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Effect of Spile Height On Maple Sap Sugar Concentration

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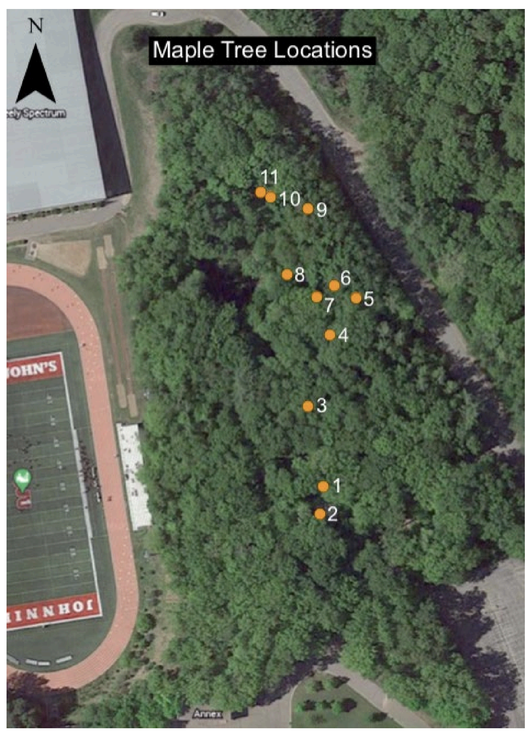
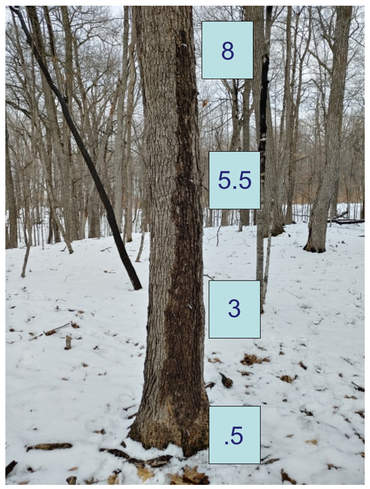
Introduction

The aim of this study was to test the maple syrup folktale that claims, "The higher the tap, the sweeter the sap" (Rechlin, 2015). If this legend holds true, the sugar concentration in the sap of sugar maple trees (*Acer saccharum*) will increase as the height of the spile increases. I predicted that there would be no measurable differences in the sugar concentration in sap samples collected at different heights.

Methods

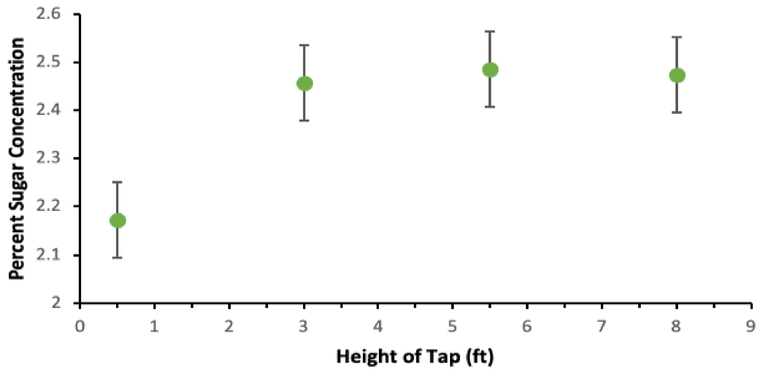
Sap was collected from eleven sugar maple trees (*Acer saccharum*) at varying spile heights: 8', 5.5', 3', and 0.5'. Sap was collected in microcentrifuge tubes and taken to the lab to be analyzed with a refractometer. This device measures the concentration of sugar in the sap to two significant digits. Samples were gathered seven times between 3/16/21 and 4/1/21 between 12 – 4 pm. Mean sap sugar concentration was calculated by day, tree, diameter and height. Data were analyzed using independent sample t-tests. This study was done at Saint John's University east of the football stadium.





Spile Height

- There are no statistical differences between mean sap sugar concentrations from the 8', 5.5', and 3' spile heights.
- The lower mean sugar concentration of the 0.5' tap is statistically significant.



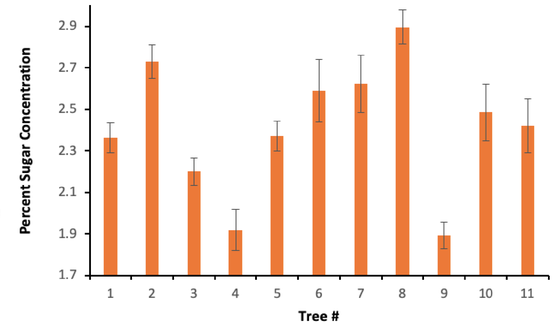
Comparison	p-value
8 vs. 5.5	0.46098
8 vs. 3	0.42802
8 vs. 0.5	0.00117
5.5 vs. 3	0.38633
5.5 vs. 0.5	0.00106
3 vs. 0.5	0.00025
8, 5.5 vs. 3, 0.5	0.00948
8, 5.5, 3 vs. 0.5	0.00002

Diameter

- There is no relationship between tree diameter and mean sap sugar concentration.

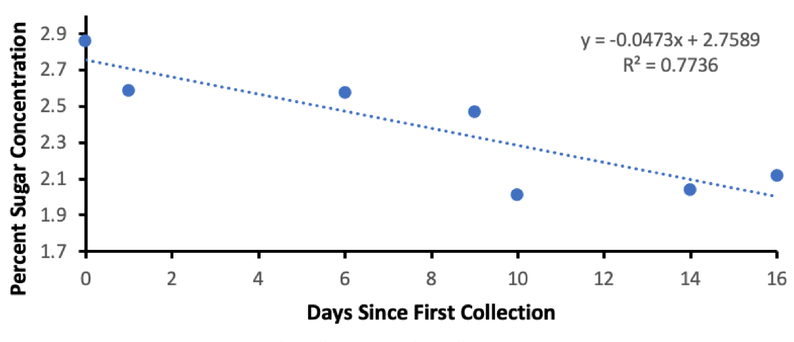
Tree Variability

- Mean sap sugar concentration varied extensively between trees.
- Max concentration of 2.9%, min concentration of 1.9%



Seasonal Trend

- Mean sap sugar concentration decreased from 3/16 to 4/1.
- Date of collection and sugar concentration are strongly related, R^2 = 0.77



Discussion

- The lack of statistical differences in mean sap sugar concentration between the 8', 5.5', and 3' spile heights shows that spile height and sugar concentration are not correlated.
- The old maple myth, "The higher the tap, the sweeter the sap", does not hold true.
- The lowest spile height, 0.5', showed a significantly lower sugar concentration from other spile heights. We hypothesize this is due to its proximity to the roots, the source of water.
- Variability in sugar concentration among trees is common. Individual trees at Saint John's have been found to reach sugar concentrations of up to 8.3% (Nunnink, 2004).
- The decrease in sap sugar concentration found over the course of the collection period is typically observed in most maple operations.