longest-running annual conference and trade show. The event has been held every year for decades, and attracts sugarmakers of all sizes, along with researchers, regulators, and professionals from related industries for four days of research presentations, practical skills workshops, meetings, tours, and networking.

October 26 will feature two tours of Massachusetts sugarhouses and other innovative farms. The evening will include a Taste of Massachusetts feast! Twelve presentations from maple researchers, educators, and extension specialists will be offered on October 27, with sessions on topics such as improving tree health, optimizing yields, and maple export opportunities. A celebratory banquet will cap off the evening.

Saturday, October 28 is a day of practical skills workshops, with sessions ranging from a beginners clinic, to sugarbush management, to best practices in the sugarhouse. An industry panel in the morning will offer insights into trends and opportunities in the maple world.

The event will host a trade show featuring all of the major equipment manufacturers showing off their latest tools and technology. A maple products contest will be open to all attendees who want to show off their best products. An extensive display of maple antiques, and a silent auction benefitting the North American Maple Syrup Council's Research and Education Fund will be held throughout the weekend as well.

For more information and to register, visit: https://www.massmaple.org/2023mapleconference/



Shrinking the Maple Tap Hole. Does it impact production?

Adam Wild, Director Cornell University Uihlein Maple Research Forest

For the past couple decades, 5/16-inch diameter tap holes have been the commercial maple industry standard since switching from 7/16 inch spouts. Over the years, folks have experimented with even smaller diameter tap holes with mixed results. More detailed research has shown that ¼ inch diameter tapholes yield 10% less than a 5/16 inch diameter tapholes (3rd Ed. North American Maple Syrup Producers Manuel) while many equipment catalogs and producers claim they get the same yield from ¼ inch diameter spouts or smaller. So how do smaller diameter spouts perform? Having a smaller diameter spout has the potential of creating narrower compartmentalized wounds within a tree. This is beneficial for trees that have been tapped for many decades and trees located in marginal soils or short growing seasons.

During the maple season of 2022 and 2023 we tested the sap yield from 5/16 (0.3125) inch diameter tap holes, 1/4 (0.25) diameter tapholes and 9/40 (0.225) diameter tap holes at the Cornell University Uihlein Maple Research Forest in Lake Placid, NY. The top of the sugarbush at the Uihlein Maple Research Forest is 2,300 feet in elevation and Lake Placid, NY is notorious for being a cold region with short growing seasons. Being able to tap with a smaller diameter taphole and still maintain high yields would be ideal. Each tap hole diameter was replicated three times (4-19 taps per replicate) in 2022 and five times (4-20 trees per replicate) in 2023. The 2022 maple season was above average for production at the Uihlein Maple Research Forest and the 2023 maple season was a below average production year with only a couple weeks of good sap flow data. Sap volume was collected from each replicate after each sap run. Total sap volume across the season was averaged per tap/tree from each replicate. Production volume from the 5/16 inch diameter tapholes was considered 100% of production as the industry standard. The other two diameters are shown in percentage increases or decreases above or below the 5/16 inch diameter spouts.

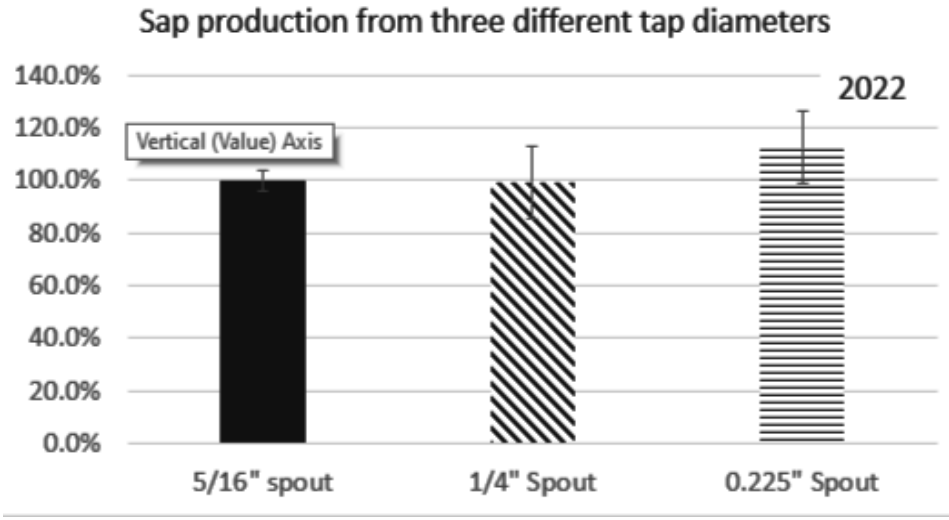
During the two years of data colletion, there was no significant difference between the three different tap hole diameters (figures 1 & 2). Although the 0.225 diameter spouts show a 12.5% increase in production during the 2022 season, there was no significant difference (figure 1). Based on the error bars that show the standard deviation, the variation is high. Quarter inch diameter spouts show similar production as the 5/16 inch diameter tion on average (15% less for 0.225

inch and 16% less for 1/4 inch diameter) than 5/16 inch diameter spouts although this was also not a significant difference. Looking at the error bars, the variation is too large between the replications. It is important to note that the 2023 maple season in Lake Placid was a short season and the data only reflects two weeks of data but the bulk of production for that season.

Only two seasons of data is not fully conclusive as to whether smaller diameter tapholes provide similar yields to the current industry standard of 5/16 inches. Although after two years of data collection at the Cornell University Uihlein Maple Research Forest there does not appear to be a significant change in production. The second year does lean towards less production. Larger diameter tap holes should in theory yield more sap.

An advantage to smaller diameter tapholes is less surface area which could reduce micro vacuum leaks in high vacuum systems. Even if smaller diameter tapholes produce less sap, this could potentially be beneficial in applications where trees are slower growing and decreasing wound potential would be more beneficial for the long-term sustainability of tapping the trees. However more work is needed to better understand non-conductive wood formation from smaller diameter tap holes. We hope to measure sap production volume on the different tap hole diameters during the 2024 maple season as well. Stay tuned for an update next year.

Acknowledgement: The project was possible thanks to funding from the Northern New York Agriculture Development Program. Thanks to Keith Otto for assistance in research set up and data collection.



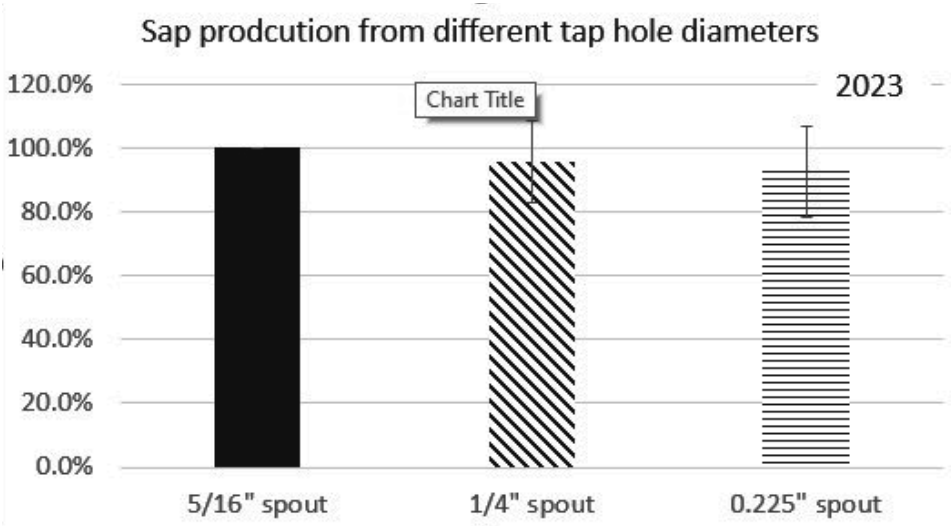


Figure 1 & 2: Sap production volume from three different tap hole diameters during the 2022 & 2023 maple season at the Cornell University Uihlein Maple Research Forest. Tap holes 5/16 inches in diameter were considered 100% of production with smaller tapholes showing a percentage change above or below 5/16 inch diameter tap holes. The error bars reflect standard deviation which shows the range that occurred across the replications. By comparing the error bars and not the average production, there is too much variation to draw significant conclusions. After two seasons there was not a significant change in production with smaller diameter tapholes. More years of data collection are needed.

