Northern New York Agricultural Development Program
2019-2020 Final Project Report

Increasing Syrup Production by Re-tapping Maples within the Sap Season

Project Leader:

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Background:

Production yields of maple syrup are directly correlated with seasonal weather patterns. Changes in climate have altered weather patterns during the maple tapping season and pose a threat of impacting maple producers' yields. Recent maple sugaring seasons have seen increased amounts of thawing earlier in the winter to be followed by extended freezes and later thaw-outs. For example, the 2018 maple season saw a thaw that allowed sap to run the end of February but was followed with a cold period with slowed sap flow for a few weeks.

This flux in weather across the maple season has extended the duration of the sap season and warmer weather earlier in the season has the ability to increase microbial growth that can stop the flow of sap in a tap hole. Producers are challenged to capture either early or late runs, and must try to anticipate future weather patterns to optimize their sugar yield.

Maple producers who tap earlier in the season risk the chance of tap holes drying up due to microbial plugging later in the season when the sap is still flowing. This can force a maple producer to consider re-tapping trees to extend their production. However, there is not solid evidence to support the effectiveness of this method. Producers who wait to tap risk missing out on early season high quality sap and productive runs that could be a significant portion of the sap season. Either scenario risks the chance of losing out on profits in a maple sugaring operation. Choosing the optimum time to tap is uncertain and it is impossible to predict weather patterns for the maple sap season.

Northern New York Agricultural Development Program (NNYADP)-funded projects at the Uihlein Maple Research Forest in Lake Placid during the 2018 and 2019 maple syrup season looked at timing of tapping to best capture the most amount of sap. During this research it was found that trees tapped later in March did not yield as much syrup as producers missed early sap runs. Trees tapped in January were able to capture early season sap runs but yield diminished slightly near the end of the

season due to microbial plugging (Orefice, 2018). Based on this data, a tree re-tapped later in the sap season could have the ability to increase syrup yield by at least 20%; a $6 increase in profit per tap.

If a maple producer were to tap earlier in the winter, they could come back later that same season and re-tap by moving the spout to a new tap hole or add an additional tap on a different drop line to capture maximum sap yields late in the season. This would allow a maple syrup producer to capture high levels of yield across the season. If the re-tapped hole was directly above the preliminary tap hole less damage would be created within the tree by taking away clean un-tapped wood. However, not enough data has been collected to determine whether the effort and added cost of re-tapping will bring a return on the investment. Preliminary work on re-tapping at the Cornell Arnot Teaching and Research Forest near Ithaca, New York, found 19% increased sap yields when trees were re-tapped the same season (Childs, 2020). Colder climate patterns of Northern New York present new challenges which have not been studied. Re-tapping maple trees could have the potential for increasing profits for maple sugaring producers across the Northern New York region under a changing climate.

Methods:

To test the feasibility of re-tapping maple trees during the sap season an NNYADP-funded project was conducted in 2019 at Cornell University's Uihlein Maple Research Forest in Lake Placid, NY, using four treatments (Table 1). Each treatment was replicated three times with five trees tapped for each treatment. All trees were under vacuum with only one tap per tree, except for the treatments that were re-tapped later in the season. Each tree was tapped using 5/16-inch spouts and tubing. Spouts were brand new; lateral and dropline tubing had been used for two seasons previously.

Treatment 1 was tapped February 4, 2019, then pulled and added into a new tap hole on April 15, 2019, drilled 8 inches above the initial tap hole (Figure 1). This new tap was into new wood that had not been compartmentalized into a dead zone and in theory did not create further damage within the tree. During the following growing season the tree would compartmentalize this area of the tree creating a dead zone. Treatment 2 was also tapped February 4, 2019, with an additional tap hole added directly above on April 15, 2019 (Figure 1). In this treatment the original spouts stayed within the original tap hole and a second spout with its own drop line was added to the new tap hole. Treatment 3 and 4 were considered control treatments. Treatment 3 was tapped on February 4, 2019, the same time as treatment 1 and 2 and was not re-tapped later in the season. Treatment 4 was tapped later in the winter on March 1, 2019. This treatment ran the risk of missing potentially earlier season sap runs but could flow better later in the season. Sap volume and sap sweetness was captured for each replicated treatment each time the sap ran.

