Maple Syrup Digest

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GREETINGS FROM YOUR PRESIDENT

Now that the busy summer is behind us it's time to once again start thinking about the up-coming maple season and ways to make it not only easier but more profitable than the last. This is normally the time of year I start to put into motion the changes I've planned for the coming season. These changes are either something I've thought of or learned about through attending maple seminars or read about in the Maple Digest or some other maple publication. For me it's actually kind of an exciting time, a time when I can think back through my experiences of producing maple syrup over the past 40 plus years and I'll be honest with you, not all of these experiences were good ones but that's how we learn is from our mistakes. In my mind a good sugarmaker is someone who's always looking for ways to make things a little better for the next season and with all the research and testing of new products happening now there is definitely a lot to look at and think about for the coming season.

A great way to see and learn about all this new and exciting research that's being done is to attend the NAMSC/IMSI Annual Meeting this October 20th - 23rd in Stratford, Ontario. Anyone who receives "seed money" from the NAMSC which is used to help fund maple related research must present his/her findings to our membership at our annual meeting once it has been completed. If you have never attended one of these annual meetings maybe this is the year you should think about starting, with the prices we're all now receiving for our maple products it doesn't take much of an increase in production or an energy saving tip to pay for the cost of attending. It's also an excellent opportunity for you to visit with other maple producers from all over the maple producing region and hear first-hand how things are being done in their area. These meetings have one of the largest Trade Shows you'll see anywhere, it's a great opportunity for you to take a good look at some of this new equipment and talk with the company reps on just how this new technology can work in your maple operation. For more information about attending this year's annual meeting please visit the North American Maple Syrup Council's web site at www.NAMSC.org or contact Dave Chapeskie by phone at 1-613-658-2329 or email agrofor@ripnet.com.

I look forward to visiting with you all in Stratford so please have a safe trip.

Rick Marsh

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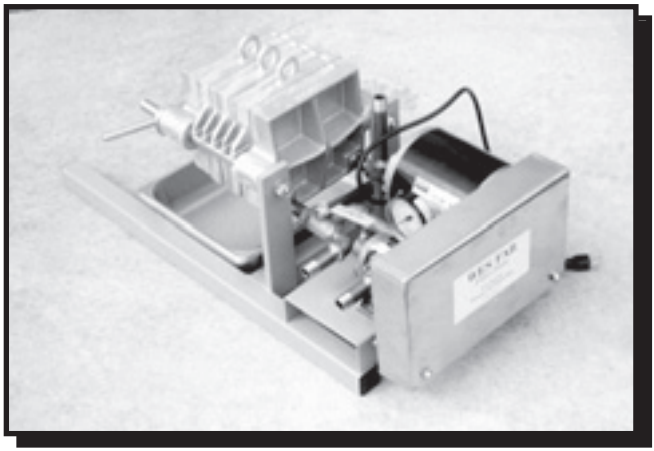

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IMSI NEWS

By: Dave Chapeskie, R.P.F., Executive Director, IMSI

September 2010

The quarterly Board of Directors meeting of the International Maple syrup Institute was held in St. Hyacinthe, Quebec at the Agricultural Research Centre on Friday August 20, 2010. The Board meeting was hosted by Centre Acer and was attended by 12 members of the Board with two additional Board members participating by teleconference. Maple advisors from the Canadian Food Inspection Agency and the Ontario Ministry of Agriculture, Food and Rural Affairs attended the meeting.

IMSI Strategic Planning Committee Report

Richard Norman, Chair of IMSI's Strategic Planning Committee was unable to attend the Board meeting so President Gary Gaudette and Executive Director Dave Chapeskie provided an update. Some minor changes to IMSI's By-Laws were adopted by IMSI's membership at IMSI's annual meeting in Bar Harbor in October 2009. Further changes to the objectives and a revised use of logo policy were developed after that Annual meeting and a new Code of Ethics was also developed for the Institute. IMSI's Strategic Planning Committee is currently reviewing the duties of Executive Members and will be adding a description of the duties of IMSI Directors as well. It is expected that the overall review of IMSI's Strategic Plan will be completed within the next month so that IMSI's Directors can consider all additional modifications in advance of the next Board of Directors meeting in Stratford, Ontario this October. The intent is to table any proposed changes and additions (Code of Ethics) for consideration by IMSI members at the upcoming Annual meeting.

Nominations Committee

Every year a nominations committee is appointed to develop a slate of IMSI Executive Officers and Directors to serve for the upcoming year. Dave Chapeskie, Jerry Kless, Ray Bonenberg and Jacques Couture make up the committee for 2011. All current IMSI Directors will be approached to determine if they wish to let their name stand for another year. IMSI members have been asked to bring nomination or expressions of interest for elected positions including Executive Officers and Directors to one of the Nominations Committee members.

Standard Maple Grades Committee Report

Dave Chapeskie chairs this committee and reported to the Board. Since the last Board meeting some further work has been done in developing awareness and educational materials in support of this initiative. For example, Dave distributed a mock-up of a post-card sized double-sided summary of the standardized grades proposal which was suggested for development at the IMSI Board meeting in Croghan, New York in May. Dave mentioned that he hopes to have an awareness/educational exhibit focused on the standardized maple grades initiative at the Annual

IMSI-NAMSC meetings in Stratford this fall. Youth may assist with staffing the exhibit in special consideration of the long-term benefits to be derived from this initiative. IMSI representatives in attendance at the Board meeting from Lapierre-Waterloo-Small and CDL agreed to assist with translation of English materials to French for the standardized grading initiative.

Dave also mentioned that a "Call for Expressions of Interest" in test driving the standardized grading system in a few test markets is under development, and work on the supporting document to regulatory agencies in Canada and the US is beginning.

Nutritional and Health Benefits of Maple Syrup Project

Ray Bonenberg reported that a research scientist from Natural Resources Canada is assisting with a literature review of related information. Ray has also been looking into options for messaging and packaging of research findings with IMSI members foremost in mind. Ray is working with Dave Chapeskie to arrange content related to this topic as part of the technical and marketing program at the upcoming NAMSC-IMSI Annual meetings in Stratford, Ontario. The session including presentations related to nutritional and health benefits of pure maple syrup is scheduled for Friday October 22nd in the afternoon.

