Maple Syrup Digest

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In-Person International Meetings Cancelled

Tapping Walnut Trees

Vacuum Granulated Sugar Production

The Newsletter of the North American Maple Syrup Council


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Greetings from your President

Thinking back on the last two years as your NAMSC President it's been quite a ride. As I took over the reins from David Briggs in Duluth none of us ever imagined what the next two years would bring us. Conference calls became a thing of the past as we navigated into ZOOM meetings. Having limited internet access, I needed to make the decision to shut video down so I could have audio during a delegate meeting if there was more than four or five people on the meeting. Figured that out and then we had to get used to the delay in audio – how many times did we wait for someone to talk and then all talked at once. However, we pushed through that and I feel we have accomplished quite a bit.

Determining where we are headed as an organization and updating our strategic plan was a major project over the past year. We were fortunate to have a great group who spent many hours working with Bill Corwin to accomplish this and come up with a plan. I appreciate the time they spent and look forward to hearing the final results.

Unfortunately, but understandably, public safety concerns meant that the New York State Maple Producers Association had to make the difficult decision to cancel the international meetings, which had been scheduled for October in Niagara Falls. I appreciate how much time and effort they had put into planning what looked like was going to be a great event. Watch for some announcements about online events we will hold to help keep maple producers connected and informed.

Since this is my last column as your President, I want to thank my executive team of David, Howard, Joe, Winton and Mike. They each shared their knowledge of maple, suggestions, guidance and occasional sounding board. The state and provincial delegates didn't hesitate to share their opinions & ideas which is what makes organization work and move forward.

The nominating committee will recommend that Howard Boyden of Massachusetts be our next President of NAMSC. I support this recommendation, and look forward to working with Howard and am confident that our organization will continue to move forward under his leadership.

Debbi Thomas
NAMSC President

In this issue...

Cover: Lyle Merrifield of Merrifield Farm in Gorham, MA. Photo by Jo-Ann Merrifield.

Seeking Photos and Articles

We're alwats looking for good maple photos and articles for the *Digest*. Send to mapledigest@gmail.com.

In-Person International Meetings Cancelled

After two years of planning and preparation for "Maple at the Falls" – the Niagara Falls, NY NAMSC/IMSI meetings to be held in late October 2021 – we regret that the conference has been cancelled. The New York State Maple Producers' Association attempted nearly every avenue to make these meetings work and to ensure that they would be held, especially after having to cancel the convention last year. But, border closures and restrictions, a rapidly rising COVID 19 infection rate nationwide, travel restrictions being placed on research presenters/specialists, and vendor hesitation left the committee with few choices.

The NYSMPA is grateful to all who preregistered and please know that we are now arranging for full refunds. If you registered with one of the convention hotels, make sure that you cancel your accommodation in a timely manner to avoid a cancellation fee. The Committee responsible for arranging the scientific sessions is considering how to provide a virtual venue for dissemination of current papers and research reports as well as to provide an opportunity and forum for specialists to interact prior to the 2022 meetings.

We are grateful to the trade vendors, specialists, researchers, educators as well as the delegates and officers from both international organizations, for their input, support and patience. We encourage everyone to now look forward to assisting and supporting our colleagues in Wisconsin as they prepare for the 2022 conference in LaCrosse. Moving forward and understanding that conventions are planned out several years, the New York State Maple Producers' Association will endeavor to rejoin the host queue for a future meeting.

Timing of Spout and Dropline Deployment Has No Effect on Sap Yield

Timothy D. Perkins, Abby K. van den Berg, Wade T. Bosley, University of Vermont Proctor Maple Research Center

Sap yields in tubing systems are strongly influenced by sanitation practices used in collection systems, particularly close to the taphole (Perkins and van den Berg 2012). Taphole "drying", due to microbial plugging of tapholes, is highly related to spout/dropline sanitation (Perkins et al. 2018). Several strategies to reduce microbial contamination of the taphole are useful in improving sap yields and net profits, particularly in vacuum tubing system operations (Perkins et al. 2019). In general, replacement strategies produce higher net profits than cleaning or sanitizing with chemicals. These methods typically involve the use of new standard or new check-valve spouts each year, and periodic replacement of droplines.

However, if conducted during tapping, putting on a new spout or dropline can slow down the process, delaying completion of tapping during a critical time period when there is considerable uncertainty about when sap will begin to flow. Use of the stub spouts and spout adapters can speed up replacement of spouts/adapters during tapping to some degree, but due to a wider range of spout choice, availability, cost and other considerations, some producers prefer entire spout replacement to the use of adapters. To ensure tapping progresses quickly, some producers install new spouts or replace droplines in the late-fall or early-winter while repairing lines at a time when snow depth is typically less. Therefore, when tapping does start at some point later in the winter it can proceed at a faster pace. This approach however does raise the question of whether deploying spouts and droplines well before tapping might lead to reduced levels of sanitation, since if they are placed in the field early they might conceivably get contaminated while in the woods in the timeframe between deployment and tapping. In this case, early spout deployment might not achieve the highest levels of sanitation, and lower yields might be expected compared to if spouts or droplines were deployed during tapping.

This aim of this project was to determine whether early spout and dropline deployment before tapping could be used while maintaining good sanitation levels and high sap yields.

Methods

Research was conducted in the "Red Series" section of woods at the University of Vermont Proctor Maple Research Center in Underhill Center, Vermont, prior to and during the spring sap flow season of 2021. Sixteen mainlines, each serving an average of 80 trees, were used. Each mainline was connected to its own custom Lapierre mini-releaser

Spout replacement: continued on page 10

Spout replacement: continued from page 9.

equipped with a counter to record the number of dumps. Releasers were calibrated in place to allow the calculation of total sap production per mainline for the season. The entire system of mainlines was connected to a common Busch 1142 rotary claw vacuum pump on a VFD pulling an average of > 27" Hg throughout the 2021 season.

All mainlines were the same age. All droplines and spouts (polycarbonate, non-CV style) were new. Five mainlines were randomly selected to have new spouts and droplines installed and left dangling (not inserted onto tees) in mid-October 2020. A second set of five mainlines had new spouts and droplines installed in mid December 2020. The final six mainlines had spouts and droplines installed in mid-February 2021 during tapping. Trees with new spouts and droplines deployed in October and December 2020 were tapped at the same time as those installed in mid-February 2021.

