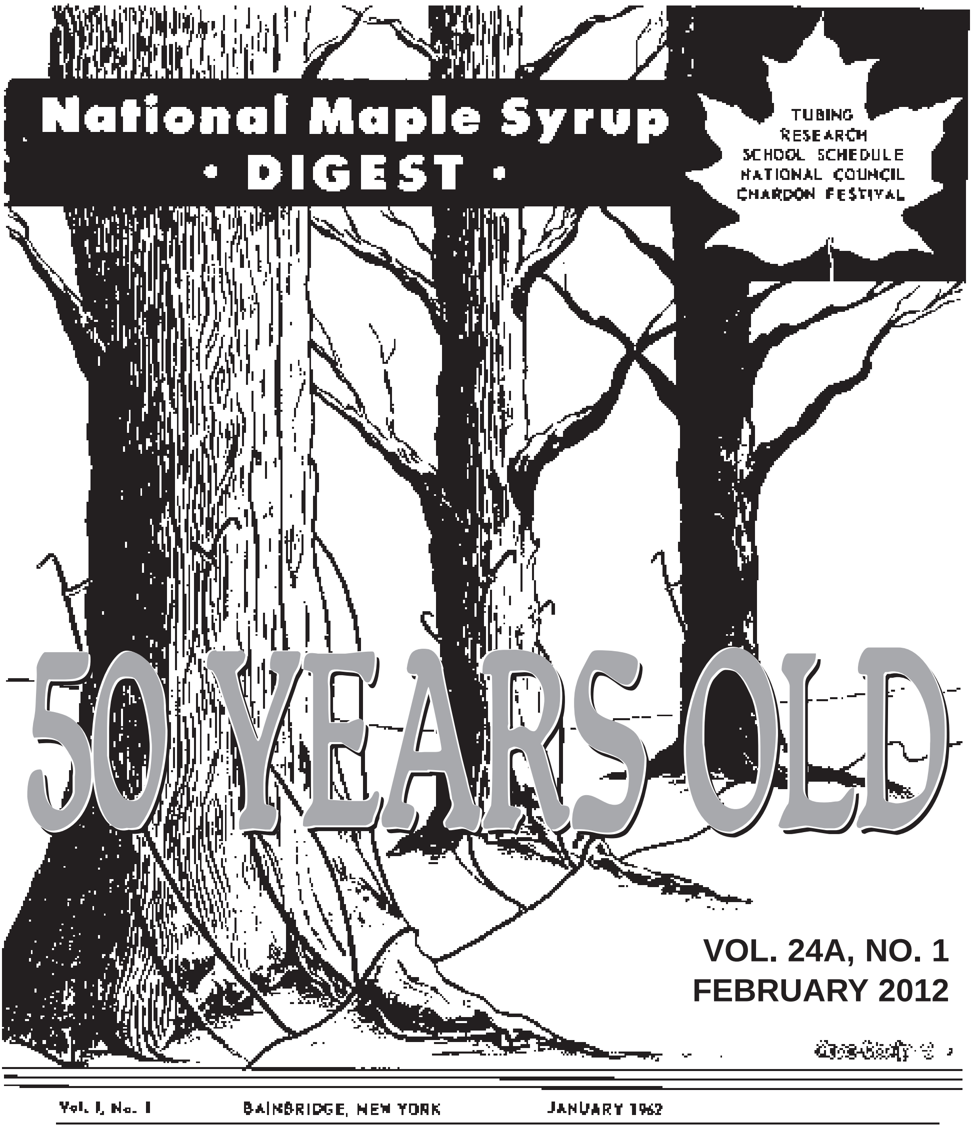

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COVER: First cover of the Digest, January 1962

GREETINGS FROM YOUR PRESIDENT

The holidays are here and already our thoughts are turning to the upcoming sugar season.

What will 2012 offer? Will we produce a bumper crop? What about the quality? And as production increases, will sales follow suit?

Will our pure, natural syrup be appreciated for its true value in the face of competition from substitutes? We should be proud of our product. We should sing its praises and get people to sample the delicious flavour for themselves, so they can taste the difference. Despite the pretenders invading the shelves, rest assured that our customers can taste the difference.

We also need to invest in research focused on increasing syrup quality. I hope that the manufacturers of sugaring equipment and containers and the companies in the transformation business continue to participate in this research by subscribing to our contribution policy.

We also need to continue the work begun with the IMSI to ensure that syrup, whether produced in the U.S. or Canada, can be recognized by consumers using a single grading system.

Our industry will always be faced with new challenges, and it's up to all of us to rise and meet them.

I wish you all an excellent sugaring season and prosperity for the new year.

Le temps des fêtes s'achève à peine et déjà nous pensons à la saison des sucres qui s'annonce.

Que sera la saison 2012? Produirons-nous une grande quantité de sirop? Sera-t-il très bon? La production de sirop augmente, est-ce que les ventes suivront la même courbe?

Notre sirop pur, sera-t-il apprécié à sa juste valeur nonobstant le prix des substituts? Nous devons être fiers du produit que nous fabriquons. Nous devons en vanter les mérites et le faire goûter afin que les gens sachent combien la saveur d'érable est importante. Malgré la présence de ces substituts qui envahissent les tablettes, soyons confiants que nos consommateurs en feront la différence.

Nous devons continuer de favoriser la recherche afin que s'accroisse la qualité de notre sirop. J'espère que les fabricants d'équipements d'érablière, les fabricants de contenants et les transformateurs continueront à participer à la recherche en souscrivant à notre politique de contribution.

Nous devrons aussi continuer le travail commencé avec l'IMSI afin que le sirop, qu'il soit produit aux USA ou au Canada, soit reconnu par les consommateurs sur la base des mêmes catégories.

Notre belle industrie a toujours de nouveaux défis à relever et notre travail à tous permet de les relever.

En terminant, je souhaite à tous une excellente saison des sucres et une année 2012 prospère.

Cécile B. Pichette
Présidente, NAMSC

FIFTY YEARS

With the mailing of the December issue, we completed 50 years of the Maple Syrup Digest. Here's to 50 more!

IMSI NEWS

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

As the calendar turns to 2012, it is appropriate for both the IMSI and the IMSI's membership to reflect on accomplishments of the organization over the past year. 2011 was a very busy year with work emphasis being focused primarily on:

- enhancing the IMSI's offerings and transfer of information in the French language,
- communications designed to raise awareness regarding potential misrepresentation of competing sweeteners in the marketplace,
- nutritional benefits of maple syrup initiative, and
- standardized grades and nomenclature initiative.

The organization also continues to place very high priority on the maintenance of their adulteration testing service which is available to the membership. There have been opportunities to enhance collaboration with the North American Maple Syrup Council (NAMSC), which both the IMSI and NAMSC have been in favour of. There is currently an excellent rapport between the Executive Committees of both organizations and their respective Executive Directors are in regular communication on issues of concern to maple syrup producers, maple packers and other maple industry stakeholders.

The IMSI's progress and accomplishments were summarized as part of the IMSI Annual meeting report and are outlined below.

Growing the IMSI Membership

The IMSI continues to outreach to potential IMSI members through Executive Committee activities and through the current IMSI membership. There has been significant growth in the IMSI membership over the past four years. This effort includes raising awareness regarding the existence of the IMSI, various project initiatives and reporting on accomplishments.

Enhancing French Translation and Information Transfer

In 2011, the IMSI established a Committee to review and make recommendations regarding the IMSI's offering of French language service and information transfer. It was recommended that summaries from all formal meetings would be made available in the French language. These summaries are being distributed to IMSI members and others who may benefit from this information and who are able to further disseminate the information within francophone maple communities. Other French translation of administrative and program materials will be completed on a priority basis and in consideration of available funding. The IMSI members are encouraged to offer assistance with translation and/or dissemination of this information. Those who assisted or have offered to assist the IMSI's French translation requirements in the future are specially thanked.

Adulteration Testing

The IMSI continues to administer an adulteration testing service for its membership and places high priority on this program. It is noteworthy that in 2011 the Vermont Agency of Agriculture, Food and Markets reported that one of the syrup samples submitted for adulteration testing using the IMSI's program was found to test positive for adulteration with test results indicating that the sample was 100% cane sugar. This case is being taken to court by the US Food and Drug Administration. This adulteration test finding was also considered when Vermont legislators recently introduced proposed legislation at the federal level to stiffen penalties, making adulteration of maple syrup a felony.

Misrepresentation of Syrup

The North American Maple Syrup Council (NAMSC) and the IMSI have formally communicated their concern to Pinnacle Foods regarding use of a container that is very similar to the Sugar Hill Jug for the marketing and sale of a table syrup under the brand name of "Log Cabin - All Natural Table Syrup". It is believed that Pinnacle Food's use of a traditional pure maple syrup jug creates confusion and misleads the consumer who could easily mistake the Log Cabin product for pure maple syrup, due to the characteristics of the jug. The Log Cabin jug has the same unique shape, color and graphics of our traditional container which has an established and longstanding identification to pure maple syrup. We believe that the use of this "trade dress" by Pinnacle creates confusion for consumers. There is also concern about shelf-placement of this product as well as other table or blended syrups with pure maple syrup in retail outlets. The concern is that blended maple syrup is often integrated or grouped with pure maple syrups in product displays in retail stores. The containers and product labels used can be misleading to consumers. The NAMSC and the IMSI have communicated their concern regarding shelf-placement to major food retailers in the United States and Canada. The IMSI is leading these efforts in cooperation with the NAMSC.

