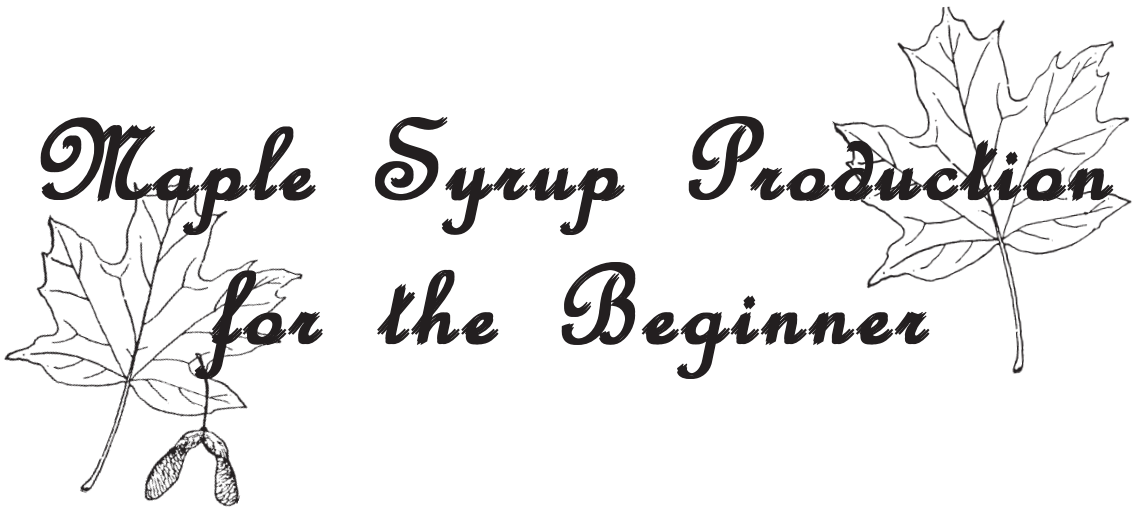
Maple Syrup Production for the Beginner



Anni L. Davenport
School of Forest Resources
The Pennsylvania State University

Lewis J. Staats
Department of Natural Resources
Cornell University
Cornell Cooperative Extension

Maple Syrup Production for the Beginner

Background

Maple syrup is among the oldest natural food products produced in North America. Folklore credits the Native Americans with the discovery of this flavorful natural sweetener. Although modern day commercial operations differ greatly from those of our ancestors, the basic process of converting maple sap to syrup still requires the removal of water from the raw sap to form the finished product. Most novice producers find the experience of producing maple syrup rewarding far beyond the sweet product of their labor. After a few years of experience, many beginners develop a level of enthusiasm that advances them to commercial-size maple production. This leaflet provides instruction for those producing maple syrup for the first time, primarily for home or family use. **Remember,** although you may want to innovate to minimize production costs, maple syrup is a food product and should be produced only with equipment and materials that are approved for food application.

Species to tap

Although several types of maples grow in the Northeast, sugar maple (*Acer saccharum*) is the traditional species tapped for maple syrup production. The sap of the sugar maple generally contains a higher level of sugar than the other maples. Identify sugar maple by its bark, its dark, brownish-colored, sharp buds, and its five-lobed leaves. Red maple (*Acer rubrum*) can be tapped also, but its sap is less sweet and the tree breaks bud before sugar maple. When buds break, or expand in late spring, the sap becomes off flavored and is not desirable for processing. The red maple has red colored, rounded buds and its three-lobed leaf is known for its vivid brilliant red color in autumn. Another species, black maple, varies slightly in the visual characteristics of sugar maple, but otherwise yields sap of similar quality to the sugar maple. Most syrup producers treat the black and sugar maple as one species (**Figure 1**).

Trees growing along roadsides, in lawns, or in open settings, where their crowns have grown large

