



# Maple Syrup

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## Introduction

Maple syrup is one of North America's oldest value-added food products. Native Americans in the Great Lakes and St. Lawrence River regions used maple syrup and sugar for barter.<sup>1</sup> European settlers learned from American Indians how to boil maple sap into syrup. Although U.S. maple syrup production peaked during World War I, maple syrup remains popular today as a table syrup, food ingredient and popular specialty food and gift item.

Maple syrup is made by processing (boiling) tree sap. Sap may be processed from all maple tree species; the highest sugar content usually occurs in sugar maple and black maple sap. Maple sugaring may occur wherever late winter temperatures permit sap collection, ideally when nighttime temperatures are below freezing and daytime highs do not exceed 45F. Kentucky is among the southernmost states for commercial maple syrup production.

## Marketing

Wholesale and retail markets for both maple sap and syrup are well established in the Northeast and upper Midwest, where U.S. maple syrup production is most common. Food safety guidelines and restrictions apply for processing maple sap into syrup, sugar, candies and other food products. House Bill 391 allows Kentucky farmers to process value-added products and sell them from Kentucky Department of Agriculture-registered farmers



markets, Kentucky Farm Bureau Certified Roadside Stands, or from the processor's farm. House Bill 391 includes two processing categories, Homebased Processor and Homebased Microprocessor. Maple syrup is among the low-risk products that homebased processors are allowed to produce and sell. To be certified as a homebased processor, maple syrup producers must file an application form with the Kentucky Cabinet for Health Services, Food Safety Branch, and follow labeling requirements.<sup>2</sup> Maple syrup producers who want to sell from other locations must apply to be food manufacturers. They will be subject to inspections of their facility, and they will have to pay a permit fee based on the size of their facility.

In general, if 75% or more of an operation's product sales are retail, or sold directly to consumers, the manufacturing operation is



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permitted and inspected through its local health department. Exceptions include any operation selling packaged food over the internet or across state lines, which is subject to manufacturing rules. Food manufacturing businesses that primarily sell their product wholesale (sell to another wholesale or retail outlet) or sell over the internet are permitted and inspected through the Kentucky Food Safety Branch. In Kentucky, individuals who produce less than 4,500 pounds, 500 gallons, or \$6,000 of maple syrup per year (whichever is least), are usually not required to obtain a commercial permit, but they are required to label their product properly. For an overview of federal, state and local rules and regulations for manufacturing food products in Kentucky, including maple syrup, see Commercial Food Manufacturing in Kentucky – A Starter Guide, from Kentucky Public Health.<sup>3</sup>

Maple syrup is typically sold by grade, although Kentucky does not require it to be graded. If your buyer requires grading, guidelines are established by the USDA Agricultural Marketing Service. The grade must be displayed on the maple syrup container. Details on USDA maple syrup grades are discussed below under Production Considerations, Evaporating and Packaging. Failing to properly process maple sap and syrup using quality control practices can result in off-color and/or off-flavored syrup and may result in a less desirable grade of syrup.

Kentucky producers mainly focus on processing sap into syrup. Kentucky maple syrup is successfully sold at farmers markets, farm stands, and through online sales and specialty retailers. Wholesaling packaged syrup may also be possible, especially to specialty grocers and food businesses focused on regional or specialty foods. Increased profits can be made by further processing syrup into maple confections such as maple candy, maple granulated sugar, maple cream/spread, etc.

## **Market Outlook**

Maple syrup enjoys consumer perception as a wholesome and natural sweetener. Maple syrup

is unrefined and delivers more nutritional value than many other sweeteners. Pure maple syrup provides enhanced antioxidant levels compared to other foods, including apples and broccoli. In addition to its nutritional content, researchers have found that maple syrup contains numerous phenolic compounds, commonly found in agricultural products such as berries, tea, red wine and flax seed.<sup>4</sup> Maple syrup is also a desirable gift and specialty food product.