Results

In general, the fall and winter in northern Vermont during the study were not unusual in terms of temperature. Mid-late October 2020 into early-November was slightly warmer than normal, but after that through mid December 2020 were slightly colder than the long-term average (Figure 1). The remainder of the winter and spring through late-March 2021 was several degrees warmer than typical, but not extremely so. Average daily temperatures from mid October 2020 through mid-February 2021 tended to be below freezing.

Light sap runs began February 28, 2021 (less than two weeks post-tapping), with more normal, heavier sap flows beginning in mid-March and continuing through April 7, 2021. Overall sap production over the season was slightly below average, but sap sugar content during the 2021 season was almost 0.5°Brix below normal.

Total average sap yields were essentially the same (not significantly different) for all spout deployment dates in mid-October, mid-December, and mid-February (Figure 2). This suggests that the level of microbial contamination of spouts between deployment in mid-October and mid December until sap flows began in late-February was not sufficient to affect the level of taphole drying. This may be because the prevailing cold temperatures during the period sufficiently inhibited microbial, and or that the lack of lack of nutrition (sugar) for microbes on and in spouts doesn't allow microbes to become established.

Although based upon a single year at a single location representing only one set of weather conditions, it appears that deployment of new spouts onto droplines up to several months prior to tapping, as long as temperatures are expected to remain cold, might be a useful strategy to utilize labor during a slower period of time and that an adequate degree of spout sanitation is maintained to not negatively affect sap yield during the subsequent spring flow period. A follow up study will examine the

Spout replacement: continued on page 13

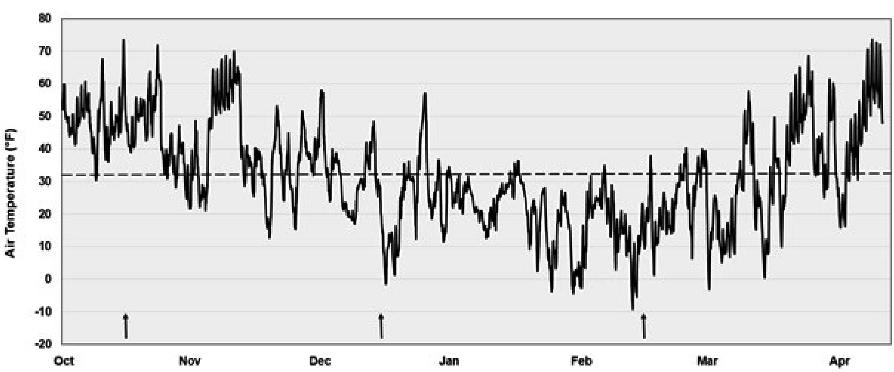

Figure 1. Air temperature at UVM PMRC in Underhill, Vermont, during the study period from October 2020 through April 2021. The dashed line represents the freezing point (32°F). Arrows along the bottom of the graph indicate the approximate time periods of spout and drop deployment in mid-October and mid December 2020, and mid-February 2021. Tapping was conducted during the spout and drop deployment in mid February. Raw data available are at: https://www.uvm.edu/femc/data/archive/project/forest-environmental-monitoring-canopy-tower/dataset/raw-forest-canopy-meteorological-tower-data Duncan J., and C. Waite. Forest Canopy Meteorological Tower Data. University of Vermont. FEMC.

Spout replacement: continued from page 11.

timing of spout deployment on used droplines on sanitation and sap yield.

Acknowledgements

We thank Jed Abair and Nigel Waring for their technical assistance. This research project was performed as part of the UVM Agricultural Experimental Station with funding from the U.S. Department of Agriculture.

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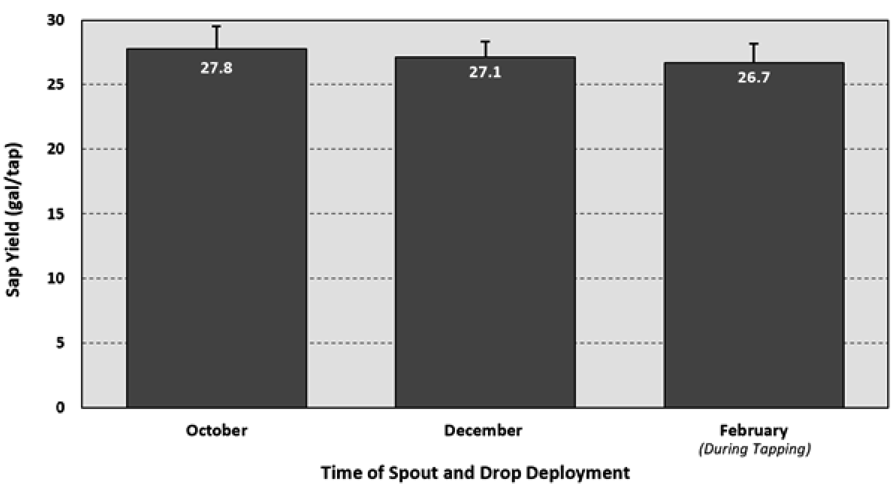

Figure 2. Effect of timing of spout and drop deployment on average sap yield (+ SE) during the subsequent flow season. All treatments were tapped in mid-February. Differences in sap yield are not statistically significant. N = 5, 5, and 6 mainlines averaging 80 trees each respectively.

Tapping Walnut Trees: Studies on Walnut Sap Flow

Mike Rechlin and Kate Fotos, Future Generations University

Tapping tree species other than maple and boiling the sap provides syrup producers the opportunity to apply their skills, and capitalize on their existing equipment, to expand into new and potentially lucrative markets. Just as bourbon barrel aged and various flavor infused syrups are opening new markets for maple syrup, the unique tastes of alternative tree syrups, and their maple blends, are finding a place in today's "foodie" economy.

Black Walnut (Juglans nigra) is a tree to consider tapping, and Butternut (Juglans cinerea) has similar characteristics and can produce syrup. When considering tapping, however, it is good to understood that walnut trees and not just maples with compound leaves and big edible nuts. Walnuts have anatomical and physiological characteristics that affect tapping and syrup making.

A different tree

Wood anatomists classify maple as a "diffuse porous" hardwood. In maple trees small vessels, commonly called pores, carry water and nutrients up the tree in the summer and carry sweet sap to your tap during the sugaring season. These vessels are diffused or evenly distributed throughout the tree's annual growth ring. Walnut, on the other hand, are classified as a "semi-ring porous" species. They have small, diffused pores like maple, but also large pores – similar to true "ring porous" species such as oak and hickory – that are more prominent in the early annual growth or springwood. As anyone who has ever looked at the end of a walnut log can tell you, walnut trees have a large very dark heartwood area, with a small band of white sapwood. A young healthy maple tree, on the other hand, can have mostly sapwood. Maple, and especially sugar maple, also called "hard maple" or "rock maple," is a very hard wood, whereas walnut wood is comparatively soft.