Table 1: Breakdown of experimental treatments applied at Uihlein Maple Research Forest, 2019.

	Method
Treatment 1	**Trees tapped February 4th. Original tap pulled and inserted into a new tap hole on April 15th directly above initial tap.**
Treatment 2	**Trees tapped February 4th and tap left in the tree all year. Additional tap added on April 15th directly above initial tap.**
Treatment 3	**Trees tapped February 4th and left in all season.**
Treatment 4	**Trees tapped on March 1st and left in all season.**

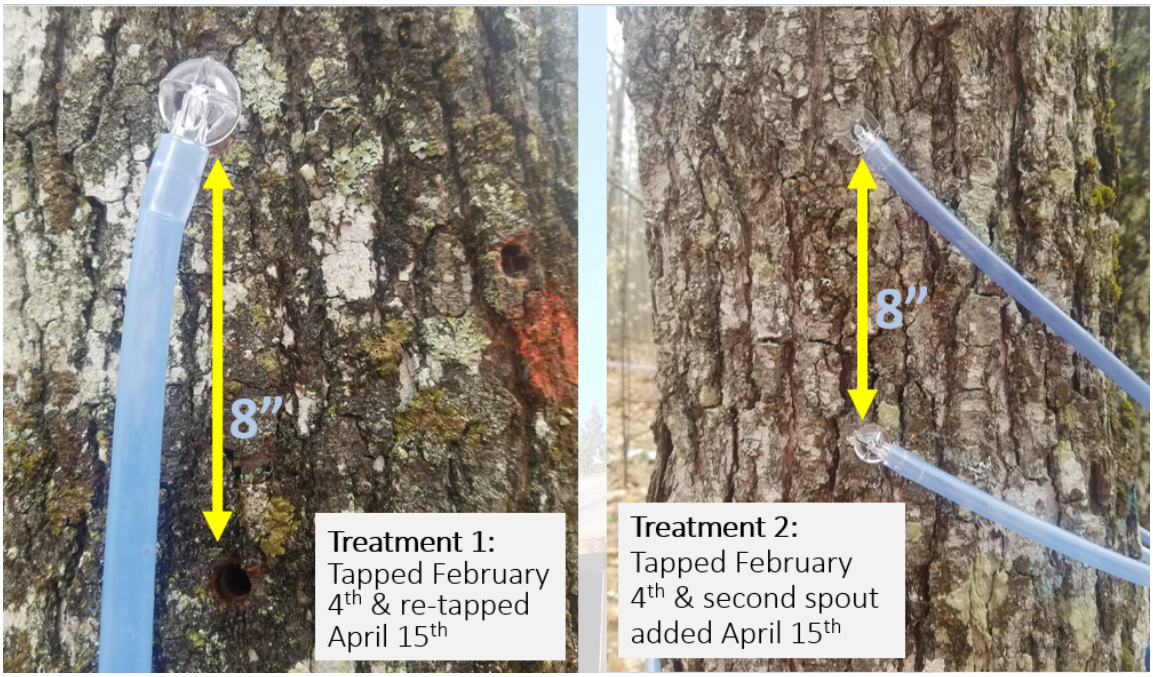

Figure 1: Left: Treatment 1 where the spout was removed from the tap hole on April 15, 2019, and moved 8 inches up to a new tap hole. Right: Treatment 2 where a second drop line with a new spout was added into a new tap hole on April 15, 2019, 8 inches above the initial spout tapped February 4. Photos: Adam D. Wild

Results:

Results of the study from 2019 at the Uihlein Maple Research Forest showed that re-tapping trees into a new tap hole or adding a second spout later in the season was not effective for increasing syrup production (Figures 2 & 3). No statistically significant difference was observed between any of the tapping methods. Although not significantly different, oddly enough, the most amount of syrup per tap was produced by the control treatment, Treatment 4, when the trees were tapped March 1 and not re-tapped. This was a 25% increase in syrup production over trees tapped in early February and not re-tapped (Treatment 3). Trees that had a second dropline and spout added near the end of the season (Treatment 2) were the second best with an 18.5% increase in syrup production over trees tapped at the same time but not re-tapped late in the season. Treatment 1 where the spout was pulled near the end of the season and inserted into a brand new tap hole produced 5% less syrup per tap even though in the last few days of the season the spout was in a new, clean tap hole. The reduction in sap production could be a result of the old tap hole acting as a vacuum leak as the old tap hole was not plugged. However, no loss in vacuum was observed.