Maple syrup helped increase U.S. per capita consumption of edible syrups to 0.8 pounds per capita in 2014, the highest level in 50 years. This is largely driven by the “locally grown” food movement where consumers want to know where their food comes from in efforts to eat healthier. Total U.S. maple syrup consumption in 2014 exceeded 7 million gallons (production plus imports, minus exports), a significant increase from the 4 million gallons consumed annually in the late 1990s.<sup>5</sup> More than half of the maple syrup consumed in the U.S. comes from Canada, where Quebec produces more than 10 million gallons per year.

U.S. maple syrup production ranged from 3.2 million gallons in 2014 to 3.4 million gallons in 2015.<sup>6</sup> Production in the top 10 maple syrup states was valued at \$132 million (2013) and \$117 million (2014). Vermont, New York and Maine produced 75 percent of the maple syrup volume, and about 70 percent of the value, from 2013 to 2015. States with lower production volumes – Ohio, Wisconsin, Pennsylvania, Michigan, Massachusetts, New Hampshire and Connecticut – usually report higher prices per gallon of maple syrup.<sup>7</sup> In June of 2016, the National Agricultural Statistics Service reported maple syrup production from Indiana (12,000 gallons), Minnesota (14,000 gallons) and West Virginia (6,000 gallons) for the first time.<sup>8</sup>

## **Production considerations**

### *Site selection*

Maple syrup can be produced from the sap of any maple tree species (*Acer* spp.). Sap sugar content increases in the winter as starch stored by the

tree in its root system and is converted to sucrose and stored in the sap. Sap from the sugar maple (*Acer saccharum*) usually has the highest sugar content, or brix. Black maples (*Acer nigrum*) also produce sweeter sap in large quantities. Average sap sugar content of 2 to 2.5 brix, or percent sugar, will yield about 1 gallon of syrup from 40 to 42 gallons of sap. Brix is the percentage of sugar in a solution. The higher the degree of brix in maple syrup, the higher the density of the syrup will be. To be legal maple syrup under USDA standards, syrup must be between 66 and 68.9 brix, or percent sugar.

Sap from other maple species, with lower sugar content, may require 60 or more gallons of sap to produce 1 gallon of syrup. Sap from silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), and boxelder (*Acer negundo*) are lower in sugar content. Tree genetics, health, diameter and crown size, root zone conditions and environmental conditions also affect the brix of sap in all maple species.

The group of trees tapped for making syrup is called a “sugar bush.” Extension foresters suggest at least 10 to 20 maple trees, each with at least a 12-inch diameter, as the minimum size for a Kentucky sugar bush.

Sap collection usually occurs in northern Kentucky from mid-January to mid-March. Sap collection will start sooner farther south. Aspect also plays a large role in determining when to tap, and is a factor in the valleys and on mountains in Kentucky. South facing sugar bushes will warm up faster and will start producing earlier than sugar bushes that face north. Sap collected toward the end of the season, when trees are nearing budding, tends to be lower quality. Sap collected during and after the swelling of maple tree buds results in an off-flavor in the syrup called “buddy.” Red and silver maples will bud out about a week to a week and a half earlier than sugar maples. Producers need to watch the red and silver maples and pull the taps early while leaving them in the sugar maples.



Maple trees are tapped by drilling 1½ to 2½ inches below the bark and inserting a metal or plastic spout, called a spile, into the hole. Drilling too deeply increases the chances of hitting stained or brown wood, which is nonconductive and does not produce sap. Trees with a diameter of 12 to 18 inches should have one tap, while trees more than 18 inches in diameter should have two taps. Research has shown that additional taps do not produce more sap. In fact, use of additional taps creates more brown or stained wood, which never again produces sap. Spout size should be 5/16- or 19/64-inch as these health spouts/spiles will produce the same volume of sap as the old larger traditional taps. The smaller health spouts create less damage and staining of sap wood, which has long-term benefits for the tree.

#### *Evaporating and Packaging*

Collecting maple sap can be labor-intensive, especially when sap is collected from each tree in buckets or bags. Trees in the sugar bush should be located near each other to reduce labor needed for sap collection. Sap collection using plastic tubing, as well as vacuum or reverse osmosis systems, is used to reduce labor and create efficiencies in larger-scale maple operations. There are many options for vacuum and reverse osmosis technology on the market for small-scale “hobby” maple syrup operations.