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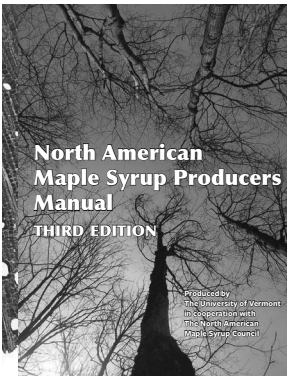

Maple Cream Trouble Shooting

Catherine Belisle, Ph.D., 2022, Cornell University

Overview

This article provides guidelines for addressing issues commonly encountered when making maple cream. Maple cream is a thick, smooth, spreadable confection derived from maple syrup. Its peanut butter-like texture develops when small sugar crystals are formed and held in a supersaturated or concentrated syrup solution. The consistency and quality are controlled by water content and inverted sugar levels. The desired water content is 15 to 18% (Hartel, 2018). Boiling syrup to 25 °F above the boiling point of water (ABPW) yields a cream with approximately 15% water content, while boiling to 22 °F ABPW yields approximately 18% water content (Norish, 1967; Hartel, 2018).

The main factor determining which temperature is appropriate for making maple cream is the level of inverted sugars present in the maple syrup. Sucrose, the primary sugar in maple syrup, forms a stable crystal in maple cream. The invert sugars, glucose and fructose, help maintain moisture and reduce crystallization. The recommended range of invert levels for cream are 0.5 to 3% with 1.5% as ideal. For a detailed recipe, please refer to "Making Maple Cream" by Stephen Childs. More information on invert sugars and measurements can be found in the New York State Maple Confections Notebook.

Crystallization or Graininess

Large crystals can form at three points during the production process: prior to stirring the heated syrup (sugar solution), during stirring, or during storage. Crystal size must be controlled during production of maple cream, as formed crystals will continue to grow during storage. To reduce the formation of large crystals, follow the guidelines below.

Inhibit crystals prior to stirring. As the sugar solution is cooling, do not agitate the mixture. Any type of agitation can cause sugar crystals to form and grow. This will lead to large sugar crystals in the final maple cream. During heating, brush the sugar crystals from the side of the pot into the sugar solution using a water-wetted silicone brush. After the sugar solution has reached the desired heating temperature, a fine mist of water can be sprayed on the surface of the solution to prevent crystal formation – in this instance, heating the solution an additional 1 to 2 °F higher can help account for the added moisture.

Cool the sugar solution. Large crystals will form if the solution is stirred when warm, this is because the sugar crystals move more easily in a warm solution, thus increasing the likelihood of sugar crystals binding to each other. Stirring a cooled solution will produce a large number of small crystals and re-

sult in a smooth fondant. The ideal temperature range for stirring maple cream is below 70 °F and above 45 °F.

Control the crystal size with "seeding". Seeding is the process of adding sugar crystals of an ideal size to an uncrystalized solution. Stirring the sugar crystal "seeds" into the solution initiates the crystallization reaction. To accomplish this, add maple cream with desired crystallization to the cooled, unmixed sugar solution at 1 to 2 tablespoons per gallon of syrup used or 5% of the heated solution.

Stir sugar solution quickly. Stirring too slow or too fast will produce a fondant with larger crystals. If all other guidelines have been followed and graininess is still developing, alter your stirring speed.

Thick or Hard Cream

Cream viscosity (thickness) is dependent on two characteristics: water content, and sugar crystal concentration and distribution. The factors determining viscosity can be controlled during production or during storage.

Use higher levels of invert syrup. The invert sugars have two functions, glucose reduces the crystallization of sucrose and fructose acts as a humectant that softens maple cream. The recommended invert levels are 0.5 to 3% with 1.5% as ideal. A recipe with low-invert can harden. In this situation, it is recommended to increase the invert levels of unheated syrup. To slightly increase invert levels, add ¼ to 1 teaspoon of liquid or powdered invertase per gallon of maple syrup. Allow solution to sit at ambient temperature for 1 to 6 hours and monitor frequently. Once the desired invert level is measured, heat the solution to inactivate invertase activity.

Reduce finishing temperature. The finishing temperature (22 to 25 °F ABPW) is correlated with water content (approximately 15 to 18%) (Norrish, 1967). The higher the finishing temperature, the lower the water content. A thick or hard cream can be fixed by reducing the finishing temperature by 2 to 5 °F.

Add inverted syrup to heated sugar solution. An alterative method for producing maple cream is to add inverted syrup to the heated sugar solution. Since water content is a key characteristic to control, a low-invert syrup (0.5 to 1.0%) would be heated to approximately 35 to 38 °F ABPW. The fully inverted syrup would be heated slightly (to about 150 °F) and then added to the sugar solution once it has reached the finishing temperature. It is recommended to add 5 parts heated sugar solution with 1 part fully inverted syrup to yield a water content between 15 to 18%. The combined sugar solutions would then cool and procedures would continue as recommended in the "Making Maple Cream" article (Childs, 2007). In thick creams, the invert sugars, particularly glucose, will reduce crystallization during storage and thus reduce drying of the cream.

Add water to finished cream. Maple cream will harden during storage. This occurs due to the crystallization of sug-

ars or drying of the product (Ozcan et al. 2019). The water content of fondants is typically 15-18%, but can be slightly lower or higher (Hartel, 2018). Packaging creams in water barrier packaging with a tight seal will reduce water loss during storage. However, if drying does occur, add approximately 2% water by volume of the cream (34 mL of water per 177 mL of cream). For reference, a halfpound jar of maple cream is about 177 m

Add invertase to finished cream. Invertase can soften hard creams during storage by reducing crystallization (Ozcan et al. 2019). However, invertase will not reduce graininess caused by large sugar crystals. Add invertase at 0.1 to 0.3% of the cream solution or 5 to 15 g per 5000 g of syrup and store cream at room temperature for 24 to 48 hours. For reference, a gallon of syrup is approximately 11 lbs or 4989 g.

Thin or Soft Cream

Similar to thick or hard cream, the viscosity of thin creams is dependent on water content and sugar crystals. Viscosity can be controlled during production or during storage.

Use lower levels of invert syrup. In maple syrup, the 66 °Brix consist of sucrose and invert sugars. Further, the invert sugar level is inversely correlated with sucrose levels. In a 66 °Brix solution with an invert level of 2%, the sucrose level will be 64%. If invertlevels are too high and the sucrose content is too low, there will not be enough crystalline sugar to provide firmness. By using lower invert syrup, the sucrose sugars can crystallize and result in a firmer fondant. The recommended invert levels are 0.5 to 3% with 1.5% as ideal.

Increase finishing temperature. A lower finishing temperature results in a higher water content. The higher water content results in a softer, runnier fondant. To combat this, increase the finishing temperature by 2 to 5 °F.

Separation of Cream

Separation of maple cream occurs when the water content is too high or the invert level is too low. Cream separation does not occur until storage; however, its occurrence can be reduced during production or during storage.

Increase finishing temperature. Sugar crystals form a matrix in maple cream. When water content is high, some of the water is removed from the matrix and settles on top of the cream. By reheating the cream solution to a finishing temperature 2 °F higher than the initial finishing temperature or heating the initial sugar solution 2 °F higher, the solution will be thicker and less likely to separate. When reheating a finished cream, add 500 to 750 mL of filtered water per gallon of syrup used. This will allow the sugar crystals to dissolve in the solution and is imperative to reduce development of a grainy texture.

Add inverted syrup to heated sugar solution. The methods for this recommendation can be found in the "Thick or Hard Cream" section. Invert sugars will draw in moisture and hold it in solution (Hartel, 2018), reducing separation. However, too high invert will result in a soft, thin cream that may be

undesirable.

Add invertase to finished cream. Invertase breaks sucrose into fructose and glucose. In this process, a water molecule is used. This reduces the available water in the solution and consequently reduces separation. Add 5 drops of liquid invertase or a few granules of powdered invertase per 6 oz container of cream, stir, and store at room temperature for 24 to 48 hours. This will result in a softer cream.

Acknowledgements

The author thanks Aaron Wightman and Ailis Clyne for contributions to editing andCornell University and the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service, Acer Access and Development Program for research funding.

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Maple Syrup Grading School to be Offered in Massachusetts

The *International Maple Syrup Grading School* is for maple producers, bulk syrup buyers, state inspectors, and others needing to accurately grade maple syrup or judge maple product entries at fairs and contests. Quality control issues are also addressed. This school provides a strong scientific base combined with intensive hands-on exercises. This approach enables participants to learn how to grade or judge maple products with confidence. Past course participants have shared that the class offers, "Excellent explanations, exercises and interaction. Far better than reading available material only."

