

# Connecticut Maple Syrup Producers Manual



Production & Quality Control Guidelines

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Maple Syrup Producers Association of Connecticut, Inc.

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This material was adapted by the Maple Syrup Producers Association of Connecticut, Inc. from the University of Maine Cooperative Extension publication #7038, *Maple Syrup Quality Control Manual*, which was prepared by UMCE Educator Kathryn Hopkins in cooperation with the Maine Department of Agriculture, Food and Rural Resources, Division of Quality Assurance & Regulations; the Vermont Department of Agriculture; and the Maine Maple Syrup Producers Association, for educational purposes.

Appendix information included by the Maple Syrup Producers Association of Connecticut, Inc. with citations as noted.

## Cleanliness and Maple Syrup Quality

The two most important factors in the production of high quality maple syrup and syrup products are cleanliness and attention to detail in all parts of the production process.

The most important contributor to maple syrup quality is cleanliness. Microorganisms, bacteria and yeast are enemies of high quality syrup. They affect both color and flavor. Since these culprits are found on unclean equipment, and may grow rapidly in sap and syrup, careful sanitary practices are critical when you collect sap, and make, pack and store syrup.

## Sanitizers and Maple Syrup Quality

Although cleanliness is a "must," most cleaning compounds cannot be used in maple production. Household detergents, and soaps that have any fragrance, and iodine-based dairy sanitizers should not be used to sanitize syrup production equipment. They can ruin syrup flavor, making the syrup unsaleable.

Remember that anything added to sap, even in minute quantities, will become concentrated as the sap is boiled to syrup, causing an off-flavor. Lots of clean, hot water (180 degrees F) and plenty of "elbow grease" are the safest and best cleaning and sanitizing agents for maple syrup equipment.

An alternative method one can use the following: One part unscented household chlorine bleach (such as unscented Clorox™) to 20 parts of clean water may be used for rinsing, but you will need to flush equipment afterwards with clean, clear water. Do not use a stronger solution, or let the solution stand in galvanized or stainless steel equipment, because flavor problems may result or equipment may be damaged.

Most important, remove any trace of these agents from your equipment with a thorough hot water rinse.

## Quality Begins in the Sugarbush

The equipment you use will also have a big impact on your final product. Don't use rusty or corroded spouts, buckets, or other maple utensils. Otherwise you may find toxic metals and metallic off-flavors in your syrup.

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**Household detergents, and soaps that have any fragrance, and iodine-based dairy sanitizers should not be used to sanitize syrup production equipment.**

## Spouts

Before using spouts, sanitize them. To sanitize the spouts use boiling water. Place them in a pot of boiling water. This will keep the tap hole open longer, increasing sap yield and will help keep tubing lines free of microorganisms.

## Buckets and Pails

Scrub buckets and pails thoroughly by hand or by machine with hot water. Do this at the end of the season so next year's work is easier, and to prevent metal deterioration.

## Pipelines, Tubing and Conduit

### *Installing Pipeline for High Quality Production*

Pipeline, tubing and conduits help the sugarmaker get the freshest possible sap to the sugarhouse. "Down hill, straight and tight" is a slogan to keep in mind when installing tubing. Pipeline that sags, or is not pitched enough, may retain sap, which can develop microorganisms as it ages, lowering syrup quality. Use pipeline of sufficient diameter to move sap quickly, so you maintain the sap's high quality. Tubing installation guidelines have changed substantially in recent years. Research new techniques and materials available when planning your new tubing system or updating your present system.

### *Choosing Tubing for High Quality Production*

Install tubing that's specific for maple syrup production. Tubing companies have designed products that move large volumes of sap long distances in favorable conditions. Black plastic water pipe, which draws heat from the sun, should be used with care. Sap flowing long distances in dark pipeline exposed to the sun may reach temperatures as high as 80 degrees, even though air temperatures are much lower. Warm sap in lines, and later in storage tanks, encourages microorganism growth.

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**No matter what piping you use, be certain that lines have no sags; sags trap the sap, and permit bacteria growth.**

To prevent this problem, dark colored pipe may be painted white with a non-toxic paint. No matter what piping you use, be certain that lines have no sags; sags trap the sap, and permit bacteria growth. If you use pipe that is not designed specifically for sap collection, it must be of high grade,

the kind that is designed for drinking water. Be certain that all tubing is made of food-grade materials.

### ***Clean Tubing and Quality***

Clean tubing is vital to maximize production of high-quality syrup. Sanitize tubing right after the last sap run. Ideally, a hot water/air-mixture can be pumped through the sap lines. The turbulence of the air mixed with water is an effective cleaner.

An alternative method: just pump clean water through the lines.

## **Tree Tapping**

### ***Tap Only in White Wood***

Drill all tap holes into healthy, clean, white wood. Generally a depth of not more than 1½" inches is recommended. When dark-colored wood shows in a hole, that tap should not be used. A bad tap hole will yield little or no sap, and may spoil the flavor of large amounts of syrup. Although you can use the 7/16" spout, current practices encourage using the 5/16" spout.

### ***Clean the Tap Holes***

Insert spouts right after drilling. Tap them gently to avoid any unnecessary damage to the tree. Remove wood chips; use a clean tool to brush them out. Blowing into the hole to remove chips is an unsanitary practice. It will contaminate the tap hole.