Most producers boil maple sap into syrup in a well-ventilated building or shed designed for the purpose (the “sugar shack”). An outdoor fire with adequate smoke exhaust may also be used;

improperly ventilating smoke away from the fire can create an off-flavor in the syrup. Sap is boiled in an evaporator pan that allows flow of sap to a finishing pan (or “syrup pan”).

Investment in some specialized facilities and equipment is necessary for producing saleable maple syrup. This includes proper firebox construction and food-grade stainless steel evaporating equipment. Properly evaporating the sap into syrup also requires measuring and monitoring the sap/syrup brix (percent sugar) with a hydrometer. Only food-grade and lead-free materials should be used in maple sap or syrup operations. Both sap and syrup are acidic and will etch the metal, and if lead-based metals are used the potential for lead in the finished product will increase. Only food-grade plastics should be used. If food-grade plastic materials are not new, use only containers that held a neutral-based, non-flavored food such as milk, ice cream, icing, butter, etc. Never use containers that held an acidic food such as orange juice, vinegar, tomato paste, etc., as even if washed the sap/syrup can etch the flavor out of the plastic, creating an off flavor. Finished maple syrup should only be hot packaged into clean new containers (glass or plastic), as syrup will pick up the off-flavor from the contents of a used container. For example, containers that have been used for peanut butter, pickles, tomato paste, etc., will cause an off-flavored maple syrup, as maple flavoring is easy to destroy.

USDA grade standards were updated and made official in 2015. According to Agricultural Marketing Service guidelines, there are three grades of maple syrup: U.S. Grade A, Processing Grade, and Substandard. There are four color and flavor classifications for U.S. Grade A maple syrup: golden (delicate flavor), amber (rich flavor), dark (robust flavor), and very dark (strong flavor). To meet Grade A requirements, each of these classifications must 1) possess a good maple flavor (taste) characteristic of the color; 2) be clean, free from turbidity or cloudiness, and free from off flavors and odors; and 3) have a good uniform color (the syrup color must be bright and

typical of maple syrup. Processing Grade maple syrup fails to meet the requirements of Grade A, “but possesses a fairly good characteristic maple taste and may contain off-flavors, but is fairly free of damage, fairly free of turbidity or cloudiness, and is fairly clean.” Maple syrup classified as Substandard fails to meet the requirements of Processing Grade.<sup>9</sup>

### **Economic considerations**

Maple syrup production has more profitability potential for Kentucky producers who are able to sell maple syrup at a retail or premium wholesale price. Those interested in developing a commercial maple syrup enterprise should list the costs of the necessary equipment for startup using a worksheet like the one in the Ag Alternatives publication from Penn State University. These costs can then be entered into an interactive spreadsheet, such as that available online from The Ohio State University. See Selected Resources, below, to access these publications.

Two considerations of maple syrup production – labor management and land use – can be attractive in a whole farm business plan or woodlot management plan. First, processing maple sap occurs during a time of year when farm labor needs may be low in Kentucky. This can create positive returns for landowner labor time or allow retaining hired workers on a longer basis. Second, maple sugaring can potentially generate cash flows from wooded areas managed for conservation and/or forestry purposes on farms.

A third consideration is the significant cost of purchasing food-grade evaporating and processing equipment. Using the equipment for another income-generating use, like sweet sorghum syrup production, will help improve the feasibility of a farm investing in the necessary equipment.

The Ohio State University estimates, calculated in 2012 and assuming an \$11 wage rate, show a

\$777 return to labor and management per season (about \$4,000 above variable costs) for a 1,000-tap bucket system using a wood-fired evaporator. The assumed price was \$45 per gallon for half of the syrup produced and \$33 per gallon for the other half of syrup produced.