Standard Maple Grades and Nomenclature Initiative

Progress continues to be made in moving towards the implementation of the IMSI's Standard Grades and Nomenclature initiative. In 2011, the IMSI completed the regulatory submission in support of standard grades and distributed the submission to maple regulatory authorities at the federal and state/provincial levels in Canada and the United States. Operational market trials to engage maple producers and packers with the standard grading system were advanced in 2011. Activities focused on raising awareness among maple syrup industry stakeholders, in particular maple producers and packers, were also continued and enhanced. Market trial exposures and awareness activities will continue and be extended in 2012 as the IMSI awaits regulatory approvals in the United States and Canada.

Nutritional and Health Benefits of Maple Syrup

In 2011, the IMSI consolidated information related to the nutritional and health benefits of pure maple syrup and reviewed these materials. A poster and rack card have been developed, taking into account a review of this material, input from Health Canada and the US Food and Drug Administration, as well as input from IMSI members. It is planned that the IMSI's nutritional and health benefits position statement, scientific papers, and the poster and rack card will be available to the IMSI members in the January–March 2012 time period. A policy is currently being developed by the IMSI regarding availability of the poster and rack card information as well as a CD which will consolidate information which IMSI has brought together on the nutritional and health benefits of maple syrup.

Other IMSI Activities

The IMSI continues to provide an effective forum for ongoing communications, including quarterly Board of Directors Meetings held in both Canada and the United States as well as dealing with issues as they emerge on an ongoing basis.

The IMSI continues to administer the Lynn Reynolds Memorial Leadership award and the Golden Maple Leaf Awards.

The IMSI's Executive Director satisfies many requests for information and serves in an advisory role to the IMSI members and others on an ongoing basis. The IMSI Executive Committee meets regularly to map out and discuss the IMSI's program agenda and help address ongoing and emerging issues.

The Maple Digest readership may contact the IMSI's Executive Director Dave Chapeskie if they require information regarding the IMSI and the IMSI's program initiatives for 2012. Dave can be reached at agrofor@ripnet.com or 613-658-2329.

RELATIONSHIPS BETWEEN TUBING SYSTEM COMPONENT AGE AND SAP YIELD
A Preliminary Assessment

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INTRODUCTION

Although a number of factors affect maple sap flow in vacuum tubing systems, it has become increasingly apparent that sap yields are largely a function of two major influences: vacuum level at the taphole and taphole and tubing sanitation. Vacuum controls sap yield by heightening the pressure differential between the inside of the tree and the inside of the tubing system, therefore causing more sap to flow than otherwise would without vacuum (Heiligmann et al. 2006, Chapeskie and Staats 2006, Wilmot et al. 2007). Good vacuum is primarily a matter of proper tubing system design and installation, vacuum pump capability, and the control of leaks.

Taphole drying, the slowdown or cessation of sapflow, is the direct result of microbial contamination (Naghski and Willits 1955). A multi-year study at the UVM Proctor Maple Research Center demonstrated that tubing systems show fairly rapid reductions in sap yield as they age, and that these reductions are due to the level of tubing system contamination (Perkins, Stowe, and Wilmot 2010). Numerous research studies and abundant maple producer practice have adequately demonstrated that a wide variety of microbes rapidly colonize maple tubing systems (Lagacé et al. 2004, Figure 1), and that changes made in the tubing system aimed at improving sanitation in the immediate vicinity of tapholes (annually changing spout adapters, new droplines, Check-valve adapters, silver antimicrobial spouts) significantly increase sap yield (Perkins 2009, Perkins 2010, Childs 2010).

The objective of this study was to determine the strength of the relationship between the age of the major components of maple tubing systems and sap yield. Eventually a predictive model could be constructed to allow maple producers to evaluate their own tubing systems in order to judge potential improvements and determine the cost versus the benefits of making various changes.

MATERIALS AND METHODS

Maple producers using vacuum tubing systems for sap collection in Vermont and New York were asked to participate in a survey in January - June 2011 describing their tubing systems. A limited geographic area was used in order to limit the impacts of varying weather conditions across a wider area on sap yields. Over 250 surveys were distributed.

For the purposes of this experiment, each individual section of the collection system that was distinctly different (in terms of tubing age, cleaning method, or tap/taphole sanitation practice) and for which sap could be separately measured, was counted as a distinct individual system. Therefore, an individual maple producer could complete a survey for several "different" collection systems. Detailed descriptions of each system were required, including: number of taps, average tree diameter, type of spout used, age of spouts, average number of taps per lateral, vacuum level, type of releaser system, vacuum management style (on all the time, or on/off during season), single or dual-pipe system and sizes, age of mainlines, age of lateral lines, age of droplines, the percentage of droplines or lateral lines changed this year and last year, and sap yield. Producers were also asked to collect 10-20 3" pieces of dropline cut from the spout end of the dropline

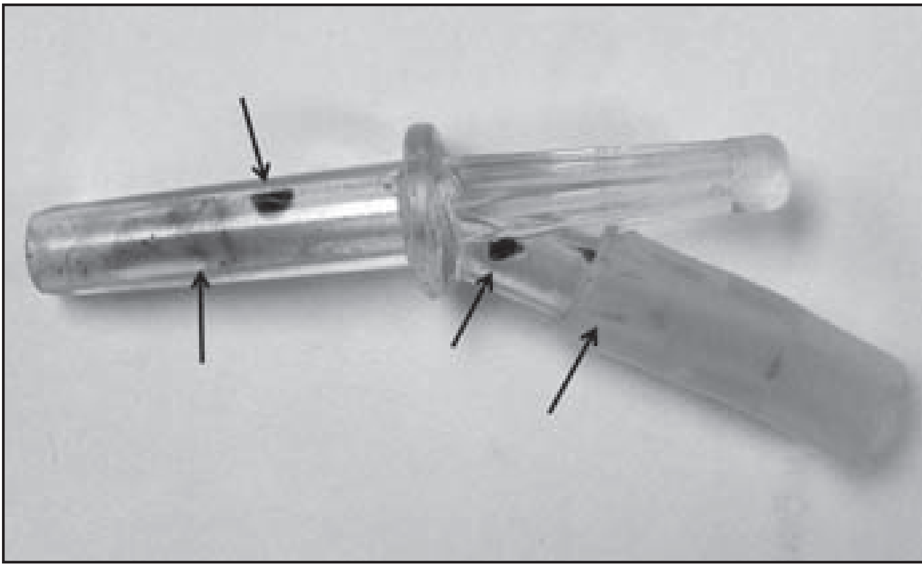

Figure 1. *Microbial contamination in a spout and 5/16" tubing after a single season of use. The recent introduction of clear spouts has made this problem more visible, however it is present even in opaque spouts. Arrows point to large microbial colonies on the inside of the spout and tubing.*

for each different tubing "system" during tapping for the 2011 season. These samples were to be placed into a sealed plastic bag (provided) and shipped via a pre-paid mailer to the UVM Proctor Maple Research Center for microbial analysis with a Charm Sciences© Firefly Luminometer. This device provides a rapid quantitative estimate of the amount of microbial contamination of surfaces based upon the amount of ATP (cellular energy compound in all living things) present, and has been shown to be useful in measuring microbial loads in maple sap (Lagacé et al. 2002).

Data were subjected to simple linear regression analysis to determine the relationships and trends between tubing system attributes and sap yield. The overall goal of this research was to begin to determine the quantitative relationships between tubing system properties and sap yields to help develop a predictive tool for maple producers to evaluate their systems to judge the possible gains in yield that might result from making modifications to their systems. This report is a preliminary assessment of the technique and initial results, and presents only a limited array of early results, focusing primarily on tubing system components (spout, dropline, lateral line, and mainline). A larger survey is planned which should help further develop our quantitative model.

RESULTS

Participation in this survey was relatively modest. A total of 42 surveys with tubing samples were returned. Of these, 33 provided enough complete data to be included in the analysis. The low response rate (over 250 surveys were distributed) precluded a detailed multiple regression analysis due to lack of statistical power, however the data acquired provide some information on general trends, and demonstrates that this technique, with an adequate sample size, might provide a useful approach for quantitative assessment of tubing systems to guide management decisions.

The relationships between individual tubing system component age and sap yield are presented in Figures 2A-2D. For each graph, the individual data points as well as the linear regression between the variables are shown. In addition, the R^2 value and slope are also presented. The R^2 value, or Coefficient of Determination, ranges from 0 to 1, and is an indicator of the strength of the relationship between two variables, with lower values (closer to 0) indicating less of a relationship, and higher values (closer to 1) indicating a stronger relationship. It is important to recognize that the R^2 is not an indicator of causation. In this case, tubing system component age can be used as an indicator or predictor of sap yield, but by itself, tubing system component age doesn't cause changes in yield. More likely, something related to tubing system age and use (probably microbial contamination level) actually causes the observed changes. Slope represents the change in one variable (in this case sap yield) as the other variable (tubing system component age) changes by one unit (in this case 1 year). The steeper the slope, the more rapidly the change occurs.

