Producing Syrup from Black Walnut Trees in the Eastern United States

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Though it is not well known, all species of walnut (*Juglans spp*.) produce a sweet sap that can be boiled down into valuable syrup. There is a well-established resource of black walnut (*Juglans nigra*) trees throughout eastern North America that could be utilized for syrup production to complement existing sugaring operations. However, very little information exists on the optimum tapping time for these species, the expected yields from traditional bucket or more modern vacuum-enhanced tubing systems, and the overall economic outlook for producing walnut syrup. Although many sugarmakers are interested in tapping these trees to complement existing sugaring operations, better data is needed on potential yields and market opportunities before investing in planting these trees or seeking out existing trees to tap.

Although the number of tappable black walnuts is significantly less than the number of tappable maples (Farrell 2013), there are excellent opportunities for sugarmakers to utilize the trees they currently have while also planting these trees for long-term benefits. They grow extremely fast and are relatively easy to establish in open fields and along watercourses as riparian buffers. Most people currently plant walnut trees for their timber value and nut production. If it is also economically viable to tap them for syrup production, this could result in many more trees being established throughout the Northeast.

Sap flow in walnut trees was first reported in North America in the 19th century as part of a comprehensive study of sap flow in plants (Clark 1874). Sap flow in English walnut (*Juglans regia*) has also been studied in France due to the worldwide importance of nut production in this species (Ewers et al. 2001). Controlled research in an English walnut orchard and greenhouse demonstrated the capacity of autumn, winter, and spring sap flows through a combination of stem and root pressures. The researchers never investigated the potential to use this sap as a source of syrup production and there is no such data on potential sap yields and sugar content for tapping black walnut in the United States.

The only research on using the sap of black walnut trees for syrup production took place in Kansas nearly a decade ago (Naughton et al. 2006). It was limited in nature and meant as a preliminary study. Despite the promising results, no follow-up studies were conducted. Todd Leuty from the Ontario Ministry of Agriculture recently conducted research on tapping Japanese walnuts grafted onto black walnut rootstock in Ontario. His findings, as well as other practical experience, indicates that the sugar content of walnuts mirrors that of maples, yet the amount of sap flow is significantly less. Whether the amount of sap produced is so low that it limits the commercial potential of this species is not yet known. Furthermore, none of the previous studies were done with

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high-vacuum tubing and there isn't yet any reliable data on what one can expect from tapping black walnuts. Since vacuum tubing can produce two to three times the amount of sap as gravity flow in maples, it is important to determine the effect of vacuum assisted sap flow on walnuts. This article will address preliminary research exploring the potential yields from black walnut trees in the eastern U.S.

Methods

In order to determine potential yields from black walnuts, we collected sap at four sites in New York, Pennsylvania, and Indiana during the winter of 2014. In New York, we tapped 58 trees using individual bags and 5/16 spouts on Cornell's campus in Ithaca and 96 trees using vacuum tubing at Lemoyne College in Syracuse with the assistance of Kris Dulmer and Steve Cacccamo. A sap puller diaphragm vacuum pump was utilized at this site with an average reading at the pump of 18" Hg. Jacob Noonan served as a research collaborator and tapped 35 trees on buckets with 5/16 spouts in Erie, PA. Rich Hines also tapped 10 trees with 7/16 spouts and buckets in Indiana. Whereas the trees at most sites were tapped in mid-February, Hines tapped his trees on November 19 to explore the possibility of sap flow in autumn. At all locations, every time sap was collected (usually every 4-7 days), the total volume and sugar content of the sap was measured and recorded. At the end of the season, all of the data was analyzed and normalized to equate to ounces of syrup produced, following the rule of 87.1.

Results

Figure 1 shows the running total of ounces of syrup produced per tap at the four locations. The highest yielding site (Erie PA) produced an equivalent of 11 ounces of syrup per tap whereas the lowest performer (Syracuse) yielded only 6 ounces of syrup per tap. Figure 2 displays the total sap production per tap during each collection at the four sites. These should not be considered daily totals, since sap was not collected on every day that it ran, but rather at longer intervals due to labor restrictions and the low volumes of sap flow. Figure 3 displays the average sugar content during each collection at the four locations. In a similar manner to maple sap flow, sap sugar content was very low in the fall (less than 1%) and much higher in the spring (2-3.5%). Although not shown in Figure 3 since it only displays the average sap sugar concentrations, the highest reading taken was 6.2% and there were many trees producing sap in the 4-5% sap sugar concentration range.