<sup>1</sup>Willits, C.O. 1958. Maple Sirup Producers Manual. USDA, Agriculture Handbook No. 134. <http://naldc.nal.usda.gov/download/CAT87208919/PDF>

<sup>2</sup>Homebased Processing and Microprocessing, University of Kentucky Department of Dietetics and Human Nutrition. <https://dhn-hes.ca.uky.edu/content/home-based-processing-and-mircroprocessing>

<sup>3</sup>Commercial Food Manufacturing in Kentucky – A Starter Guide. Kentucky Public Health <http://chfs.ky.gov/NR/rdonlyres/CC5DF026-6A6A-412B-BA25-59E9DDA2FF86/0/CommercialFoodManufacturinginKyAStarterGuide.pdf>

<sup>4</sup>International Maple Syrup Institute. <http://www.internationalmaplesyrupinstitute.com>

<sup>5</sup>Sugar and Sweeteners Yearbook Tables. Accessed March 2016. USDA Economic Research Service. <http://www.ers.usda.gov/topics/crops/sugar-sweeteners.aspx>

<sup>6</sup>Crop Production 2015 Summary. January 2016. USDA National Agricultural Statistics Service, page 79. <http://usda.mannlib.cornell.edu/usda/current/CropProdSu/CropProdSu-01-12-2016.pdf>

<sup>7</sup>Crop Values 2015 Summary. February 2016. USDA National Agricultural Statistics Service, page 43. <http://usda.mannlib.cornell.edu/usda/current/CropValuSu/CropValuSu-02-24-2016.pdf>

<sup>8</sup>Northeast Maple Syrup Production. June 2016. USDA National Agricultural Statistics Service, page 1. [https://www.nass.usda.gov/Statistics\\_by\\_State/New\\_England/includes/Publications/Maple\\_Syrup\\_2016.pdf](https://www.nass.usda.gov/Statistics_by_State/New_England/includes/Publications/Maple_Syrup_2016.pdf)

<sup>9</sup>United States Standards for Grades of Maple Syrup (USDA). [http://www.internationalmaplesyrupinstitute.com/uploads/7/0/9/2/7092109/revise\\_u.s.\\_standards\\_for\\_grades\\_of\\_maple\\_syrup\\_march\\_2,2015.pdf](http://www.internationalmaplesyrupinstitute.com/uploads/7/0/9/2/7092109/revise_u.s._standards_for_grades_of_maple_syrup_march_2,2015.pdf)

## Selected Resources

North American Maple Syrup Producers Manual, 2006 <http://estore.osu-extension.org/North-American-Maple-Syrup-Producers-Manual-Second-Edition-Looseleaf-P110.aspx>

Forest Farming: Have Maples Will Sugar... UK Agroforestry FOR-118 <http://www.ntfpinfo.us/docs/other/Hill2010-ForestFarmingHaveMaples.pdf>

Penn State Ag Alternatives [http://extension.psu.edu/business/ag-alternatives/forestry/maple-syrup-production/extension\\_publication\\_file](http://extension.psu.edu/business/ag-alternatives/forestry/maple-syrup-production/extension_publication_file)

2012 Ohio Enterprise Budget – Maple Syrup Business Planning Guide <http://aede.osu.edu/about-us/publications/2012-ohio-enterprise-budget-maple-syrup-business-planning-guide>

Cornell Maple Program [www.cornellmaple.info](http://www.cornellmaple.info)

Maple Syrup Production for the Beginner (Penn State and Cornell) <http://extension.psu.edu/natural-resources/forests/maple-syrup/resources/maple-syrup-production>

United States Standards for Grades of Maple Syrup (USDA) [http://www.internationalmaplesyrupinstitute.com/uploads/7/0/9/2/7092109/revise\\_u.s.\\_standards\\_for\\_grades\\_of\\_maple\\_syrup\\_march\\_2,2015.pdf](http://www.internationalmaplesyrupinstitute.com/uploads/7/0/9/2/7092109/revise_u.s._standards_for_grades_of_maple_syrup_march_2,2015.pdf)

Hobby Maple Syrup Production F-36-02 (Ohio State University) [http://www.sugarbushsupplies.com/pdfs/OSU\\_How\\_to\\_Tap\\_a\\_Tree.pdf](http://www.sugarbushsupplies.com/pdfs/OSU_How_to_Tap_a_Tree.pdf)

Maple Candy and Other Confections F-46-02 (Ohio State University, 2002) <http://www.ohiomaple.org/documents/Maple-Confections.pdf>

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