In addition, there is likely to be substantial interaction among the different tubing system component age variables that makes statistical analysis and interpretation difficult. For example, it is highly unlikely that any maple producer would put old spout and droplines on new mainlines, therefore it is not possible to directly observe and separate all possible (however unlikely) effects. Similarly, the vast majority of survey respondents replaced all or a majority of their spouts or spout adapters each year. Therefore the sample distribution is lower than would be optimal.

In looking at the individual components of a tubing system, we find that spouts/ spout adapters (Figure 2A) has a moderately high R^2 value (0.402). This can be interpreted as meaning that 40.2% of the sap yield can be explained by spout/spout adapter age. In addition, the steep slope of -7.3 (a loss of 7.3 gallons of sap per tap each year) shows that as spouts/spout adapters age, the loss in sap yield occurs quite rapidly. Therefore, if spouts/spout adapters are used for more than one season, there is a strong negative impact on sap yield. The rates observed in this study are considerably higher than those found in another project investigating the loss in sap yields as tubing systems age (Perkins, Stowe and Wilmot 2010), and may be related to the low sample size of spouts older than one year in this survey or may simply be a reflection of the experimental designs. Similar trends of reduced sap yield with tubing system component age are observed in the relationship between dropline age and sap yield (Figure 2B). Nearly half of sap yield (R^2 value of 0.487) is attributable to differences in dropline age. However, the lower slope of this relationship (-2.0 gal/year) indicates that increasing dropline age has a smaller negative impact on sap yield than does increasing spout or spout adapter age.

In contrast, the influence of lateral line age (Figure 2C) on sap yield is less than half as strong as that of spout/spout adapter or dropline age. The consequences of increasing lateral line age are relatively low, with the average loss of only 1.0 gal of sap per tap each year as lateral line ages. Mainline age appears to have very little influence on sap yield (Figure 2D).

A comparison of sap yields from producers using standard small spouts versus the Leader Check-valve spout adapter revealed an 18.9% increase in sap yield for those producers using Check-valve adapters.

Finally, although the range of vacuum level reported fell within a fairly narrow band (minimum 18" Hg, maximum 25" Hg), there was a significant positive relationship such that as vacuum level increased, sap yield increased at a rate of 6.5% for each inch of Hg vacuum pulled, which confirms the approximate magnitude of this relationship in previous findings (Wilmot, Perkins and van den Berg 2007).

DISCUSSION

The results presented in this preliminary assessment are consistent with recent reports

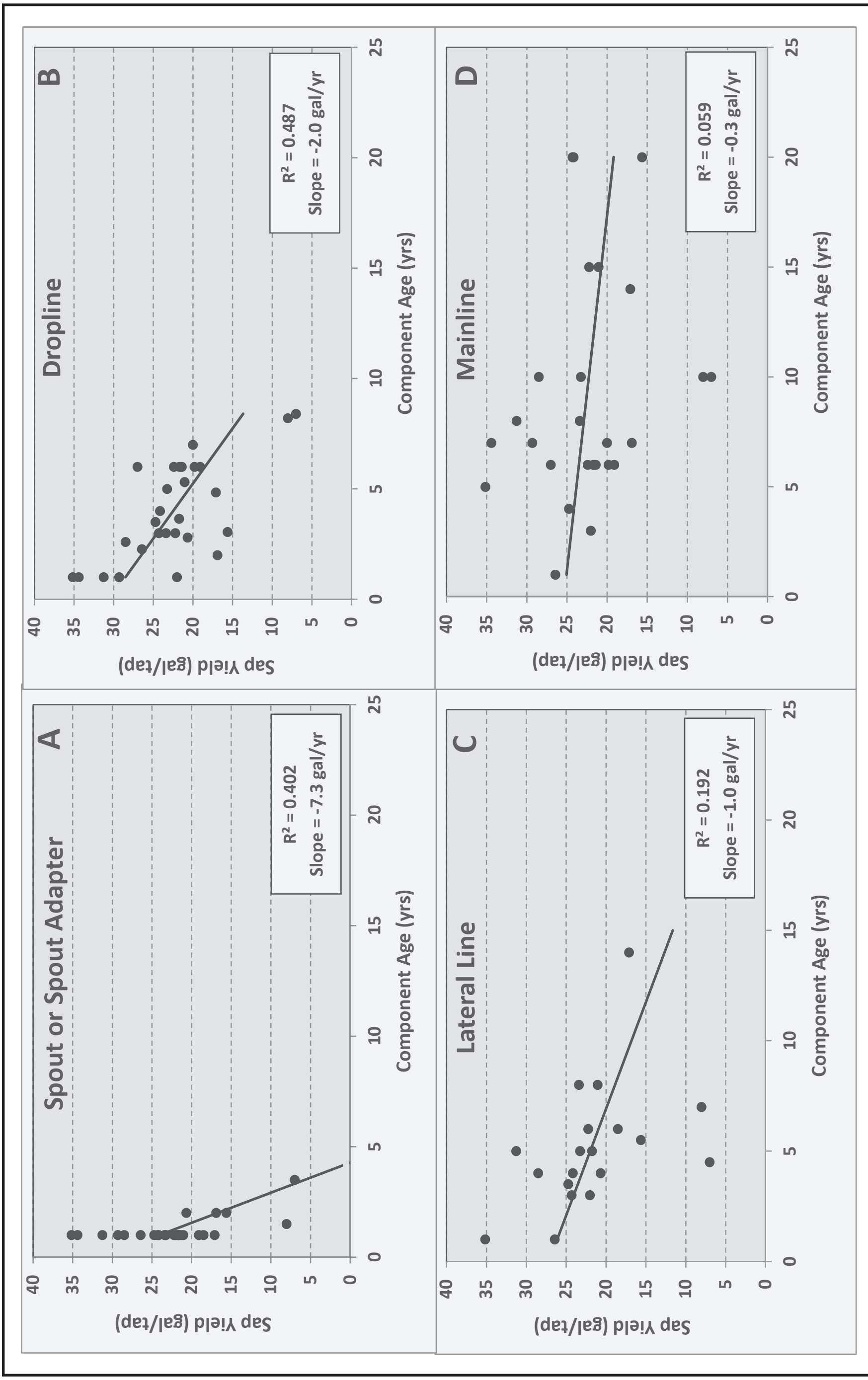

Figure 2. *Relationship between tubing system component age and sap yield (gal/tap) for spouts or spout adapters (A), dropline (B), lateral line (C) and mainline (D).*

that microbial contamination in parts of the vacuum sap collection system nearest the taphole have a strong influence on sap yield. Both spout/spout adapter age and dropline age strongly affect sap yield, although the impact of increasing spout age is 3.7 times greater than that of increasing dropline age (slopes of -7.3 gal/yr versus -2.0 gal/yr respectively).

If we assume the cost of a new spout adapter ranges from $0.15-0.35, it is readily apparent that it is economically advantageous to use a new spout adapter each season, with net profits of $3.30-3.50 per taphole (assuming sap value of $0.50/gallon and negligible costs for installing new adapters). On the other hand, although they have a moderately strong influence on yield, the economic case for installing new droplines is less clear. Given a slope of -2.0 gallons of sap per tap per year, putting in a new dropline each year would have to cost less than $1.00 (2 gallons of sap x $0.50/gallon) in order to simply break even. A dropline cost higher than $1.00 would result in an economic loss. Considering most maple producers replace tees when they install new droplines, it would be hard to justify replacing droplines every year, however the impact is additive, therefore a dropline replacement interval of every 2-3 years would likely result in a marginal profit. If we also factor in the labor cost of making the new drops, bringing them into the woods, their installation, and removal of old drops, then a dropline replacement interval of 4-6 years would likely be required to recoup costs and produce a net profit. The low relationship (R^2) and low impact (slope) of either lateral line or mainline aging and the high cost of replacement of these components strongly argues against replacement as a strategy for increasing sap yields. Instead, it is the useful lifespan of the materials and any breakdown of these components that dictates their periodic replacement.

The use of a new Check-valve spout each year instead of normal spouts changes the economic calculation considerably. If a maple producer can achieve nearly the same result through the replacement of a fairly inexpensive spout as they would through the replacement of both the spout and the dropline (and the tee as is common practice), then replacement of droplines would not be necessary as often, and it may be simpler and more cost effective to only replace drops approximately every 10 years or when an entire system is replaced due to breakdown.

Additionally, this project reinforces previous work that sap yield is linearly related to vacuum level (Wilmot, Perkins and van den Berg 2007). Therefore, in addition to good tubing system sanitation, achieving good vacuum is also important for producers wishing to achieve maximum yields in maple tubing systems.

ACKNOWLEDGMENTS

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NAMSC/IMSI ANNUAL MEETING

The annual Meetings of the North American Maple Syrup Council (NAMSC), the International Maple Syrup Institute (IMSI) and the Maple Syrup Producers Association of Connecticut (MSPAC) will be held October 22nd to 25th, 2012 at the Mystic Marriot Hotel and Spa in Groton, CT.

Tapping Into Connecticut is our theme. MSPAC is hosting the annual meetings. The last time we did this was in 1997. The meetings were held in The Ramada Inn, Meriden, CT.

The annual business meeting of the NAMCS and IMSI and MSPAC are planned with research and technical sessions, Companion tours and the state tour. Equipment and dealers from the maple industry will all be there. Maple syrup and photo contests will be held.