### ***Tapping Guideline***

In recent years, maple trees throughout much of the northeastern United States have been subject to severe stresses from gypsy moth, pear thrips, pollution, and weather. As a result, tapping guidelines have become more conservative, with one commonly recommended guideline suggesting 12 inches as the smallest tree to tap. One tap (1) for a tree that is 12 to 18 inches in diameter and 2 taps 19 inches and greater and no more than 2 taps in any tree. Research and field observations show that the volume yield of sap per taphole can increase substantially when fewer tapholes per tree are used. In summary, using more taps per tree does not necessarily mean proportionally more sap.

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**The volume yield of sap per taphole can increase substantially when fewer tapholes per tree are used...using more taps per tree does not necessarily mean proportionally more sap.**

**Warning: Don't use paraformaldehyde pellets.** In the past, paraformaldehyde pellets were recommended for use in tap holes; some out-of-date sugaring manuals still suggest their use. Research shows that the use of paraformaldehyde pellets can damage trees. They are now illegal. Similarly, the use of denatured alcohol as a disinfectant for tapholes is also illegal.

## **Sap Collection**

### ***Timing is Important***

Gather sap promptly when temperatures are above freezing. Fresh, clean sap kept cool during collection and prior to boiling will produce syrup that is one to two grades higher than old, contaminated sap. Since higher quality syrup commands a higher price, it makes sense to collect and boil sap as quickly as possible.

### ***Sap Gathering Pails***

Gather sap from buckets in containers that are specifically for that purpose. Don't use pails that have contained non-food products.

### ***Be Observant***

Maple sap and syrup pick up off-flavors easily. Be sure that particles from exhaust pipes of tractors do not float into gathering pails or tanks. If sap has contact with any petroleum product it is especially damaging to finished syrup.

### ***Sap Ice***

Ice formed in sap buckets can help keep sap cool in storage; however, many sugarmakers throw it away because they believe that it contains very little sugar. With today's high fuel costs, you may wish to check the sugar content of melted ice before deciding whether or not to keep it.

## **Sap Filtering**

You'll need to filter sap through multiple filters, first through a coarse filter to remove bark, small wood shavings and debris, then through a finer filter. Removing foreign materials from the sap before it is evaporated will usually upgrade syrup by at least one grade. Change sap filters often and keep them clean to avoid off-flavors. (Please see manufacturer's information regarding the care of filters.) For filtering sap, many sugarmakers use filtering materials that are available from maple equipment suppliers.

## Sap Tanks

### ***Keep Tanks Clean Throughout the Season***

Rinse and scrub gathering and storage tanks with hot water between runs, when practical.

### ***Keep it Cool and Covered***

Tanks should be located outside the sugarhouse, preferably on the north or northwest side, away from direct sunlight. A loose covering over the storage tanks will prevent rain and foreign materials from lowering the quality of the sap.

### ***Storing Sap***

Sap should not be left long in tanks when weather is above freezing; the quality of the sap will begin to deteriorate, producing lower-grade syrup. Boil sap immediately after every sap run. This will insure the highest quality product.



*Typical covered  
sap bucket*

## Quality Continues in the Sugarhouse: Processing Sap

### **Prompt Processing: One Key to High Quality**

For the highest quality syrup, evaporate sap as soon and as quickly as possible. Holding sap in buckets or tanks lowers the quality of the syrup produced from that sap. Try to boil the sap from a day's run within 12 hours, especially in warmer temperatures. In the evaporator, a shallow sap depth of 1"-2" and a hot, steady fire make for rapid syrup production, and high-grade syrup.

### ***Reverse Osmosis***

Reverse osmosis units are becoming more common. They allow the sugarmaker to remove large quantities of water before the conventional evaporation process. As with all sugaring equipment, cleanliness is critical. Follow the manufacturer's suggestions for cleaning. If you use an anti-bacterial storage solution, or any sanitizing solution, be sure to rinse thoroughly with clean water before processing sap to avoid off-flavor and/or syrup contamination.



**Defoamer**

Use as little defoamer as possible, and be sure it's fresh. Old defoamer becomes rancid, and causes a rancid flavor in syrup. Excess use of some defoamers can also cause "fatty" off-flavors. Defoamer is available in liquid and dry granular forms.

If you use vegetable oil because of special market requirements (religious or dietary) take care to use the smallest possible amount. In recent years, some off-flavors due to vegetable oil have occurred; the vegetable oil flavor tends to especially affect the light amber grade syrup.

**Evaporator Pan**

Keep pans clean. Change draw-off sides or remove and clean syrup pan regularly to prevent the accumulation of niter (sugar sand), which can cause scorching and off-flavored syrup. In recent years producers have noted an increase in off-flavored syrup due to burnt niter. When evaporating with reverse osmosis concentrate, niter build-up is faster, requiring more frequent cleaning. Should any scorching occur, shut down and clean up the burned area to prevent off-flavors in the next batch of syrup.

**Maple Syrup Quality Control  
Puts the Accent on Flavor**

Maple syrup flavor must be guarded from sap to store shelf. Flavor can be damaged from contaminated, unfiltered, or old sap, new and used filters, caramelized sugar, fermentation and mold, detergents, chemicals and rust.

**Syrup Density**

Maple syrup must be evaporated to a density between 66 to 67 percent Brix at 68 degrees F. Remember that syrup having a density reading below 66 percent Brix will ferment. Syrup with a density above 68 percent Brix may crystallize, causing consumer complaint. Various instruments can be used to check the density: hydrometers, hydrotherms and refractometers. Maple syrup reaches the proper density at 7½ degrees F above the boiling point of water. Remember to check the boiling point of water on any given day, as the boiling point varies with changes in the barometrical pressure. For best results, know how the instrument you use works and how to protect its accuracy.