Finally, walnut sap, with a brix of 1.0 to 1.5, also contains pectin. Pectin is a natural constituent of plant cell walls where it helps bind adjacent cell walls together. And, as anyone who has made fruit preserves can attest, when boiled in an acid environment, pectin forms a gel. When present in high enough concentrations this pectin can gum up an RO, inhibit filtering, and make walnut syrup into walnut jelly.

Tapping walnut trees

We know a lot about tapping maple trees and making maple syrup. We've been at it a long time and there is an extensive body of research that has led to improved practices and increased production. The same is not true for walnut. In 2006, Gary Naughton at Kansas State did a tapping study on

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the University's walnut plantation. He correlated various physical and biological factors to sap flow and found that thickness of the sapwood was the best predictor of sap flow volume (Naughton et al., 2006). Thickness of the light-colored sapwood in walnut is to a great degree a factor of the tree's growth rate (FPRL, 1976). This would indicate that a faster growing tree, which is often a younger tree, may produce more sap than an older, slower growing tree. Ferrell and Mudge (2014) looked at walnut sap production from four locations under varying sap collection systems. They found, much to their surprise, that the trial under vacuum produced the least sap, but qualified this result by stating that it was a preliminary study and needed replication.

There are also several studies by a research team in France that looked at sap flow physiology in walnut trees. Ewers published a paper in Tree Physiology, titled the "Seasonal variation of xylem pressure in walnut trees: root and stem pressures." In this study it was found that 7% of osmotic potential was (like with maple) due to stem pressure, whereas 55% of osmotic pressure was (like with birch) due to root pressure (Ewers et al.,2001). Osmotic pressure is at least partly responsible for sap flow in maple. This then begs the question of when to tap; during the period of freeze/thaw cycles when maple sap runs, or after the period of freeze/thaw cycles, when birch sap runs?

For the past three years, Future

Generations University's (FGU) Appalachian program has been studying various aspects of walnut sap flow and syrup production. This paper presents a synopsis of the results of that work and relates those findings to the unique anatomical and physiological characteristics of walnut.

2019 Season

During the 2019 field season we put in 107 walnut taps, about half on sap bags and half on 3/16″ tubing. This was our first year of tapping walnut and it was a season of trial, error, and observation (mostly error). Our seasons average sap collected per tap was 1.6 gallons. Certainly nothing to write home about, especially for a maple sap collector. Even though we had over 20 feet of elevation change on the 3/16 lines between our last tree and the collection tank, we were never able to develop more than 9 inches Hg of natural vacuum. Theoretically we should have been closer to 18 inches.

We noted that the straight-barreled polycarbonate spouts were seating deeply in the soft walnut wood, potentially cutting off sap flow (Rechlin, 2019, mapleresearch.org). The deep spout seating combined with the thick walnut bark meant that many spouts were buried up to the shoulder. We also noticed that the 3/16″ tubes were mostly filled with gases, whereas maple sap collection tubes are mostly filled with sap. By analyzing a series of photos, we determined that walnut tubes contained only 9% sap compared to 85% sap in maple. This lack of a continuous sap column was most likely why we failed to develop any appreciable vacuum.

2020 Season

In 2020, we worked with the Robert C. Byrd Institute for Advanced Manufacturing to develop a longer barreled more highly tapered, to seat at less depth, walnut spout (Figure 1). Working with four walnut syrup producers collecting with buckets we found that the spouts they were using produced an average of 1.7 gallons of sap per tap whereas the new walnut spouts produced 2.6 gallons of sap per tap.

That year we also reached back to the Ferrell and Mudge study and tried our

Figure 1. 7/16-inch spout and a longer barreled walnut spout.

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hand at applying artificial vacuum to our lines. We established two lines with 20 taps on each line on trees in a similar streamside environment. Without vacuum the A line outproduced the B line in three of the five collections, with both lines producing equal amounts of sap in the other two collections. A Shurflo DC diaphragm pump was then installed on the lower producing B line. With an average of 8 inches of vacuum the B line produced 0.74 qt/hr., double the sap production of the A line with 0.37 qt/ hr.

2021 Season

Which brings us to this past sap flow season, 2021. Having shown that a low level of vacuum significantly increases sap production, the next question is what could you achieve with higher levels of vacuum? We attempted to answer that question.

The walnut syrup producer we were working with installed a vacuum pump allowing us to regulate the amount of vacuum on each of our research lines. Figure 2 shows the amount of sap collected in vacuum chambers with each line at 15 inches Hg vacuum. As in the previous season with gravity flow, when both lines received the same level of vacuum the A line, producing 1.4 qt/hr., outproduced the B line which av-

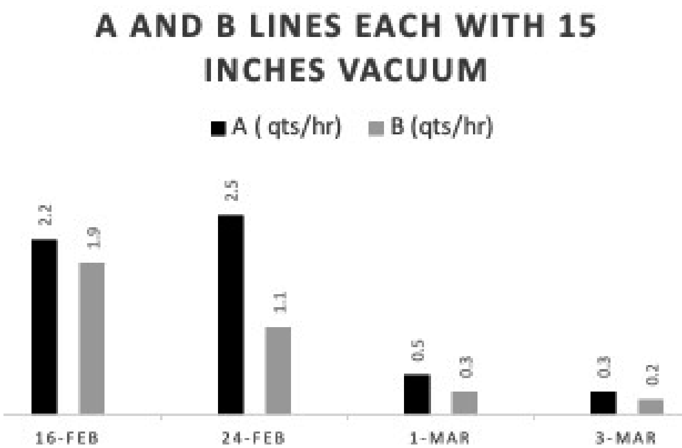

Figure 2. Sap collected in qt/hr. with equal vacuum applied to each line

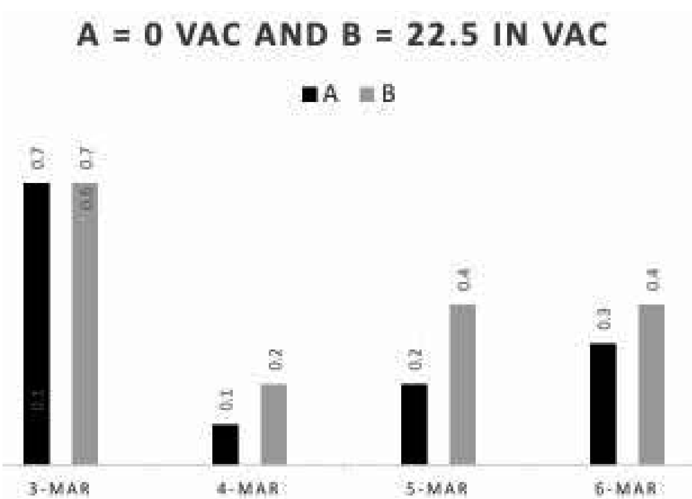

Figure 3. Sap collected in qt/hr. without vacuum on the A line and 22.5 inches of vacuum on the B line.