Journey way back in time, to discover the native and natural history of Southeastern Connecticut, long before the Europeans landed here. Set sail to a 19th century coastal village, and the Charles W. Morgan, the last of the tall whaling ships. Dive into the first nuclear powered sub, the Nautilus. This is just a ‘drop in the bucket’ of what we have planned.

So raise the gang plank, retrieve the mooring lines, set the main sail, and chart your course to Mystic Connecticut in October.

Please contact info@ctmaple.org if you wish to place an ad in the booklet.

For more info about this conference email Ron Wenzel at info@ctmaple.org.

2011 UPDATE OF MAPLE TUBING AND TAPHOLE SANITATION RESEARCH AT CORNELL

Stephen Childs, New York State Maple Specialist

During the 2011 maple sap season a variety of research trials were conducted at the Arnot Forest of Cornell University and in the woods of a number of cooperators both with vacuum and gravity systems. This research was primarily funded by the New York State Farm Viability Institute. Research conducted over the last five years has shown that significant increases in sap yield can be obtained by keeping the tap hole from contamination by bacteria and yeast. This contamination usually comes from an old spout or an old drop line. By replacing the spout and the 20 to 30 inch drop line in a tubing system, experiments have shown significant increase in yield each year regardless of seasonal conditions. These experiments were conducted with tubing that had been in place for 5 or more years. This condition of using aging tubing systems represents the current status of over 65% of the maple tubing systems in New York. Testing in 2007 and 2008 were only conducted on gravity systems.

In 2009 tests were again run on gravity systems where new spouts and drops were compared to old spouts and drops. The new spouts and drops produced 88% more sap for the season than the old spouts and drops. Old spouts and drops averaged 6.4 gallons of sap per tap while the new spouts and drops averaged 12 gallons of sap per tap. In 2009, check valves were installed into drop lines where both treatments had new spouts, then a check valve followed by either a new drop line or an old drop line. In this case the check valve seemed to keep the tap hole from contamination and both treatments had the same yield of about 10 gallons of sap per tap but two gallons less than where a new spout and drop were used. Also in 2009 a larger study was done with Breezie Maples Farm in Otsego County. Here about 2700 spouts and drops were replaced in one woods to compare with older spouts and drops in woods nearby on the same farm where vacuum held at about 21 inches and with the vacuum being shut off when sap in the system became frozen. In this case the updated woods out yielded neighbor woods in the same area on the same farm by producing 2.4 times more sap. When compared with the yield in the same woods the year before, the new spouts and drops produced 2.2 times more sap. In 2009 the updated woods produced 22 gallons of sap per tap while surrounding woods with old spouts and drops produced just 10.5 gallons of sap per tap. Records were also kept on the material and labor cost involved in updating the woods resulting in a total cost of about $2.12 cost to install each new tap and drop. Though this cost may seem high, the additional sap resulted in the production of an extra quart of syrup per tap or a retail value of between $10 to $18 per tap depending on sale price.

In 2010 replicated studies were done with both vacuum and gravity systems using drop and spout replacement, Leader Evaporator check valve spouts and imbedded silver spouts. With vacuum operating at about 15 inches Hg at the lateral line, a new spout and drop out produced old spouts and drops by 151%. Old spouts and drops averaging about 7.9 gallons of sap per tap while new spouts and drops averaged 19.8 gallons of sap per tap. Tests with a new check valve spout on an old drop verses an old spout on an old drop showed the check valve producing 114% more sap than an old spout and drop. Check valve treatments averaged 15.6 gallons of sap per tap while the old tap and drop averaged 7.9 gallons. Where a new silver spout on and old drop was compared to an old spout and drop the difference was 13.7 gallons of sap with the silver spout and 8.1 gallons from the old spout for an increase of 69% in sap yield. The final test was to compare a Leader check valve spout that had been used the previous year and then rinsed in water as a cleaning and compared with an old spout and drop. In this case only a 38% increase in yield was observed.

In 2010 replicated tests were also conducted on gravity systems. When a new check valve spout on an old drop line was compared to a new check valve on a new drop line the difference was a 18% yield improvement where the new drop was used. This would indicate that on the gravity system the check valve is giving the tap hole a lot of protection but the protection is not perfect. With a new drop line the check valve produced 5.9 gallons of sap per tap while the check valve on an old drop line produced just 5 gallons per tap. Where a new spout and drop were compared to old spout and drop the result was 76% more sap. The new spout and drop yielded 6 gallons of sap per tap vs. the old spout and drop which produced 3.4 gallons of sap per tap. Where a silver spout on a new drop was compared with a silver spout and old drop the difference was just 13% indicating that the silver spout provided significant protections against taphole contamination from the old drop line. The new drop with silver spout resulted in 4.6 gallons of sap per tap while the old drop with a silver spout yielded 5.2 gallons of sap.

The replicated tests run in 2011 used the same system of two taps per tree each tap with a different treatment used in prior years. The following picture shows a typical tapping set up, in this case a new spout and drop next to an old spout and drop located 8" to 10" apart to keep the orientation of the two taps about the same.

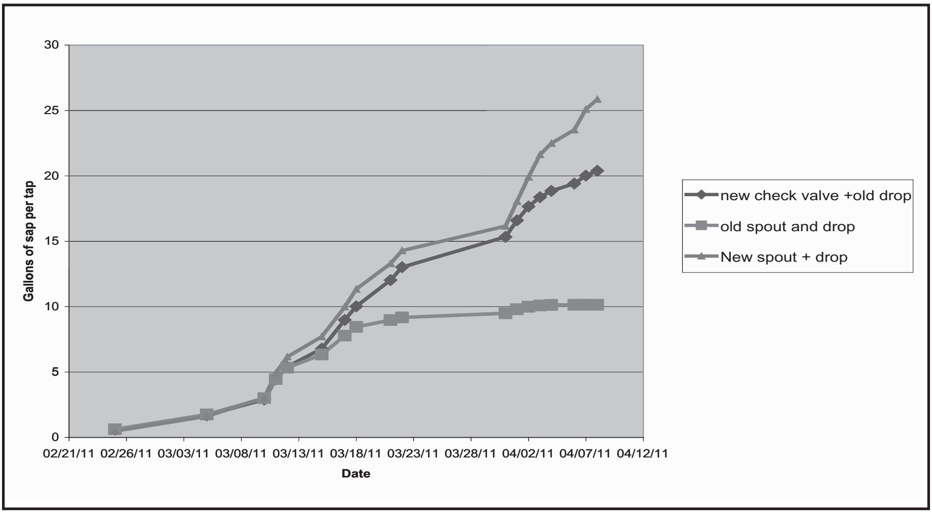
With vacuum held at about 16" to 17" Hg at the lateral line the following results were measured. Where the test was new spouts and new drops vs. old spouts and old drops, the new spout and drop out yielded the old by 120% or 2.2 times or 14.1 more gallons of sap per tap than the old spout and drops.

Where the test was a new check valve spout and old drop compared with an old spout and old drop, the check valve treatment produced 101% or 2 times or 10.2 more gallons of sap per tap than the old spout and drop.

For the sake of a broader comparison, the new spout and drop produced more than the new check valve on an old drop as reflected in Figure 1.

In 2010 a treatment was set up using a new silver spout on an old drop compared to

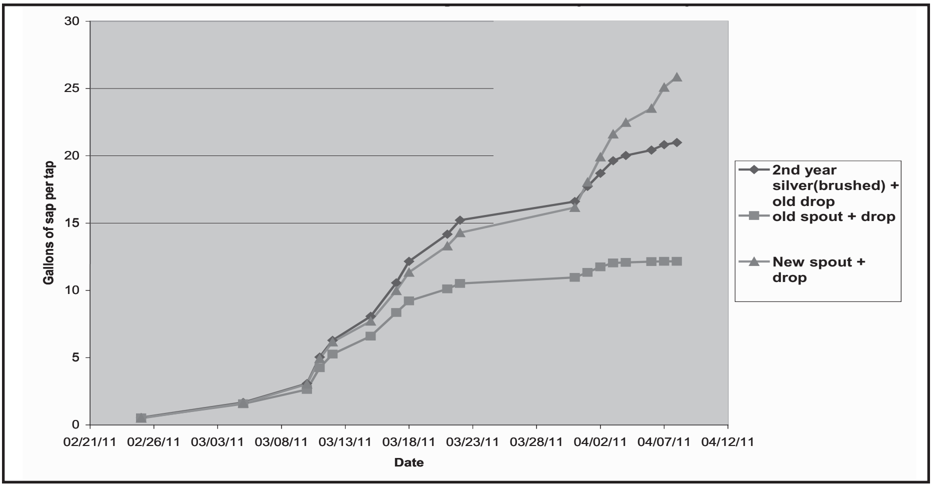
Figure 1. Vacuum: Check valve vs. old vs. new



an old spout and drop with the result showing a 69% increase in sap flow over the season where the silver spout was used. In 2011 the same systems were used only a stiff 5/16" brush was scrubbed into the silver spout. So the silver spouts were being used for the second year with the same old droplines that were used in 2010 still in place. In this case the second season brushed silver spouts and old drops produced 72% or 1.7 times or 8.8 more gallons of sap per tap than the old spout and old drops.