### ***Low-Density Syrup***

Common causes of low-density syrup:

- Not making an adjustment of syrup temperature when checking density with a hydrometer.
- Not making an adjustment for changes in the boiling point of water on thermometer.
- Using an inaccurate hydrometer or thermometer.
- Inaccurate adjustment of heavy-density syrup.
- Steam condensing on surfaces, and running into the last containers of syrup to be packed. The last syrup in the tank should not be canned unless checked carefully for proper density.

### ***Density Check at Draw-Off***

Use a deep container of small diameter (hydrometer cups are convenient) so that the hydrometer may be floated immediately after each draw off. Lower the hydrometer gently. Be sure that the hydrometer does not touch the bottom or sides of the hydrometer cup. Make the reading at the point on the hydrometer stem that is level with the surface of the syrup (not the top of the meniscus).

### ***Syrup Refractometer***

Syrup refractometers are instruments that may be used to test maple syrup density. They are available through maple equipment dealers. If you use a refractometer, be sure to follow instructions. Occasionally, problems can occur that are due to incorrect calibration of the instrument, leading to light or heavy syrup. Also, producers and the Department of Agriculture have found that some instruments do not consistently provide accurate readings when testing hot syrup. You can check a refractometer by comparing measurements to those taken with an accurate, tested hydrometer and a thermometer, or a refractometer.

### ***Hydrotherm***

Hydrotherms are special hydrometers with thermometers built in to locate the point on the hydrometer to measure standard density syrup. It is used like a hydrometer but allowed to sit for 30 to 40 seconds for the thermometer column in the hydrotherm to warm or cool to the syrup temperature. The Department of Agriculture does not



*Syrup Hydrometer*

recommend using hydrotherms because they are not calibrated to a standardized scale.

### ***Thermometer***

Thermometers are often used to determine when syrup is ready to draw off. Syrup reaches the proper density at 7½degrees F above the current boiling point of water. Although this is a relatively accurate method of finishing syrup, it is recommended that the density be confirmed with a hydrometer or other method specifically designed to measure density.

### ***Automatic Draw-off***

Automatic draw-offs are not completely accurate. Change the draw-off side or clean syrup pan regularly every several hours of boiling, or when your scoop shows niter beginning to build up in the pan. Using a hydrometer or refractometer, test the first syrup drawn off of the clean pan. Adjust the draw-off frequently each day, using a hydrometer or refractometer, to establish the right adjustment.

**Important Note: Do not scoop near the automatic draw-off until after it shuts off. Scooping near the draw-off will change the density reading of the drawn-off syrup. Clean the control when changing sides or cleaning the syrup pan. Nylon scouring pads (unscented and soap-free) are helpful. Never use steel wool. It will scratch the pan and speed the build-up of niter.**

## **Syrup Filtering**

### ***Care of Filters***

Filters can impart off-flavors to syrups, making the product unfit for sale. Do not store filters in mothballs, cedar closets, airtight containers, or near scented materials. Clean filters thoroughly, dry thoroughly, and store in a cloth bag in clean, dry, airy, storage. The only method is hot water. Despite repeated washings, rinsings and airings, filters that have been washed with bleach still impart off-flavors to syrup. Scented cleansers, fabric softeners, and "dryer sheets" should not be used either. New filters and pre-filters must be thoroughly boiled in clean water (not in sap pans) and air dried (in the sun if possible). Use the "sniff" test to provide an added check for your filters. Musty old filters or new chemical-smelling filters should not be used.

The use of synthetic filters as pre-filters ("cone type" or "flat type" filters) save much labor. When they are used, more effective filtration results,

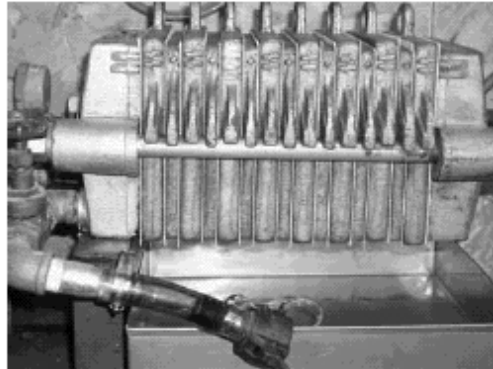
and the heavy filters may be in service longer between cleanings. Wash and dry pre-filters often in pure, hot water.

Old, threadbare filters will cause cloudy syrup. Hold filters up to bright light to check for filter problems (cloudy syrup must be graded substandard). Remember to filter hot syrup (210 degrees F) immediately after removal from the pan. Do not stir syrup through the filter.

### **Pressure filters**

Clean all pressure filter parts thoroughly with hot water prior to each reassembly.

Filter plates have numbers or patterns that indicate how the filter press plates should be assembled. Line up the plates accordingly and smooth each cloth or paper so that there are no creases. Put a thin rod through the plates during assembly to help maintain the correct position. Care taken with the assembly of pressure filter units will help to prevent niter in finished syrup, and loss of finished syrup.



*Clean all pressure filter parts thoroughly with hot water prior to each reassembly.*

Follow the recommendation of the manufacture as to the amount of food grade Diatomaceous Earth needed to filter the syrup.

Filter cloths or papers should be changed often enough and the pressure regulator should be watched to avoid building up of pressure and bursting of filter paper; careful monitoring of the filter press will help to avoid cloudy syrup.