Marketing and Research Initiatives of the Quebec Federation of Maple Syrup Producers

Genevieve Beland of the Quebec Federation of Maple Syrup Producers provided IMSI's Board and others in attendance at the meeting with an overview of important research and marketing initiatives of the Federation which have been underway for a few years now. This work has been focused primarily on supporting and facilitating research activity to help document the nutritional and health benefits of pure maple syrup as well as strategic and very significant media coverage of documented findings. The presentation was very interesting and provided those in attendance with a fuller appreciation of the extent and significance of this important work. Genevieve is thanked for her excellent presentation. It is hoped that Genevieve can also present a similar overview for the NAMSC-IMSI Annual meeting program in Stratford so that others may benefit.

Preparation of Air Injection Guidelines

Dave Chapeskie advised the Board that Angela Wheeler from Lanark County Ontario has agreed to prepare the draft guidelines. Dave Chapeskie will help Angela access supporting information as required. Anyone who has experience or information to share on the use of air injection should contact Dave.

Log Cabin Imitation Syrup

Dave Marvin lead discussion regarding a product labeled "New Log Cabin All Natural Syrup" which is being marketed in the United States. Ingredients include 4% pure maple syrup, brown rice, sugar, natural flavor, xanthan gum (a natural thickener), caramel color and citric acid. The jug used for this product and its sale in the same display area as pure maple syrup, as well as its lower

price, have the potential to negatively impact sales of pure maple syrup in areas of the United States. The Vermont Agency of Agriculture, Food and Markets is reviewing this situation and will be providing a letter to FDA. Dave Chapeskie will be preparing a letter expressing concern regarding this product and the draft letter will be approved by IMSI's Executive Committee, signed by IMSI's President and forwarded to FDA and the packer/distributor of this product on behalf of IMSI's members.

IMSI Lynn Reynolds and Golden Maple Leaf Awards

The deadline for the receipt of nominations for IMSI Awards from IMSI members was August 15th. Several nominations were received for the Golden Maple Leaf Award and one nomination was received for the Lynn Reynolds Award. IMSI's Executive Committee has selected the winners for these two awards and the awards will be presented at the Annual NAMSC-IMSI Annual Meeting banquet event to be held at Arden Park Hotel in Stratford, Ontario on Saturday October 23rd.

IMSI Sponsored Maple Grading School

John Henderson provided an update on the IMSI sponsored Maple Grading School which will be held on October 19th and October 20th at Arden Park Hotel in Stratford, Ontario. Sixteen people were registered to take the course by August 20th and it is anticipated that another 10 or possibly more will register before the course is held. IMSI members should contact Kathy Hopkins or John Henderson for further information.

Federation of Quebec Maple Syrup Producers Report

Bernard Perrault of the Federation reported that 67 million pounds of syrup had been graded with about 93 % being classified as AA and B. It was mentioned that from the 2010 maple crop, 15 million pounds of syrup was for sale to interested buyers.

Several IMSI members reported that maple syrup sales were normal and that it was expected that there would be sufficient syrup to satisfy international markets leading up to the 2011 production season.

Scheduled IMSI Meetings in 2010

IMSI's next Board of Directors meeting will be held in conjunction with the Annual NAMSC-IMSI meeting in Stratford on Wednesday, October 20th and IMSI's Annual meeting will be held on Friday October 22nd.

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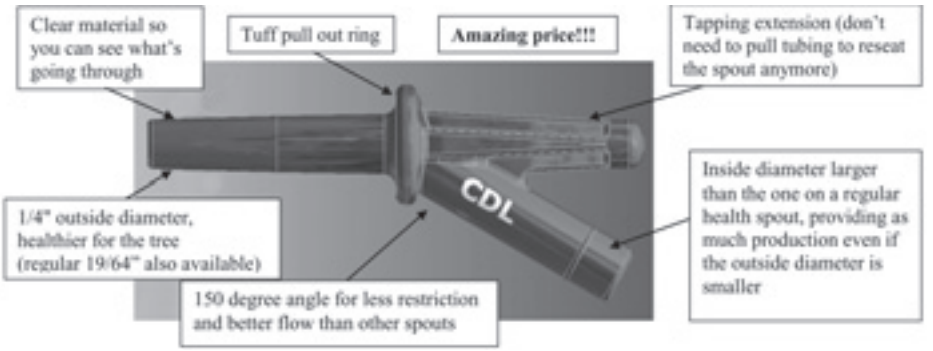

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EXCERPTS OF POSTINGS ABOUT LEADER CHECK-VALVE ADAPTERS ON WWW.MAPLETRADER.COM

Timothy Perkins, Ph.D. -- Director, UVM Proctor Maple Research Center
Compiled April 2010

"These taps work."

"We were still getting a gallon of sap per tap plus last Friday when I shut the pumps down. On Tuesday morning we had leaves on the maples. My belief is the check ball valves helped enough to more than pay for themselves."

"I put 5000 CV in on new drops and 5000 in on 5 year old drops with new stubby and got the same amount of sap from each (30 gal). Tapped 10,000 with 1 to 5 year old tree saver drop lines and got 17 gal of sap per tap. The CV lines were in my warm bushes and they ran 7 days longer than my cold woods."

"I had both CV's on one bush and regular adaptors on the other. The last 2 gatherings the volume off the CV's were simply double per tap. It was clear to me that the CV's were doing it."

"I got 25% more sap from my CV's on old tubing than from another bush that was all new spouts and/or adapters. The CV's produced 50% more sap than other bushes with older spouts. I believe my numbers."

"My set up allowed for a good side by side study. Almost all of my tubing is two to three years old. The area that got the CV's is all three year old tubing and drops. They all did get new stubbies and of course CV's. The control bush was two and three year old tubing and they got new adaptors. The results were as clear as they could be, 7 gallons of sap per tap more on the CV's!"

"On my system that had 900 of 1400 CV's I ran a max of 18" of vac and later had to back it down to 15 or 16. Late season sap flows still were double the other side of the woods. It seems that the first warm up slowed the flow on the non-CV side, which generally is cooler, but the CV side held strong and out-performed the non-CV side 2 to 1. I made 50% more syrup (on 1.5% sap) than I've ever made before."