Again for the sake of comparison the results of new spouts and new drops are added to the graph for comparison. See Figure 2.

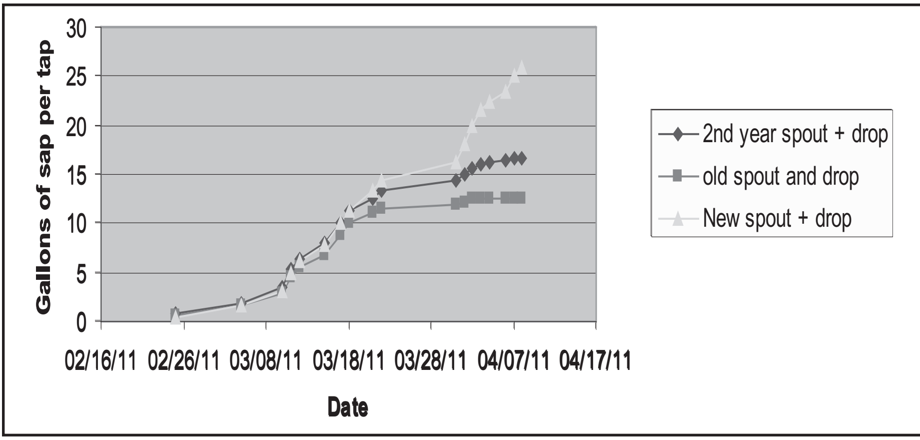
Figure 2. Vacuum: new vs. 2nd year silver (brushed) vs. old



Once a maple producer has updated his tubing system by replacing spouts and drops the key question is how soon does that need to be done again to maintain the highest profitability of that tubing system. For how many years is there a production benefit and how big is that benefit? In 2011 under vacuum a treatment of old spouts and drops was compared with spouts and drops in their second season. The second year spout and drops produced just 31% or 1.3 times or 3.9 gallons of sap more than the old spout and drops.

When compared to the new spout and drop results from nearby tests we see that the second year spouts and drops have lost significant productivity in just the second season of use. See Figure 3.

Figure 3. Vacuum 2nd year vs. old vs. new



In the 2010 season this same test was run. Only in the gravity treatments were results more disappointing for those looking for lasting results. However, a similar treatment was conducted with one replication on one of the cooperator sites with interesting results. At this cooperator the vacuum was held at 22" Hg and second season spouts and drops were compared with a treatment of new spouts and new drops. In this case the second year spout and drops slightly outperformed the new spout and drops.

In 2011 tests were conducted comparing a new silver extender spout on old drops vs new spout and new drops. In this case the new spouts produced 28% or 1.3 times or 4.7 more gallons of sap per tap than the silver extender spout on old drops. When compared to the average of old spouts and old drops in the same area the silver extender would fall a little better than half way between new spout and drop and old spouts and drops as seen in Figures 4A and 4B.

A general conclusion to the tests with the various spout and drop combinations is that most any action taken to protect the tap hole from bacteria and yeast being pulled back in during freezing weather when the tree is experiencing internal negative or vacuum pressure results in significant production increases. Figuring out which system pays best under given conditions is the maple producer's challenge. See Figure 5.

A new check valve on old drop lines was tested against a new spout and drop line. The new spout and drops yielded 21% or 1.8 times or 1.8 more gallons of sap per tap than a check valve with old drops.

This would actually represent fairly good protection of the tap hole on the part of the check valve spout. This is fairly easy to see if we include the average of yield from old spouts and drops from the replications in the same area. See Figure 6.

Spouts and drops that were new in 2010 were used for the second year in 2011 and

Figure 4A. Vacuum: Silver extender = old drop vs. new spout + drop

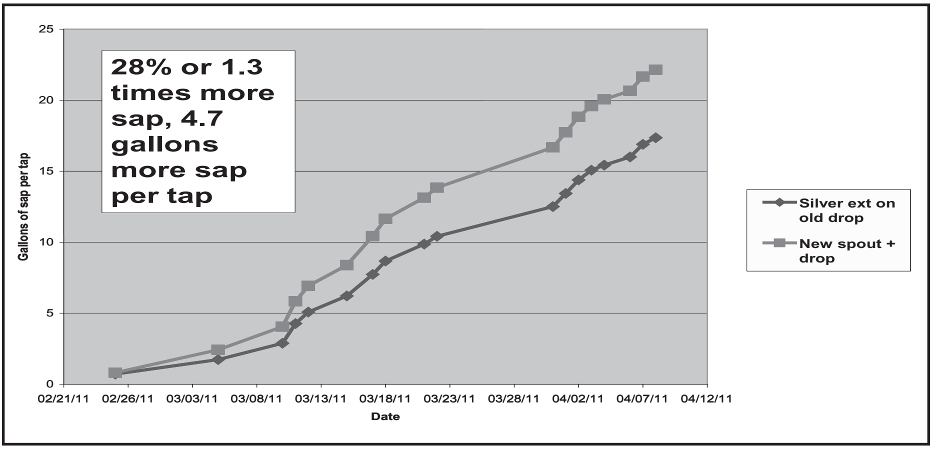
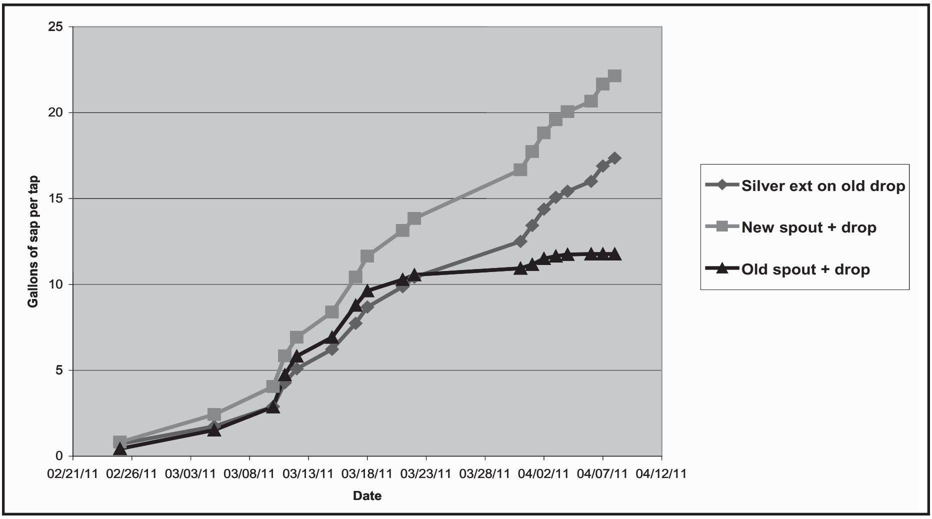


Figure 4B. Vacuum: Silver extender + old drop vs. new vs. old



compared with old spouts and drops. In this case the second year spout and drops yielded 100% or 2 times or 4 gallons more sap than the old spouts and drops did as is reflected in Figure 7.

This seems like an excellent result except when we compare it with the yield result experienced with new spout and new drop from nearby replicates. By adding that data to the chart below it is easy to see that the two year old spout and drops was just a little better than half the yield improvement experienced with the new spout and drop. See Figure 8.

The performance of the second year spout and drop was much better in 2011 than what was recorded in 2010 as reflected in Figure 9. The weather in 2010 warmed into the 50's and above much earlier than it did in 2011. That may be a key factor in the kind of results one could expect experience with second year collection equipment. See Figure 9.

Figure 5. Gravity: New spout + drop vs. old spout + drop

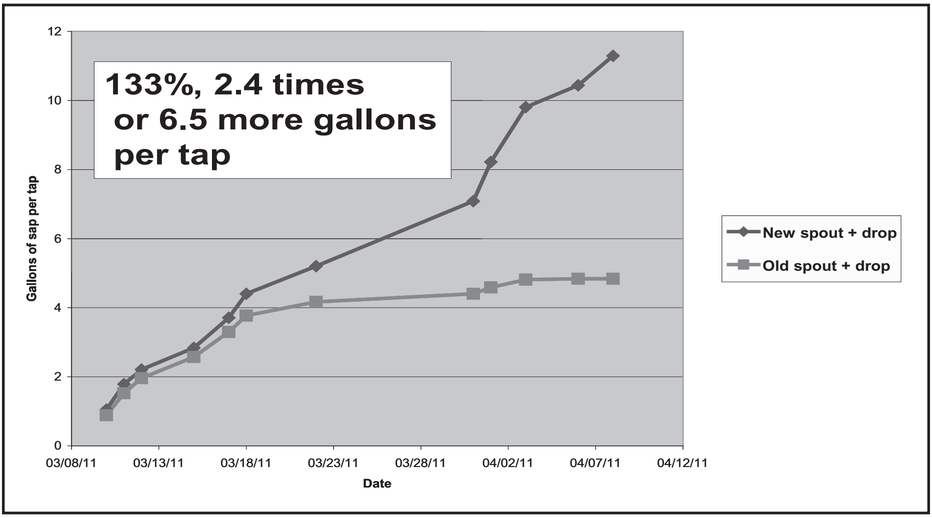
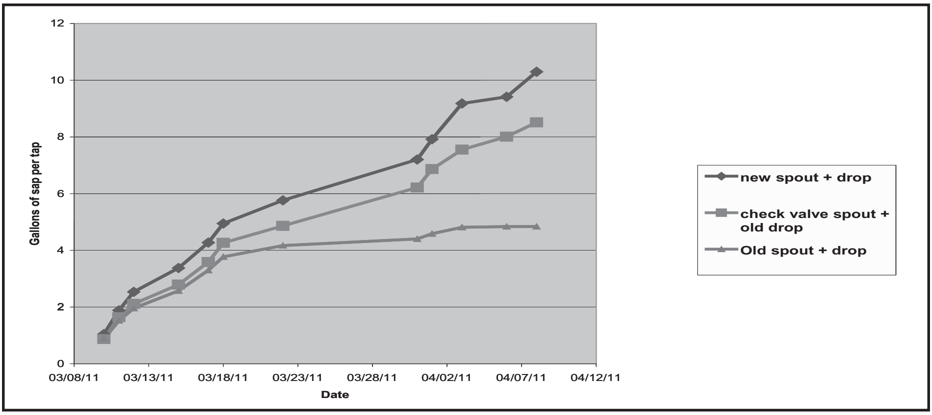