## **Quality Continues in the Sugarhouse: Syrup Packing**

Most sugarmakers will find it advantageous to pack some syrup in consumer-size containers during the producing season. However, at least part of the crop should be packed in bulk containers for later reheating and packing. Bulk containers offer these advantages when used for long-term storage.

Packing syrup closer to the date of sale reduces the possibility of grade change in the consumer size container. This is especially important when packing in plastic jugs.

- The potential of metallic flavors from cans is reduced.
- Reheating at packing time renews the fresh maple flavor.
- The possibility of rusty containers is lessened.
- The producer has greater flexibility in meeting the current market demand for a specific container size and style, but also maintains the potential for bulk sale.
- The potential of waste due to leftover, unwanted sizes is reduced.
- You can blend different "runs" to achieve greater uniformity of product. For small producers, five-gallon cans offer similar advantages to the 30-gallon barrel.

## **Packing in Bulk**

Here are some tips for successful bulk packing:

- Carefully examine bulk containers before filling.
- More bulk syrup is downgraded or ruined due to storage in drums that are in poor condition than by any other single storage cause.
- Use a flashlight to examine the interiors of drums.
- Use only bulk storage barrels or five-gallon cans that are rust-free, clean and dry. Steam cleaning is the best assurance of completely clean barrels.
- "Sniff" test the barrel and do not use if a foreign odor is present.
- If you are buying new barrels, always purchase food grade quality barrels, preferably stainless steel.

## **Filling Drums**

For the best results fill containers or drums with hot syrup (above 180 degrees), and fill them full. Any air space in the drum may cause problems. Use new gaskets; tighten bungs as soon as possible. Keep a sample from each drum in your freezer and identify each sample and its drum number. You can then select the syrup to repack using the drum samples rather than opening drums unnecessarily. Remember to store drums in a cool, dry place, and to educate your bulk syrup customers in the proper storage and handling of bulk syrup.

## Filling Retail Containers

Here is a list of suggestions that will help ensure a high-quality product ready for retail sale.

- Open the cartons in which syrup containers are packed so that the empty containers are upside down. Keep the containers in that position until they are filled, so foreign material can't get inside.
- Closely examine all containers, especially cans. Return any that are damaged by excess flux or solder, dents or other imperfections. Do not fill cans that have any rust.
- "Sniff" test empty containers. This will sometimes help you cull out unusable containers.
- Fill containers full to assure correct volume for the consumer, and to minimize airspace, that contributes to product spoilage.



*A variety of retail syrup product containers.*

### **Hot Packing**

"Cold" packing of syrup has caused more spoilage than almost any other factor. Always pack syrup hot! When packed at the right temperature, the hot syrup will sterilize its container, preventing spoilage. Then, when properly sealed, a vacuum will be created, preventing contamination.

The lowest safe temperature for packing syrup is 180 degree F when the cap goes on. Syrup that is left uncapped for a few moments can cool sufficiently and collect enough yeast and mold spores from the air to spoil some containers in an otherwise perfect lot.

Research completed by Dr. MariaFranca Morselli of the University of Vermont Maple Research Center indicates that packing syrup at temperatures higher than 180 degrees F (but not higher than 200 degrees F) will result in fewer trouble-causing microorganisms. However, if temperatures are raised too high for too long, new niter may precipitate, causing cloudiness. (Refiltering reheated syrup can eliminate cloudiness.) Continue to check temperature with a sterile thermometer immediately prior to filling the container.

Remember, the last container filled from any batch may not be of correct density. When a cover is used on filter tanks, condensation may cause the last syrup to be thin. If no cover is used, the last syrup may be heavy.

When sealing plastic containers, be sure the inner seals in the container caps are in place and clean when they are put on.

After capping the hot syrup, immediately lay each container on its side, neck down, to sterilize the air pocket and cap. Check the closure for leaks.

When containers are cool, spot checking a few for density, color and flavor is strongly recommended. This will insure that the syrup meets the standards for which it is labeled.

### ***Avoid "Stack Burn"***

"Stack burn" is the change in the grade of packed syrup caused by stacking hot containers of syrup together, intensifying the heat, and prolonging the cooling time. Stack burn can change a low Grade A Medium Amber syrup to Grade A Dark Amber. This is a common cause of grade violations.

To prevent stack burn, make sure you cool containers quickly. Space containers apart so that air may circulate around them. Do not place containers in cartons or on pallets until cool. A fan may help to speed the cooling process.

### ***Code All Syrup***

Code each batch of syrup as it is packed. If problems are found later, positive identification will allow you to recall only the syrup from the lot that is defective. Codes are typically marked or stamped on the bottom of the container. It can be any alpha or numeric code that will provide the producer reference information.

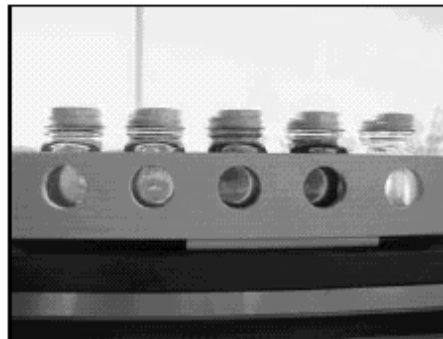
## **Grading Syrup for the Retail Container**

### ***Grading Kits***

Grading is an important step in your production process. First, be sure that your grading kit is accurate, and right for your operation. You can't grade a round bottle of syrup in a kit intended for square bottles, or by using bottles of different sizes. This can cause off-grade syrup. Also, colored glycerin grading guides fade with age. After one year, most of these temporary guides are off-grade. Check old kits, or replace them.