This year's program is scheduled to take place immediately after the NAMSC Annual Meeting on October 29th and 30th in Grafton, MA. Sign up for the Grading School interest list to be the first to learn when registration opens. https://extension.umaine.edu/maple-grading-school/2023-schools/

Characterizing Buddy Maple Syrup Flavors

Catherine Belisle PhD, 2023, Cornell University

Maple syrup produced at the end of the harvest season is commonly termed "buddy maple syrup." The flavors of this syrup can range from a subtle butter or mocha flavor to a prominent metallic or sulfur flavor. To ease the classification of buddy maple syrups, the Cornell Maple Program partnered with the Cornell Sensory Evaluation Center (CSEC) to develop a buddy maple syrup flavor wheel (1)

Flavor wheels and descriptors were previously developed for Grade A maple syrup (2, 3) and were used as a starting point in developing the buddy flavor wheel. The flavor wheel (Fig. 1) consists of terms to describe the flavor and mouthfeels that can be found in buddy maple syrup. This standardized se7sory vocabulary was designed for defining the many nuanced flavors of buddy maple syrup..

The most frequent terms used to describe buddy syrup are bitter, sour, sweet, metallic, butter, coffee, fruity, floral, and astringent, according to the CSEC. Flavor characteristics vary among individual syrups (1), which may be due to the level of amino acids in the sap, the storage conditions, among other factors. Regardless, characterizing the flavors of buddy syrups can ensure the proper syrups are chosen for value-added products or processing grade sales. For instance, a mocha or chocolate flavor can be complimentary in an orange infused syrup. Meanwhile, those selling or buying processing grade syrup can have an idea of the syrup's characteristics prior to tasting.

Acknowledgements

This project was funded by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service, Acer Access and Development Program.

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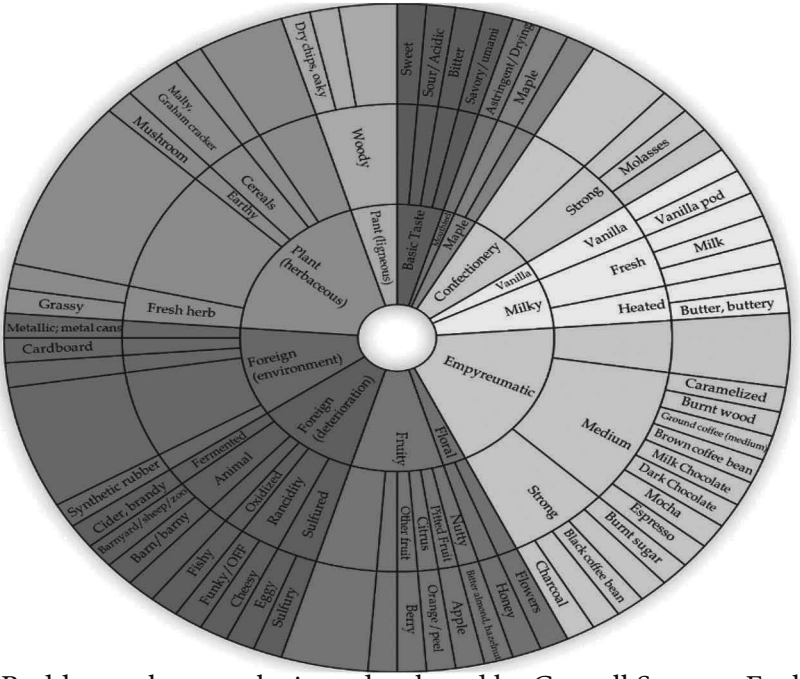

Fig.1 Buddy maple syrup lexicon developed by Cornell Sensory Evaluation Center

Maple Marshmellow Spread

Xingrui Fan, Anna Bica, Young Kim, Jordan Roth, Catherine Belisle PhD, 2023, Cornell University

The Cornell Maple Program works with industry collaborators and university partners to facilitate the development of new maple products. This product isa shelf-stable maple marshmallow spread, sweetened solely with maple syrup and maple sugar. It was developed using amber maple syrup and maple sugar for one formulation and dark syrup and sugar in a second formulation.

Maple marshmallow spread is designed to compete as a gourmet version of popular marshmallow spreads. It has a variety of suggested uses such as a hot beverage topping, sandwich spread, baking ingredient, and enjoyed by the spoonful as a treat. This product is formulated with physical properties and additives to ensure a quality, stable, and safe product. Commercial production requires an approved, food safe process and a certified facility.

Currently, the market of maple syrup is growing rapidly, with a compoundannual growth rate (CAGR) of 5.9 % anticipated from 2023 to 2031 (Straits Research, 2022). Maple syrup is recognized as a sustainable, natural sugar with a distinctive flavor profile. Unlike highly processed sweeteners, maple syrup contains compounds with potential health benefits including minerals, amino acids, vitamins such as riboflavin and niacin, and antioxidants including gallic acid, quercetin, and kaempferol (Mohammed et al., 2022). Popular commercial brands of marshmallow spread contain corn syrup and cane sugar as sweeteners, which positions maple marshmallow spread to compete well in this sector. Production cost and price analyses indicate strong potential for profitability.

The Science of Maple Marshmallow Spread

Maple Syrup and Sugars

Maple syrup consists of 66 to 68.9 % sugars, according to the Food and Drug Administration (FDA) and United States Department of Agriculture (USDA) regulations.The majority of sugar in maple syrup is sucrose, a disaccharide composed of one glucose and one fructose. Sucrose can be hydrolyzed into glucose and fructose when it is subject to the enzymatic activity of invertase. The 1:1 composition of glucose and fructose is called invert sugar. Invert sugar can impede the crystallization of sucrose, decrease the water activity (measurement of free water in the product), and reduce viscosity and reduce viscosity (Childs & Wightman, 2022).

Due to these beneficial properties of invert sugar, the maple marshmallow spread was developed to have all sugars converted to invert sugar to achieve a better shelf-stability and spreadability.

Egg White

Egg white, also known as albumen, contains 10 to 15 % protein and 85 to 90 % water (Brady, 2013). When egg whites are whipped, air is incorporated into the viscous liquid and a foam structure forms. The albumen proteins temporarily stabilize the air bubbles in the egg white foam; these proteins uncoil when whipped and the hydrophilic ends are attracted to water while the hydrophobic ends are attracted to air pockets. Within a few minutes, the proteins recoil, liquid drains out between the air pockets, and the foam collapses. In order to create a shelf-stable foam structure, the stabilizers, cream of tartar and xanthan gum are added.

Stabilizers

Cream of tartar, the potassium salt of tartaric acid, is often used to stabilize egg whites and prevent sugar crystallization in confections, both of which are necessary when producing marshmallow spread. It also lowers the pH, which prevents the egg white proteins from recoiling, and thus maintains a stabilized foam for longer (Brady, 2013).

Xanthan gum is a food hydrocolloid, a type of nondigestible polysaccharide, commonly used as a stabilizer and thickener. It can help to stabilize the foam structure, provide a thicker mouthfeel, and reduce water activity. These characteristics improve the sensory properties and food safety of marshmallow spread. Another benefit of using xanthan gum is that it has a special shear-thinnng property, which allows consumers to more easily spread the product on bread or other foods.

Necessary Equipment and Supplies: Stand mixer with whisk attachment, Rubber spatula, Saucepan Kitchen scale, High moisture barrier packaging, Thermometer, Measuring spoons and Piping bags and tips.

Recipe

Ingredients

250 g Inverted maple syrup1

150 g Maple sugar

120 g Water

95 g Pasteurized liquid egg white

2.9 g (½ teaspoon) Cream of tartar

1.0 g (¼ teaspoon) Xanthan gum

0.49 g Potassium sorbate (0.1% of the total recipe)

0.1 g (3 drops) Invertase (0.02% of the total recipe)

1To fully invert maple syrup, add 1 tsp of invertase per gallon of syrup. For rapid conversion, hold maple syr

up with invertase at 120 – 150 °F for 24 hours. Where time is not a factor, stir the solution thoroughly and store at room temperature for 3 – 5 days

Directions

1. In a medium saucepan, add inverted maple syrup, granulated maple sugar, and water. Stir over low heat until sugars dissolve.

2. Heat the sugar mixture to 240 °F on medium-low heat. Immediately remove from heat and allow to cool to ≤180 °F.

3. While the sugar mixture is cooling, add pasteurized liquid egg whites and cream of tartar into the bowl of a stand mixe with a whisk attachment. Whip the mixture on medium-high speed until reaching a soft peak (approximately 5 minutes).

