6th Edition

New York State Maple Confections Notebook

Making Quality Maple Value Added Products

Cornell Maple Program, County CCE, SARE and the New York State Farm Viability Institute

Cornell Cooperative Extension
Cornell Maple Program
USDA Agricultural Marketing Service
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Maple Confections Notebook

Sixth Edition

Table of Contents

Acknowledgements

Ailis Clyne served as principle editor of the 6th edition of The New York State Maple Confections Notebook published 2022. Aaron Wightman and Catherine Belisle, Ph.D. contributed significantly to the work undertaken to produce this new edition.

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Cornell Maple Program

Section 1

Maple Syrup: The Raw Product for Making Maple Confections

1.1 Chemistry of Maple Syrup

Stephen Childs (2014), Cornell Maple Bulletin 202
Revised (2022): Aaron Wightman

Originally adapted from C.O. Willits and C.H. Hill 1976. Maple Syrup Producers Manual. USDA Agriculture Handbook No. 134 and North American Maple Syrup Producers Manual, 2nd ed., 2006

Introduction

Understanding syrup chemistry aids in the production of high-quality syrup suitable for retail sale and in production of top notch confections. The basic concepts outlined here explain the reasoning behind syrup processing methodologies, how flavor develops, and why a variety of different products can be produced from pure maple syrup.

Maple syrup is a single ingredient product made by concentrating and heating sap collected from trees of the *Acer* genus. Processing aids such as defoamer and diatomaceous earth are sometimes added to the sap as it is processed. However, these substances do not remain in the finished product and are therefore not considered ingredients.

Maple syrup is primarily composed of sugars, water, and minerals. In addition to these three components, maple syrup contains small amounts of other compounds such as organic acids, amino acids, proteins, phenolic compounds, and even a few vitamins. Variation in the levels of these components, coupled with differences in processing conditions, give maple syrup the broad spectrum of flavors found in syrup from different sugarbushes and from different sap runs at the same location.

Making quality confections requires careful evaluation of your syrup. Selecting syrup with excellent flavor is the first step in making high-quality confections. Choosing a syrup based on correct chemistry for the desired confection is the critical second step and should be determined with properly calibrated instruments rather than guesswork. Once a syrup is selected based on these two criteria, a cooking, cooling, and stirring program can be selected to make the desired product. Following these steps will give you consistently high-quality confections.

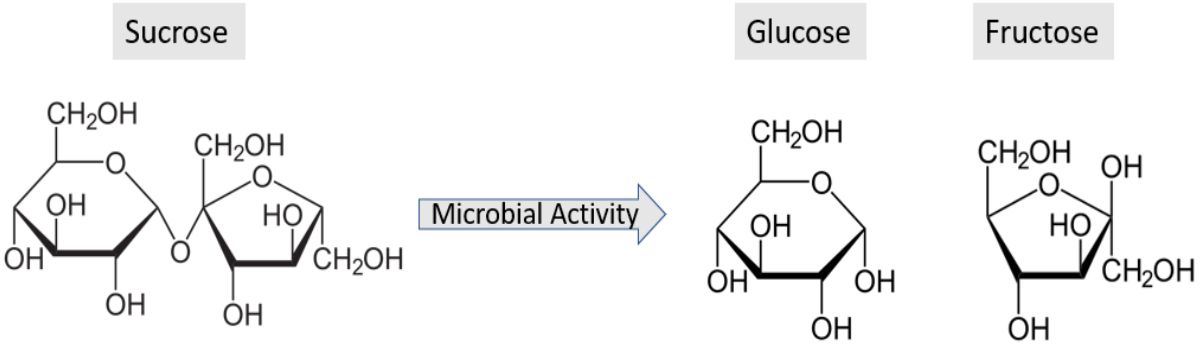
Grade A maple syrup must meet specific grade standards defined by the United States Department of Agriculture and adapted into enforceable regulations by governmental agencies at the state level. Compliance with these requirements helps ensure that syrup is both legal for retail sale, and suitable to produce high-quality confections. The key factors evaluated within this regulatory framework are clarity, flavor, color, and density.

Clarity

As sap is concentrated into maple syrup, minerals may precipitate out of solution forming "sugar sand" or "niter" in the bottom of the evaporator pan. This precipitate forms when organic acids and minerals become less soluble due to increasing sugar concentration in the evaporator. They combine under heat to create solid particles. These particles are primarily salts of calcium and potassium which can give syrup a cloudy appearance and gritty texture or settle on the bottom of a container as a layer of sediment. This precipitate must be removed with a filter to make syrup legal for retail sale and usable for confections.