Figure 6. Gravity: New vs. check valve vs. old



Silver spouts were tested on a gravity system where a second year silver spout on a second year drop was compared with a new silver spout on old drops. From Figure 10 it is clear that the second year silver spout and second year drop yield was comparable to a new spout and drop. In this case the second year silver spout was not brushed or cleaned in any way. A new silver spout on an old drop yielded about two gallons or 22% less sap per tap than a new spout and drop did but 2.2 times or 125% more sap than an old spout and drop.

As was observed in the vacuum tests, with gravity systems all attempts to protect the tap from contamination on old spouts or sap flowing back from contaminated spouts and drops resulted in significant improvements to sap production. The challenge is for the maple producer to determine which practice is most cost effective for them and implement a taphole sanitation practice.

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Figure 7. Gravity 2nd year spout + drop vs. old spout + drop

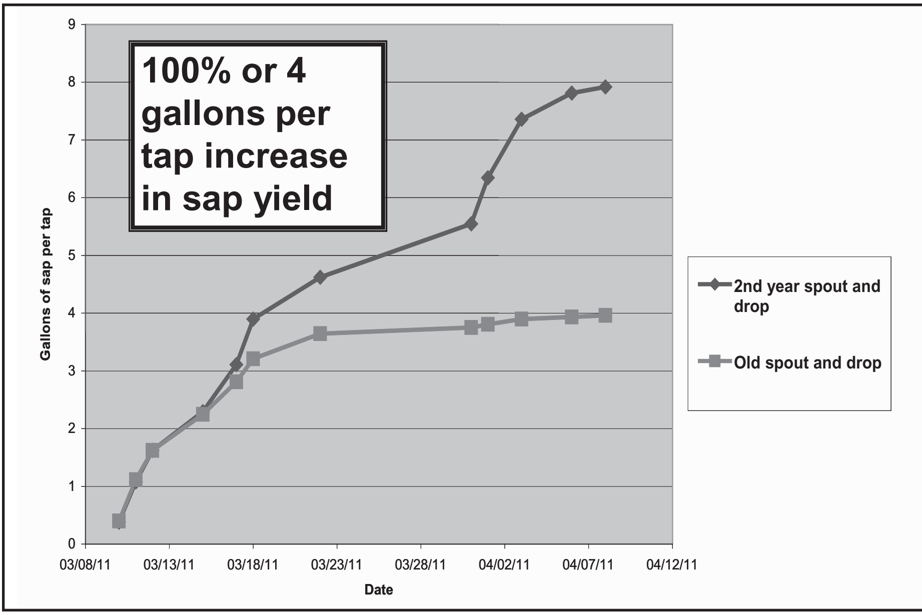

Figure 8. Gravity: 2nd year vs. old vs. new

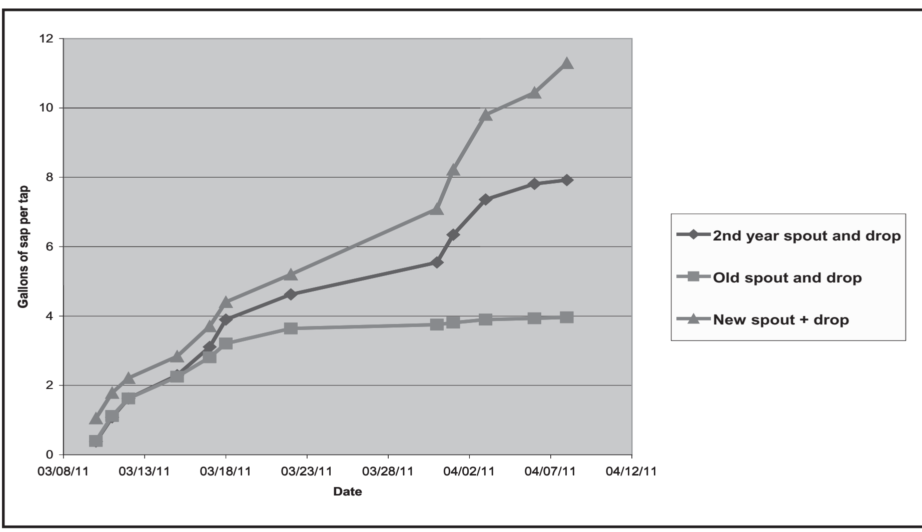

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Figure 9. 2 year old spout and tap vs. old tap and drop - gravity

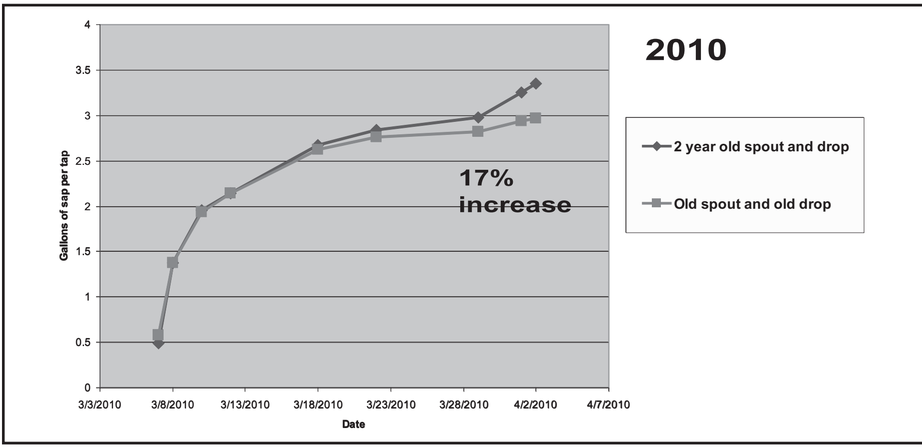
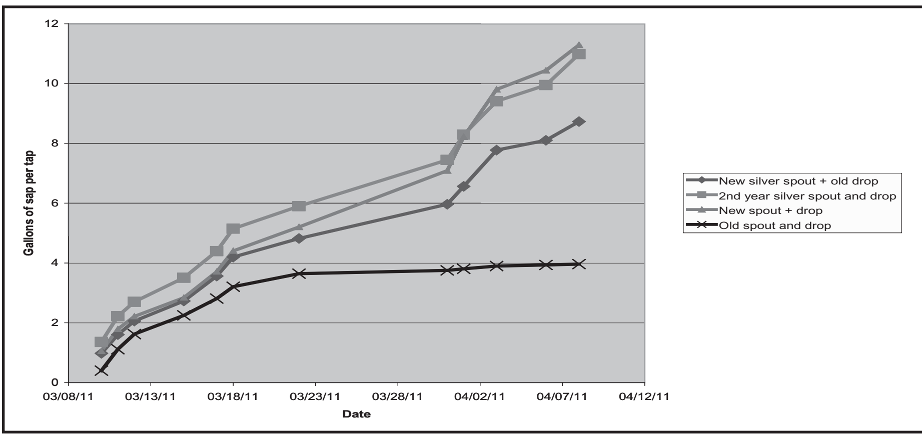
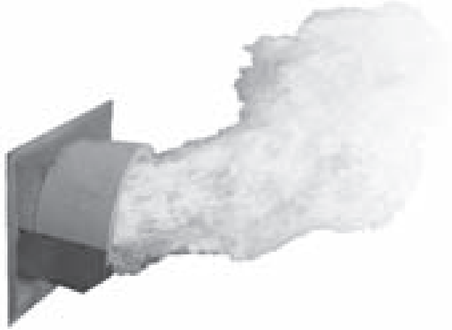
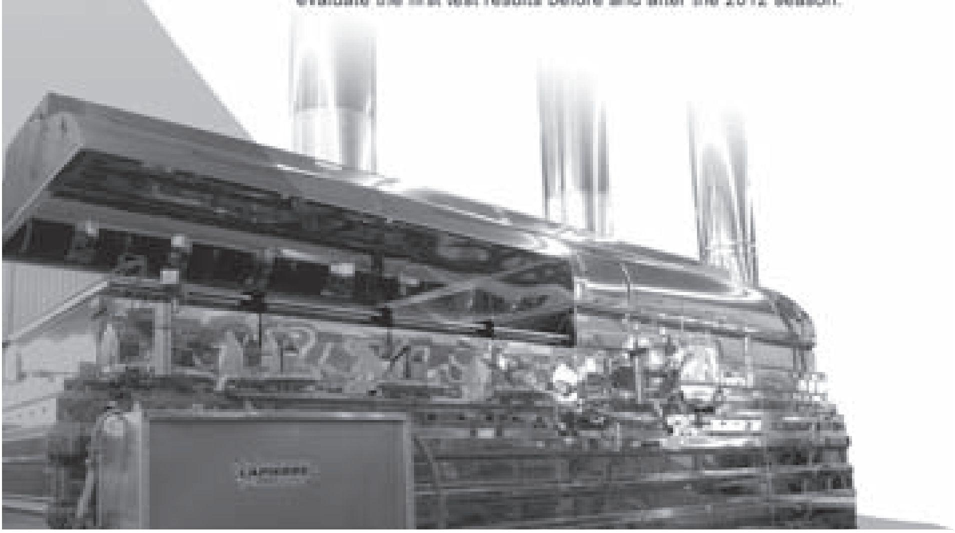