"I was very impressed with how these check valves worked. Temps in the 60s shut other trees right down, but the trees tapped with the CV spouts (on Lapierre stubbies) kept on running and running. There is no question we will be upgrading everything to the CV adaptors for next season."

". . . the bush with the CV's produced 3 USG per tap more than another bush with all new tubing on 7/16 to 5/16 adapters."

"In 2009 our one bush ran 20% better than the rest of our bush. This year, with the Leader CV's, it ran 56% better than the rest. The last 3 days we gathered (Mar 30-Apr 1) the 400 tap bush with the CV's produced as much sap as our 1500 tap bush with 3+ year old health spiles."

"Pulled the 1st 50 CV's this morning - after 4 days of 75 degree weather clear sap still drips from the holes on every tree when I pull the spout."

"This year was probably not the best of years, but don't seem like anyone is seeing anything but an increase. If they give you another 1 gallon of sap per taphole, then they have paid for themselves about 3 times the cost of the investment as a gallon of sap is worth aprox $ 1 in retail syrup and about 1.5 to 2 times in wholesale syrup."

"We will use the CV again next year. Even though we had a shortened season due to weather, yesterday I ran the vacuum pump to drain the lines and sap was still flowing."

"I'm switching the 2nd half of my woods over to CV's next year. . . . I can't see any negative about 250 gallons more syrup- that $10,000 will easily pay for those spouts and stubbies."

"My tap holes still have not dried up AND I do not have vacuum."

"I have no doubt that I was satisfied with the CV's. . . . My non CV's slowed way down a week before."

"Pulled more taps today, Holes have water setting in them, some ran water down the tree, video this time, and some pictures. I hope Dr. Perkins knows that the tree huggers will be picketing his house when they find out that the trees keep on running and it's all his fault."

"I was looking at my lines today with the vac pump off. They were full, and the drops had 12-16" of sap in them. These things are working. I tapped right around Valentine's day. So I will be using them next year."

"My CV woods are still doing it, my regular Leader adaptor woods is completely done as there was very little 2 days ago. Turned the pump off there yesterday. The CV woods is still hammering, but am throwing in the towel in the morning, will be dumping all that as I am sick of this season and need to get on with cleanup. No one has convinced me NOT to use them. My comparison and research is 2 thumbs up for CV."

"CV's are in for me next year - My trees are still running well in 80 degree weather with the VAC off . . ."

"I figure that the CV's made me about $4.40 per tap. Well worth the $.64 investment."

"…I made 74% more syrup this year than last. The check valve were the only thing I changed to help get more sap."

"Started pulling CV's yesterday, and flushing lines whether the large lady is singing or not. I should have made a video of some of the holes. All of the holes still had water in them, some actually was running water down the tree almost like a new tap hole would before a spile could be put in. All holes looked like the wood was very white, very little staining . . ."

". . . I believe from my experience this season I will give checkvalves two thumbs up."

"Our CV's are on a 400 tap bush that is normally the first to shut down. The tubing is 8 years old and we put the stubbies on the existing droplines. Our main bush is newer tubing (3-4 years) and almost 1500 5/16" taps that have been used as many seasons as the tubing. Yesterday we got the same amount of sap from the 400 taps on CV's as we did on the 1500 health spiles."

"I'm up in the air about these, but I do think they helped and I will try them again next year to see how they fare."

"The dealer that I deal with buys syrup. He said he had called one of the producers he buys from in Vermont. The producer told him that by this time in his season he usually has 60 barrels of syrup, he had over 100 barrels so far and felt he had a very good week coming this week. He credited his success to Check Valves spouts."

"Last year was a great production year in our area. Yet I produced 20% more syrup this year than last and my yield per tap was about triple other producers I have talked with."

"Looking forward to next season, and using CVs again. I'm not afraid to tap early with them."

". . . Heath Spouts with adapters produced 17gpt of sap and the CV's gave 25gpt of sap. I will say it was a good season."

"Re-worked some manifolds yesterday to get ready for tubing washing and the **** mainlines were still running sap! . . . Check valves are still wet too, others are dry . . . I believe!!"

". . . all in all I think the CV did a great job and definitely extended the season for us."

". . . I produced 20% more syrup this year than last and my yield per tap was about triple other producers I have talked with. I am totally sold on the CV adapters and will replace 1400 (brand name deleted) 3 year old adapter spouts next year."

"We have one bush on CV's and one on health spouts. The bush on CV's ran well. The other bush produced nothing. Similar experiences with others in the area. . . . After this season, I don't think there will be much debate. Tell Leader to order up a lot of plastic."

BILL CLARK INDUCTED IN VERMONT AGRICULTURAL HALL OF FAME

By Larry Myott

Wilson "Bill" Clark, long time President of the Vermont Maple Sugarmaker's Association, Inc. was inducted into the Vermont Agricultural Hall of Fame during the recent Champlain Valley Exposition. The Expo is Vermont's largest fair, with annual attendance of about 300,000, and home of the eight year old Hall of Fame.

Clark is shown here being presented his Hall of Fame Award by Vermont Governor Jim Douglas. Bill Clark has been known as a maple leader in Vermont and around the maple world since he was elected president of the Vermont Maple Sugarmaker's Association in 1969, a position he held until 2001. He was cited for his many credits, including being a founder of the IMSI, and leader in the North American Maple Syrup Council. At the more local level Clark led Vermont in the development of the popular Vermont Maplerama, in 1966. He has also been very involved in farmer market development in Vermont, he has long been a vendor at the Rutland City Farmer Market selling his home grown vegetables, fruit, maple products and wife Sue's jam's, jellies and other canned foods.

Four new members are selected each year, also selected for 2010 was former U.S. Senator George D. Aiken. Aiken also has ties to the Vermont maple industry, he was Uncle to Burr Morse, owner of the Morse Farm in East Montpelier, a long time maple family attraction and year around maple store. Other selected for 2010 are Ryle Dow, former general manager of the St. Albans Cooperative Creamery, where he worked for 33 years and Catherine Beattie, dairy farmer and long time Vermont legislator. Aiken and Dow received the honors posthumously. [Photo by Larry Myott]

Pure Maple Syrup Contains Medicinally Beneficial Compounds

ScienceDaily (Mar. 25, 2010) — Before you dig in to your next stack of French toast or waffles, you might want to pour on pure maple syrup.