Flavor and Color

It is important to understand that there are many different chemicals that we call "sugar". When sap is produced by a maple tree, it contains only one type of sugar called "sucrose". Sucrose is composed of two smaller sugar molecules, glucose and fructose, that are connected by a chemical bond to form a larger molecule. Over time and under the right conditions, microbial activity in raw sap breaks down a portion of the sucrose into the simple sugars glucose and fructose. In the maple products industry, we often refer to these simple sugars as "invert sugars" or simply "inverts".



Maple flavor is mainly created by heat dependent chemical reactions that occur when raw sap is boiled in the evaporator. Processes such as caramelization and Maillard reactions create the mix of flavor compounds that give maple syrup its unique and recognizable flavor. The simple sugars glucose and fructose are more reactive to the heat-driven chemical changes taking place in the evaporator than sucrose. Therefore, differences in the proportion of invert sugars in sap will yield different color grades of maple syrup.

Fresh sap subjected to less microbial activity has a lower percentage of invert sugars and yields delicate flavored, light-colored syrup. This generally occurs early in the season when temperatures are cooler and sap collection systems are cleaner with less microbial buildup. Sap subjected to a greater degree of microbial activity, which is common later in the sugaring season, has a higher percentage of invert sugars that undergo a greater degree of chemical changes in the evaporator. The result is dark, strong flavored syrup.

Flavor Defects

Microbial activity, seasonal changes in tree sap chemistry, and a variety of handling errors can give sap undesirable flavors. Some of the most common flavor defects are:

- Sourness due to sap spoilage prior to processing
- Fermentation caused by incorrect bottling, resulting in sickly sweet alcohol flavor
- Metabolism, a woody flavor created by temporary changes in tree metabolism
- Buddy flavors associated with bud swell at the end of the sugaring season
- Smokiness when sap is exposed to exhaust smoke from the evaporator
- Defoamer residue resulting from overzealous foam management which leaves a greasy feeling in the mouth
- Contamination due to the improper use of cleaning agents or non-food grade materials

A common misconception is the belief that good confections can be made from bad syrup based on the mistaken reasoning that additional cooking will intensify desirable flavors and cover up bad flavors. Unfortunately, this belief is incorrect. Most flavor defects are concentrated and intensified when syrup is cooked for confections. Therefore, off-flavored syrup is not suitable for producing traditional value-added maple products. Since flavors are intensified during confection production, the best flavored syrups are usually selected for value-added products.

Density

Maple syrup density is determined by measuring the sugar concentration which is usually expressed in degrees Brix. This unit is a measure of the percentage of sugar in an aqueous solution by mass. For example, if a 100 gram solution of sugar and water contains 10 grams of sugar, the density is 10.0 °Brix.

The legal range for maple syrup density in most states and Canadian provinces is between 66.0 and 68.9 °Brix. At this density, the sugar is completely dissolved in a stable solution.

When you continue to cook syrup, the concentration of sugar increases as temperature rises and water is lost. The sugar remains in solution even as most of the water boils away due to the high temperature. This is because the heat of cooking transfers kinetic energy to the sugar molecules which allows them to remain dispersed in a liquid state.

After syrup is further concentrated by cooking to the desired temperature for a particular confection and begins cooling, there is more sugar than can remain in solution at lower temperatures. At this point, the solution is said to be supersaturated. Agitation or stirring of any kind can cause the sugar to crystallize and come out of solution until the sugar in solution reaches a stable concentration for its temperature.

This ability to increase the sugar concentration above the stable level enables the production of crystalized maple products. Most traditional maple confections depend on producing a supersaturated syrup solution and then either encouraging, controlling, or preventing the subsequent sugar crystallization process that occurs with cooling. The chemistry of the supersaturated syrup can be identical, but the products made can be completely different due to the different ways the syrup is cooled and stirred. At the same time, differences in the chemistry of supersaturated syrups cooled and stirred exactly the same way can result in very different qualities of the final product.

Crystallization

A crystal in maple syrup is a collection of sugar molecules that adhere to each other to form a solid structure that is no longer in solution. The formation of sugar crystals in many confections and recipes is controlled by temperature and stirring procedures. Syrup chemistry is also an important factor. Controlling crystal size is critical in the production of many sugar confections and candies.

Crystal size is a key factor in determining the consistency and mouth feel of pure maple products. It is determined by a number of factors, all of which must be considered when making quality confections. These factors include:

- the amount of excess sugar in solution beyond the solution’s saturation point
- the presence or introduction of crystals from another source
- the rate and extent of cooling
- syrup chemistry
- the speed, power, and length of stirring

The effect of these factors is illustrated at one extreme by large crystals like those found in rock candy. These are formed when slightly supersaturated syrup is cooled slowly and stored for a long time without agitation. A glass-like non-crystalline concentrated syrup represents the other extreme. This is formed when highly supersaturated syrup is cooled rapidly to well below room temperature without stirring, as when making sugar on snow.