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eraged 0.9 qt/hr. From this we can gather that the A line trees are intrinsically more productive than the B line trees.

We then dropped the vacuum to zero (gravity flow only) on the A line and applied 22.5 inches of Hg vacuum, the maximum this system would provide, to the B line (Figure 3). The B line trees now produced 0.5 qt/hr., outproducing the A line at 0.3 qt/hr. As with the previous year, the application of vacuum increased sap flow. March 3rd is an unexplained anomaly, where the gravity line produced as much sap as the line under vacuum.

Next, we raised the vacuum on the A line to 10 inches, which reduced the maximum achievable vacuum on the B line to only 17 inches. With maple, higher vacuum positively correlates to greater sap flow. However, here the relatively lower vacuum level A line averaged 0.4 qt/hr., whereas the higher vacuum level B line produced only 0.2 qt/hr. Again, March 11th was an unexplained anomaly, with B outproducing A (Figure 4).

Interesting, but what might be happening and how does it relate to the anatomical characteristics of walnut? Diffuse porous hardwoods, like maple, create stem pressure in the spring to dissolve gasses in their xylem allowing growing season sap to flow up the tree to support bud break. Ring porous species followed a different evolutionary strategy. They just grow new large vessels in the spring to transport water and nutrients, not bothering to develop pressure to dissolve the gases in their older vessels. Which, by the way, is why you should not bother tapping an oak or hickory tree. Walnut, being semi-ring porous, is somewhere in the middle. They do create pressure to clean out their small vessels, but that may not apply to their large vessels, which then would remain filled with gas. This could account for the large quantity of gas we recorded in 2019 as present in the walnut sap. It could also explain why, in this study, more vacuum did not lead to more sap flow, just be pulling of more gas from those large vessels.

I liken it to trying to get those last drops off the bottom of your milkshake. You can suck really hard on a straw and just swallow a lot of air or reduce the vacuum you are applying to the straw and finish off the shake.

Summary of walnut tapping lessons:

1. With the soft wood it is important not to over-drive the spouts. The familiar hammer bounce and pitch rise on a straight barreled maple spout is too far. Choose a spout with as much taper as possible. Hopefully soon we will have a commercially available walnut specific spout.

2. Vacuum does increase sap flow. Relatively low levels of vacuum nearly doubled sap output in the 2020 and 2021 studies.

3. Unlike what is expected with maple, in this study, higher levels of vacuum in walnut did not result in corresponding increases in sap flow. However, it should be stated that as a preliminary study this result should be corroborated in future research.

FGU's Appalachian program continues to research and promote the tapping of alternative tree species. In this coming season we will be working with the Byrd Institute to develop and commercialize a more productive spout for tappable species with softer wood, and with Marshall University on the pectin issue. Our work also includes expansion of preliminary work we have been doing with American sycamore (Paltanus occidentalis). Whether in addition to tapping maple or as an expansion of tree syrup production beyond the commercial sugaring range of maple, the unique flavors of alternative tree

Walnut: continued on page 20

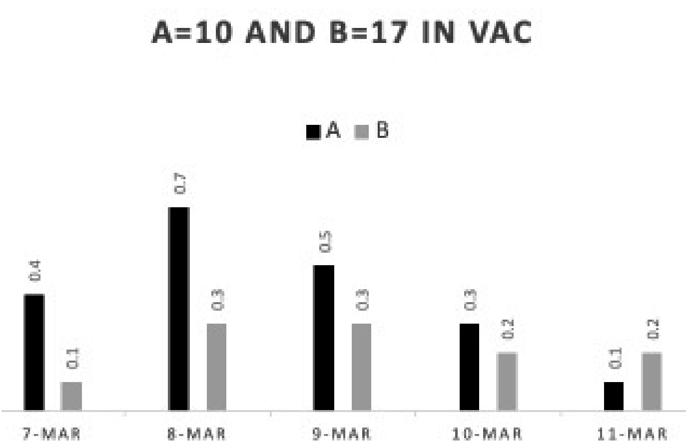

Figure 4. Sap collected in qt/hr. with 10 inches of vacuum on the A line and 17 inches of vacuum on the B line.

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syrups are helping expand our industry and serving niche markets for the sweet flavors from our forests.

Acknowledgements

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The early History of the Plastic Maple Syrup Jug: Part Two – The 1970s

Matthew M. Thomas

The unique and instantly recognizable shape of the modern plastic maple syrup container got its start in the early 1970s when a pair of New England inventors and their companies introduced a new container made from a stiff, unbreakable plastic that could handle the requirements of hot-packed syrup and hold up to the rigors of shipping and transport.

Kress Creations – Elmer Kress

Elmer Kress got his start as a potter when he opened Kress Ceramics in Seymour, Connecticut in the 1950s. According to his daughter Sarah Jean Davies, Elmer developed health problems related to exposure to ceramic dust and needed to make a change in his business. He sold the pottery business in 1967 and decided to give the manufacturing of plastic maple syrup containers a try under the name Kress Creations. Kress had previously dabbled with producing small, novelty size stoneware jugs for maple syrup sales, so he had a familiarity and design idea in mind that resembled an antique loop-handled stoneware jug.

Kress invested in his own blow molding equipment and made his containers from a new plastic called XT Polymer developed by the American Cyanamid Corporation in Wallingford, Connecticut. XT Polymer was chosen by Kress because it could handle the hot packing of syrup. Kress jugs also featured a metal tamper-proof cap made by the ALCOA Company. Kress' daughter tells that her father did not want his jug to look like cheap plastic, so he specifically used a heavier, glossier plastic that looked more like ceramic. XT polymer was more expensive, but Elmer felt it looked nicer. As an artist, Elmer Kress drew his own designs for the exterior sugarbush scene and did the one-color screen printing on-site at the Kress Creations

Examples of Kress Creations plastic jugs in one pint and a half gallon sizes.