4. Add xanthan gum to the egg white mixture and mix for one minute.

5. Once the sugar mixture has cooled to ≤180 °F, turn the stand mixer on low. Slowly add the syrup to the whipped egg white mixture by pouring it down the side of the mixing bowl.

5. Increase the stand mixer speed to high and continue to whip for 10 minutes.

6. To prevent crystallization and mold during storage, add invertase and potassium sorbate to the finished spread in the stand mixer and whip until combined.

7. Transfer the spread into food grade, high moisture barrier containers. Store the finished product in the freezer, refrigerator, or at 50 to 70 °F and out of direct sunlight to maintain quality. Refer to the "Packaging" section for storage options.

Recipe yield is approximately 490 g (17 oz

Regulations

Regulation Requirements Commercial production of maple marshmallow spread requires a scheduled process from a process authority and production in a licensed kitchen inspected by a state department. For New York, this is the New York State Department of Agriculture and Markets. This product has a water activity >0.75; to prevent or eliminate food safety hazards, water activity will serve as a "critical control point" or step in the manufacturing process that must be monitored and recorded. For more information, please see the Basics of Maple Marshmallows bulletin and the Getting Started: Value-Added Products bulletin.

Food Additives

A food additive is any substance that becomes a component of or otherwise affects the characteristics of any food. Food additives must be "generally recognized as safe" (GRAS) or approved for use by the FDA; these include preservatives, stabilizers, anti-caking agents, among others. Three food additives are recommended for this product tomaintain quality and stability (cream of tartar and xanthan gum) and to pre-

vent mold growth (potassium sorbate). Please refer to "The Science of Maple Marshmallow Spread" section for information on the functionality of the stabilizer food additives.

Cream of tartar (Potassium acid tartrate) stabilizes egg whites and prevents sugar crystallization. In addition to marshmallow spreads, this food additive is commonly used as a stabilizer in bakery products (USDA-ARS, 2023). The FDA has labeled cream of tartar as a GRAS food substance. There are no limitations on the amount added to food products (Potassium acid tartrate, 2023).dairy products (USDA-ARS, 2023). amount added to food products (Potassium acid Sorbate, 2023)

Xanthan gum is used as a stabilizer and thickener. r. It is common in marshmallow spreads, bakery products, sauces, and dairy products (USDA-ARS, 2023). This additive can be used in marshmallow spreads if a "food grade" label is on the xanthan gum packaging. To safely use the additive, follow guidelines provided on the manufactures label (Xanthan gum, 2023).Potassium sorbate is a common food preservative used to prevent mold growth. Mold growth can occur when the water activity is at or above 0.65. Although, most molds grow in products with a water activity of >0.80 (Roos et al. 2018). The water activity of the marshmallow spread is >0.75, thus control of mold growth should be considered.

Potassium sorbate is considered a GRAS food substance with no limitations on the amount added to food products (Potassium Sorbate, 2023).

Packaging

Marshmallow spread requires packaging that is suitable for preventing moisture migration and microbial contamination. Plastic jars are the current industry standard for marshmallow spread products. Among all types of plastic, high density polyethylene (HDPE) and polypropylene (PP) have the best barrier property against moisture (Qorpak, 2022). Other marshmallow spread products use an opaque polyethylene terephthalate(PET) which can prevent moisture migration and protect color changes and quality loss. During consumer evaluations, maple marshmallow spread received good acceptance scores on appearance (see "Consumer Evaluations" section below), so a clear container or opaque container can be used. It is worth noting that the color of maple spread maydarken during storage. However, this was not evaluated

Market Projections

The market size of maple syrup was USD 1.57 billion in 2022, and it is predicted to reach USD 2.63 billion in 2031 (Straits Research, 2022). Maple marshmallow spread can be an excellent addition to the range of maple-related products. The demand for premium confections has risen significantly, and the popularity of flavored marshmallows has grown due to consumers' increasing interest in diverse and innovative flavors (Fortune Business Insights, 2021; Introspective Market Research, 2023).

As such, maple marshmallow spread has the potential to capture a portion of this growing market segment. The unique flavor profile of maple syrup, combined with the novelty of the marshmallow spread format may attract consumers seeking new, unique products. By targeting niche markets, it is possible to gain a competitive advantage. Unlike commercially available marshmallow spreads which use corn syrup and other highly-processed sugars, maple marshmallow spread includes sugars processed through boiling maple tree sap. Additionally, the beneficial nutrients and antioxidants in maple (Eggleston et al., 2022; Phillips et al., 2009) are maintained in the syrups. As of 2022, roughly 47% of consumers occasionally purchase confections that they consider"healthier" or "better-for-you" (National Confectioners Association, 2022). Meanwhile, around 90% of consumers care about environmental commitments and social responsibility practices (National Confectioners Association, 2022). Given these benefits, maple marshmallow spread is expected to have promising growth potential in the market. At the time of this publication, gourmet marshmallow spreads are uncommon in the marketplace. The few products sold are packaged in 5.9 oz (168 g), 7 oz (198 g), or 8 oz (227 g) containers and sold for $1.28 to $2.19 per ounce. Based on the ingredients only (Table 1), maple marshmallow spread has a per ounce production cost of $0.31. The cost can decrease with bulk purchasing and sourcing for competitive pricing.

Estimated costs of ingredients per 17 oz (490 g) batch.

Ingredient Cost per 490 g batch

Maple Syrup (Cornell)1 $4.63

Invertase (LorAnn Oils) $0.02

Liquid Egg Whites (Bob Evans) $0.56

Xanthan Gum (Bob's Red Mill) $0.07

Cream of Tartar (McCormick) $0.07

Potassium Sorbate (Modernist Pantry) $0.03

Total cost per 490 g batch: $5.38
1Includes syrup used to make granulated sugar and inverted syrup, using a wholesale price of $50 per gallon. Does not include the cost of converting syrup to sugar.

Consumer Evaluation

To understand consumer insights, a sensory test was conducted with 72 participants at the Cornell Sensory Evaluation Center in Ithaca, NY. Consumers were given samples of two formulations and a sample of a commercial vanilla marshmallow spread. On a 9-point scale, with 1 as "dislike extremely" and 9 as "like extremely", the average overall liking score was 6.54 for amber maple spread (Figure 1a), and 6.51 for dark maple spread (Figure 1b); both received higher scores as compared to the commercial marshmallow spread (6.46). As a reference, the average overall liking score in the Cornell

Sensory Evaluation

Center database is 5.94. An alternative perception of this data is that amber and dark marshmallow spreads were each liked moderately or more by 59% of panelists (Figure 1a and b). Overall, the formulations received good acceptance rate from the panelists. Panelists were asked to provide insight on specific characteristic of the marshmallow spread. The commercial marshmallow spread was rated as being too sweet, sticky, and thick. The maple marshmallow spread could be improved by lowering the sweetness andfoaminess in both formulations, and increasing the stickiness for the amber syrup formulation. Following the feedback from panelists, the recipe was adjusted to include a heating temperature (240 °F) and an addition of invertase to increase stickiness of the final product. The recipes presented above reflect these changes. Additional improvements to the maple spread could be using a blend of dark and amber syrups to achieve a desired flavor intensity

Acknowledgements

The authors would like to thank Dr. Bruno Xavier and Dr. Robin Dando for their kind help and advice throughout this project. We highly appreciate the resources and advice from the Cornell Maple Program. We would also like to thank Alina Stelick for her help in designing the sensory test, Patti Wojcik for the reservation of the product development innovation lab, and Aaron Jacobsen for the use of equipment in the food science teaching lab.

This project was conducted by students in the 2023 Capstone Project in Food Science Course (FDSC 4000) in the Department of Food Science at Cornell University. Editorial support was provided by Aaron Wightman and Ailis Clyne in the Cornell Maple Program.