Figure 10. Gravity: Silver spout comparison







A NEW METHOD FOR PRICING SAP

By: Michael Farrell, Cornell Maple Program

How do you know what to pay for sap? The *Maple Digest* has traditionally published sap prices each year in a table that is based on the sugar concentration of the sap. While you may think that sap pricing should be relatively simple and easy to understand, there are actually many factors that can and should affect sap prices. This article presents a new method for pricing sap and explains how it differs from the traditional pricing guidelines that have been posted annually in the *Digest*. Because there are other variables besides sap sugar content to consider, this article may seem a bit confusing at first. However, if you read through it carefully and experiment with the sap pricing table (available as a download from the Cornell Maple program website), you should be able to fully comprehend all of the concepts and ideas presented here.

First of all, it is important to understand that since sap is the raw material (and only ingredient) necessary in producing maple syrup, the value of the sap should be directly tied to the value of syrup (using bulk syrup prices). If sap pricing is based solely on sugar content, it only accounts for how many gallons of sap are needed to produce a gallon of syrup. In actuality, pricing should also be based upon the quality of syrup produced from that sap, the bulk prices for the grade of syrup produced, the cost of converting the raw sap to syrup, whether the sap is delivered or needs to be picked up, and the distribution of syrup (or bulk syrup revenues) between the person who gathers the sap and the person who processes that sap into syrup. In order to account for these additional variables, I developed an Excel-based sap price table that can be downloaded from the Cornell Maple Program website at http://maple.dnr.cornell.edu/sapbuying.htm. Downloading the spreadsheet and experimenting with it will greatly improve your understanding of sap pricing and the variables involved.

Once you have downloaded the spreadsheet, the only variable you need to input a value for is the "Percentage of Bulk Syrup Price Provided to Sap Seller" - this determines how to distribute the syrup (or syrup revenues) between the sap buyer and seller. Using this value, the spreadsheet does the rest of the work calculating sap prices based on various combinations of sap sugar content and bulk syrup prices. The formula used to determine the price of a gallon of sap is as follows:

= ((1/(87.1/ sap sugar content))*11.1382)* % distribution of syrup revenues * bulk syrup price

Table 1 provides a snapshot of the table when the sap seller receives 50% of the bulk price of syrup that is produced. This was chosen as the default value since it is the most commonly reported method for distributing syrup by people who boil sap "on shares". Once you download the spreadsheet, you can enter in whatever value works for your situation and the sap prices will change accordingly. If the sap seller gets more than 50% of the syrup revenues, the prices will go up. Likewise, if the sap seller gets less than 50% of the syrup revenues, then of course the sap prices would be less.

Table 1. *Sap pricing table when the percentage of bulk syrup revenues provided to sap seller is 50%. Values are provided in the table as $/gallon of sap.*

Sap Sugar Content (%)	Bulk Syrup Price ($/lb)													
	$1.40	$1.60	$1.80	$2.00	$2.20	$2.40	$2.60	$2.80	$3.00	$3.20	$3.40	$3.60	$3.80	$4.00
1	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.26
1.1	0.10	0.11	0.13	0.14	0.15	0.17	0.18	0.20	0.21	0.23	0.24	0.25	0.27	0.28
1.2	0.11	0.12	0.14	0.15	0.17	0.18	0.20	0.21	0.23	0.25	0.26	0.28	0.29	0.31
1.3	0.12	0.13	0.15	0.17	0.18	0.20	0.22	0.23	0.25	0.27	0.28	0.30	0.32	0.33
1.4	0.13	0.14	0.16	0.18	0.20	0.21	0.23	0.25	0.27	0.29	0.30	0.32	0.34	0.36
1.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.36	0.38
1.6	0.14	0.16	0.18	0.20	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41
1.7	0.15	0.17	0.20	0.22	0.24	0.26	0.28	0.30	0.33	0.35	0.37	0.39	0.41	0.43
1.8	0.16	0.18	0.21	0.23	0.25	0.28	0.30	0.32	0.35	0.37	0.39	0.41	0.44	0.46
1.9	0.17	0.19	0.22	0.24	0.27	0.29	0.32	0.34	0.36	0.39	0.41	0.44	0.46	0.49
2	0.18	0.20	0.23	0.26	0.28	0.31	0.33	0.36	0.38	0.41	0.43	0.46	0.49	0.51
2.1	0.19	0.21	0.24	0.27	0.30	0.32	0.35	0.38	0.40	0.43	0.46	0.48	0.51	0.54
2.2	0.20	0.23	0.25	0.28	0.31	0.34	0.37	0.39	0.42	0.45	0.48	0.51	0.53	0.56
2.3	0.21	0.24	0.26	0.29	0.32	0.35	0.38	0.41	0.44	0.47	0.50	0.53	0.56	0.59
2.4	0.21	0.25	0.28	0.31	0.34	0.37	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.61
2.5	0.22	0.26	0.29	0.32	0.35	0.38	0.42	0.45	0.48	0.51	0.54	0.58	0.61	0.64
2.6	0.23	0.27	0.30	0.33	0.37	0.40	0.43	0.47	0.50	0.53	0.57	0.60	0.63	0.66
2.7	0.24	0.28	0.31	0.35	0.38	0.41	0.45	0.48	0.52	0.55	0.59	0.62	0.66	0.69
2.8	0.25	0.29	0.32	0.36	0.39	0.43	0.47	0.50	0.54	0.57	0.61	0.64	0.68	0.72
2.9	0.26	0.30	0.33	0.37	0.41	0.45	0.48	0.52	0.56	0.59	0.63	0.67	0.70	0.74
3	0.27	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.58	0.61	0.65	0.69	0.73	0.77
3.1	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.55	0.59	0.63	0.67	0.71	0.75	0.79
3.2	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.57	0.61	0.65	0.70	0.74	0.78	0.82
3.3	0.30	0.34	0.38	0.42	0.46	0.51	0.55	0.59	0.63	0.68	0.72	0.76	0.80	0.84
3.4	0.30	0.35	0.39	0.43	0.48	0.52	0.57	0.61	0.65	0.70	0.74	0.78	0.83	0.87
3.5	0.31	0.36	0.40	0.45	0.49	0.54	0.58	0.63	0.67	0.72	0.76	0.81	0.85	0.90
3.6	0.32	0.37	0.41	0.46	0.51	0.55	0.60	0.64	0.69	0.74	0.78	0.83	0.87	0.92
3.7	0.33	0.38	0.43	0.47	0.52	0.57	0.62	0.66	0.71	0.76	0.80	0.85	0.90	0.95
3.8	0.34	0.39	0.44	0.49	0.53	0.58	0.63	0.68	0.73	0.78	0.83	0.87	0.92	0.97
3.9	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
4	0.36	0.41	0.46	0.51	0.56	0.61	0.66	0.72	0.77	0.82	0.87	0.92	0.97	1.02

Details of the Sap Price Table

In the sap pricing table presented in this article, sap sugar concentrations range from 1-4% at 0.1% intervals while bulk syrup prices range from $1.40 to $4.00/lb at $0.20 intervals. You can match up the sugar concentration and bulk syrup prices to figure out how much a gallon of sap is worth. The table provides the price per gallon of sap based on these two variables and whatever value is entered in for "the percentage of the bulk price of syrup given to the sap seller". In this example, that value is set to 50% and the sap prices reflect this equal sharing of revenues throughout.

There are a few important observations to be made about the sap pricing table. Not surprisingly, the higher the sugar concentration of the sap, the more valuable the sap is. Likewise, the greater the price of bulk syrup, the more money the sap is worth. For example, consider a gallon of sap that contains 2% sugar. If bulk syrup was selling for $3.00/lb, then the sap would be worth $0.38/gallon. If bulk prices were $2.20/lb, then the sap would only be worth $0.28/gallon. While this is only $0.10/gallon, that money adds up quickly, especially when thousands of gallons of sap are being bought and sold.

Since individual sugarmakers have no control over bulk syrup prices, rather than locking in a set price for sap before the season starts, it may be better to just agree on how to split the revenues once the syrup is sold. Waiting until the end of the season to be paid would be difficult for folks who want to know the prices beforehand and be paid whenever they deliver a load of sap. However, if the sap seller can wait for payment until after bulk syrup prices are set and/or the syrup is sold, then it could allow for a more equitable sharing of revenues. One possible compromise is to estimate what bulk prices will be before the season and then adjust payments (as needed) if the bulk prices wind up being different than what you thought they would be. This protects both parties from fluctuations in the bulk syrup market.