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factory. Kress jugs were originally released in early 1970 in pint and quart sizes, with half-gallon and a unique three-quart sizes added later. The company outgrew the plant in Seymour and moved to a new facility in Oxford, Connecticut in 1975.

The Kress operation was a true mom-and-pop business with the Kress family often taking weekend road trips around New England to peddle their containers out of the back of their car. Kress sold the plastic jug company in 1990 to a Southbury, New Hampshire firm, which in turn sold the molds to Pioneer Plastics in Greenville, New Hampshire which continued to manufacture and sell the Kress jug until around 2005. Elmer Kress passed away in 2005.

Example Bacon's Sugar House plastic jug in one quart size.

Bacon's Sugar House – Charlie Bacon

As a syrup maker from Jaffney Center, New Hampshire, Charles "Charlie" Bacon was dissatisfied with metal syrup cans bursting when he shipped syrup across the country. Deciding plastics would be a better option, around 1967 he began researching food grade plastics that could handle hot packing of syrup. According to Bacon's son, Jim Bacon, Charlie settled on high density polyethylene as the best option and, working from a simple sketch, had a wood form made in the shape of an old-fashioned crockery jug which was then made into a durable metal form for blow-molding by Hillside Plastics in Sunderland, Massachusetts. Early examples of Bacon jugs featured a metal cap with an interior heat activated seal.

The first Bacon jug was available for sale in early 1971 in a quart size followed by a half-gallon and a pint a few months later, and lastly, a one-gallon jug in 1973. Jugs were screen printed and distributed from the Bacon farm. Eventually, they were available in five sizes with either a standard one-color screen-printed design or option to do custom designs. Adoption of Bacon jugs spread quickly with the assistance of a network of dealers located around the maple region to more directly connect with nearby syrup producers. By 1980, Bacon was manufacturing a million jugs a year. Jim Bacon shared that his father never obtained a design patent on his jugs. Although he considered it, Bacon realized that it was not worth the expense of filing the patent paper-

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work since another maker could come along with a slightly different design that was virtually identical, and there was nothing Bacon could do about it.

Bacon became concerned with the quality of manufacturing at Hillside Plastics in the early 1980s. In response, in 1983 he took his molds to the Hussey Molding Corporation of Manchester, New Hampshire for production. Bacon sold the jug manufacturing, printing, and sales to Hussey around 1986. A few years later, a sales agent for Hussey that knew Hussey was interested in getting out of the screen printing and sales portion of the syrup jug business, recognized that both Dave McClure's Honey and Maple Products and Roger Ames' American Maple Products of Newport, Vermont were each buying a lot of jugs. The agent put McClure and Ames in touch and in 1988 McClure and Ames partnered to purchase the painting and sales portion of the Bacon Jug Company, opening a shop in part of the old Cary Maple Sugar Company warehouse in St. Johnsbury, Vermont. Hussey continued to serve as their jug manufacturer.

A few years later McClure bought out Ames and moved the printing and distribution to a new facility in Littleton, New Hampshire. McClure himself sold the Bacon Jug Company in 1997 to Dutch Gold Honey, Incorporated and its subsidiary, Gamber Container, out of Lancaster, Pennsylvania, who continue to own and operate the Bacon Jug Company from the Littleton location. Under the ownership of Dutch Gold and Gamber, manufacturing of the Bacon jug was moved from Hussey and returned to Hillside Plastics which had moved to Turners Falls, Massachusetts. Charlie Bacon passed away in 2006.

R.M. Lamb – Bob Lamb

Robert "Bob" Lamb, inventor and manufacturer of Lamb Naturalflow plastic tubing, also offered a blow-molded plastic jug for maple syrup in the 1970s and 1980s. The R.M. Lamb jug was shaped and colored to look like a stoneware loop handle jug with very rounded shoulders and a tapered base. These were made from XT Polymer plastic, similar to the Kress jugs, and silkscreened with a one color, old-time sugarbush scene. When first released, the Lamb jug featured a metal ALCOA tamper-proof cap, like the Kress jugs, and later replaced by a plastic cap. Not a lot is known about the Lamb jugs. They were released in 1973 in two metric sizes of 125 and 500 milliliters and appear to have been targeted for sale to

Canadian maple syrup producers. In 1975 Lamb expanded his line to include 1-liter and 2-liter jugs.

The fact that the Lamb jugs were made of XT Polymer plastic suggests that they may have been manufactured by Elmer Kress for Bob Lamb. Interestingly, in the years that Lamb advertised sale of these jugs in the Maple Syrup Digest, Kress Creations stopped advertising in the Digest, suggesting that Lamb and Kress may have had an agreement. The Lamb jug appears in advertisements in the Digest from 1973 through 1977 and in Canadian equipment sales catalogs in the early 1980s before being discontinued by 1985.

Fairfield Plastics – S. Allen Soule

S. Allen Soule, the Vermont inventor of the first lithographed metal can for maple syrup producers in the late 1940s, got into the plastic jug making business in 1975 when he purchased a blow molding machine for the manufacturing of small sized polypropylene plastic containers. Soule's containers were designed for sales in gift shops and the tourist trade. Most of Soule's jugs were made for use in bottling syrup from his Fairfield Farms brand pure maple and blended syrups. In addition to making containers for his own maple products, Soule sold containers to syrup makers under the name Fairfield Plastics. Soule's containers resembled small ceramic jugs with short necks and loop handles and in some cases were made from a bright yellow plastic. According to John Soule, son of S. Allen Soule, Fairfield Plastics ended production in 1987 when the molding machine and molds were destroyed in a fire at their Fairfield, Vermont bottling plant.

This article is the second of three articles on the history of plastic syrup containers. Part one appeared in the June 2021 edition of the Maple Syrup Digest. Part Three of this article will focus on plastic jugs introduced in the 1980s by Dick Haas and Sugarhill Containers, Gerard Fillion and Les Cruchons J.U.G.S, and Peter Stransky and Stransky Jugs.

Examples of R.M. Lamb plastic jugs in half liter (16.9 ounces) and 1 liter (33.8 ounces) sizes.

UVM Proctor Center needs your HELP!