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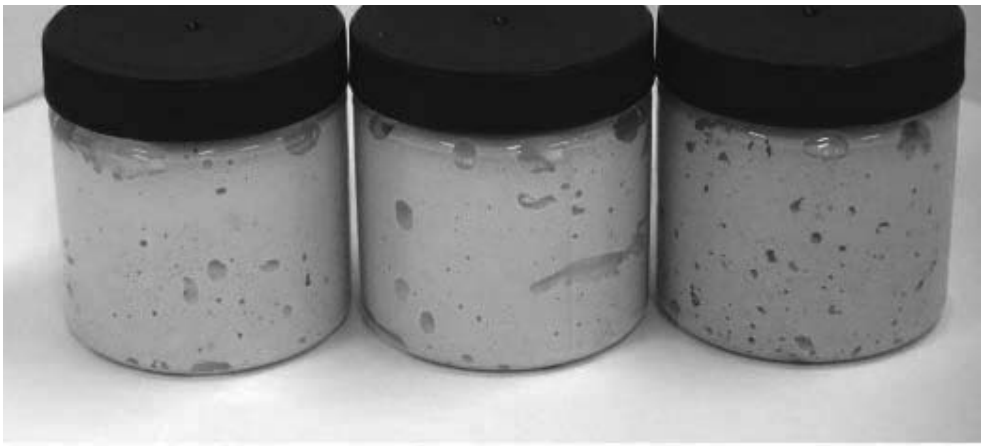

Maple marshmallow spread in transparent packaging

COME TO MASSACHUSETTS FOR THE

2023 INTERNATIONAL MAPLE SYRUP CONFERENCE

Quality from Tree to Table

October 25-28 • Sturbridge, MA

The Massachusetts Maple Producers Association invites you to join us for the 2023 **International Maple Syrup Conference: Quality from Tree to Table**. The industry's largest and longest-running annual conference and trade show will be held October 25-28 in Sturbridge, MA, within a day's drive of 90% of the world's maple syrup producers, convenient to interstate highway travel and easily accessible from several airports.

The event has been held every year for decades, and attracts sugarmakers of all sizes, along with researchers, regulators, and professionals from related industries for four days of research presentations, practical skills workshops, meetings, tours, and networking.

Preliminary schedule

- Wednesday, 10/25: Meetings for NAMSC delegates
- Thursday, 10/26: Tours of sugarhouses and local attractions, and a Taste of Massachusetts dinner
- Friday, 10/27: Research presentations, evening banquet
- Saturday, 10/28: Practical skills workshops

Register online today!

We are also seeking submissions for workshop presentations, as well as donations for the annual auction to benefit NAMSC's Research and Education Fund. For more information, and to register, see:

www.massmaple.org/2023mapleconference/

Maple Community Goodbye

Dr. Gary Graham, OSU Extension Maple Specialist (Retired)

A thank you and Farewell to Everyone

Working within the maple syrup production world has been one of the greatest experiences of my career. I've met so many wonderful people experienced different production areas and tasted the local cuisine. I was privileged to work with some of the greatest minds across the maple region.

After 38 years in the education/public service career, with 23 of them as the maple specialist for Ohio State University, I'm retiring at the end of June to start the next chapter of life. It is exciting to get to this point but also a bit sad as it truly has been the people that make the years of service worth it

When OSU State Forestry Specialist Dr. Randy Heiligmann knew I had maple in my background and asked me to join him in maple syrup programming I did not know how much joy would come to me through this work. There were also some hardships too, but I had the most fun working with maple producers across Ohio and North America.

Constant Change is the one theme that keeps coming to mind when I discuss my career in Maple Syrup. I started after the discovery of issues with lead solder, some of my first workshops were teaching on "getting the lead out." It was also when equipment companies started to merge or buy each other out and names changed. Since then, it has been a huge number of changes within the maple equipment industry. Yet all the companies were willing to help with schools I held or with knowledge on new pieces of equipment they developed.

Through my work I discovered more maple production in Ohio than USDA NASS reported on a yearly basis. I tried hard to get more Ohio producers to register to be counted. I will admit that I am on the side of maple syrup producers should be register and inspected to make and sell syrup. There are so many positives for producers and the industry if inspected. The issue I have with the inspections is the agencies conducting them think that a sugar house that is open 4 to 6 weeks of the year needs to look like a commercial kitchen. Friends in the regulation field see the issue but they have rules to follow. The regulations need boiled down to a more common-sense approach. Yes, I realize that common sense within regulations is an Oxymoron statement, but it is dreadfully true. I wrestled with the regulation issue all my career as maple syrup is a mostly cash business and people don't want anyone to know about their business. I do see where common sense regulations would help the industry and protect it as a commodity. Another big change was remember sitting in a committee meeting in Massachusetts to discuss the potential of a new grading system for all of North America. Realizing there were great changes to traverse but all could see the greater

good of the same name anywhere would mean getting the same product.

Over a decade later the new grading system was unveiled with lots of disagreement. Some more tweaking and research conducted to see consumers opinions and it was clear the new system was superior. Now it just seems normal, but it was a partnership process between NAMSC and IMSI.

The job taught me a lot and provided lots of experiences. I was able to travel, conduct research and provide educational programming and meet so many wonderful people all across North America.

The biggest change on the university side is that fewer people are assigned to work within maple production. Many colleagues have retired in before me, and many are close. So yes, more changes in the maple research and education would are coming.Many of these colleagues became great friends. Henry Marckres and I shard a lot of laughs traveling to meetings. Dr Tim Perkins, Dr Abby van der Berg and Mark Isselhardt from Proctor were always great promoters of Maple and great friends. Kathy Hopkins, George Cook and many others have been and will continue to hold a special place in my maple work. Joe and Barbra Polak in Wisconsin have opened their sugarbush for research and their home on many a trip to Wisconsin.

People are what I will miss most. I'm grateful for the awards and induction into the Maple Hall of Fame, but without many great maple producers and university colleagues who I was priveleged to work with could not have gotten there.

Thank you, Dr. Gary Graham, OSU Extension Maple Specialist (Retired)

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EXTENSION

Maple Syrup Hydrometer Care & Use

Hydrometers are thin glass, precisely weighted tubes with a printed graduations sealed inside. Hydrometers are the most commonly used instrument for measuring the density of pure maple syrup. All that is needed is a relatively inexpensive but accurate hydrometer, an accurate thermometer and a hydrometer cup. Maple syrup hydrometers rely on the principal of displacement: a floating hydrometer displaces a volume of syrup equal to the mass of the hydrometer. Given that the viscosity of pure maple syrup can differ greatly depending on if it is hot or cold, it is critical to measure the temperature of the syrup in which the hydrometer is floating.

Willits C.O and Hills, C.H. Maple Syrup Producers Manual 1976, USDA Agricultural Research Service. Agricultural Handbook No. 134

Syrup Hydrometer Range

**For syrup hydrometers calibrated in °Brix at 60° F*

Syrup Temperature *(Degrees F)*	Acceptable range of hydrometer °Brix readings *(For syrup with legal minimum of 66.9 °Brix)*	
	Min	Max
209°	59.0	61.0
202°	59.60	61.60
195°	60.10	62.10
190°	60.25	62.25
185°	60.50	62.50
180°	61.40	63.40
175°	61.0	63.0
170°	61.25	63.25
165°	61.55	63.55
160°	61.80	63.80
155°	62.10	64.10
150°	62.35	64.35
145°	62.65	64.65
140°	62.90	64.90
135°	63.15	65.15
130°	63.40	65.40
125°	63.65	65.65
120°	63.90	65.90
115°	64.15	66.15
110°	64.40	66.40
100°	64.90	66.90
90°	65.40	67.40
80°	65.90	67.90
70°	66.40	68.40
60°	66.90	68.90

Concept for table by Deborah Fuller, Vermont, 2023

Occasionally the paper inside a hydrometer can shift. Place a recently tested hydrometer next to the diagram and mark the location of the "hot test" and "cold test" lines. The marks can be used as reference to see if the paper has shifted in the future.

Density Reduction

Volume of water added to 1 US gallon of syrup to lower its density a desired amount

	Density reduction of syrup desired (°Brix)							
	0.5°	1°	1.5°	2°	2.5°	3°	3.5°	4°
	Fluid US ounces (oz.) of water to add per US gallon of syrup to reduce density							
0° (Water)	1.26	2.52	3.8	5.08	6.38	7.68	8.99	10.32

Always make sure water used to dilute syrup is potable and everything is well mixed before taking another hydrometer reading.