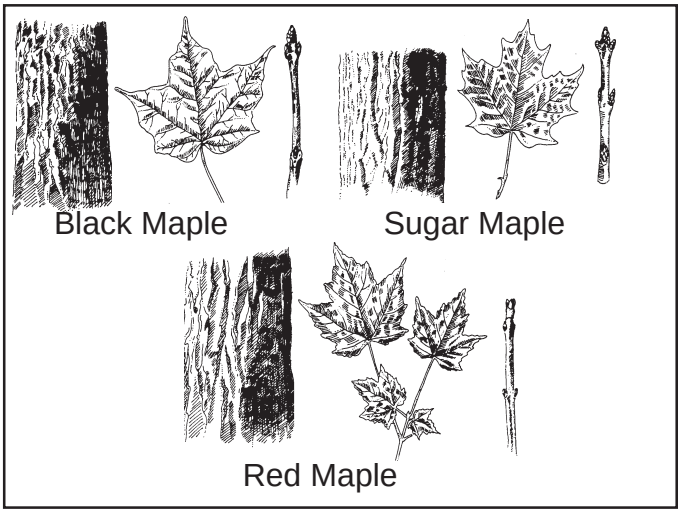


Figure 1

without competition from other trees, generally produce more and sweeter sap than forest-grown trees. Open grown trees are capable of producing one half gallon of syrup in one season (15 to 20 gallons of sap), whereas trees growing in a forest setting generally produce about one quart of syrup (about 10 gallons of sap). In addition to greater sap volume and sweetness, open grown trees generally offer greater accessibility for sap collection.

Equipment

Most of the equipment required for tapping may be available in the home workshop or purchased with minimal investment. Buckets, covers, and spiles (also called spouts) are available from maple equipment dealers and many hardware stores. Other possible sap containers include clean plastic milk jugs or plastic containers with covers. The equipment for processing sap will require greater investment, but will last for many years if maintained properly. Used equipment may be purchased but use judgement and acquire only equipment free of rust and fabricated of food-grade materials. Following is a suggested list of equipment and materials for making maple syrup for home-use.

- carpenter's hand brace or breast drill with 7/16 inch diameter drill bit
- spile (or spout), either metal or plastic for each taphole
- bucket with cover, plastic sap collection bag, or plastic tubing (food grade materials)

- collection or storage containers, such as plastic or metal trash cans (several gallons in capacity and leakfree) for sap storage before processing. Storage capacity of 1 to 2 gallons for each tap (ex. 25 taps = 25 to 50 gallons storage) should be adequate.
- pan with high sides and a heat source for boiling sap. The pan size will vary with the number of taps. Heat source can be wood fire, propane or camp stove. Stainless steel pans fabricated with lead-free solder or welded seams are strongly suggested.
- thermometer calibrated to at least 30 degrees F above the boiling point of water. Kitchen or candy thermometers may be adequate but must be easily readable above 200 degrees F.
- food approved filter for filtering hot finished syrup
- containers for storage of the finished product (canning jars, syrup jugs, etc.)

Procedures

Tapping - Tap maple trees in early spring when daytime temperatures go above freezing while nighttime temperatures fall below freezing. The exact time depends on the elevation and location of your trees and your region. In Pennsylvania and southern regions of New York, first sap flow traditionally takes place in mid to late - February. In northern regions and at higher elevations, the season often begins in early to mid-March. Sap usually flows for 4 to 6 weeks or as long as the freezing nights and warm days continue. If you are uncertain about when to tap, consult with a nearby maple producer or contact your Cooperative Extension Office.

The minimum suggested tree diameter for tapping is 10 inches in diameter (*Note: not circumference*) measured at 4 1/2 feet above ground (see **Other sources of information** for making a diameter measurement stick). A quick and easy way to determine the diameter of the tree is by using a household measuring tape. This will give the circumference of the tree, which can be converted to diameter from Table I.

Table I. Guideline for number of taps per tree

Diameter (inches)	Circumference (inches)	Number of taps
10-17 inches	31-53 inches	1
18-24	57-75	2
25 +	79	3

Tapholes should be drilled when temperatures are above freezing to reduce the risk of damage to the tree. Use a 7/16 inch diameter drill (available from hardware stores or maple equipment dealers) in a hand brace or breast drill. Drill into the trunk of the tree in an area that contains sound wood (free of scars, wounds, or older tapholes). If sap will be collected in buckets, a height of two to three feet above ground level allows for easy collection. However, the height can vary depending on preferences, age, and size of the individual tapping the tree. If the tree has been tapped in previous years, locate the new taphole at least 6 inches laterally and 24 inches vertically from the old taphole to insure tapping into good, productive sapwood. For trees with more than one tap, distribute the tapholes around the circumference of the tree. Drill 2 to 2 1/2 inches into the tree at a *slight* upward angle to facilitate flow of sap from the hole (**Figure 2**).

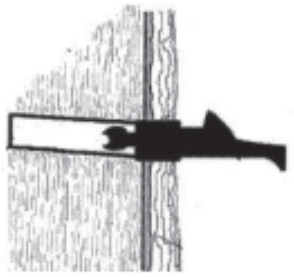


Figure 2

Notice the color of the shavings from the drill as you bore. Shavings should be light or cream colored, indicating live healthy sapwood. Shavings that are dark brown indicate wood undesirable for sap production, and another taphole should be drilled at a new location.