### ***Light Transmittance Meter***

A light transmittance meter is used to check syrup color. In a light transmittance meter, a syrup sample is checked for color by passing light through the sample. The percent of light transmission is compared to light transmission rates set for different grades. When using one, you need to be sure there are no fingerprints on the syrup test bottle, and that the syrup sample has no bubbles or cloudiness. Any of these conditions may diminish the light that is transmitted through the sample and therefore lowers the grade of the sample.



*Grading is an important step in your production process. First, be sure that your grading kit is accurate, and right for your operation.*

### ***Color***

Proper grading can only be done against a correct background. A clear, blue sky is ideal; a fluorescent light is better than a regular incandescent bulb.

Syrup should not be graded too close to the minimum. Allow a little extra premium color, especially when packing in plastic or ceramic containers. Stored syrup tends to darken in color, particularly when packed in plastic and ceramic jugs.

## **Care and Storage of Packaged Syrup**

The three main enemies of all stored syrup are temperature, air, and time.

*Temperature:* Store syrup in a clean, dry place of cool (if not refrigerated), uniform temperature. Some producers use a household air conditioner in the storage room to retain syrup quality, protecting grade and price.

*Air:* Even small heads of air in containers can cause problems. Be sure to completely fill all containers.

*Time:* When packing or repacking into retail-size containers, plan to fill only the amount that you will sell within the next few weeks. Retail containers may lose their sales appeal, and the syrup may lose flavor, color and grade when stored for long periods. (Grade loss is especially true of some plastic containers, in which syrup has been found to darken as much as one grade in only three months.)



## Reducing Lead in Syrup

Because it is a natural product, maple syrup's lead content is normally low. Lead does not come from trees but from the environment. The only way to know the actual lead content of syrup is to have it tested. Connecticut testing services are available at the Connecticut Agricultural Experiment Station.

If you are interested in testing your syrup for lead, contact any of the following labs:

The Connecticut Agricultural Experiment Station  
123 Huntington St.  
PO Box 1106  
New Haven, CT 06504  
Phone: 203-789-7214  
Fax: 203-789-7232

Analytical Laboratory  
Department of Plant, Soil & Environmental Sciences  
5722 Deering Hall, Rm. 407  
University of Maine  
Orono, ME 04469-5722  
Phone: 207-581-2917  
Cost: \$23.00

Agricultural and Environmental Testing Lab  
220 Hills Building  
University of Vermont  
Burlington, VT 05405

New Hampshire Public Health Labs  
Attn: George Robinson  
6 Hazer Dr.  
Concord, NH 03301  
Phone: 603-271-4784

### **Equipment**

If lead is a concern, survey the equipment used in your operation. Use as much lead-free equipment as possible. Sap collected with lead-free plastic tubing accumulates virtually no lead.

Equipment that may include lead are: 50/50 solder used in the production of many evaporators, tanks and some buckets manufactured before 1995; most galvanized equipment made before 1994; most brass and bronze fittings or pump parts; and tern plate, an alloy used in some older equipment. Check with your equipment dealer or manufacturer for specific information regarding the use of lead in the manufacture of the equipment you are using.

Sugar sand concentrates any lead in the sap. Roadside dust and dirt that blows into open buckets can introduce lead into sap as well. Old metal spouts frequently contained lead and these may introduce lead into the sap. Old tin buckets and buckets made with a shiny tern plate leach lead into maple sap for as long as the sap

sits in the bucket. Older, galvanized storage tanks, and lead-soldered evaporators and barrels can add significant amounts of lead to the boiling syrup or stored syrup.

### ***Practices***

Here are some practices that can reduce the amount of lead in syrup:

- Replace older, lead-containing equipment with stainless steel or plastic equipment as the budget allows.
- Drain the front pan of partially boiled syrup after shutting down the evaporator. Do not leave the syrup in the evaporator overnight.
- Clean the front pan with water to remove the sugar sand. Do not use an acid-based cleaner as this leaches out more lead from the solder.
- Filter syrup to remove sugar sand. Do not filter into old tern plate or galvanized milk cans where filtered syrup can pick up more lead.
- Avoid excessive pumping of syrup if the pump has brass or bronze parts.

## **After Sugaring: Quality Begins For the Next Season**

To ensure quality for next year, clean all equipment as soon as possible at the close of the maple season.

### **Care of Evaporators**

Some producers allow sap to ferment in English tin or stainless steel pans. If this method is used, watch the fermenting action carefully. When scale loosens, scrub with a nylon pad. If fermenting sap is left in pans too long, serious damage to the pan may result. Rinse with clear water, and dry. If chemical cleansers are used, be sure to rinse thoroughly to prevent possible damage to the pan, and off-flavors next season. Some producers add baking soda to a rinse after using chemical cleaners to neutralize acids. Be sure to flush out any residue from the baking soda.

Materials that collect on the underside of the evaporator during the season are generally corrosive to metal; if corrosive deposits are permitted to remain until the next season, holes may result in the bottom of the front pan, or in the flues. To avoid damage, clean the underside of the front pan, and use a brush to clean the flues. You can buy special flue brushes from maple equipment suppliers. Some manufacturers suggest raising

pans off arch a few inches during off-season storage to provide air circulation between arch and pans.