Have you attended a conference presentation done by someone from Proctor within the past three years? Perhaps you've read an article in The Maple News or Maple Syrup Digest about PMRC research. Maybe you've viewed a YouTube presentation on the PMRC webpage https://tinyurl.com/Proctor-YouTube? Or possibly you've had to settle an argument with your neighbor by looking up a topic on tapping or something else about sugaring on https://mapleresearch.org/

If any of these sound the least bit familiar, UVM invites you to return the favor by completing a short survey at:

https://tinyurl.com/PMRC-Survey1

You can use this QR code to link directly to the survey as well

This very short (5-10 min) questionnaire is aimed at helping us gauge our effectiveness in conveying information to maple producers. It will be used to both report to granting agencies on the effectiveness of our work and to improve our outreach program to producers. The survey is completely anonymous – no personal information will be collected (other than which state/province you are from) unless you offer your contact info and ask us to get back to you about some question. Either way, we can guarantee that nobody from our group will contact you about your auto warranty expiring.

So…in short, you can help us to help you by helping us. It's really pretty simple if you think about it. But seriously, it is something we could really use your input on.

Thank you all in advance and we look forward to seeing everyone again at meetings (in person) soon.

Dr. Tim Perkins, Director
Dr. Abby van den Berg, Asst. Director
Mark Isselhardt, Extension Maple Specialist

Research: Value-added

Producing Intense Flavored Maple Sugar Through Vacuum Boiling

Aaron Wightman, Maple Specialist and Co-Director of the Cornell Maple Program

Maple sugar has many potential applications. One challenge to the expanded use of maple sugar in multi-ingredient confections is the mild flavor profile of sugar produced with the traditional recipe. Using an alternative vacuum-cooking method, intense flavored maple sugar can be produced from high-invert, dark syrup. Cooking under vacuum lowers the boiling point which allows syrup to be cooked to a very high density while preserving flavor and avoiding scorching. Trials conducted using this method produced sugar with a strong flavor that remained detectable and added maple character in a variety of foods and beverages.

Traditional maple sugar is produced by cooking maple syrup to 450 to 500 Fahrenheit over the boiling point of water, then stirring once the syrup cools to 2000 F. Cooking to this high temperature creates a supersaturated solution wherein the syrup contains more dissolved sugar molecules than it can hold in a stable state. Stirring the syrup provides a nucleation-inducing shock that initiates a rapid crystallization process in which the sugar molecules bond to form stable crystals. For this traditional process to work, syrup must contain less than 2% invert sugars. The presence of glucose and fructose at levels higher than 2% may prevent crystallization and result in a failed batch. These low invert levels are typically limited to golden and amber syrups which yields sugar with mild flavor.

As an alternative, intense flavored maple sugar can be made from high invert dark syrup by carefully cooking it to 2950 to 3050 F, then cooling it to form an amorphous solid or hard candy. This solid can then be ground into a sugar and sifted into different size classes. Two drawbacks of this method are the possibility of scorching, and potentially creating flavors that are too intense for some applications due to the high finishing temperature.

Vacuum cooking is an approach that creates strong flavored sugar from dark syrup while avoiding these pitfalls. Vacuum cooking works because liquids boil at lower temperatures in a vacuum. Atmospheric pressure influences boiling point by acting like a heavy blanket on top of a liquid. In order to boil away water, each molecule needs enough heat energy to fight its way through the blanket. In a vacuum, the weight of the atmospheric blanket is reduced so water molecules need less energy to escape the syrup. Therefore, the boiling point of a liquid is lower in a vacuum.

To test this process, we constructed a system capable of boiling syrup under 24 inches Hg of vacuum. Under these conditions, the boiling point of water is 1400 F (Figure 1). Without vacuum our target finishing temperature for amor-

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Sugar: continued from page 27

phous sugar was 3050 F which is 930 above the boiling point of water. With a target of 930 F above the boiling point of water under 24 inches of vacuum, the finishing temperature is adjusted to 2330 F. This temperature is well below the scorch point and causes less caramelization.

To process syrup in this manner, a heat resistant vacuum vessel was needed. In our experiment we used a specialized steel chamber that resembled a heavy pot with a thick acrylic cover. The lid was fitted with a vacuum inlet, vacuum gauge, temperature gauge, and a valved release vent.

The next requirement was a vacuum system with a moisture trap capable of collecting and condensing steam to avoid damaging the vacuum pump. For our experiment, we connected a supply line to the releaser of a sap collection vacuum. This 60 cfm pump was capable of maintaining 24 inches of vacuum while the releaser fitted with two moisture traps protected the pump from condensed steam. The

Vacuum (in Hg)	0	5	9	16	21	24	26	28	29
Boiling Point (^{0}F)	212	205	194	176	158	140	122	104	80

Figure 1. Boiling point adjustments under vacuum

final requirement was a controllable heat source. We used a small propane burner designed for use with a finishing pan.

Once the equipment was assembled, cooking the syrup was straightforward. The temperature was continuously monitored to maintain a boil without allowing foam to overflow into the vacuum port.

A small amount of granulated defoamer was added once early in the boil by sprinkling it in the vacuum release valve, then gently opening the valve to draw the defoamer into the cooking vessel. The valve was opened very slowly to avoid splashing syrup on the lid.


Vacuum boiling vessel

Our total cook time for three gallons of 5% invert dark syrup was about two hours. After reaching the desired finishing temperature, the syrup was poured into shallow greased pans and allowed to cool for several hours. The cooled hard candy was then ground with a grain grinder and sifted through a sieve shaker with a mixture of sieve sizes.

The flavor of our experimental batch was a strong, classic maple flavor, much more intense than the flavor of maple sugar produced through the traditional crystallization method. Trial batches of recipes utilizing this sugar have shown a notable boost in maple flavor in the finished product. So far, sugars made from high invert syrups have been used in beer, chocolate, cotton candy and coffee sweetener. Other potential applications include general baking use and ice cream topping.

Importantly, the physical properties of this sugar are somewhat different. As a non-crystalline solid, the particles are more likely to attract water molecules. Therefore, storage in a sealed container with the air removed is needed to prevent caking and clumping. Finer particles will attract water and become sticky more quickly, while larger particles may stay clump free for months in a simple zip lock bag. Further research is needed to improve shelf stability.

This research was conducted with generous support from the USDA National Institute of Food and Agriculture and the NY Department of Agriculture and Markets.

For more information on value-added products and new product development, visitwww.cornellmaple.com.

New Cornell Sugarhouse Sweetens NY's Maple Industry

Krishna Ramanujan

The Cornell Maple Program has opened an advanced, New York state-funded maple research laboratory, an upgrade that will enable research on how to produce the highest-quality syrup, develop new maple products and improve existing ones – all at commercial scales.