After making sure that the new taphole is free of shavings, insert the spile and seat it with a light hammer. Tap, *not pound*, the spile in the taphole. Seat the spile properly so it can support the bucket. Driving the spile with force can split the bark delaying taphole closure and causing a substantial wound on the tree for many years (**Figure 3**) . Do not treat the taphole with disinfectants or other materials at the time of tapping. After removing

spiles from the tapholes at the end of the maple season, do not plug the taphole. Tapping done properly will allow tapholes to close naturally (covered by bark) in about two years and will allow the tree to remain healthy and productive for generations.

Plastic tubing may be used in place of buckets, but its use will not be discussed here. For more information on using maple tubing, consult your maple equipment dealer, local maple producer, or Cooperative Extension Office.


Figure 3

Collection - The volume of sap collected during a flow period will vary from less than a quart to several gallons per tap, depending on the tree, weather conditions, and duration of the flow or run. The sugar content of sap varies between trees, will fluctuate between runs within a season, and from year to year.

Collect sap daily if possible. It can be filtered through a clean cloth or paper filter to remove debris if desired. Sap can be stored in a clean tank (a 30 gallon storage can works fine) for more convenient processing. The storage vessel should be placed in the shade to keep the sap as fresh and cool as possible. Because sap is a mixture of sugar and water, it is a perfect medium for bacterial growth. Therefore, it should be collected and processed as quickly as possible to ensure a higher quality product. Clean pails, one for each hand to offer better balance, may be used for collecting sap from the trees for transfer to the collection tank. When using buckets, make sure each bucket has a cover to keep rain water and other debris from contaminating the fresh sap (**Figure 4**).


Figure 4

Processing - Usually about 40 gallons of sap are required to produce one gallon of finished syrup. Actually this figure can vary from 20 to 60 gallons or more depending primarily on sap sugar content. A large amount of water must be evaporated from the sap to produce the finished syrup of 66 to 67 percent sugar. Because the large amount of steam caused by evaporation of the sap could be damaging to interior wall surfaces, the bulk of the boiling should be done outside of the home.

For individuals with 50 or more taps, hobby-size continuous feed evaporators are commercially available. However, most hobbyists boil sap continuously in one pan over an open fire, camp stove, or discarded gas range. Multiple pans (sap is added to the first, concentrated sap from the first pan is added to the next, and so on) offer more capacity with more efficiency and are often used by producers with more experience. If wood fuel is used, a support (called an "arch") can be constructed with concrete blocks to support the boiling pan and provide a firebox. Dry good quality firewood is most desirable for a hot fire (**Figure 5**).

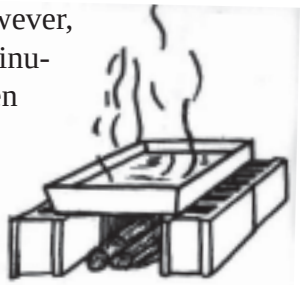


Figure 5

Before the fuel is ignited, fill the pan with several inches of sap. Throughout the boiling process, make certain the liquid level is deep enough (about 1 1/2 inches) so the sap will not scorch and damage the pan. As sap is evaporated (liquid level reduced), add more sap. The faster the sap boils, the greater the potential for producing a higher quality product. This "batch" method allows the sap to be processed to a point near the final stage of evaporation. The more concentrated sap can then be finished with more controlled heat on the kitchen range.

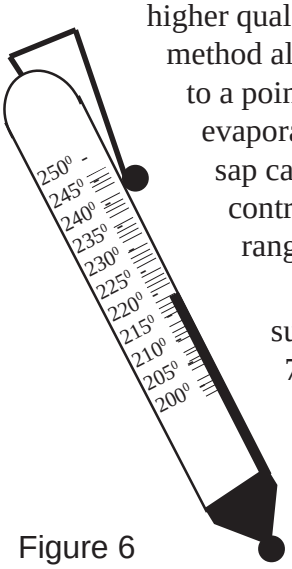


Figure 6
Temperature increments are used for illustration.

Sap becomes syrup (66-67 % sugar content) at approximately 7 1/4 degrees F above the boiling point of water (ex. if water boils at 212 degrees F, proper density for syrup would be slightly over 219 degrees F). (**Figure 6**). Concentrations below 66%

sugar content can sour over time. If boiled above the 67% density of syrup, sugar crystals can form in the bottom of storage containers. The boiling point of water, which varies with elevation and daily changes in barometric pressure, is easily determined by noting the temperature in the raw sap when it is boiling vigorously. Finished syrup will often "apron" or create a wide sheet or drip on the edge of a spoon when dipped in and quickly withdrawn above the boiling liquid. To maintain the experience of boiling sap an enjoyable one, **always practice safety**.