Adapted from Table 8.3, North American Maple Syrup Producers Manual, Third Edition 2022
University of Vermont in cooperation with The North American Maple Syrup Council
Perkins, T.D., Heiligmann, R.B., Koelling, M.R. and van den Berg, A.K. Editors

Revised Jones Rule

The number of gallons of sap/concentrate needed to make 1 US gallon of syrup

	Original Jones Rule of 86 for 65.5 °Brix Syrup	New Jones Rule of 87.1 for 66.0 °Brix Syrup	New Jones Rule of 88.2 for 66.9 °Brix
°Brix	Sap (US gal)	Sap (US gal)	Sap (US gal)
2	43	43.23	43.78
4	21.5	21.46	21.73
8	10.75	10.57	10.71
10	8.6	8.39	8.5
20	4.3	4.04	4.09
40	2.15	1.86	1.89
60	1.43	1.13	1.15
65.5	1.31	1.01	1.03
66	1.3	1	1.02
66.9	1.29	0.98	1

*These estimates do not account for "shrinkage" caused by losses in transport and production of pure maple syrup.

Adapted from "The Jones Rule of 86 Revisited" Perkins, T.D. and Isselhardt, M.L. 2013

Hydrometer Tips & Care

Hydrometers are delicate, glass instruments that can provide years of use but are also easily damaged or rendered inaccurate if not used properly.

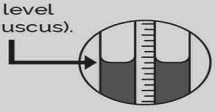
It is critical to know the temperature of the syrup while using the hydrometer. Syrup cools rapidly. Make sure the thermometer being used is accurate.

Make sure to test hydrometers for accuracy and ***retest periodically***.

Keep Hydrometer clean! 0.5g of extra weight in the form of syrup, sugar crystals or accumulated niter can result in hydrometer readings 2 °Brix heavy (2 °Brix is the entire legal range of density for pure maple syrup).

Gently lower the hydrometer into syrup. Pouring syrup over hydrometer can result in syrup clinging to the stem, thus causing inaccurate readings.

Read the point on the hydrometer stem where the syrup level crosses and not the highest point the syrup reaches (minuscus).



Check out the UVM Extension Maple instructional video on density and hydrometers

Funding for this resource was made possible by the U.S. Department of Agriculture's (USDA) Agricultural Marketing Service through grant AM190100XXXXG033. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. University of Vermont Extension, Burlington, Vermont.

www.uvm.edu/extension/agriculture/maple Version 1. 2023

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NHMPA Ready for NH Fair Seson

JAFFERY, N.H. – It's fair season across New Hampshire and the New Hampshire Maple Producers Association (NHMPA) is joining in on the fun! The NHMPA will be attending several fairs throughout the end of summer and early fall selling New Hampshire maple products and sharing on the maple making process.

The NHMPA will be attending the Lancaster Fair happening August 31-September 5, the Deerfield Fair from September 28-October 1, and the Big E in Springfield, Massachusetts happening September 15-October 1. At each fair the NHMPA will be featuring a wide range of NH-produced maple products such as maple syrup, candies, nuts, popcorn, cream, sugar, BBQ sauce & mustard, cotton candy, and sometimes ice cream.

Fairs give maple producers the opportunity to educate the public on maple and the maple making process. Depending on the fair, NHMPA booths will feature displays or maple equipment. For instance, the maple building at the Deerfield Fair features a retired evaporator. Producers at the fairs are always willing to give explanations and encourage attendees to ask questions about the products, process, and industry.

NHMPA was at the Cheshire Fair earlier this summer which was well attended. Doug Byam of Goosebrook Meadows Sugarhouse helped operate the NHMPA booth during the event and reported that they had a good time. "Apart from one bad weather day it was a good year with above average attendance. Attendance was up 20% from last year," he said.

Representation of the NHMPA at the fairs requires planning and cooperation amongst members. Apart from making their own products, members help transport each other's' products to the fair locations. Members volunteer their time to help organize prior to the events and participate during the events.

The hard work appears to be paying off as interest in maple at these events continues to grow each year. Amy Boisvert of Journey's End Maple Farm has supplied maple cream and candy for the Deerfield Fair and Big E in recent years and said, "The number of jars of cream and boxes of candy have doubled over the last few years which is very encouraging. The sugarhouse seems to be one of the most popular stops at the fair and people love coming in to get products, especially the maple cotton candy!... Each year the sugar house seems to get busier and busier with repeat customers who remember products they purchased the prior year and they come back for those items year after year."

Overall, the fairs provide the NHMPA an opportunity to interact with and sometimes introduce themselves and their products to the public. "The fairs are a great place to network with other producers and get to know them and work together for a common goal," said Boisvert. "We all have the other's best interest in mind and want each producer who sends product to sell and be suc-

cessful, while also educating the public about maple production and products that can be made with maple syrup."

Similarly, Doug Byam shared, "New Hampshire is a force in the maple industry and does well despite its small size. Through the fairs we can let people know that New Hampshire not only produces maple products, but produces quality maple products."

To find out more about the NHMPA and New Hampshire-produced maple visit the NHMPA website at https://nhmapleproducers.com/.

Future Generations University Future.Edu Appalachian Program

Fall Extension Activities

9/6 – 9/8 Maple Bootcamp- St. Friedens, Pennsylvania

Join Penn State Extension along with the Ohio State University and Future Generations University's Appalachian Program for a three-day curriculum that begins with a sugarbush assessment, then builds sequentially through all phases of maple syrup production, from sap collection to boiling, bottling, and sales. This event provides beginner and intermediate maple producers with intensive, hands-on training. Participants will gain the skills necessary to safely, efficiently, and profitably produce maple products. For more information visit https://extension.psu.edu/pa-maple-bootcamp

9/21 Out of the Woods: Growing Income from Your Forest- Join the Future Generations Appalachian Program as they host the Sundance Film Festival's 'King Coal' production team, University faculty, current students, and members of the WV Mushroom Club for a community conversation. Future Generations University has a mission to promote research, learning, and action toward inclusive and sustainable community change worldwide, and the Appalachian Program works to accomplish this mission in Central Appalachia. To do so, the Appalachian Program has to reckon with ongoing bumpy economic transition away from coal. Coal mining in Appalachia has a long a complicated history. In some Appalachian communities, it hasn't been just a job or economic sector; it's been something like a way of life. Union halls have been communal gathering places.

The film King Coal, which will be shown at the Warner Drive-In in Franklin on September 23rd, paints a beautiful picture of this complicated time in coal country. For this webinar, we will be joined by one of the film's creative team, members of the WV Mushroom Club, and the Director of the Appalachian Program. The Appalachian program promotes agroforestry because we see it as a living Appalachian tradition which is of increasing importance economically, socially, and emotionally during this time of transition. The celebration of wild mushrooms & mushrooming by the WV Mushroom Club

is an excellent example of the type of cultural tradition that the Appalachian Program sees as essential for a just, sustainable, and inclusive transition from coal. To register visit: https://future-edu.zoom.us/webinar/register/WN_bXoPssdyQbqiA8Wyvv0oVQ#/registration

9/23 Guided Mushroom Walk- 400 Road Less Traveled, Franklin, WV King Coal screening at Warner's Drive-in- Franklin, WV For more information on all King Coal events in Pendleton County, WV, visit https://www.future.edu/king-coal/

9/30 Spotted Lantern Fly Workshop- Monitoring & Control- Morgantown, West Virgini The objective of workshop is to provide landowners with the knowledge and skills to: identify spotted lanternfly in its various life stages; understand its potential significance to the maple syrup industry; know what steps to take to minimize its impact and spread; and know what to do if you see one. For more information: https://secure.touchnet.net/C20389_ustores/web/product_detail.jsp?PRODUCTID=3065&SINGLESTORE=true

10/14 Forest Management for Sap Production workshop – Tom's Creek Family Farm A workshop for landowners and natural resource professionals designed to give participants the knowledge and skills necessary to have maple sap and syrup production as a forest management option. This workshop will introduce Natural Resource Professionals to the maple industry, show how their skills are applicable to its woodlot management needs, and direct them to the technical support they would need to promote tapping. It will help sugarbush owners and landowners interested in sugaring begin to develop the potential of their forest lands for increased sap and syrup production. For more information or to register email syrup@future.edu

10/19 Out of the Woods: Growing Income from Your Forest

The Appalachian Program hosts walnut producer Bill Whipple for "Thars gold in them thar hulls!": Integrating black walnuts into the diversified farm system. Learn about growing and harvesting black walnuts and how you could get started integrated this crop into your farm! To register visit: https://future-edu.zoom.us/webinar/register/WN_bXoPssdyQbqiA8Wyvv0oVQ#/registration

10/25 – 10/28 North American Maple Syrup Council in Mass. Hundreds of maple producers from the US and Canada will gather in Sturbridge, MA, October 25-28, 2023 for the industry's longest-running annual conference. The event has been held every year for decades, and attracts sugarmakers of all sizes, along with researchers, regulators, and professionals from related industries for four days of research presentations, practical skills workshops, meetings, tours, antique displays, and networking. For more information visit: https://www.massmaple.org/2023mapleconference/