The research, educational materials and expertise that the facility will generate will inform New York state maple producers and help ensure that the industry continues to grow. The U.S. Department of Agriculture valued the state's 2020 syrup sales at $30 million.

On July 29, a ribbon-cutting ceremony commemorated the opening of the new facility at the Arnot Teaching and Research Forest in Van Etten, New York.

"This state-of-the-art facility positions New York's already thriving maple industry for new successes and that's a win for maple researchers, producers and consumers alike," said Benjamin Houlton, the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences. "We're grateful for the continued support of the New York State Department of Agriculture and Markets, the Appalachian Regional Commission, and the advocacy of New York State Senate Agriculture committee chair Senator Michelle Hinchey and New York State Assembly Agriculture committee chair Donna Lupardo to bring this space to life."

Houlton attended the ceremony along with Richard Ball, commissioner at NYS Department of Agriculture and Markets, and Lupardo, New York State Assembly member (D-123rd Dist.).

The new maple lab was built with $500,000 from Ag and Markets – plus an additional $50,000 to hire a food scientist – and $150,000 from the Appalachian Regional Commission, as well as maple program funds.

The 4,200-square-foot sugarhouse features:

- A vacuum system: Sap is collected through a closed vacuum tubing system that pulls sap from the trees, through tubes and into storage tanks in the sugarhouse. The sap collection system was extended to connect the new facility with 7,800 tapped trees in the Arnot sugarbush. This vast tubing network now includes more than 50 miles of tubing spread over four miles of forest. The facility also includes a new vacuum pump.

- A filtration unit: Sap directly from trees and concentrated sap will run through this unit to remove bacteria.

- Storage tanks: Once sap reaches the sugarhouse, it will flow into eight 2,000-gallon stainless steel storage tanks. An additional 1,500-gallon refrigerated tank was donated by the Western New York Maple Producers Association for long-term storage of concentrated sap.

- A reverse osmosis system: The facility now has two identical reverse osmosis units that remove water from sap and concentrate it. The excess water is then reused to wash the tanks at the end of each day. By duplicating the reverse osmosis system, the staff will be able to run experimental and control tests to determine optimal processes.

- Evaporators: Two state-of-the-art evaporators have been installed in order to cook the sap. The equipment collects waste heat from the steam and transfers it back to preheat the inflow of sap before it enters the evaporator.

- A fully equipped, commercial-grade certified research kitchen: The only new maple product development lab in the country, the kitchen will develop products such as maple soda, beer, wine, kombucha, chocolate, and sports and nutritional drinks.

- Classroom space: The old sugarhouse lacked a safe classroom area (without hot surfaces); the program now has dedicated room for running workshops.

The space replaces a 920-square-foot rustic sugarhouse, which was built in 1957 from wood harvested and milled at Arnot Forest. The old house had an uneven floor, was constructed to accommodate up to 2,000 sap taps and lacked heat, running water and a proper restroom. In 2019, during normal operations prior to the COVID-19

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pandemic, the Arnot Maple Program tapped 7,800 trees, and people spent a lot of time at the sugarhouse.

"Boiling sap like that oftentimes kept us there all night," said Aaron Wightman, co-director of the Cornell Maple Program. "We've done 48-hour shifts; staffing [those shifts] is just incredibly painful and difficult."

Also, much of the research relevant to New York maple producers must address the needs of larger-scale systems, as state commercial operations typically tap 5,000 to 10,000 trees. Along with a cement floor, hot tap water, a bathroom and insulation, the new facility meets commercial standards.

In addition to accommodating larger systems, the facility will help keep the state's maple industry robust.

"The maple industry in New York has grown about 400% in the last 15 years," Wightman said. "All appearances suggest that we will continue to expand, which is a great benefit to upstate New York, where a lot of other agricultural businesses have been losing ground. This is a new opportunity."

But, he added, producers need to keep gaining efficiency and improving and maintaining quality in order to keep it profitable. When maple syrup reaches the shelf, consumers don't distinguish between sources, he said, so bad batches can lower consumer perceptions of the entire industry. Right now, more research is needed to understand steps in the process that influence flavor and syrup color (which determines the grade).

"I'm trying to create guidelines and decision-making tools that allow maple producers to control the process," Wightman said.

The new facility is one of two in the country (along with the University of Vermont) with redundant systems. The setup will let Wightman run experiments to determine optimal storage conditions; microbe levels that convert sugars and affect color; temperature; dissolved oxygen levels; and the right time to boil sap.

Also, improving related products – such as maple candy and sports drinks – and developing new products are necessary to keep the industry growing.

Maple wine allows producers to enter the state's $4.5 billion wine industry. Maple chocolates and candies can add to the $200 billion annual U.S. confections market. Maple sugar is another area where the industry could make inroads: Americans consume about three ounces of maple syrup a year per capita, but they consume about 150 pounds of sugar.

All of this information will continue to be shared throughout the state and beyond, through summer maple bootcamps at Arnot Forest, workshops throughout the state, conferences, the Cornell Maple Program's "Sweet Talk" podcast, publications, industry newsletters and by answering individual inquiries.

The Cornell Maple Program includes the new lab at the Arnot Research Forest and a sister facility at the Uihlein Maple Research Forest, managed by maple program co-director Adam Wild, in Lake Placid, New York. CALS administers the maple program, while the Department of Natural Resources and the Environment oversees both forests.

Aaron Wightman, left, chats with Richard Ball about the new facility.

Highlights of June IMSI Board Meeting

The IMSI held a Board of Directors meeting on June 29, 2021. The Canadian food inspection and Health Canada presented an update of the Canadian Food Labelling Regulations. Topics covered included changes to the label with sample labels, reference amount and serving size, daily values, list of ingredients and sugar labeling.

The 5-year transition period ends on December 14, 2021, however for the first year, the CFIA will focus its efforts on education and compliance promotion. As of December 15, 2022, CFIA will verify compliance and apply enforcement discretion.

Other food labelling initiatives, such as front-of-package nutrition labelling, continue to be a priority for Health Canada but timing is delayed due to the pandemic.

The USDA's Maple Syrup Production Report by the National Bureau of Statistics Survey (NASS) was discussed. Participants expressed no confidence in the accuracy of reported numbers and pointed out problems with the data collection system. For example, many large producers don't get surveyed, which skews reported production much lower. Participants said they were not well served by this report and that it doesn't support the industry's need for data used to manage capital investment and other resources needed to measure and promote its economic value. The IMSI will form a committee and appeal to the USDA and NASS, seeking improvements.