That's because University of Rhode Island researcher Navindra Seeram, who specializes in medicinal plant research, has found more than 20 compounds in maple syrup from Canada that have been linked to human health, 13 of which are newly discovered in maple syrup. In addition, eight of the compounds have been found in the Acer (maple) family for the first time.

The URI assistant professor of biomedical and pharmaceutical sciences in URI's College of Pharmacy presented his findings March 21 at the American Chemical Society's Annual Meeting in San Francisco. The project was made possible by Conseil pour le développement de l'agriculture du Québec (CDAQ), with funding provided by Agriculture and Agri-Food Canada's Advancing Canadian Agriculture and Agri-Food (ACAAF) program.

Several of these anti-oxidant compounds newly identified in maple syrup are also reported to have anti-cancer, anti-bacterial and anti-diabetic properties.

Prior to the study, the Federation of Quebec Maple Syrup Producers already knew that its product was full of naturally occurring minerals such as zinc, thiamine and calcium. But it enlisted Seeram to research the presence of plant anti-oxidants. The Federation awarded Seeram a two-year, $115,000 grant with the help of the CDAQ and Agriculture and Agri-Food Canada. His research continues to determine if the compounds exist in beneficial quantities.

Serge Beaulieu, president of the Federation of Quebec Maple Syrup Producers, said Seeram's lab is but one in an expanding multi-national network of research facilities dedicated to the study of maple products from Canada.

"We are proud that our producers are generously supporting this research, bringing to light a greater understanding of the gastronomic and health benefits of maple products. It is not just for Canada, but for the welfare of consumers around the world," Beaulieu said. Geneviève Béland, federation marketing director, said the group has learned that maple products are much more than sugars with only calories to contribute.

"Recent research findings, such as those by Dr. Seeram, reveal a whole array of bioactive compounds that promise to offer many health benefits," she said. "Our journey to understanding these benefits has just begun."

Seeram, who was named the 2009 Young Scientist of the Year by the American Chemical Society's Division of Agricultural and Food Chemistry, said his goal is to educate the research community and the public about the many benefits of a variety of plant and berry foods, as well as natural products. His message is receiving widespread attention. Seeram had two of the Top Ten Most Accessed Articles in the Journal of Agricultural and Food Chemistry in 2008.

"We know that plants must have strong anti-oxidant mechanisms because they are in the sun throughout their lives," Seeram said. "We already know that berries, because of their bright colors, are high in anti-oxidants.

"Now we are looking at maple syrup, which comes from the sap located just inside the bark, which is constantly exposed to the sun."

During his maple syrup research, Seeram and his research team found phenolics, the beneficial class of anti-oxidant compounds also found in berries. "We speculated that the sugar maple is wounded when it is tapped for its sap, and that it secretes phenolics as a defense mechanism."

Seeram said the sap probably has low concentrations of these native phenolics. "But when you boil the sap down, there could be higher levels because syrup is a highly concentrated liquid. Plus, the natural plant bioactives could remain intact or undergo process-induced chemical changes during the heating process resulting in further-derived bioactive compounds."

The biomedical scientist said such early research is exciting because many people would not associate such a sugary product with healthy biological properties.

"At this point, we are saying, if you choose to put syrup on your pancakes, it may be healthier to use real maple syrup," he said. "The Federation of Quebec Maple Syrup Producers found that 50 percent of consumers don't know whether the syrup they consume is real maple syrup."

Seeram acknowledges that real maple syrup is pricier than commercial brands with maple flavoring or even those with no or very little maple syrup. "But you pay for what you get and you get what you pay for, meaning there are consequences for what you eat.

"We know that anti-oxidants are present in the leaves, bark and twigs of the maple tree, so looking at the sap make sense."

Seeram now has a sugar maple tree trunk sitting in his lab so he can begin a more comprehensive study of the entire tree.

"In a certain sense, people view sap as the life blood of the tree," Seeram said. "Maple syrup is unique in that it is the only commercial product in our diet that comes from a plant's sap. This is a niche resource for northeast North America. Canada is the biggest producer of maple syrup and the United States is the biggest consumer."

The above story is reprinted (with editorial adaptations by ScienceDaily staff) from materials provided by University of Rhode Island, via EurekAlert!, a service of AAAS.

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"...Health Spouts with adapters produced 17gpt of sap and the CV's gave 25gpt of sap."

"I'm switching the 2nd half of my woods over to CV's next year...I can't see any negative about 250 gallons more syrup."

"My tap holes still have not dried up and I do not have vacuum."

"I figure the CV's made me about $4.40 per tap."

"...I made 74% more syrup this year than last. The check valve were the only thing I changed to help get more sap."

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CHANGES IN SAP YIELDS FROM TUBING SYSTEMS UNDER VACUUM DUE TO SYSTEM AGING

By: T.D. Perkins, B. Stowe, and T.R. Wilmot
UVM Proctor Maple Research Center / UVM Maple Extension
P.O. Box 233, Underhill Ctr., VT 05490

INTRODUCTION

Maple producers who install a new vacuum tubing system in their woods generally experience significantly higher sap production in the first few seasons, with gradually diminishing sap yields evident as tubing systems age. Sap flow reductions are related to microbial contamination of tapholes (Naghski and Willits 1955), which is introduced through contaminated spout/tubing systems via contact of an old spout with a fresh taphole, or through sap backflow into tapholes during periods when vacuum loss occurs (Perkins 2009). The maple industry has attempted to counter microbial contamination impacts on sap yield by using chemicals or air/water introduced under pressure to clean tubing, through the use of annually replaceable spout extensions or spout adapters, via semi-regular replacement of droplines, by occasional retubing sap collection systems, or most recently, by using spouts or spout adapters designed to reduce or limit taphole contamination (Chapeskie and Staats 2006, Heiligmann et al. 2006, Perkins 2009, Perkins 2010, Childs 2010).

