



Extension FactSheet

School of Natural Resources, 2021 Coffey Road, Columbus, Ohio 43210

Hobby Maple Syrup Production

Randall B. Heiligmann

State Extension Specialist, Forestry

Late winter and early spring is maple season, when commercial maple producers in Ohio and other parts of northeastern North America tap trees, collect sap, boil it down to produce maple syrup, or further process it into maple sugar, fudge, nougat, cream, or other products. If you have access to a few maple trees, whether growing in your yard or in a woodland, you can produce your own maple syrup and even enough extra to use as gifts for family or friends. It's easy, great fun, and a very educational family activity.

Sap to produce maple syrup can be collected from any native species of maple, but in Ohio, sugar and black maples are the first choice when they are available. Making maple syrup from sap requires boiling off water until the desired sugar concentration is achieved. Sugar and black maple usually have considerably higher sap sugar contents than red and silver maple, resulting in less sap needed and less time and energy required to produce a given volume of syrup. Good syrup can be made from red or silver maple, but it is more likely to be cloudy.

Tapping season is also likely to be shorter when tapping red or silver maple because both species tend to break bud at an earlier date than sugar or black maple. Once the trees begin to break bud, chemical changes within the sap cause syrup to have an unpleasant flavor, often referred to as a "buddy" taste.

"Maple" syrup can also be made from the sap of boxelder, which technically is a maple (it belongs to the maple genus), but boxelder sap should not normally be combined with sap from other maples. Boxelder syrup can have a heavy, almost sorghum-like flavor that may be perceived as somewhat bitter compared to syrup made from other maples. Good boxelder syrup, however, is quite palatable, and is produced and marketed in parts of North America where other maples are not common.

Equipment Needed

Maple syrup can be produced on a small scale with very little equipment, but there are some standard items required to do the job correctly. You may already have many of these items or can buy them at a local store. Others, such as metal collecting spouts (called spiles), an hydrometer, collecting buckets or bags, and

finishing filters, are unique to maple production. Depending on the item, it might be made, purchased second hand from a maple producer, or purchased from a maple equipment supplier. Check with your county Ohio State University Extension office, ODNR Division of Forestry Service Forestry office, or a local maple producer for the names of suppliers. Equipment you will need to properly produce maple syrup includes:

- A drill (a portable electric works well) or carpenter's brace with a sharp bit the proper size for the spouts being used (e.g., 7/16-inch bit for traditional spouts or 5/16-inch for most small diameter spouts).
- A metal or plastic collecting spout (spile) for each taphole. The spouts should be the type intended for use with buckets or bags (not those intended for use with plastic tubing, unless you are, in fact, going to use tubing).¹ Homemade spouts can also be fabricated from a variety of materials, including some that are very traditional, such as elderberry stems which are easily carved and have a soft pith that can easily be pushed out forming the hollow center. If you do choose to fabricate your own spouts, be sure they are made of a material that is food grade and one that does not cause an allergic response.
- A collecting container for each taphole (Figures 1 and 2). Metal or plastic buckets or plastic bags are available from equipment suppliers. Buckets should be covered with a lid to prevent rainwater from diluting the sap and to keep out debris. A capped plastic milk or juice gallon jug is an acceptable disposable collecting container. Clean the jug thoroughly, making sure it is free of any food residue, then punch a hole in the side to hang it on the spile. If you modify other containers for sap collection, be certain that they are food grade and have never contained any harmful substances such as pesticides or engine oil products.
- Some type of storage tank, bucket, or other container in which to store sap before boiling. This container is not absolutely necessary in a small hobby operation, but it allows you to

¹ Be sure that any metal spouts, containers, storage tanks, and boiling pans that are used are free of rust and corrosion, and contain no lead (e.g., solder).



Figure 1. Maple sap buckets with covers.



Figure 2. Maple sap bag.

collect more sap, particularly during periods of large sap flow. Plastic tanks such as those sold to store and transport agricultural chemicals work well. Again, be sure it is made of food-grade material and has never contained harmful chemicals.

- A large pan and a heat source for boiling down the sap. The size of the pan and the heat source will depend on the amount of sap to be processed (discussed later). At a minimum, however, the pan should be at least 6, and preferably 8, inches deep to prevent boiling over. If possible, boiling should be done outside

the house, or some method should be available to vent the steam outside the house. Steam given off during boiling carries small amounts of sap and syrup that can make surfaces very sticky.

- A thermometer calibrated to at least the nearest degree with a readable scale in the range of 200° to at least 230°F. Some candy thermometers are satisfactory.

- A hydrometer and hydrometer cup are inexpensive optional pieces of equipment that are used to measure the density of hot or cool syrup (Figure 3). Syrup that is not dense enough will be thin, weak flavored, and more likely to spoil; syrup too dense will form sugar crystals in the storage container.

