



## Northern New York Agricultural Development Program 2017-2018 Final Project Report

### Comparison of Sap Yields Per Timing of Tapping Schedules for Maple and Birch Syrup Production

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**Background:** This project was designed to provide producers with information about the impacts of tapping timing on maple and birch sap production through the season.

**Maple:** Maple syrup producers are on the front lines of dealing with the effects of climate change. Climate variations have increased the unpredictability of when sap will flow in maple trees due to early-winter thaws, extended frozen periods in the early spring, and exceptionally warm mid-spring temperatures. The challenge for maple producers is to determine when the most appropriate time is to tap their trees.

Past research from Vermont documents that trees which are tapped too early may capture early season sap runs but suffer from reduced late season sap yields (Wilmot 2008). Producers who wait until traditional dates to tap their trees may miss unexpected early season sap runs. The 2017 season in Northern New York was an excellent example of this dilemma because weather conditions allowed sap to flow in February prior to many producers having their sugarbushes fully tapped. This was followed by a March that yielded little sap flow due to frozen temperatures.

Maple producers in Northern New York may be losing profits if they tap too early or if they tap after an unexpected mid-winter thaw. Producers are not likely to be able to extend their season far into the spring when temperatures are consistently warm due to bacterial plugging of tapholes and off-flavored syrup development.

**Birch:** Birch syrup is a relatively new agricultural product being produced in Northern New York. Birch syrup serves as a way for maple producers to diversify their revenue streams and optimize their capital investments in forestland and syrup-producing equipment. Cornell's Uihlein Maple Research Forest has been a leader in advancing the understanding of producing birch syrup in Northern New York. This project aims to continue that leadership by providing birch syrup producers with information on appropriate timing of tapping for birch trees.

Birch producers, unlike maple producers, do not have a few hundred years of traditional knowledge to serve as a guide to when to tap their trees. Additionally, climate change causes unknown variability in the timing of birch sap flow. Lack of traditional knowledge coupled with unpredictable climate requires birch producers to essentially guess as to when they should tap their trees. Some birch producers will tap their trees during the last few weeks of maple sap runs, some will tap their birch trees after maple season ends, and some are considering tapping their birch trees immediately after they finish tapping their maple trees. Much as with maple, tapping too early in birch may cause early taphole closure and tapping too late may miss early- season sap flows.

This project will document how timing of tapping will affect yields of sap in birch trees and provide information to producers about appropriate timing of tapping in birch.

### **Methods: Maple**

This research utilized a randomized complete block design to study how timing of tapping affects maple sap yields. Three complete blocks were located at the Uihlein Maple Research Forest in Lake Placid, NY, and one block was located at the Paul Smith's College sugarbush in Paul Smiths, NY. Each block contained the following timing for when trees were tapped: week of January 15, week of February 19, and week of March 19. These three treatments represent very early pre-season tapping, traditional pre-season tapping, and mid-season tapping.

Ten sugar maples were tapped in each treatment with one tap per tree, under vacuum. New 5/16" tubing drop lines and spouts were utilized to ensure consistent taphole sanitation. Tubing from the 10 trees in each replicate flowed into a collection canister. A technician monitored canisters and recorded sap volume and sugar content during each sap flow event. These data were analyzed at the end of the season to determine differences in timing of sap flow and total sap yield per tap between treatments.

### **Methods: Birch**

The birch portion of this research took place on the Uihlein Maple Research Forest in Lake Placid, NY. This project served as a preliminary study of a longer-term investigation into the timing of tapping for birch sap production. The forest was equipped with three sections of birch production under vacuum, each with its own mechanical releaser and sap flow gauge. Technicians tapped each section of birch at different times during the season, resulting in the

following three treatments: tapping immediately after finishing tapping maples (week of March 5), mid-maple season tapping (week of April 2), and post-maple season tapping (approximately the week of April 23).

Approximately 150-200 paper and yellow birch trees were tapped in each section using 5/16" tubing under vacuum. New spouts were utilized to ensure taphole sanitation. Sap yield was monitored for each section over the course of the season using sap flow gauges and sugar content was measured during each sap run.

Results of sap yield and sugar content were compared between treatments at the end of the birch syrup season to document differences in total yield per tap and timing of yield. Replication will be achieved in future years (out of the scope of this application), by rotating treatments between the three sections of birch production on the Uihlein Maple Research Forest.