Discussion

Although the sap yields observed in this study were extremely low when compared to traditional maple syrup production, it is important to realize

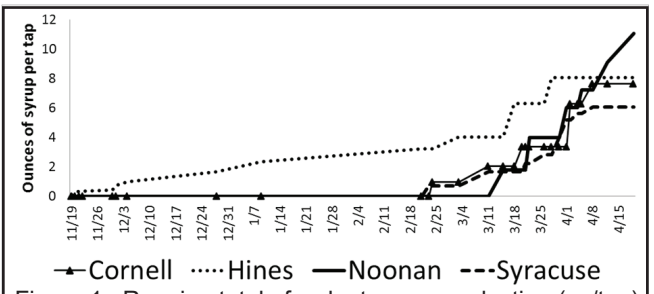

Figure 1. Running total of walnut syrup production (oz/tap) at four locations during the 2014 sugaring season

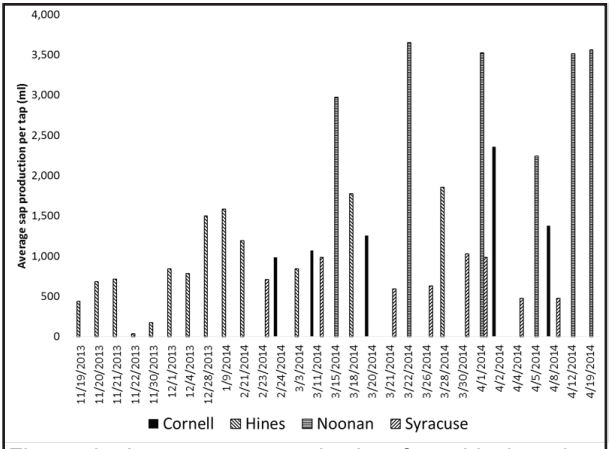

Figure 2. Average sap production from black walnut trees at four locations during 2014 sugaring season.

that this report only covers the first year of what will ultimately be a long-term study. As with maple, the differences in yields are likely to be significant between years based on local weather conditions, so it would be premature to make assumptions based on one year of data. The sample year, 2014, was also very cold throughout March and soils were deeply frozen due to a lack of snow cover, which could explain part of the low yields. Although this study suggests that it is unlikely that a walnut sugarbush will ever produce similar quantities of sap as a typical maple sugarbush, there were a few trees on some sites that did produce large quantities of sweet sap in a similar manner as maples. It is possible that there are genetic differences within black walnuts that allow some trees to produce large quantities of sap whereas others may produce very little. Further research should explore the specific qualities of individual trees to help determine what may cause the differences in yields. Though it was surprising that the vacuum tubing system produced the lowest quantities of sap, this was only a preliminary study without any replicated trials. Thus, future research should explore sap yields under vacuum at additional sites over the course of several years before any conclusions can be made regarding the effect of artificial vacuum on walnut sap flow.

Another aspect of walnut syrup production that requires further attention is the large quantities of pectin often found naturally occurring in the sap. Pectin can make filtering the sap and syrup extremely difficult and time consuming, clogging filters much more rapidly than the sugar sand often found in maple syrup. There seems to be tremendous variation in the amount

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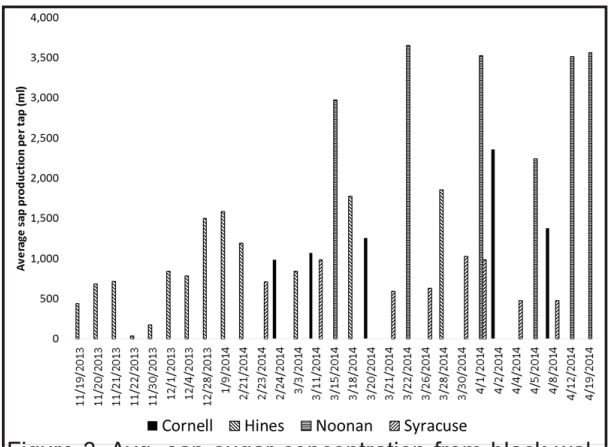

Figure 3. Avg. sap sugar concentration from black walnut trees at four locations during 2014 sugaring season

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of pectin produced between individual trees and sites as well as the time of the year that the sap was collected. We did some initial experimentation with using pectinase, an enzyme that is designed to break down the pectin, obtained from Carolina Biological. Our initial trials were not extensive enough to come to any conclusions on the efficacy of pectinase, but given the problems associated with filtering and the prevalence of pectinase in so many other food processing industries, this idea deserves further attention.

Finally, additional research is necessary to explore the economics of producing walnut syrup for existing sugarmakers. Although yields from walnuts are likely to be much less than from maples, it may still be a viable enterprise if the syrup can sell at a high enough price. Black walnut syrup is a unique, novelty item that can potentially sell at much higher prices than maple syrup, especially when packaged in small decorative bottles for the gift market. A following report will outline the economic feasibility of producing walnut syrup based on variations in yield and prices.

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