## Storing Equipment

Store all equipment where it will remain dry, lessening the potential of rust.

## Cleaning Pipelines

There are many different ways sugarmakers have developed to clean tubing. The following three are probably the most common:

1. *Pulling Up and Cleaning:* To do the best job, laterals should be rolled up and tied in bundles, taken to the sugarhouse for cleaning and then stored under cover. Before doing this, number the system so it can be rehung in the same location next season. This is best done by painting numbers or letters on trees and putting a tag with a corresponding number or letter on the tubing. You don't have to number each tree, usually every fifth or sixth is adequate.

There are countless variations of identification systems, but the important thing is that the laterals go up in the same place every season. Once the laterals are numbered, roll them up into bundles of about 25 taps. Take each bundle to a tank filled with cleaning solution and fill the bundle with solution. This can be done by pumping solution into the bundle or mounting the bundle on a rack that rotates the bundle through the solution. Let the bundles sit in the sun for one or two days and flush them with clean water. As an added precaution, some sugarmakers let the first sap run through the lines onto the ground. The same procedure works well for cleaning main lines. The rinse step is particularly important in preventing off-flavors.

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**The two most important factors in the production of high quality maple syrup are cleanliness and attention to detail in all parts of the production process.**

2. *Cleaning in Place:* Many sugarmakers leave their tubing up in the woods year round and clean it in place. They usually do this by hooking up a vacuum pump to the lower end of the line, going to the top with a bucket of cleaning solution, pulling a spout, placing it in the bucket so solution is sucked through the tubing, then capping the spout and moving to the next. Some

tubing manufacturers make fittings that are tight under positive pressure as well as vacuum. With this type of fitting, the cleaning solution can be pumped from the lower end of the line back up the system.

3. Commercial Systems: Maple equipment suppliers have commercial pipeline cleaning equipment which consists of a portable compressor pump that injects air with the cleaning solution, thus increasing the turbulence in the tubing, and improving the cleaning action. Some producers have purchased these in conjunction with one or more other sugarmakers to share the expense.

### **Summary**

The purpose of this manual is to assist sugarmakers in the production and packaging of a quality maple product. Keep in mind the two most important factors in the production of high quality maple syrup are cleanliness and attention to detail in all parts of the production process. Producing the best maple syrup possible not only compliments the Connecticut syrup producer but will generate a long list of satisfied customers.

## APPENDIX A

### Sugarmaker's Quick Reference

#### *Production, Quality Control, Finishing, Packing & Other Maple Tidbits...*

Jones Rule:	The number 86 divided by the % sugar content of sap = number of gallons of sap needed to make one gallon of syrup.
Package Syrup at:	180 to 190°F Reheating syrup above 200°F or more may cause new niter to precipitate causing cloudiness, requiring re-filtering.
Cleaning Filters:	Use clean hot water ONLY - press dry filters
Syrup Sugar Content:	The solids content of finished maple syrup in CT is between 66% and 67% by weight (brx) at 68° Fahrenheit.
Volume:	1 cu. ft. = 7.48 gal. (US) 1 gal. = 231 cu. in. 1 gal. = 3.79 liters
Pressure:	1 foot water (depth / vertical) = 0.4335 psi
Vacuum:	1 ft. water (depth) = 0.8826 in. of mercury
Weight:	Water = 8.35 lbs. per gal. Syrup = 11 lbs. per gal.
Temperature Conversion:	°F = (1.8 x °C) + 32 °C = (°F-32) divided by 1.8

#### **Maple Products Guide**

The temperatures for making maple products change with the barometric pressure. Check the boiling point of water several times a day. Humidity will impact the results and quality of some sugar products.

Draw off Syrup.....	219°F	7½°F above the boiling point of water
Sugar on Snow.....	232-234°F	Pour on hard packed snow or ice!
Maple Cream.....	233-235°F	Cool without agitating to 100°, Stir.
Maple Candy .....	236-240°F	Cool to 165°, Stir, Pour into molds.
Hard Sugar.....	245-248°F	Stir while hot, Pour into molds
Indian Sugar.....	255-265°F	Stir continuously until granulated, Burns easily, use low heat to finish.

One Gallon of Maple Syrup = 7½ lbs. Maple Sugar

#### **Nutritional Value of Pure Maple Syrup**

One tablespoon of Pure Maple Syrup contains 50 calories (about the same as white cane sugar), 35mg of potassium, 21mg of calcium, less than 2mg of sodium and traces of iron, phosphorous and several B-vitamins.

## APPENDIX B

### Syrup Hydrometer Temperature Adjustment

Correct Baume or Brix Hydrometer Reading For Syrup Temperature

Syrup °F	°Baumé	°Brix	Syrup °F	°Baumé	°Brix
209+	32.0	59.0	120	34.5	63.9
202+	32.25	59.5-	110	34.75	64.4
193+	32.5	60.0-	100	35.0	64.9
185	32.75	60.4+	90	35.25	65.4
176	33.0	60.9	80	35.5	65.9
167	33.25	61.4	70	35.75	66.4
158	33.5	61.9	60	36.0	66.9
149	33.75	62.4	50	36.25	67.4
140	34.0	62.9	40	36.5	67.9
130	34.25	63.4			

For use with Hydrometers calibrated at 60°F only.

#### NEVER TAKE A HYDROMETER READING WITHOUT USING A THERMOMETER EXCEPT AT THE DRAW-OFF

Hold Hydrometer at eye level at the surface of the syrup. Allow extra time for hydrometer to seek its level at temperature below 60°F. It is extremely difficult to obtain an accurate reading at 50°F or less.