This pilot study provides valuable baseline data for future work into timing of tapping for birch sap production.

### **Results: Maple Production**

Cumulative syrup yield, calculated from sap volume and sugar content over the course of the 2018 season, was greatest among trees tapped during mid-February (Figure 1). However, trees tapped in mid-January produced a similar amount of syrup. Trees tapped in March yielded less syrup due to not having been tapped during the first sap runs in February 2018.

We also found that sugar content was very low (less than 1% sugar content) during January sap flow events. Sugar content did not rise to 2% until February 7. Maples tapped in January saw reduced yield during late April sap flow events, while trees tapped in March were more productive than earlier tapping. However, the late sap flow events of April did not make up for missing February sap flow events for trees tapped in March.

### **Results: Birch Production**

Early taphole closure was very evident in our birch tapping study. Trees that were tapped in March saw lower yield throughout the season. These trees were tapped well over a month before the first birch sap flow events. Trees tapped in April saw much higher sap yields through the season when compared to trees tapped in March.

### **Conclusions:**

We found that early pre-season tapping of maple trees is competitive with tapping trees in mid-February. Waiting to tap trees until late February and early March risks missing early-season sap flow events and having less total season production.

Low sugar contents during January sap flow events were likely a result of sugar not yet being converted from starches within the tree and also not being released into the sap. This suggests that producers could use early, small runs of sap to flush mainlines and justify not processing that dirty sap.

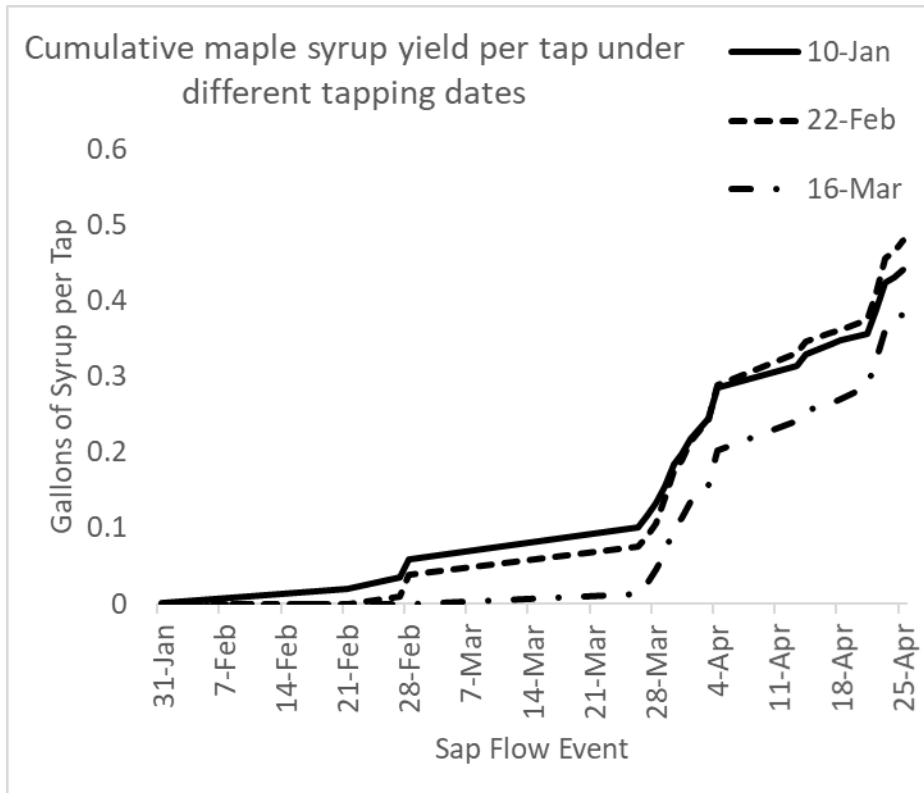


Figure 1: Cumulative maple syrup yield per tap under different tapping dates, NNY, 2018.