At the conclusion of this study the results were not as expected, most likely a result of the weather and short maple season during 2019. Sap flow did not fully start until March 15, 2019, at the Uihlein Forest therefore tapping early more than likely incubated bacteria in the tap holes sooner. Once the season started, the weather was a consistent freeze-thaw across the sap season until it quickly ended April 19 (Figure 4). Right up until when the season ended the tap holes were still flowing well, even tap holes from early February. One could say that it was a consistent, ideal maple season. There were no large warmups without freezing nights and no extremely high temperatures with a following freeze that would have created an environment conducive for re-tapping. Once the weather warmed up, it stayed warm and did not freeze for a couple of weeks. At that point the trees had budded out.

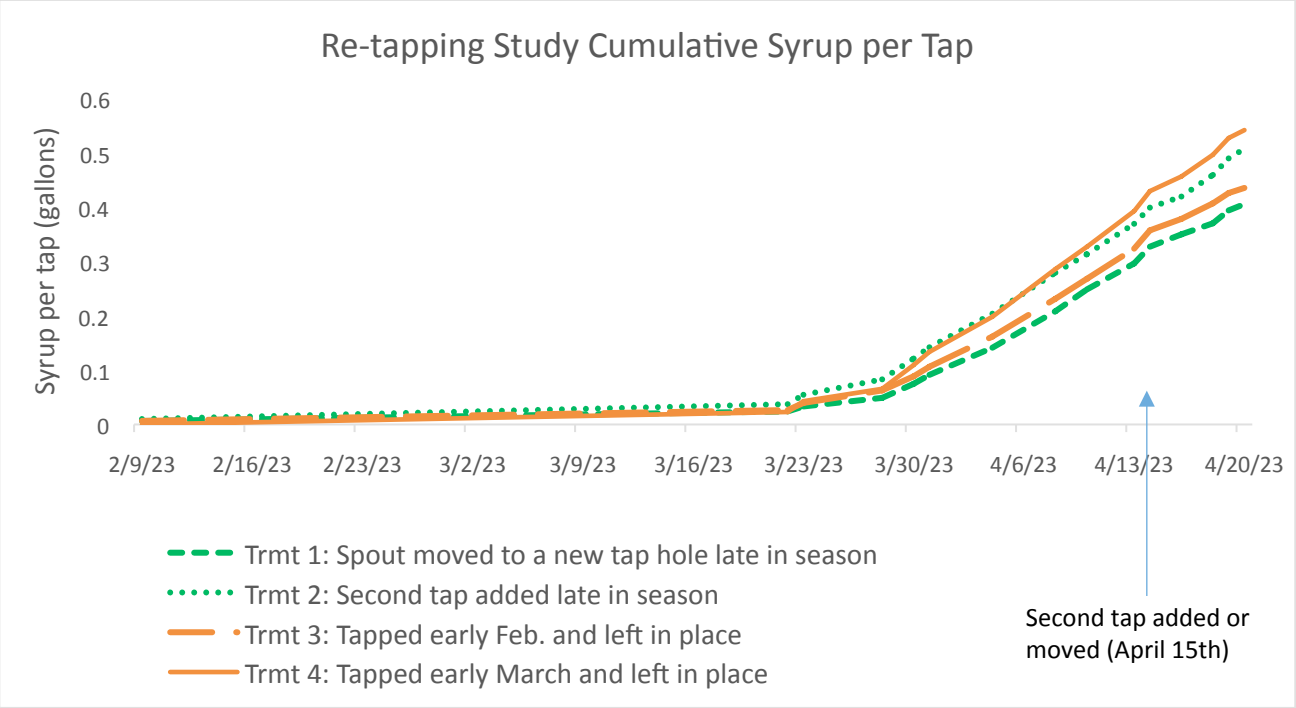

Figure 2: Cumulative maple syrup yield per tap under different re-tapping methods at the Cornell University Uihlein Maple Research Forest, 2019. Green lines represent trees that were re-tapped near the end of the season. All trees were tapped on February 4, 2019, except for Treatment 4 where trees were tapped March 1, 2019. In Treatment 1 the spout was pulled and inserted into a new tap hole 8 inches directly above the initial tap hole. In Treatment 2 a second spout and dropline were added 8 inches above the existing spout. Treatments 3 and 4 acted as controls that were not re-tapped but tapped at different times.