Distribution of Syrup Revenue using *Maple Digest* Prices

When using the method described in this article, you don't necessarily have to understand the complicated formulas that determine the sap prices. The only thing you really need to figure out is how to split the revenues between the sap seller and buyer- the spreadsheet does all of the calculations for you. The majority of people I have talked to either do a 50/50 split on the syrup produced, or try to figure out what the syrup is worth and split the revenues equally. How you decide to split the revenues should be based largely on how much it costs you to process the sap, whether you have to pick it up or it comes delivered to your sugarhouse, and the personal relationship you have with the sap seller. I've heard from many people who would like to split revenues on a 50/50 basis and also use the sap prices posted in the *Maple Digest* to pay their suppliers. However, this practice rarely winds up with a 50/50 split between sap sellers and buyers. Table 2 shows the percentage of the syrup revenues that winds up going to the sap seller using the 2009-2011 Digest prices based on various combinations of sap sugar content and bulk syrup prices.

Table 2. *Percentage of bulk syrup revenues given to sap seller when using the Maple Digest sap prices from 2009-2011. The values are given for different combinations of sap sugar concentration (SSC) and bulk syrup prices. For instance, when bulk syrup is $2.60/lb and SSC is 2.1, the sap seller receives 50% of bulk syrup revenues.*

	Bulk Syrup Prices ($/lb)													
Sap Sugar Content (%)	**$ 1.40**	**$ 1.60**	**$ 1.80**	**$ 2.00**	**$ 2.20**	**$ 2.40**	**$ 2.60**	**$ 2.80**	**$ 3.00**	**$ 3.20**	**$ 3.40**	**$ 3.60**	**$ 3.80**	**$ 4.00**
1	26%	22%	20%	20%	18%	15%	15%	14%	13%	13%	12%	11%	11%	10%
1.1	40%	34%	30%	30%	26%	23%	23%	20%	18%	18%	16%	15%	15%	15%
1.2	50%	45%	40%	36%	32%	30%	27%	26%	24%	23%	21%	19%	19%	18%
1.3	60%	53%	48%	42%	37%	35%	33%	30%	29%	27%	25%	23%	22%	21%
1.4	68%	60%	54%	48%	42%	39%	37%	34%	32%	30%	28%	27%	25%	24%
1.5	75%	65%	59%	51%	47%	44%	41%	38%	35%	33%	30%	29%	27%	26%
1.6	80%	70%	62%	55%	50%	46%	43%	40%	37%	35%	33%	31%	29%	28%
1.7	83%	72%	65%	58%	52%	48%	45%	41%	38%	36%	34%	32%	30%	29%
1.8	86%	75%	68%	60%	55%	50%	46%	43%	40%	38%	36%	34%	32%	30%
1.9	87%	78%	69%	62%	57%	52%	47%	44%	41%	39%	36%	34%	33%	31%
2	91%	80%	71%	64%	58%	53%	49%	45%	42%	40%	37%	35%	34%	32%
2.1	92%	82%	72%	65%	60%	55%	50%	46%	43%	41%	38%	36%	34%	33%
2.2	96%	84%	75%	67%	61%	56%	52%	48%	45%	42%	40%	38%	36%	34%
2.3	98%	85%	75%	68%	62%	57%	52%	49%	45%	42%	40%	38%	36%	34%
2.4	100%	87%	77%	70%	63%	58%	54%	50%	46%	43%	41%	39%	37%	35%
2.5	101%	88%	78%	70%	64%	59%	54%	51%	47%	44%	41%	39%	37%	35%
2.6	103%	90%	80%	72%	65%	60%	55%	52%	48%	45%	43%	40%	38%	36%
2.7	104%	91%	80%	72%	66%	60%	56%	52%	48%	45%	43%	40%	38%	36%
2.8	105%	92%	82%	74%	67%	62%	57%	53%	49%	46%	43%	41%	39%	37%
2.9	106%	92%	83%	74%	67%	62%	57%	53%	49%	46%	43%	41%	39%	37%
3	107%	94%	83%	75%	69%	62%	58%	53%	50%	46%	43%	41%	40%	37%
3.1	108%	94%	84%	76%	69%	63%	59%	54%	50%	47%	45%	42%	40%	38%
3.2	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	40%	38%
3.3	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	40%	38%
3.4	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	40%	39%
3.5	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	40%	39%
3.6	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	40%	39%
3.7	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	41%	39%
3.8	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	41%	39%
3.9	110%	96%	85%	77%	70%	64%	59%	55%	51%	48%	45%	43%	41%	39%
4	110%	96%	86%	77%	70%	64%	59%	55%	51%	48%	45%	43%	41%	39%

At the current prices for bulk syrup and average sugar contents, the distribution of syrup revenues tends to hover around 50%. However, if bulk syrup prices are low, using the typical Digest prices results in distributions to the sap seller much higher than 50% of the bulk syrup revenues. On the contrary, if bulk syrup prices are higher than expected, the sap seller winds up getting much less than 50% of syrup revenues. When considering sap sweetness, low sugar sap winds up giving far less than 50% to the sap seller whereas high sugar sap results in distributions that exceed 50% in most cases. This phenomenon occurs because the Digest prices are weighted to pay more for sweet sap and proportionately less for low sugar content sap. It takes less time and fuel to process sweet sap than it does low sugar sap, and sweeter sap usually tends to make higher quality syrup, so sap sellers are compensated proportionately more for sweeter sap.

While this practice makes a lot of sense for small producers, it is not as necessary for large producers with energy efficient ROs and evaporators. The fuel and time costs are much lower when you have efficient equipment, so you don't need to offer a lot less money for lower sugar content sap than you do for high sugar sap. On the other hand, for small producers who spend a lot of time and fuel processing sap- this type of stratified distribution makes sense.

Advanced Distribution Calculator

Because it often makes sense to change the revenue distribution based on sap sugar content (SSC), I have created an advanced sap price table that allows users to add this feature. It lets you set the target figure for your "normal" distribution of syrup revenues and then specify the % change in revenue distribution for a given % change in SSC. Producers who have relatively high fuel and time costs for processing sap may want to tie revenue distribution closely with SSC. On the other hand, producers who can process sap quickly and cost-effectively may not need to change the revenue distribution very much based on sap sugar content. This advanced calculator allows you to tailor the revenue distribution according to your particular situation. If you would like to use this feature when pricing sap, you can download the sap pricing file from the Cornell Maple website and click on the worksheet entitled "advanced % calculator". If you don't use this feature, all of the syrup revenues will be allocated at the one percentage you specify. However, if you would like to pay less for low sugar sap and are willing to pay more for higher sugar sap, then you should definitely use the advanced calculator.

The Economics of Buying Sap

Just talking about pricing can get complicated enough, so I have only focused on sap prices in this article. The next installment will discuss the economics of buying sap- how to determine if it makes economic sense for you to buy sap and what percentage of the syrup (or syrup revenues) you can offer to folks who sell you sap. As a quick preview, it is difficult for small producers to buy sap and make any money, especially if you don't have very efficient equipment or a lot of spare time to boil extra sap. On the other hand, it is usually very economical for large producers to buy sap, especially if you have efficient equipment and could find more time to process sap.

Additional Help is Available

If you decide to use this method for pricing sap and have any questions, I can usually be reached by calling (518) 523 9337 or mlf36@cornell.edu I realize that not all producers are comfortable using Excel, so if you need assistance, please call or email at any time. You can also go to the Cornell Maple Program website and watch an archived webinar on how to price sap and use the Excel spreadsheet- go to www.cornellmaple.com for more information.

2012 SAP PRICES

We normally publish sap prices in this issue, but are not doing so this year. Please refer to the previous article "A New Method for Pricing Sap" by Michael Farrell for an in-depth explanation of sap prices. It includes a table that provides sap prices based on an equal sharing of revenue between the sap buyer and seller. The sap price table can be downloaded from http://maple.dnr.cornell.edu/sapbuying.htm and you can reach Michael at (518) 523-9337 or mlf36@cornell.edu with any questions.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COMING EVENTS

22nd ANNUAL HEBRON MAPLE FESTIVAL
March 10 & 11, 2011 - 10:00 a.m. to 4:00 p.m.
Blizzard dates - March 17th and 18th
Hebron, Connecticut, Route 66 & 85
Contact: www.hebronmaplefest.com or E-mail: info@hebronmaplefest.com

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26th WARKWORTH MAPLE SYRUP FESTIVAL
March 10 & 11, 2011
Warkworth, Ontario, Canada
Contact: Alice Potter Tel: 705-924-2057 Fax: 705-924-1673

ONTARIO MAPLE SYRUP PRODUCERS ASSOC.
2012 Summer Tour - "Tapping into Healthy Markets"
July 12-14, 2012
Hidden Valley Muskoka Resort, Huntsville, Ontario
Contact: Bill and Lori Hubbert - (705) 384-7847 - bhubbert@vianet.ca

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NAMSC/IMSI ANNUAL MEETING
October 22-25, 2012
Mystic Marriott Hotel & Spa
Mystic, Connecticut
For more information contact:
Ron Wenzel at: rlwenzel@snet.net

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