However because of year-to-year fluctuations in sap production, the actual loss of sap yield over time has not been well described. Producers know it happens, but are unsure precisely how much sap is lost when using a system of a certain age and contamination level, or how aging of tubing systems affects sap yields over time.

This research was designed to examine age-related losses in sap yield in tubing systems operated under vacuum, and to explore different strategies to reduce tubing microbial contamination induced sap yield losses.

METHODS

In the fall of 2006 we established 12 treatment plots in the "Red Series" forest management area at the U.V.M. Proctor Maple Research Center in Underhill Center, Vermont. Each plot consisted of an average of 52.6 trees (range 37-69 trees) with an average diameter (dbh) of 14.8" (range 13.5-16.2"), with one tap set per tree regardless of diameter. The stand is predominantly sugar maple, but approximately 39% of the tapped trees were red maple (range in plots 19.6-61.5%). Each plot was serviced by an individual 3/4" maple mainline (Figure 1) and 5/16" lateral lines averaging 5 taps per line. The entire tubing system was installed new in the fall of 2005. During each flow season, the vacuum was pulled on all the mainlines via a common liquid-ring vacuum pump pulling 22-25". Each mainline has an individual vacuum releaser equipped with a counter

Figure 1. Experimental plot mainlines entering the UVM PMRC "Red Series" sap shed

Figure 2. Inside of UVM PRMC "Red Series" sap shed. Each releaser is calibrated and equipped with a counter to measure total sap yield. All releasers and mainlines are connected to a common vacuum pump.

(Figure 2). Releasers were calibrated to give a known volume of sap for each release.

The sap flow season of 2006 was used as a calibration year to determine the baseline level of sap produced by each treatment plot. Sap yield was calculated on a per tap basis to standardize the results for varying number of taps. Before the sap season of 2007, four treatments (replicated in three plots each) were randomly assigned to the study area:

1. Replacement of all lateral (5/16") lines, fittings and spouts annually (HIGH CONTROL)

2. Cleaning and maintenance of tubing system annually (LOW CONTROL),

3. Use of new spout adapters annually (Leader Evaporator Co. Tree Saver Spout Extensions on Darveau 5/16" spouts) (EXTENSIONS)

4. Various treatments

a. Replacement of spouts annually (2007-2008) (SPOUTS)

b. Replacement of spouts and dropline (2009) (DROPS)

c. Use of Check-valve spouts with replacement of droplines (2010) (CV+DROPS)

All treatments were cleaned each year at the end of the season via an injection of air/water mixture (no chlorine or other chemical sanitizers were used) from the bottom of the system. Spouts were pulled and air/water blown out through each spout for 5-10 seconds. The inside of the spout was cleaned with a small brush and the outside wiped with a sponge. The spout was then capped. After cleaning was complete, replacement of tubing, drops, and spouts was completed as dictated by the treatment regime.

The HIGH CONTROL (replace all) treatment is designed to produce the maximum amount of sap each year due to minimal tubing contamination, and thus represents the most sap a producer could expect to get from those trees if the site was retubed. This treatment, when considered to be 100% each year, also allows us to correct for the year-to-year variations that obscure age-related sap yield changes in the other treatments. The LOW CONTROL (clean/maintain) plots represents the typical situation after a producer retubes a section of their woods, so we would expect to see a reduction in sap yield over time in this treatment. The various other treatments examine the effects of various methods designed to increase sap production above the standard situation of clean/maintain only. More correctly, these treatments allow us to examine approaches to reduce the impact of microbial induced sap yield losses.

RESULTS & DISCUSSION

During the sap flow seasons of 2006-2010, sap flow was measured from each plot and average sap yields calculated for each treatment. As expected, after the first calibration year, replacement of all lateral tubing and spouts (HIGH CONTROL) produced the highest sap yields, and cleaning/maintenance only (LOW CONTROL) produced the lowest yields (Figures 3 and 4). When compared to the

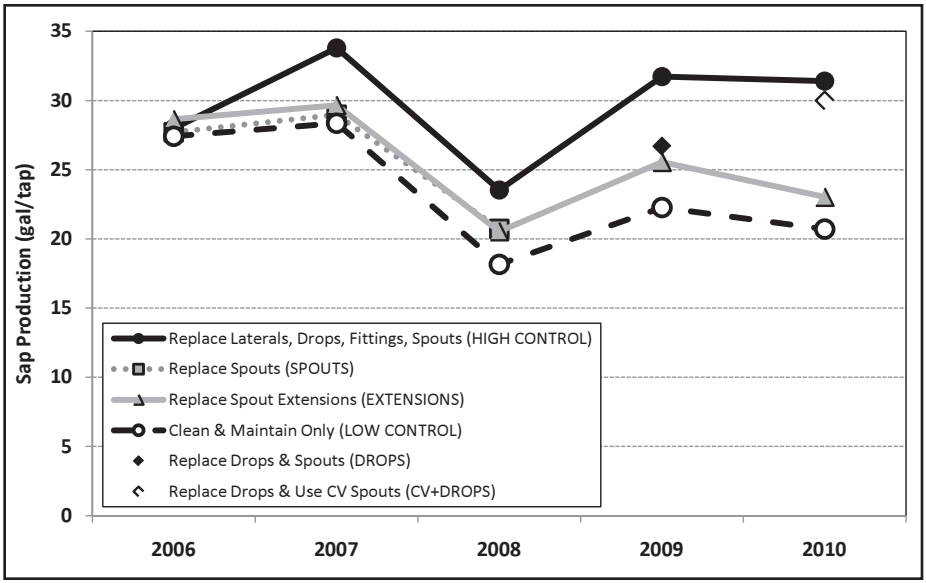

Figure 3. Average sap production (gal. sap/tap) from the various treatments. Each point is the average of 3 mainlines with an average of 53 trees per mainline.