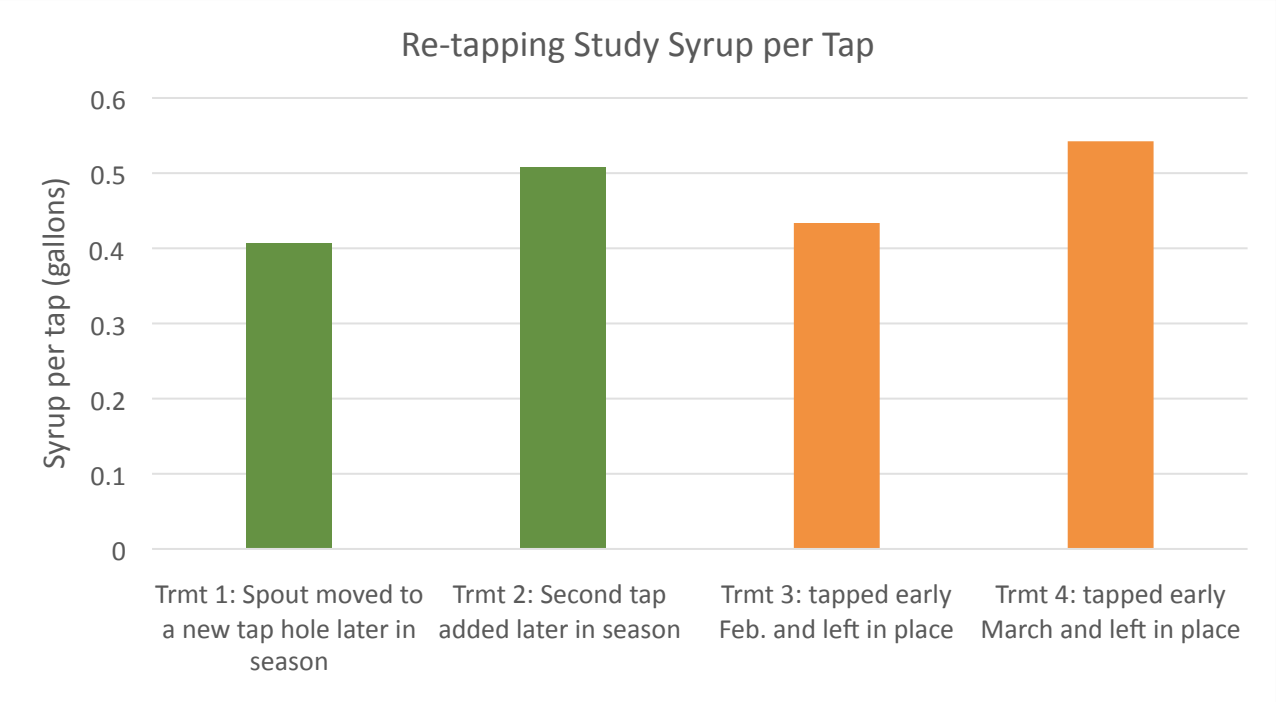

Figure 3: Average syrup production per tap under differing re-tapping (green bars) and control treatments (orange bars) at the Cornell University Uihlein Maple Research Forest, 2019. Refer to Table 1 for treatment descriptions.

A recent study conducted at the Proctor Maple Research Center in Vermont showed that the circular growth and slight twisting of wood grains within the maple tree makes it nearly impossible to stay within the same stain column. Dissecting trees where a second tap hole was added directly above showed that the compartmentalized zone was larger than if only one tap hole was created. Now knowing this, it would be best to avoid re-tapping unless a distinct slowdown in sap flow is observed.