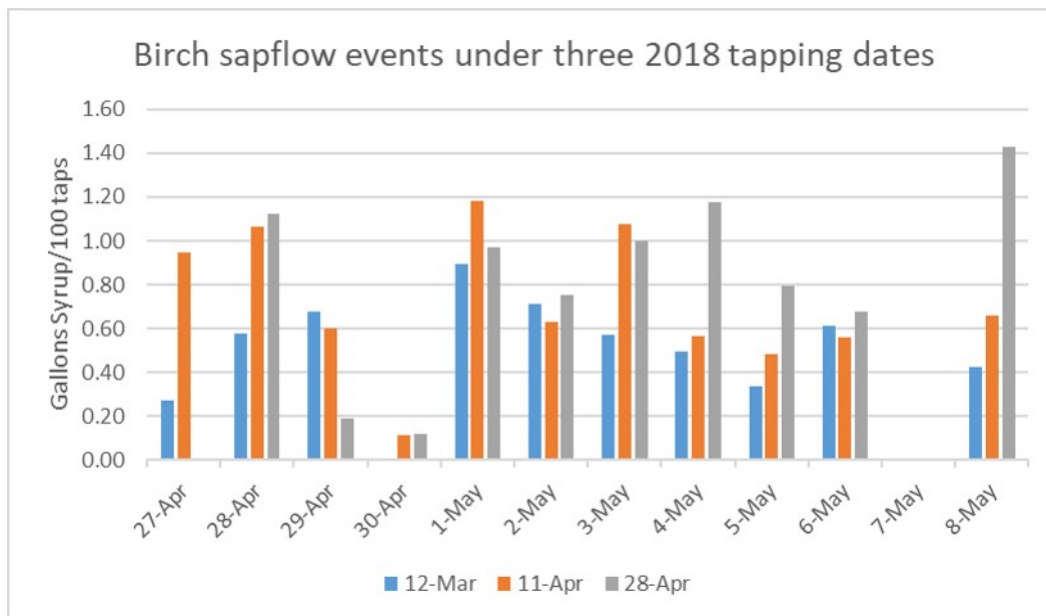


Figure 2: Birch sapflow events under three 2018 tapping dates, NNY, 2018.

We did find early taphole closure in maple trees that were tapped in January, however, the sap yield of these trees in February outweighed their reduced sap flow in late April when compared to trees tapped in March. This early taphole closure is likely due to bacterial plugging of vessels and will likely occur faster when dirty spouts and lateral lines are used.

Early taphole closure was also an issue in our birch study as trees tapped in March yielded less sap (Figure 2). We suggest that birch syrup producers wait until around the end of maple season to tap their birch trees. This will assure that they do not have early taphole closure of birch and will also reduce complications in the saphouse related to collecting different (maple/birch) saps. Producers who utilize the same equipment for maple and birch sap collection will run into issues when the end of maple sap flows overlap with the beginning of birch sap flows.

Much more research is needed to determine ideal weather conditions to predict the start of birch sap flow. Currently, with new spouts and tubing, maple can be tapped early without serious risk for reduction in yield, while birch should not be tapped early due to risk of early taphole closure. Early birch taphole closure is likely due to bacterial buildup in the taphole before birch sap begins to flow. New spouts might mitigate this, as they do in maple sap production, however, the temperatures are higher during March than January (when early maple is tapped) and bacterial buildup in the birch tapholes during March will occur faster than in maple tapholes in January.

One shortfall of this study is that all of the tubing was brand new. Future research should consider how timing of tapping dynamics affect syrup production when using old tubing. An additional shortfall of our study was that our birch study was not replicated. Future research should replicate our birch study at the Uihlein Forest by rotating which section of birch is tapped each year. This will allow for replication and more robust results of our birch research.

### **Education and Outreach:**

A write-up of this study was provided to the Maple News. A summary of the results of this project was shared with Cornell Cooperative Extension educators in the six northern NY counties. Printed copies of this summary will be made available at the Uihlein Forest in Lake Placid, NY. The Uihlein Maple Research Forest hosted an open house for producers in the summer of 2018 and showcased the results of research conducted on-site. The research in this proposal on timing of tapping was a major component of that meeting. The results of this work were presented by Joseph Orefice during a 2018 Northern New York Maple Producers Association meeting. Keith Otto of the Uihlein Forest will be presenting the results of this work at the 2019 New York State Maple Conference.

### **For More Information:**

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### **References:**

Wilmot, T.(2008). “The timing of tapping for maple sap collection.” Maple Syrup Digest. June 2008, 20-27.