Do not allow syrup to flow over top of hydrometer. Weight of this syrup will cause instrument to read incorrectly.

Rinse clean and dry after each use. Many instruments are found to be inaccurate due to coating of sugar and/or niter.

#### Hydrometer Care

- Have hydrometers tested each season
- Rinse clean and dry after each use
- Fill hydrometer cup until foam floats off
- Lower hydrometer gently into syrup
- Adjust hydrometer reading to syrup temperature (Approx.)
- Hold at eyelevel and read at surface of syrup
- Do not store on its side or in boiling liquid

Reprinted from Agricultural Development Division of the Vermont Department of Agriculture, Rev. 1986

## APPENDIX C

### Jones Rule or the Rule of 86:

To calculate the number of gallons of sap needed to make one gallon of syrup divide 86 by the % sugar content of the sap measured by a sap hydrometer or refractometer.

% SAP	Gallons Sap to make 1 Gal. Syrup	% SAP	Gallons Sap to make 1 Gal. Syrup
1.00	86.00	6.75	12.74
1.25	68.80	7.00	12.28
1.50	57.33	7.25	11.86
1.75	49.14	7.50	11.46
2.00	43.00	7.75	11.09
2.25	38.72	8.00	10.75
2.50	34.40	8.25	10.42
2.75	31.27	8.50	10.12
3.00	28.60	8.75	9.83
3.25	26.46	9.00	9.55
3.50	24.57	9.25	9.30
3.75	22.93	9.50	9.05
4.00	21.50	9.75	8.82
4.25	20.23	10.00	8.60
4.50	19.11	10.25	8.39
4.75	18.10	10.50	8.19
5.00	17.20	10.75	8.00
5.25	16.38	11.00	7.82
5.50	15.63	11.25	7.64
5.75	14.95	11.50	7.48
6.00	14.33	11.75	7.32
6.25	13.76	12.00	7.17
6.50	13.23	12.25	7.02

## APPENDIX D

### Maple Quality Control – “The Accent on Flavor”

Maple flavor must be guarded from sap to store shelf.

Flavor can be damaged from dirty equipment, dirty sap, new or used filters, scorching of syrup, caramelized sugar, fermentation and mold, chemicals and rust.

The following is a list of defective syrups encountered by the Vermont Department of Agriculture and the Maple Research Laboratory at the University of Vermont. The defects and the characteristics of these defects are as follows:

<b>Defect</b>	<b>Characteristics</b>
Chlorine	Maple flavor destroyed, salty, causes weeping of the tongue. Varying degrees of off flavor depending on P.P.M.
Detergents	Maple flavor destroyed, possible perfume odor and flavor depending on what detergent and amount used.
Non-Food Grade Paints	Imparts only, fatty flavor and appearance to syrup.
Metallic	Tinny flavor, sharp, tingly, affects teeth. Usually occurs from prolonged storage in metal containers.
Plastic	Bitter-sweet flavor, caused by prolonged storage in porous plastic containers.
New Filters	Occurs from new filters not being adequately boiled before use. Chemical flavor.
Filters	Syrup may acquire a flavor of fat or defoamer from improperly maintained filters or detergent flavor from improper washing or storage. Wool flavor. Possible mold if not dried correctly.
Defoamer	Flavor may range from oily to waxy depending on type and amount of defoamer used. May be rancid.
Musty	Yeasty, moldy flavor and odor, due to presence of fungi.
Ferment	Sickening sweet flavor and odor, alcoholic, fruity. May have a foamy appearance.
Sour Sap	Sour flavor, produces ropy syrup and lower quality flavor and color.



Burn Niter	Bitter, strong caramel flavor, biting, bordering on a burned flavor. Caused by accumulation of niter in the front pan near syrup draw-off.
Scorch	Burned, strong bite.
Buddy	Usually late season syrup, taste and color range from chocolate like flavor to strong bitter. This is due to metabolism of the tree and may vary during the season depending on the weather.
Metabolism (Earthy Flavor)	Earthy flavor due to environmental conditions and more prone to damaged, stressed trees — selective tapping, keep out of poor colored wood. Selective tapping and not boring into poor colored wood will help to lessen or eliminate this off flavor.
Metabolism (Pop Cornish)	Pre-bud effect due to warming temperatures and may occur anytime during the maple season. May be reversed with freezing temperature. Flavor may vary from palatable to unacceptable.

\* Citation: B.A. Martell, H.J. Marckres, A. Dahlberg, M.L. Whalen, and M.F. Morselli, 1986, Maple Quality Control Puts the Accent on Flavor. VT Dept of Agriculture, Montpelier, 2pp.

## APPENDIX E

### Technical Maple Publications

The following are several maple publications available. Pricing is available from source(s) noted.

#### **North American Maple Syrup Producers Manual**

A comprehensive handbook for sugarbush management and the production and marketing of all pure maple products. Current information and recommendations relating to all aspects of the industry are presented. The manual includes over 125 diagrams and photographs, covers everything you need to know about maple sugaring, from tree to table. Beautiful color cover, 180 pages on glossy paper, 6-pg. bibliography. Published by Ohio State University Extension in co-operation with the North American Maple Syrup Council - Bulletin 856 (1996 or as updated)

*continued on page 23*

## **APPENDIX E (continued)**

**Source(s):** Maple Syrup Producers Association of Connecticut, Inc.  
(Contact the MSPAC representative referenced on the cover of  
this manual)

Or Connecticut Department of Agriculture,  
765 Asylum Avenue, Hartford, CT 06105, Phone 860 713-2503

### **Sugar Bush Management for Maple Syrup Producers**

Coons, C.F., Ministry of Natural Resources. Revised 1993.