11/4 – Kentucky Maple School-Berea, Kentucky Each year the School

allows maple syrup producers to learn about current topics in maple production and to network and share ideas. For more information visit: https://ky-maplesyrup.ca.uky.edu/ky-maple-school

11/9 – 11/12 Lake Erie Maple Expo – Maple Magical Mystery Tour Sorry, the Fab Four won't be with us on this one. Funded through our ACER 2021 program Future Generations University will be organizing and providing support for a multi-state tour of maple syrup operations. We'll be heading to Ohio to learn the Magic touch of Stan Hess, a producer who routinely gets almost 1 gallon of syrup/tap. From there we'll swing into Pennsylvania to the Hurry Hill Farm and Maple Museum. Here Jan Woods keeps alive the Mysteries of the Newbery award-winning book, "Miracle on Maple Hill." The tour will end with two days of lectures, demonstrations, and a trade show at the Lake Erie Maple Expo. Plan a maple vacation and stay tuned for details! For more information email syrup@future.edu

11/12 Capital Christmas Tree Tour: Pendleton County.Each year, the White House Christmas tree is carefully selected from forests across America. This year the tree was harvested from West Virginia's very own Monongahela National Forest. Before the tree is setup in Washington, D.C., it makes its way to select cities and towns to be displayed for the public to see and admire. Join the Appalachian Program at Swilled Dog at the Industrial Park in Upper Tract, WV for an afternoon filled

with fun, education, food, and seasonal activities- all while viewing this year's Capital Christmas Tree from the forests of West Virginia! For more information email syrup@future.edu

11/18 Southwest Virginia Tree Syrup School- St. Paul, Virginia The morning will be filled with sessions for those new to tapping and tree syrup, as well as experienced producers. The afternoon will include a special syrup quality workshop led by Les Ober from Ohio State University Extension. Tours and field activities will be scheduled on the Friday before. Come get answers to your questions including what trees to tap, how to boil and bottle and how to store and sell your syrup. Online registration for the school will open soon. For more information or to register now email Phil Meeks, Extension Agent, Wise County Virginia pmeeks@vt.edu

12/17 National Maple Syrup Day #NationalMapleSyrupDay is back and better than ever! Kick off the holiday season with collaborations and partnerships across the state of West Virginia as businesses showcase the sweetest resource around! This yearly event celebrates the state's maple syrup producers and the community partners supporting our tree syrup industry! Be sure to check out https://maple.wvmspa.org for more information and a list of activities.

Don't Forget!!

National Maple Syrup Day is

December 17, 2023

We are looking for a Maple Tubing Sugarbush Working Manager/Boiling Assistant.

Must have experience on maple tubing systems, tapping, repairing and maintaining good vacuum. Some mechanical knowledge is required. Also we may need assistance boiling/ packaging as needed.

Drivers license is a plus but not mandatory. Amish person(s) are more than welcome.Pay will be based on experience, housing and work vehicle is included for the right candidate. There will be an incentive for this person to increase sap production.

Email bruceroblee@yahoo.com or text 518-774-4741.

Office number is 518-853-4022.

Wisconsin Teen Builds a Thriving Maple Syrup Business.

Heather Wanish

Will Wanish, an 18-year-old recent graduate of Colfax High School, knows exactly what he wants to do for his future—manage his own business and build his passion for maple syrup. While some 2022 graduates are planning for college or working for someone else, Will is an entrepreneur at-heart and has been shaping his future for at least five years—driven and dedicated to securing "liquid gold" from maple trees.

Five years ago, he began tapping maple trees with his uncle, Jon, in the Cadott, Wisconsin area. Then, the next season, he decided to have about 50 tree taps in his yard. Each year since that time, he has added trees and modified his operation. When, in 2019, he decided that he wanted to focus on this as a business, he had a conversation with his mom and dad, Todd and Heather Wanish.

During that discussion, both parents told him that a business was completely different than a hobby and he needed to have a plan for funding, sales, and future opportunities. "We made a list of the equipment he would need, potential sales he could make, and how he would be able to make this actually work," Todd said.

After reiterating that this was a long-term plan, Will decided to move forward and was able to secure a $30K loan from a local Regional Business Fund. This allowed him to purchase an evaporator and a reverse osmosis machine. "Without the help of Chippewa County Economic Development Corporation and the Regional Business Fund, I wouldn't have been able to get my business off the ground," Will explained.

During the 2020 spring season, he cooked down approximately 22,000 gallons of sap into maple syrup. Then, COVID-19 became a pandemic and Will had to look beyond farmer's markets and events for sales. He was able to get licensed and inspected, allowing him to sell his syrup via wholesale methods to stores. "Currently, my maple syrup is in approximately 150 stores throughout Wisconsin and Minnesota," he said. Throughout 2020 and 2021, sales remained extremely strong and business kept expanding, as Will, Todd, and Heather went on-the-road to build sales and secure new accounts.

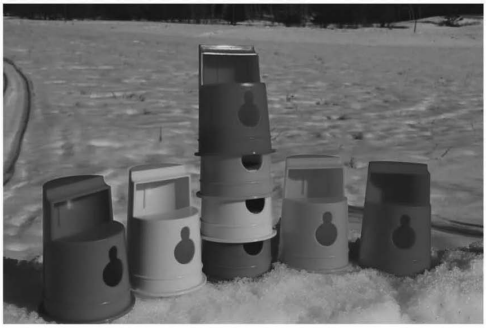
Then during the spring 2021 sap season, Will received a call from Boyd Huppert, a KARE-11 NBC reporter from Minneapolis. He featured Will and his business on The Land of 10,000 Stories, an award-winning feature on KARE-11. Within minutes of the story airing on television, hundreds of orders came through the Wanish Sugar Bush website and business to individuals catapulted. "The exposure we received from the KARE-11 story has been amazing—we are so appreciative that Boyd wanted to share Will's story," Heather said.

For spring 2022, Will made approximately 3,200 gallons of maple syrup and is already planning for next year. He went to Vermont and toured several maple equipment production facilities; he has now ordered an evaporator that is twice as big as his first one, a new reverse osmosis, and is planning an expansion to his syrup shed. Furthermore, has hopes to add more taps, build his tubing system, enhance efficiencies, and potentially expand into other products beyond the maple syrup and maple sugar he currently offers to customers.

Will's parents are proud of his accomplishments and know that he will be successful in whatever he chooses to do. "He is always on-the-go, enjoys working, and is not a teenager that has ever just sat around," Todd said. "I couldn't be more excited for what he has done so far; there aren't many kids his age who can say that they have a successful business already," Heather added.

And, Will is confident that he can make his business, Wanish Sugar Bush, a success story well into the future. "This is what I want to do and it's not an option to not be successful; I know that I can continue to grow and build this business," Will concluded.

(Pictured below Will tapping and cooking on his evaporator)



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Major Breakthrough in Maple Syrup Research

Study shows pure maple syrup better than refined sugars for cardiometabolic health

Quebec Maple Producers-Morning Ag Clips Sept. 5,2023

BOSTON, Mass. — New clinical research supports the potential health benefits of maple syrup. Substituting two tablespoons of maple syrup for refined sugars helps reduce cardiometabolic risk factors.

The research was presented today in Boston at NUTRITION 2023, the annual conference of the American Society for Nutrition (ASN) under the title "Substituting refined sugars with maple syrup decreases key cardiometabolic risk factors in individuals with mild metabolic alterations, a randomized, double-blind, controlled crossover trial." It was conducted by a Laval University team led by Dr. André Marette, PhD, the Quebec Heart and Lung Institute and

Dr. Marie-Claude Vohl, PhD, at the Institute of Nutrition and Functional Foods. The study examined the effect of substituting 5% of the total daily energy provided by added sugars, with an equivalent quantity of maple syrup, on the composition of subjects' intestinal microbiota, and its impact on recognized risk factors for cardiometabolic disease.

Dr. Marette noted: "Up until now, there had been no randomized controlled trial on the impact of replacing refined sugars with maple syrup on intestinal microbiota and cardiometabolic risk factors in humans. Our results suggest that the consumption of maple syrup as a natural sweetening agent is less detrimental to cardiometabolic health than that of refined sugars and can be associated with selective changes in gut microbiota."