- Wool, orlon, or other type filter for filtering the finished syrup while it is hot (Figure 4). These filters are available from maple equipment suppliers. Use only filter material that is intended for use in food processing. Do not try to use paper coffee filters; the pores are too small.

- Containers for the finished syrup. Containers are available from maple equipment vendors or canning jars may be used. Containers must provide an airtight seal and tolerate a hot filling and sealing at a temperature of at least 185°F.

Some commercial producers collect and transport sap to a central collection point using plastic tubing. Hobbyists sometimes use plastic tubing to collect the sap from several trees into a single container. Plastic tubing and plastic spiles used with tubing are available from maple equipment suppliers.

Tapping The Trees

Some sap flow may occur any time during the dormant season, after a maple loses its leaves, when cool nighttime temperatures (below freezing) are followed by days when there is a rapid warming above freezing (ideally, to about 40°F). Tapping for maple sap, however, is generally done only in the spring when the weather is more predictable and the sap sugar content is high.

Some producers tap by the calendar, routinely tapping each year on or before a certain date such as the second or third week of February. Others, particularly those with a relatively small number of taps who collect with buckets or bags, watch the weather. When suitable weather is predicted, they tap. Sap flow from a tapped tree will not occur every day throughout the tapping season, but only when conditions are right.

Sap can be collected for syrup production until just before tree buds begin to expand, usually sometime in late March or early April, depending on the weather and location in the state. Sap collected and processed into syrup after bud expansion begins results in “buddy” syrup, which has a distinctly unpleasant flavor sometimes described as “bitter butterscotch.”

Trees should be at least 10 to 12 inches in diameter (measured 4.5 feet above ground level) before they are tapped. The number of tapholes a tree can support depends on its diameter and its health and vigor. Traditional tapping guidelines for healthy, vigorously growing trees with no major trunk defects (dead areas, scars, etc.) are to use one tap for trees 10 to 15 inches in diameter, two taps for trees 16 to 20 inches in diameter, three taps for trees 21 to 25 inches in diameter, and four taps for trees

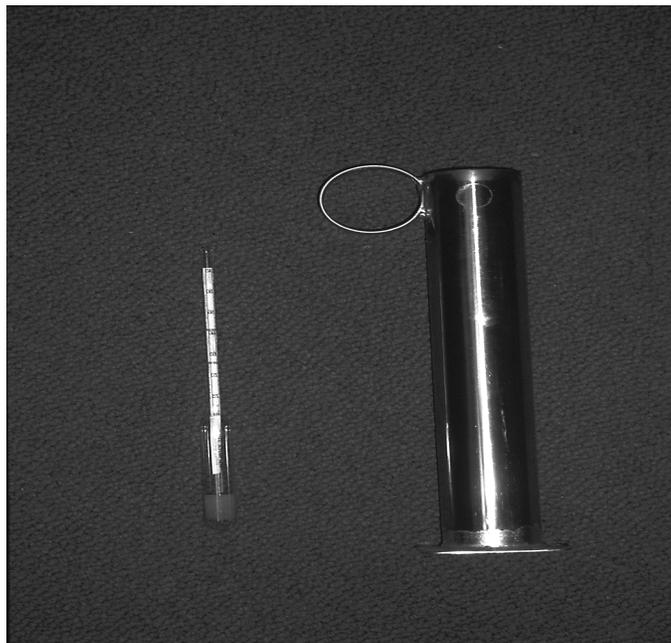


Figure 3. (a) An hydrometer and hydrometer cup.
(b) An hydrometer and hydrometer cup being used to measure syrup density at 67.4° Brix.

larger than 25 inches in diameter (tree diameter = tree circumference divided by 3.14). These should be considered maximum tapping rates and should be reduced for trees that are in less than excellent condition or have trunk defects.

In recent years many syrup producers have gone to a more conservative tapping guideline, placing one tap in trees 12 to 18 inches in diameter, two taps in trees 19 to 25 inches in diameter, and three taps in trees larger than 25 inches. This conservative tapping level is particularly recommended for trees that have



Figure 4. Maple syrup filters. From left to right, a cone filter designed to be suspended in a tank or large can, a square filter intended to be laid flat on a screen, and a prefilter intended to be placed inside a cone filter to extend its useful life.

been subjected to severe stresses in recent years from such factors as insect defoliation and drought. Reducing the number of taps does not result in a proportional reduction in sap collected because with fewer taps the sap yield per taphole generally increases substantially.

Taps can be located anywhere on the tree trunk but for convenience they are generally located between two and four feet above the ground. Tapholes are made by drilling a 7/16-inch or 5/16-inch diameter hole (depending on spout diameter) 1-1/2 to 3 inches deep into the trunk. Slant the hole slightly upward to allow sap to run out and prevent sap from collecting in the hole.