Throughout the process, excess foam may be skimmed off the surface of the boiling sap and discarded. Many types of materials, such as butter or vegetable oil, have been used to reduce foaming. However, a commercial defoaming agent available in small containers from maple equipment dealers is recommended. The defoamer should be fresh, and only a drop or two is needed. When used in small quantities, defoamers will evaporate without a noticeable trace in the syrup.

Filtering - When syrup has reached its proper temperature and density, it should be filtered to remove a gritty material called "sugar sand" or "niter" before hot packing in containers. The syrup should be filtered while hot through clean filter material such as wool or orlon available from maple equipment dealers. Syrup should be canned hot (180 degrees F) and stored in a cool dry location or under refrigeration. After a container has been opened for use, it must be refrigerated. Should mold form on syrup that has been stored for several months, simply bring the syrup to near boiling (190 degrees F), remove the mold by skimming, and repack the syrup in a clean container (**Figure 7).**

The procedure above is intended for home manufacture of maple syrup. If syrup is to be marketed, grading and labeling standards are required for retail sale in most maple producing states. Contact your Cooperative Extension Office or state Department of Agriculture for regulations covering maple products.

Cleanliness and quality control - After a period of warm weather, cloudy sap may appear in buckets or gathering equipment. This is caused by bacterial growth and can have a negative affect on syrup color and taste. A mixture of 1 part unscented household bleach to 20 parts clean water can be used with a cloth or brush to clean the inside surfaces of sap collection equipment. Follow the cleaning with a triple rinse of clean water to remove any hint of the bleach application. Sap boiling equipment can be cleaned with hot water, or the product recommended by the equipment manufacturer. Do not use any other cleaning substances in any maple equipment. Household detergents cannot be completely rinsed from equipment and will contaminate sap and syrup with undersirable tastes and odors. When washing sap or syrup filters, use hot water only. At the end of the season after cleaning in the manner described above, store equipment and supplies in a dry place.

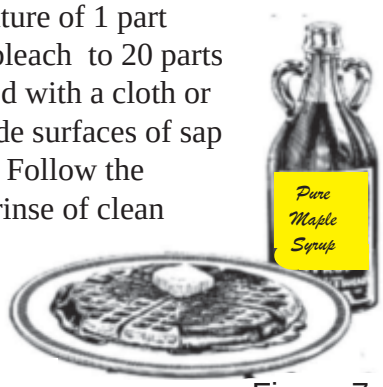


Figure 7

Equipment and supplies

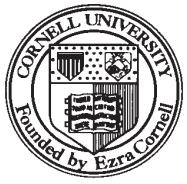
Production supplies and materials are available from maple equipment dealers throughout the maple producing regions. Many local hardware stores carry a small line of equipment such as buckets and spiles. Used equipment is often offered for sale in classified sections of local newspapers and agricultural circulars. A maple equipment dealer or distributor nearest you can be located by contacting your local Cooperative Extension Office, maple producers in your area, or through your county, regional, or state maple organization.

Other sources of information

Tapping guidelines and determining tree diameter. L.J. Staats and J.W. Kelley, Dept. of Natural Resources, Cornell University, Ithaca, NY 14853.

North American Maple Syrup Producers Manual. Single copies are available from county, regional, and state maple producer organizations or from; Ohio State University Extension, Publications Office, 385 Kottman Hall, 2021 Coffey Road, Columbus, Ohio 43210-1044. Phone: (614) 292-1607.

Educational videos for maple producers; *Sugarbush Management, Maple Sap Production, Maple Sap Processing,* produced by Cornell Cooperative Extension. Each video is about 25 minutes and can be ordered from: Cornell University Resource Center, 7 Business & Tech. Park, Ithaca, NY 14850. Phone (607) 255-2090.



Cornell
Cooperative
Extension

Helping You
Put Knowledge
to Work

PENNSTATE

College of Agricultural Sciences
Cooperative Extension

"Funding for this publication was provided in part by the New York Maple Producers Association, and the Pennsylvania Ben Franklin Technology Center, Pennsylvania Maple Producers Council, and the Pennsylvania Hardwoods Development Committee and is greatly appreciated."

Spring 1998
You may obtain copies from your local Extension office.
Available on the internet at the DNR web site through the extension page at:
http:www.dnr.cornell.edu

The authors acknowledge the following individuals for review of this bulletin: Jim Finley, Bob Hansen, H. Lee Hoar, Marianne Krasny, Paul Curtis, and Peter Smallidge.