New York Maple Association Executive Director Helen Thomas and Dr. John Goldberg discussed progress made by the IMSI Standard of Identity Committee. After more than a year of analysis, industry consultation and formal endorsements by North American producer associations, the IMSI met with the FDA in June to verify the draft petition before submitting it. The FDA shared some insights that lead to submission of the final Citizen's Petition on behalf of International Maple Syrup Institution FDA on June 28, 2021.

During that meeting, the FDA advised IMSI that there is a provision in the Food, Drug and Cosmetic Act that requires 'formal' rulemaking for standards of identity. That provision was amended in 1990 to allow 'informal' rulemaking, a much simpler and faster process to change regulations. Unfortunately, all producers, except maple syrup and dairy, agreed to the simplified informal process, so the maple industry is bound by formal rulemaking, which requires an onerous 'full hearing process' that is likely to delay processing the petition. IMSI has appealed to Congress to change the law to waive formal rulemaking and facilitate the adoption of the modernized maple syrup standard of identity.

Ask Proctor

Timothy Perkins and Abby van den Berg
University of Vermont Proctor Maple Research Center

We regularly get questions from maple producers about which defoamers are the best to use. Of course, the answer is…it depends.

Defoamers are used to break the surface tension of boiling sap and syrup, reducing the tendency to form bubbles and boil over. The objective is to use as little defoamer as possible when controlling foam to avoid developing off-flavors or an oily mouthfeel in syrup. As all producers recognize, the nature and extent of foaming varies considerably between boils and across the season, ranging from almost nonexistent foam to essentially uncontrollable foaming (especially at the end of the season). The quality of sap/concentrate, the level of heat, and the amount of niter/scale build-up on evaporator pans all affect the propensity of syrup to excessively foam. The efficacy of defoaming measures also varies, with little needed at times and large amounts needed at others.

Traditionally defoamers were whatever maple producers had at hand. Since many producers were also farmers of one kind or another, milk, cream, butter, pork fat, or even balsam brush (due to the waxy cuticle on the foliage) were used. Due to allergen, possibility of rancid off-flavors, and general food-safety concerns, these are no longer permitted for use when making syrup to be sold to consumers.

The first step in defoamer choice depends upon whether the operation is organic-certified or not. Organic-certified operations can only use approved defoamers, mostly natural plant-based cooking oils with low flavor profiles and a high smoke point. Conventional operations have a wider range of options for commercially-produced defoamer products. These are considerably more effective than organic oils, with Kascher and Atmos being amongst the more popular types. Conventional defoamers can come in liquid or powder form, and the method of application also differs, ranging from cups, drippers and automatic pumps or to manual additions as needed. Choice is typically dictated by the size and style of evaporator and what is available through the supplier of choice.

Besides organic, some defoamers are also Kosher or Halal. This is more important for bulk producers as buyers need to certify that their offerings meet the necessary qualifications to be labeled as such.

Research over many decades has been done to find active or passive mechanical means to break up foam. Some interesting examples can be seen occasionally in museums or patent filings. Most of these devices were only modestly effective but added complexity to the process and did not eliminate the need for chemical defoamers. A prototype active spray defoamer developed at the UVM Proctor Maple Research Center can be seen at: https://www.youtube.com/watch?v=rldEWuCeGcE One simple approach to defoaming is to use a stainless wire cloth (1/4" mesh works well) laid across the partitions in a pan. While this doesn't completely remove the need to use chemical defoamers, it does help to break up bubbles and reduce the need for excess defoaming.

Lastly, since most chemical defoamers are oils, they will spoil and go rancid over time and with exposure to air, especially at high temperatures, so should be replaced often. Extra defoamer should be kept frozen (or following the manufacturer's instructions) and only small amounts for daily use taken out as needed. Tasting the defoamer before the season will help to prevent a spoiled batch of defoamer ruining your syrup.

A more thorough discussion of defoaming is available in the North American Maple Syrup Producers Manual and at: https://mapleresearch.org/search/?_sf_s=defoamer

Governor Eric Holcomb (center, alongside sugarmakers John and Delores Smith of Huntington, IN) visited the Indiana Maple Syrup Association's sugar shack at the Indiana State Fair

Obituary: Robert Sterling Smith

Robert "Bob" Sterling Smith, of Skowhegan, passed away on July 13, 2021 at Somerset Rehabilitation and Living Center in Bingham where he had been a resident since October 2015.

Bob was born Feb. 20, 1933 in Augusta, the son of John Harold and Mildred Leona (Sterling) Smith. Bob graduated from Bangor High School and obtained a B.S. in Forestry from the University of Maine, Orono. Upon graduating from Orono, he worked a short time for a private forestry company before reporting to Fort Dix, N.J. to begin a 20-month period of active duty for the U.S. Army.

Upon returning home to Skowhegan, Bob worked as a forester for the State of Maine and then established his own private forestry and land management company, surveying and managing wood lots in Somerset County. Bob continued to be involved with land surveying until about 1990 and provided a wealth of knowledge regarding the local history of Somerset County and the Skowhegan area.

Bob's true passion in life was the production and promotion of Maine maple syrup. He could remember making maple syrup with his grandfather Ralph and since those early days he continued to enjoy producing, promoting, and consuming maple syrup. Bob started out fairly small, collecting sap from local roadside trees in the area and boiling it down at his sap house on Silver Street. Eventually he and his wife Barbara grew Smith's Maple Products to become one of the larger Maine manufacturers and distributors of pure maple candy and syrup.

Bob was a very hard worker but also found time to enjoy these accolades and accomplishments: Founding member and past exalted ruler of the Skowhegan Madison Elks Lodge, inductee into the North American Maple Syrup Council Hall of Fame, former president of the North American Maple Syrup Council and Maine Maple Producers Association.

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. Those funds helps us promote the maple industry and support our members. Planned giving like this is a way for you to show your support for the maple syrup industry for many years to come. It's a simple process.

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.

The information needed for your legal documents is: North American Maple Syrup Council, PO Box 581, Simsbury, CT 06070.

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FOR SALE: SMALL (2' x 6') LEADER EVAPORATOR - 1977 vintage with stainless steel front pan. Complete with smoke stacks, firebricks, new stainless front pan (2013), 150 food grade plastic 5 gallon buckets w lids, and all taps and hoses necessary for making syrup. MAKE OFFER, BUT YOU MUST CUT YOUR OWN FIREWOOD!! (:>) Chuck Walker, 740-967-6554 (leave msg.); charlesw43@gmail.com, 4012 Dutch Lane, Johnstown, OH 43031

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