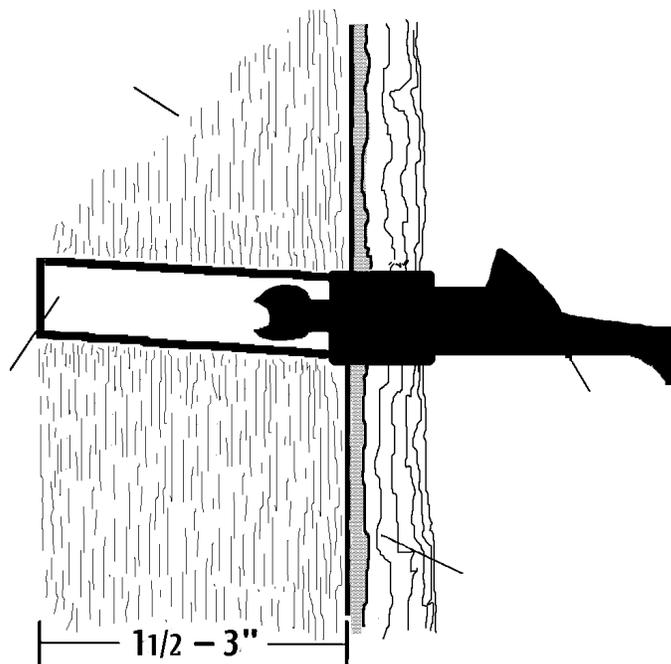


Figure 5. Installation of spile (spout) into maple tree.

On trees with more than one taphole, space tapholes evenly around the tree when possible.

If the trees have been tapped before, locate new tapholes at least six inches to the side and four inches above the height of the old tapholes. Do not tap within 24 inches directly above or below an old taphole. Tapholes should be made only into “sound” healthy, light-colored sapwood. Decayed or discolored wood should not be tapped, and tapholes should not extend into the darker heartwood. Tapholes in healthy young trees should heal in one or two years; larger, older trees may take longer.

A collecting spout or spile is then inserted into the taphole and tapped lightly to seat it in the taphole. Spiles usually have a tapered shoulder that forms a watertight (saptight) seal so that sap does not leak. Do not seat spiles with too much force, or the wood above and below the taphole may split. Also, if possible, avoid seating spiles when the trees are frozen to avoid splitting the tree.

Buckets or bags (or other collecting containers) are then hung on the spiles to collect the sap. Be sure that both buckets and bags are clean and free of debris. Both buckets and bags are generally hung on the spile by means of a hole in their side. If buckets are used, be sure they have a lid to keep out rainwater and other debris.

Collecting the Sap

Because sap flow depends on weather, it is not always consistent. Some days no sap will flow; other days, as much as a quart to a gallon or more of sap may flow during a flow period (several hours to a day or more). During the season, an average tap will produce 6 to 10 gallons of sap. Slightly more than 10 gallons of 2% sugar-content sap are required to produce one quart of syrup.

To produce high-quality syrup, sap should be collected as quickly as possible. It is best to collect sap the day it runs and process it immediately into syrup. The longer sap is left in buckets or bags the more likely it is to spoil, particularly during warm weather. During periods of cold temperature, sap can often be stored for a couple of days under the proper storage conditions without seriously reducing the quality of syrup it will produce.

However, such storage is usually not recommended or necessary for hobbyists. Usually, the season will provide enough sap in timely runs to make all the syrup you desire and have time to produce. Although not absolutely necessary, it is often desirable to filter sap through a cloth filter before it is boiled. This filtering removes any debris, such as twigs or pieces of leaves or bark, which might have fallen into the sap. Several layers of cheesecloth will serve as a filter or a reusable (cleanable) maple sap filter can be purchased.

Making Syrup from Sap

Sap is made into syrup by boiling off water, which increases the sugar content to 66 percent and causes chemical changes that darken the syrup and provide its characteristic taste. The amount of sap required to produce a gallon of syrup depends on the sugar content of the sap. On the average, in Ohio, sap averages about

two percent sugar content, requiring 43 gallons of sap to produce a gallon of finished syrup. If the sap sugar content is higher (it varies from tree to tree, with weather, and other factors), less sap will be needed to make a gallon of syrup; if lower, more sap will be required.

Most large commercial producers use a continuous feed evaporation process to make syrup. An evaporation pan is designed so that sap is added to the pan at one end and syrup is removed at the other in a “continuous” process. Most hobbyists use a “batch” approach, in which sap is placed in a pan and heated. More sap is added as water evaporates until a suitable amount of concentrated sap is present. The evaporation process is then continued with no additional sap and the entire batch is “finished” to the desired density. To batch-process syrup, a large pan, such as a roaster (teflon coated pans are ideal), is needed. The pan should be at least 6 inches and preferably 8 inches deep to prevent foaming over.