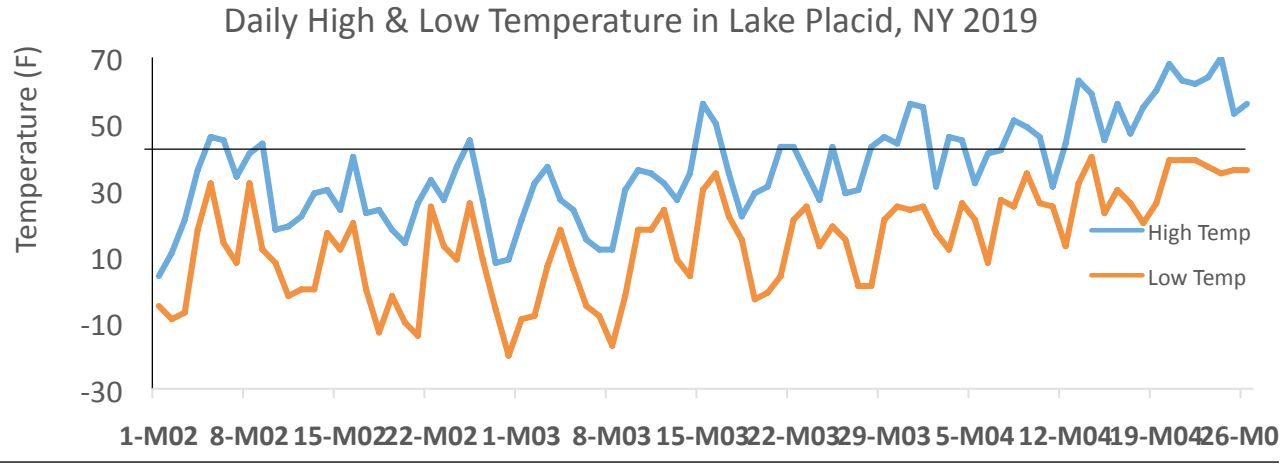

Figure 4: Daily high temperature and daily low temperature for Uihlein Maple Research Forest in Lake Placid, NY, during the sap season of 2019. The horizontal black line represents the freezing point. The productive sap season ran from March 15 to an abrupt end on April 19. No significant early thaws or extended freezeups made it conducive for re-tapping.

Conclusions:

Due to a shorter maple season in 2019, re-tapping was found not to be effective or worthwhile for maple producers in the Northern New York. Waiting to tap the trees closer to the start of the sap season showed to be more effective for increased sap production but was not significant. This could have been a result of older tubing. Further data is necessary for testing the efficiency of re-tapping maple trees at the end of the maple season to increase production when the earlier tap holes have dried up.

At this time, it would not be recommended to re-tap maple trees unless a clear slowdown of sap flow is observed. Based on current data, by not re-tapping, maple producers save on labor, equipment, and less damage to their trees. To test between-season differences, this research will be replicated in 2020 to see if results differ with different weather patterns in the sap season.

Education and Outreach:

Project leader Adam D. Wild, Uihlein Maple Research Forest Director, shared the results of this NNYADP-funded research during a tubing workshop held in Croghan, NY, in September 2019, and at the 2020 New York State Maple Conference, the largest gathering of maple producers in the world, in Syracuse. Results were also shared at regional maple schools across all of Northern New York including the Northern NY Maple Expo in St. Lawrence County (January 2020), the Lewis and Jefferson County Winter Maple School (January 2020), and the Clinton, Essex, Franklin County Northeastern New York Maple Boot Camp (January 2020). All of these opportunities provided contact with maple producers across all of Northern New York and the broader national maple producing region. Acknowledgement of the Northern New York Agriculture Development Program was identified as the funding source

during each presentation. Additionally, a write-up of this study will be provided to the Maple News trade publication.

For More Information:

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References:

Orefice, J. (2019) "Comparison of Sap Yields Per Timing of Tapping Schedule for Maple and Birch Syrup Production." Northern New York Agricultural Development Program 2017-2018 Final Project Report. https://www.nnyagdev.org/wp-content/uploads/2018/12/NNYADP19Maple2018Final-18.pdf

Orefice, J. (2018) "Timing of tapping of maple, birch, in N. Adirondacks." Maple News, June/July 2018, p 7.