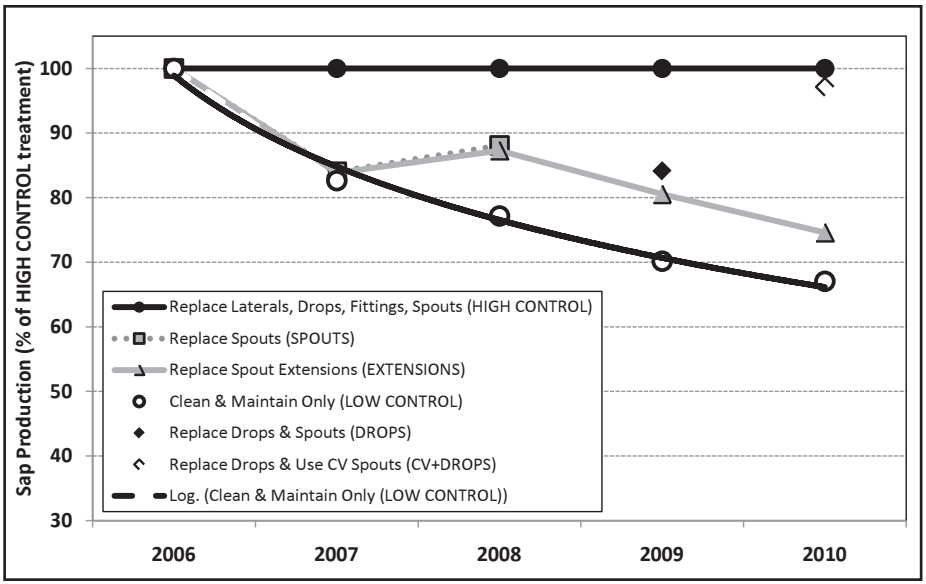

Figure 4. Average sap production expressed as a % of the HIGH CONTROL treatment. Differences between the upper line (HIGH CONTROL) and other treatments show how much microbial contamination impacts sap yields compared to a new tubing installation. Differences from the bottom line (LOW CONTROL) show the expected level of gain due to the use of various maple industry strategies to improve sap yield.

HIGH CONTROL plots, all of the other treatments had lower sap yields every year.

Figure 3 shows the average sap production in gallons per tap from each of the treatments. In 2006, the calibration year, the average yield from plots was very similar at approximately 27.4-28.6 gal/tap. In 2007, sap production in most plots was marginally higher than the previous year, however the HIGH CONTROL plots produced 33.8 gal sap/tap. Sap production was lower in 2008, with the LOW CONTROL plots producing an average of 18.6 gal/tap, and the HIGH CONTROL plots producing 23.5 gal/tap. Sap yield in LOW CONTROL plots was higher in 2009 and 2010, averaging 22.3 and 20.7 gal/tap respectively, but by that time was considerably lower than the HIGH CONTROL treatment yields at 31.7 and 31.4 gal/tap.

After 2007, all of the putative beneficial treatments (EXTENSIONS, SPOUT, DROP, and CV+DROP) showed some degree of improvement in the ability to increase yield above the LOW CONTROL (clean/maintain) treatment. Using new Tree Savers (EXTENSIONS) annually or replacing spouts each year (SPOUT) showed virtually identical responses. In 2009, by which point the systems had been used for 4 seasons, replacing spouts, droplines and tees (DROPS) was only slightly better than using spout extensions (EXTENSIONS), however in 2010 we observed that using Check-Valve Spout Adapters in combination with a new drop (CV + DROPS) resulted in sap yields of 30.0 gal/tap, far higher than the 20.7 gal/tap of the LOW CONTROL, and only slightly below the 31.4 gal/tap found in the HIGH CONTROL treatment.

It is far easier to see how the different treatments differ over time when the results are presented as a % of the HIGH CONTROL treatment (Figure 4). This visualization of the results removes the normal annual fluctuation in sap production, and thus makes patterns far more apparent. When doing this, the HIGH YIELD treatment will always be 100%.

The LOW CONTROL treatment reveals that sap production after the first year of tubing use drops quickly. Sap yield dropped by 17.4% after only one season, and then to a cumulative loss of 22.8%, 29.8, and 32.9% after the second through fourth seasons respectively. This shows that the potential loss of sap is most rapid in the first few years, and although it continues to fall, the rate of decline lessens over time in a logarithmic fashion. Despite this, it is readily apparent that these tubing systems have lost about 1/3 of their potential capability to produce sap after only five seasons of use. To look at it from the other perspective, replacing all lateral lines, droplines, fittings, and spouts after only 5 years time would results in an increase in sap yield of 50% the following season.

If the loss curve of the LOW CONTROL treatment is projected out over 10 years, sap yield falls to 50% that of the HIGH CONTROL treatment, and is still continuing downward. What this means is that retubing a system after 10 years should result in a 100% improvement in sap yield in the same woods.

Strategies to counter this loss in production do show some benefit. Although there is only a small effect of using new spout extensions or new spouts after one year of use (4.4 and 1.0% respectively), benefits are more substantial in

subsequent years as the level of microbial contamination in tubing systems rise. Use of annually replaceable spout extensions produced a gain in sap yield averaging 13.0% in seasons 3-5. Given the cost of a spout extension or spout adapter is about $0.15-0.20 each, an average gain of 13% on 20 gal of sap/tap will result in an additional 2.6 gal of sap, worth about $1.30 (with sap at a value of $0.50). Therefore the average gain on investment with spout adapters is approximately $1.10-1.15/tap. Although not included in this study, we would expect the Clear-Straight-Through Spouts to exhibit about the same level benefit in terms of sap yield and economic gain. This has been our observation in other ongoing studies (Perkins and Stowe unpublished). In short, putting new plastic in the tree reduces microbial contamination of the taphole, reduces taphole drying, produces higher sap yields, and results in an economic gain for producers.

Replacing the entire dropline assembly (dropline, tees, and spouts) produced only a modest improvement (19.9%) over that observed with spout extensions or new spouts (13.0%) in this study. Childs (2010) reported much larger increases in sap yields with dropline and spout replacement in similar sanitation studies in New York. This difference is likely due to the fact that the NY study looked at far older (and thus more contaminated) tubing systems, therefore the changes made were of greater benefit. The older the tubing system, the higher the level of contamination, and thus the greater benefit expected from making any sanitary changes to the system. The rapidity of the loss in sap yield in an aging tub-

ing system is likely related to the type and efficacy of the tubing cleaning method employed. The economic calculation becomes far more difficult, as there is added expense of replacing the 5/16" dropline, and tee, as well as the spout, and the added labor cost involved with installing the new drop in the woods. Further research will be necessary to fully determine the cost/benefit relationship of drop replacement.