**Source(s):** Ontario Forestry Association,  
200 Consumers Road, Suite 307, North York, ON. M2J 4R4  
Telephone: 416/493-4565 Facsimile: 416/493-4608

Or Dave Chapeskie, Agroforestry Specialist,  
Ministry of Agriculture, Food and Rural Affairs,  
P.O.Box 2004, Kemptville, ON KOG 1JO  
Telephone: 613/258-8302 Facsimile: 613/258-8392

### **Sugarbush Management: A Guide to Maintaining Tree Health**

Houston D.R. et al North Eastern Forest Experiment Station.  
General Technical Report NE-129. 1990.

**Source:** Dave Chapeskie, Agroforestry Specialist,  
Ministry of Agriculture, Food and Rural Affairs,  
P.O.Box 2004, Kemptville, ON KOG 1JO  
Telephone: 613/258-8302 Facsimile: 613/258-8392

## **Maple Videos**

### **Making Maple Candy & Cream**

A 10-minute instructional video showing how easy it is to make maple candy and maple cream. This package will eliminate all your fears of making these fine confections. Simple, easy-to-follow directions and visual demonstrations show how to make maple candy and maple cream both by hand and with a candy or cream machine. Includes a 16-page instruction manual and recipes. For the home candy maker or professional maple producer. The cost is \$22.00 via Priority Mail. (Priority Mail ships in 2-3 days).

**Source:** Massachusetts Maple Producers Association  
Watson-Spruce Corner Rd., Ashfield, MA 01330

## APPENDIX F

### Maple Websites

#### **University of Vermont Extension Website MAPLE PAGES**

- <http://www.uvm.edu/~uvmaple/uvnextmaple.htm>  
Under MAPLE INFO, Go to PUBLICATIONS

#### **University of Vermont Extension MAPLE PUBLICATIONS AND VIDEO CATALOG**

- <http://www.uvm.edu/~uvmaple/mpvc.htm>  
*Over 275 publications available on topics including:*
  - BEGINNING SUGARMAKING
  - ECONOMICS
  - ENVIRONMENTAL
  - FOREST MANAGEMENT
  - HISTORY
  - MAPLE PRODUCTS
  - MARKETING AND PROMOTION
  - SAP PRODUCTION
  - SYRUP PRODUCTION
  - TREE PHYSIOLOGY
  - VIDEOS

To Order: Simply choose a category and find your selection. Record the title and MR (#) number found with each entry. Use on-line **Order Form** or call the UVM Extension Offices to place order: 802-656-5433 or 802-888-4972

#### **Cornell Cooperative Extension New York Maple Website**

- <http://www.cce.cornell.edu/clinton/ag/maple.html>

#### **Massachusetts Maple Producers Association Website**

- <http://www.massmaple.org/index.html>

#### **Ontario Maple Syrup Producers Association Website**

- <http://www.ontariomaple.com/>





## **Maple Syrup Producers Association of Connecticut, Inc.**

### **Who we are...**

The Maple Syrup Producers Association of Connecticut, Inc. (MSPAC) has played an important role in the growth and improvement of maple syrup production in Connecticut. The first meeting was held in November 1977 at the Grange Hall in West Simsbury, Connecticut. The MSPAC is a nonprofit association that was organized by five sugar makers and associates as an education-based organization for Connecticut maple syrup producers.



The MSPAC operates as and is bound together by its membership's common interest in sugaring for fun and/or profit. Some members produce two gallons of syrup per year while others produce 300 gallons or more. And some members are just interested in the Connecticut maple industry.

The association's stated objective is to encourage the production and handling of high quality maple sap products in Connecticut. The MSPAC states that it shall realize its objective by:

1. Providing a medium for mutual recognition and exchange of information among its members.
2. Compiling and disseminating information on production of high quality maple sap products.
3. Promoting the standardization and proper grading of maple sap products.
4. Establishing a registered label and/or logo for use by its members.
5. Seeking representation in any organization, within or outside of the state, whose purpose is to improve the maple industry.
6. Participating in any other activity related to the support of its objective.

### **What we offer...**

MSPAC holds at least two informational meetings each year with knowledgeable and experienced speakers who emphasize practical, "how-to" topics covering all aspects of sugaring.

The association is 100% volunteer managed and its officers, board of directors and committees plan and provide numerous benefits for its membership of approximately 200. There is a periodic newsletter published for its members, including informational articles, timely tips, suggestions and a wanted to buy, sell or swap column. The association maintains an informational library at its meetings on a wide range of topics from sugarbush management to making and marketing a variety of pure maple products. Members can participate in our annual brochure of *"Sugarhouses Open to the Public."*

All members receive a subscription to the quarterly publication *Maple Syrup Digest* which is the official publication of the North American Maple Syrup Council, Inc. The MSPAC has an elected delegate on the Board of Directors of this international maple council and also participates in the activities of the International Maple Syrup Institute.

The Maple Syrup Producers Association of Connecticut, Inc., its leadership and members value their long-standing commitment to communicating and sharing ideas and continue to be the leading educational resource for Connecticut's maple syrup producers.

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