Rates of evaporation from a flat bottom pan are highly variable. Depending on many factors, including the size of the heat source and the type, size, and construction of the pan, they may range from as little as 3/4 to more than 1-1/2 gallons of water for each square foot of liquid surface. A 12-inch square or 14 inch in diameter circular pan both have one square foot of liquid surface. Remember, 43 gallons of sap are required to produce one gallon of syrup — 42 gallons of water must be evaporated. It will normally require somewhere between 28 and 56 hours of continuous boiling (and sap refilling) if a pan with one square foot of liquid surface is used. By comparison, a gallon of syrup can be produced in between 9 and 18 hours using a rectangular 24" x 18" pan (3 square feet of liquid surface). Obviously, the larger the pan, the more quickly the evaporation process will be completed.

Do not fill the pan completely, as boiling sap usually rolls and foams. Remember to boil outside the house or at least vent the steam outside. Bring the sap to a boil. If foaming occurs, skim the foam off and discard. Maple producers use a defoamer to reduce the amount of foaming. Defoamers are not, however, commonly used when batch processing small amounts of sap. If foaming over is a problem, the common solution is to use a deeper container. If needed, commercial defoamers are available from maple equipment suppliers or a flavorless vegetable oil may be used. Use the defoamer sparingly (a small drop at a time) as excessive amounts may give the syrup an off-flavor.

Continually replace the sap as evaporation occurs. To avoid burning or scorching, monitor the heat carefully (don't let the heat get too high), and keep at least 1-1/2 inches of liquid in the pan. The risk of scorching increases as the density of the liquid increases.

Finishing Syrup

The higher the sugar concentration in a sugar solution, the higher the temperature at which the solution boils. As you evaporate water from sap you will discover that the temperature of the boiling liquid is increasing. Finished syrup boils at 7.1°F above the boiling temperature of water. When you decide to finish your syrup, stop adding sap and continue the evaporation process until the liquid is boiling at a temperature 7.1°F above

that of boiling water. Monitor the heat very carefully as “finish point” is approached so that you do not scorch the syrup or go beyond the desired density. Be sure the thermometer bulb is not touching the side of the pan, or it will not read correctly.

Finishing syrup at the correct temperature is critical to producing quality syrup that stores well. Be sure the temperature reaches the finish point. If you go beyond the finish temperature to more than 7.5°F above the temperature of boiling water, add a little more sap and bring the syrup to the correct finish point.

Since the boiling point of water varies with location (elevation) and weather (pressure systems), you should determine the boiling point of water when you are making syrup. This is easily done by placing your thermometer in a pan of vigorously boiling water. Note, that since the boiling point of sap is essentially the same as water, the boiling temperature of sap when it just begins to boil is a suitable estimate of the boiling point of water.

Again, be sure the thermometer bulb does not touch the pan side. Once the syrup has reached the desired boiling temperature, it is ready for filtering and packaging. If you have a hydrometer, now is the time to check and verify the density of the syrup. The density should be at least 66° Brix (66 percent solids) and not much more than about 67 to 67.5° Brix. Less than 66° and it is not legally maple syrup, it will be very thin, and will not store as well. Much higher than 67.5° and sugar crystals are likely to form in the storage container. For instructions on the use of an hydrometer, consult the *North American Maple Syrup Producers Manual* referenced at the end of this fact sheet.

Filter hot syrup through clean wool or synthetic syrup filters to remove sugar sand and other suspended solids. After filtering,

syrup that is to be used immediately can be cooled and refrigerated. The rest of the syrup should be packaged hot in tightly sealed, clean, airtight containers. For safe storage, syrup temperature for packaging should be at least 180° and preferably 185°F. After filling and sealing the containers, immediately invert them for a short time to flood the container neck and lid bottom with hot syrup.

Maple Confections

Maple syrup also can be processed into a wide variety of confections, including granulated or molded maple sugar, “crunchy” hard maple sugar, molded soft sugar candy, maple cream, maple fondant, and “Jack Wax” or “Maple on Snow.” These confections are easy to make, delicious to eat, and make excellent gifts. Obtain a copy of Ohio State University Fact Sheet F-46 titled *Making Maple Candy and Other Confections* or consult the *North American Maple Syrup Producers Manual* for a discussion of how to make various maple confections.

More Information

Those interested in a more comprehensive discussion of maple syrup production may wish to obtain a copy of the *North American Maple Syrup Producers Manual*, a 178-page manual dealing with all aspects of maple product production from sugarbush management to marketing. This manual may be purchased through your local county Ohio State University Extension office. Ask for Ohio State University Extension Bulletin 856.

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