When dropline replacement was combined with the use of the Leader Check-Valve Spout Adapter (CV + DROPS) the improvement in sap yield was substantial, averaging 44.9%, and nearly reaching the yields produced by replacement of all materials from the mainline to the tree (HIGH CONTROL). Unfortunately the experimental design of this study did not allow us to study the effect of the Leader Check-Valve Spout Adapter (CV) on older laterals and droplines alone, but this will be a subject of study in the 2011 sap flow season. The NY study by Childs (2010), showed an improvement of 114% when using new CV adapters on old drops compared to old spouts on old drops. This equated to a gain of 7.7 gal of sap/tap at a cost of $0.35/tap, an economic benefit of approximately $3.50/tap (at $0.50/gal sap). Based upon that work, as well as our own previous work (Perkins 2009, Perkins unpublished), we anticipate that CV adapters will show significant improvements in sap yields when used on old drops as well as when used in combination with new drops.

It should be noted by producers that these observations were conducted on vacuum tubing systems. Gravity tubing systems show somewhat different results (Childs 2010, Perkins and Stowe unpublished).

CONCLUSIONS

Typical tubing systems (cleaned with air-water injection and maintained) experience rapid drops in sap yields as they age. By the time a vacuum tubing system is five years old, approximately one-third of the potential sap production has been lost. Various strategies to limit these losses have been developed and employed within the maple industry. In general, annual replacement of spouts, use of new spout extensions or spout adapters will increase sap yields by approximately 10 15% in a tubing system that is 3-5 yrs old. Replacement of droplines, tees, and spouts will increase production by 20-25%, however the level of improvement will most likely rise as tubing systems get older. Replacement of droplines in combination with the use of CV adapters resulted in the greatest benefit, although it is likely that use of CV adapters alone on older droplines will also result in significant improvements in sap yield.

ACKNOWLEDGEMENTS

This research was funded by the U.S. Department of Agriculture via University of Vermont Hatch and Extension grants, as well as through a grant from the North American Maple Syrup Council. We thank Abby van den Berg and Mark Isselhardt for their assistance in many phases of this work. We also thank Steve Childs of the Cornell University Maple Program/Extension for sharing his results and for useful discussions.

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FROM THE 1905 ALMANAC

MAPLE SUGAR - Statistics show that the yearly production of maple sugar in the United States exceeds $2,000,000 in value. These figures, however, have no great significance, since yields vary widely from year to year. The sap season is controlled by the weather, which may favor a long continued flow or cause but brief and irregular runs. Thus one year's product from the same trees may not be more than a third of the yield of the preceding season. New England, New York, Pennsylvania, Ohio, Michigan and Canada are the main sources of supply of pure goods. Vermont is the head centre, and produces more than any other state, her soil, climate and maple forests being well adapted to, and her men skilled in the industry. New York and the Western Reserve in Ohio also make considerable quantities.

Sugar Orchard - Practically the entire product is derived from the sugar or rock maple. This tree thrives best on cool, rocky uplands, and may be readily distinguished by its rough, light gray bark, its broad, five-lobed leaves with shallow depressions, and its key-winged fruit. The sugar maker speaks of his maple woods as the "sugar place," "sugar bush" or "sugar orchard." It is usually a rough, hilly, rather open forest, generally quite free from underbrush, with the sugar house, or sap boiling place, located within its limits. Maple sap is, as it were, the life blood of the tree, the constructive material from which are built the wood and leaf tissues. The tree stores starch in the Summer, which in the Winter is changed to sugar, and later on is transferred to the buds to stimulate leaf growth. The sap passes both up and down the tree in Spring in the layers immediately beneath the bark. The flow is strongest in the late Winter days, when the thawing weather comes. Sap pressure on a warm day may be as high as twenty-five pounds to the square inch, increasing with warmth and lessening with cold. "Sugaring time" in Vermont may start as early

as the last week in March, and may last two weeks or a month, according to the weather.

Average sap carries ninety-six per cent of water, about three per cent of sugar and more or less albuminous and mineral matters. These proportions change somewhat as the season advances. The early "runs" are apt to be nearly pure sugar and water, while later flows carry more albuminous and kindred substances which injure the quality of the goods.

The Process - The tree is tapped with a bit or auger, and a metallic or wooden spout is inserted, through which the sap drains slowly into the bucket hung thereon or on a spike driven into the tree. Sap is brought to the sugar house in a large wooden tank on a sled or "stone-boat" drawn by horses or oxen over the snow, and emptied into the reservoir tank, whence it passes into the "evaporator." Old time sugar makers used great iron kettles suspended over a wood fire. This is sometimes done today, but smoke and ashes do not conduce to cleanliness or to good quality. Most sugar makers now use the evaporator, a shallow pan, or series of pans, longer than it is wide. A constant flow of sap is maintained in a circuitous course over the long heated surface from the front end of the evaporator to the rear, whence it is drawn from time to time as a thin syrup. This is periodically reboiled to concentrate it. Eleven pounds to the gallon is standard, if it is to be sold as syrup. If it is to be made into sugar, the syrup is still further boiled or "sugared off" over a brisk fire until it "hairs," or the thermometer shows 236 degrees or higher, or until judgement and experience say, stop. The viscid fluid is then taken from the fire, stirred until granulation is well established, and poured into a tub, box, cake mould or brick mould to harden.

Sugar and Syrup - While most of the product is made into sugar, much is marketed as syrup, which when hermetically sealed and properly stored, keeps well. Sugar, however, keeps on the whole better. The latter is eaten as candy and is used in confectionery, but most commonly is melted for use as table syrup. Sugar sells at from four to twenty cents a pound, according to the quantity sold, the quality of the goods, time of the year, size of crop, etc. That from early runs, light in color and fine in flavor, in small cakes, sells at top prices for a few days early in the season. The main crop, good, bad and indifferent, sells at lower prices, sometimes below the cost of production. Light colored sugars and syrups, of mild and delicate aroma, command the best prices.