Reductions in Abdominal Fat, Blood Pressure, and Improved Glycemic Response

Forty-two volunteers in good health but slightly overweight were recruited to participate in this study, which consisted of two, eight-week phases. During each of the phases, subjects were asked to consume either two tablespoons of maple syrup or the same amount of a flavored sucrose syrup each day. After a four-week break, the roles were reversed: the subjects who had consumed maple syrup consumed the sucrose syrup and vice versa. This study was a randomized, double-blind, controlled, cross-over design to reduce confounding factors and increase study precision. Cross-over design ensures that the same test subject is his or her own control, consuming both placebo and maple syrup.

Study participants who consumed pure maple syrup had a better response to an oral glucose tolerance test than those who received a flavored syrup of refined sugar. This means that, after eating, their bodies better managed their blood sugar levels. The study found that subjects who consumed maple syrup tested lower systolic blood pressure than those who consumed re-

fined sugar. Lowering blood pressure contributes directly to lesser risk of cardiovascular diseases.

According to one participant: "Before the study, I would consume pure maple products regularly but not consistently. I have always enjoyed it. Today I consume at least 3-4 tablespoons daily (around 1/4 cup) and I replace refined sugar whenever I can with pure maple syrup."

Finally, this study revealed that compared to what is observed in the same subjects who consumed a placebo (sucrose solution), there is a significant reduction in the accumulation of android fat when the subjects consumed maple syrup. All these factors reduce the risk of diabetes and cardiovascular disease. Study Extends Earlier American Research into Maple Syrup Extract

Indeed, Dr. Marette's recent clinical study extends earlier findings on a phenolic-enriched maple syrup extract (MSX) by American scientist Navindra P. Seeram, PhD, of the University of Rhode Island, College of Pharmacy. Dr. Seeram showed that MSX has promising anti-inflammatory effects in several diseases, including diabetes and Alzheimer's. The difference between maple syrup and sucrose solution is the natural presence of 1% of bioactive compounds in maple syrup, known as phenolic-enriched maple-syrup extract —MSX— studied by Dr. Seeram's team since 2009. "We are learning that natural products from medicinal plants and functional foods like maple syrup might be viable alternatives to synthetic pharmaceuticals due to their diverse range of biological effects and safety profiles", noted Dr. Seeram.

Quebec Maple Syrup Producers (QMSP) President Luc Goulet is pleased with the study's results confirming maple syrup's health benefits: "This research builds on years of ongoing research on the properties of maple syrup, made solely from the sap of maple trees harvested by our hard-working producers." QMSP represents over 13,000 maple producers and 8,000 maple enterprises. Quebec produces 72% of the world's maple syrup, exporting it to over 70 countries.

Maple Is a Better Sweetener

Professor Marette has long studied the inclusion of natural sugars like honey and maple syrup in our diets. "Natural sugar clearly brings benefits, or at least fewer problems than refined sugars," he said.

Maple syrup is a popular kitchen staple, but it is also complex — much more than just a sweetener. 100% pure maple syrup contains over 100 compounds such as vitamins and minerals, amino acids, phytohormones, and 67 phenolic compounds including many polyphenols. That's what makes maple syrup a healthier choice than white sugar or other refined sweeteners. The vitamins and minerals found in maple syrup help maintain and support a healthy body and bodily function. Maple syrup is an excellent source of manganese, which is involved in many chemical processes in the body, including processing of cholesterol, carbohydrates and protein. It might also be

involved in bone formation.

General nutrition claims for 2 tablespoons of maple syrup:

Excellent source of manganese (35%).

Good source of riboflavin (15%).

Source of calcium (2%), thiamin (2%), potassium (2%) and copper (8%). Contains 15% fewer calories than in honey. Contains 12% fewer calories than in light corn syrup.

The study was jointly funded by Québec Maple Syrup Producers and the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) through its healthy food production initiative, the Programme Alimentation santé.

To find out more about the clinical study, please visit our website at ppaq.ca/en/medias/clinical-study.

Plan Now to Attend the 11th Annual Lake Erie Maple Expo November 10th & 11th, 2023 in Albion PA.

Online we are seeing lots of interest in sustainable living and homesteading. People are exploring maple syrup production for both a business and a way of producing their own syrup, sugar and candies . We hope to continue to see this interest and growth in the maple industry. People are excited about trying to be sustainable and products produced locally as well as the health benefits of 100% maple syrup. The Lake Erie Maple Expo in Northwestern PA gives lots of learning opportunities and insight into the art of Maple Syrup. We have classes for the expert as well as for the hobbyist. We are blessed to have some of the most well known experts in the industry as well as many local legends in the industry.

When the Lake Erie Maple Expo started it was a Saturday only show. Over the years the Workshop Series was added on Friday, which was a big hit. The in depth workshops give the producers a wide variety of topics to choose from and often a chance to see another sugar operation. The one that has not changed is the number of quality speakers presenting at the event. The LEME features educational presentations from the leaders in university research and the maple industry.

Because the LEME is held in early November, the program allows for both indoor and outdoor workshops on Friday to target specific educational topics on maple production. This year, producers will have five workshop topics to choose from. {The following Friday workshops will start at 9:00 am and conclude at 2:00 pm, there is a separate $30.00 registration fee for the Friday Workshops which includes lunch.}

A sample agenda for the Friday Workshops potentially includes;

●Maple Tubing Installation layout and design

●Maple Confections and Value Added Maple Products

●A Maple Workshop for Beginners

●Advanced Tubing & Vacuum

●Tour of the Maple Museum in Edinboro

On Friday evening November 10th, the Trade Show will open at 5:00 pm and will run till 7:00pm. We also have a small ice cream social planned at the Northwestern High School Sugar House from 7pm till 8pm. Saturday, the venue will be opening at 7:30 am and ending at 3pm. The trade show will feature just about every major maple equipment manufacturer from across the USA and Canada. The Saturday program is loaded with topics presented in concurrent sessions held throughout the day. Saturday registration and the tradeshow will open at 7:30 am. The seminars will start at 8:30 am. All of the speakers included in the Friday workshops will be returning with different presentations on Saturday. There will also be a host of research, commercial producers and local experts presenting a variety of maple production topics.

The location for all of the LEME events will be Albion Pennsylvania and the surrounding area. The Seminars and Trade Show will be at the Northwestern High School in Albion, PA. You do not want to miss this one, so mark your calendars for November 10th and 11th and join the fun at this year's LEME. Registration information will be available by July 1st. The deadline for pre registration will be November 1st. For additional information on the LEME registration and program go online at www.pamaple.org or Facebook the https://www.facebook.com/profile.php?id=100094489877742

Early registration ends October 15th

Pre registration ends November 1st (+ $5 per participant)

Door registration November 10th -11th (+ $10 per participant)

MMSPA Fall Meeting

October 7,2023

Grand Rapids Area (MN)

Join MMSPA for sugarbush tours with a paossible stop at Forest Histoty Center. For more information go to https://www.mnmaple.org

Support the Maple Research that Supports you!

Every time you set a tap, fire your evaporator, or put syrup into bottles, you are benefitting from research that helped us all learn how to do these things better. Much of that research has been supported by the North American Maple Syrup Council's Research and Education Fund. The Fund has given out more than $1 million in grants in the last 35 years, catalyzing the research that has helped the maple industry grow and thrive.

The fund gets its resources from industry stakeholders – equipment manufacturers, producer associations, dealers, and individual producers. Alliance Partners commit to making annual contributions that help assure the long-term sustainability of the Fund.

If you're interested in becoming an Alliance Partner, or in making a one-time donation to the fund, contact NAMSC Executive Director Theresa Baroun at mapledigest@gmail.com, or Treasurer Joe Polak at joe.maplehollow@frontier.com.

Thank you to our current Alliance Partners!

Mainline: $5,000 or more

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Lapierre
New Hampshire Maple Producers Association
Ontario Maple Syrup Producers Association
Technologie Inovaweld

Bucket: up to $999

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Indiana Maple Syrup Association
Maple Hollow
Massachusetts Maple Producers Association
Mohawk Valley Trading Co.
OESCO
Randall's Heritage Maple
Vermont Maple Sugar Makers Association
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Please Consider Including NAMSC in Your Estate Plan

The North American Maple Syrup Council has received a number of generous bequests from sugarmakers who wanted to ensure that the important work of our organization can carry on.

Contact your attorney for information on how to revise your will, or your financial institution, plan administrator, or life insurance agent for the procedures required to revise your beneficiary designations.

MAPLE RESEARCH.ORG

NORTH AMERICAN MAPLE SYRUP COUNCIL

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