MAPLE SYRUP PRODUCTION DOWN 19 PERCENT NATIONWIDE

Compiled by: New England Agricultural Statistics

United States maple syrup production in 2010 totaled 1.96 million gallons, down 19 percent from the revised 2009 total. The number of taps is estimated at 9.27 million, 3 percent above the 2009 revised total of 8.98 million. Yield per tap is estimated to be 0.211 gallons, down 21 percent from the previous season's revised yield.

Vermont led all states in production with 890,000 gallons, a decrease of 3 percent from 2009. Production in New York, at 312,000 gallons, decreased 29 percent from 2009. Production in Maine decreased 22 percent from 2009 to 310,000 gallons. Production in Wisconsin, at 117,000 gallons, decreased 42 percent from 2009. In New Hampshire, production is estimated to be 87,000 gallons, down 7 percent from last season. In Michigan, production is estimated to be 82,000 gallons, a 29 percent drop from 2009. Production in Ohio is estimated to be 65,000 gallons, down 28 percent from 2009. In Pennsylvania, production is estimated to be 54,000 gallons, 41 percent below 2009. Production in Massachusetts, at 29,000 gallons, decreased 37 percent from last season and the lowest production in the State since 1995. In connecticut, production is estimated to be 9,000 gallons, down 31 percent from 2009 and 53 percent from 2008.

Temperatures were reported to be too warm for optimal sap flow in all States. On average, the season lasted 23 days compared with 28 days last year. In most States, the season started sooner than last year. The earliest sap flow reported was January 14 in Vermont. The latest sap flow reported was May 1 in Maine. Sugar content of the sap for 2010 was down from the previous year. On average, approximately 46 gallons of sap were required to produce one gallon of syrup. This compares with 43 gallons in 2009 and 39 gallons in 2008. The majority of the syrup produced in each State this year was medium to dark in color with the exception of Maine.

The 2009 United States price per gallon was $37.80, down $2.90 from the revised 2008 price of $40.70. The United States value of production, at $90.8 million for 2009, was up 17 percent from the revised previous season. Value of production increased in Maine, Michigan, New York, Vermont, and Wisconsin.

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A BIT OF HUMOR

Hello, both my dad (Carl Hoffelder) and I receive the digest. He has been making syrup for more than 50 years and will be 90 years young in June. That's him in the first photo, stoking the arch last week in Indiana. (The season lasted a whole three days.)

I wanted to show you what is surely one of the most unique trees ever to sport a sap bucket. It is in a neighbor's woods that we tapped this year. Sometime in the past, a large maple was nearly destroyed somehow, but one large horizontal limb remained. From this limb, a perfect maple grew vertically. We decided to tap it, just to say we did. As you can tell from the ladder, the bucket is about 20 feet off the ground. We don't recommend that anyone try this at home.

Tom Hoffelder
Tolland, CT

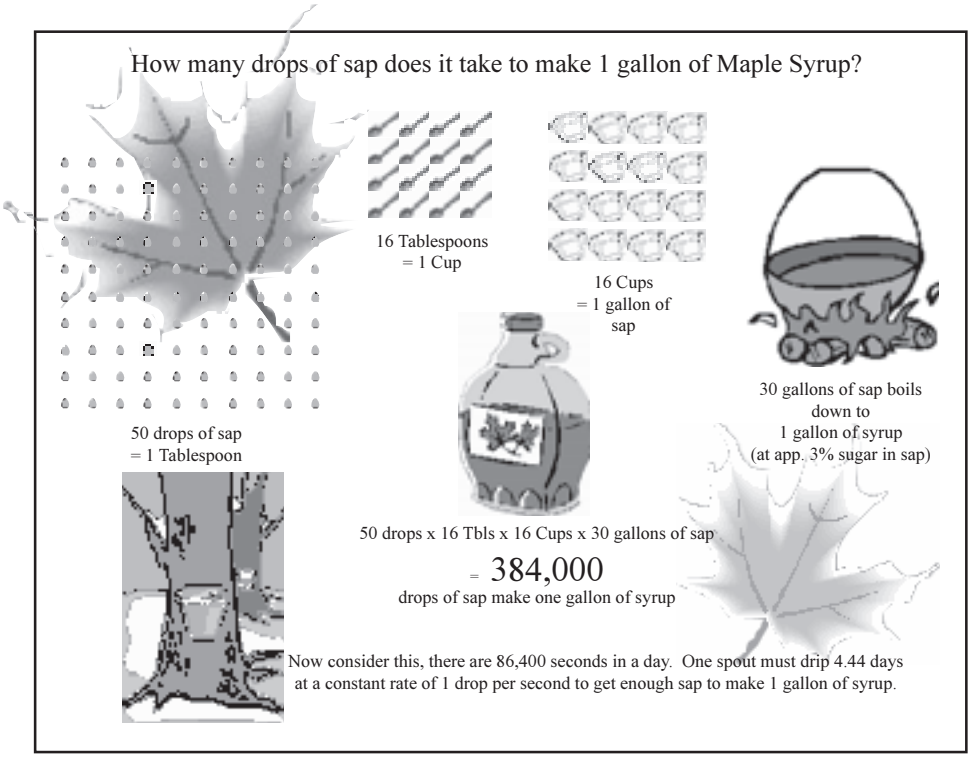
HOW MANY DROPS OF SAP TO MAKE 1 GALLON OF MAPLE SYRUP?

I am a "Maple Volunteer" at the MacKenzie Environmental Education Center in Poynette, WI (30 miles north of Madison). Our activities reach approximately 2000 school children each March when we host field visits to our sugar bush. We also have displays of how the Indians, the pioneers, and local farmers (circa 1875) made maple products.

In a recent issue you published a table that showed how many drops of maple sap were required to make one gallon of maple syrup. I gave that information to one of our volunteers who put graphics to it. The result is attached. It will become an interesting part our curriculum. If you can find a use for it, by all means do so. Please give credit to Alex Britzius for the artwork.

Regards

Donald R. Jackson



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