Different sizes of crystals are preferred in different kinds of confections. Granulated sugar, for instance, is best with fairly large crystals that can easily be seen and felt with the tongue. To make granulated sugar, syrup is cooked to the desired temperature and is

cooled only slightly or not at all before stirring is started. For maple cream the goal is to have a smooth, creamy texture where no crystals can be felt with the tongue. To achieve this, the supersaturated syrup is allowed to cool without stirring until it is somewhere between 45 and 90 °F.

Some maple confections rely on crystal formation to create texture and viscosity. In other products it is necessary to limit or prevent the formation of crystals. In both cases, it is important to further understand the nuances of crystallization and the options for preventing crystal growth.

Crystals form like building blocks locking together in a specific, regular pattern. If some of the molecules are a different size and shape, they won't fit together, and a crystal will either not form or will grow with much more difficulty. For traditional maple products that rely on crystallization, it is important to have the correct proportion of sucrose to invert sugars. All sucrose molecules have the same shape. When they are present in syrup in sufficient concentration and under the right conditions, the molecules can join together to form crystals. The invert sugars glucose and fructose have their own unique molecule shapes that are different from that of sucrose. If too many invert sugar molecules are present in a syrup solution, they interfere with the formation of sucrose crystals and inhibit crystallization.

The influence of invert sugars on crystallization needs to be well understood by maple confectioners. Many times maple producers experience batch failures when making confections because the natural mix of sugars in the syrup is outside of the normal range for the confection desired. That is why a precise measurement of invert sugars is a crucial step in producing some maple confections.

For products where crystals are not desired, a crystallization inhibitor is used to prevent crystal formation. Crystallization inhibitors include various acids, fats and proteins. The addition of acids (e.g., cream of tartar, fruit juices, vinegar) inhibits crystal growth. Fats, like those found in margarine, butter, cream, or chocolate, also inhibit crystal growth, as does protein found in milk, egg whites, and gelatin. Fats and proteins inhibit crystallization by acting as physical barriers that coat the crystal face and prevent one molecule from locking on another. This behavior keeps the sugar crystals small or stops crystallization altogether. Intentionally increasing the proportion of invert sugars can also retard crystal formation. That is why corn syrup or honey, both high in invert sugars, are often used in candy making; they promote supersaturation by inhibiting the formation of crystals.

Many specialty products can be made using maple syrup along with various crystal inhibitors. These candies do not have sugar crystals when they have sufficient crystal inhibitors in them or when they are cooked to such a high temperature that most of the water has evaporated and the syrup is too viscous for the sugar molecules to orient themselves into a crystalline structure. Examples include: caramels, taffies, brittles, hard candies, marshmallows, meringues, frostings, and gumdrops.

Crystal formation is sometimes unintentionally inhibited. For example, the excessive use of a fatty defoamer in making crystalline confections may result in unexpected soupiness or lack of proper crystal formation.

Invert Sugar

Sucrose is a twelve-carbon sugar having the chemical formula $C_{12}H_{22}O_{11}$. Invert sugars are six-carbon sugars, such as glucose and fructose, which have the same chemical formula ($C_6H_{12}O_6$), but are structurally different from each other (structural isomers).

Different levels of invert sugar are desirable depending on the type of maple confection to be made. Invert sugars are more soluble in water than sucrose at room temperature, meaning, more total sugar can be held in solution before crystallization occurs. In maple cream for example, a small amount of invert sugar can help the product maintain moisture, and encourages smaller sugar crystals to form resulting in smooth mouthfeel. Too little invert sugar can cause the resulting maple cream to be grainy; too much may prevent formation of crystals altogether, resulting in soupiness.

Other properties of invert sugar include:

- increases sweetness compared to sucrose
- has lower caramelization, melting, and scorch temperatures than sucrose
- reduces viscosity, making it easier to spread creams or frostings
- softens product texture
- reduces water activity, making products more resistant to microbial spoilage
- depresses the freezing point so products stored in the freezer are less likely to crystallize or change in crystal structure

In general, all grades of maple syrup contain some invert sugar, and the amount varies among different grades. Lighter grade syrup, particularly that made early in the production season, generally has the least invert sugar; Very Dark syrup, particularly that made late in the production season, has the most invert sugar. The color of syrup can be a very general guide in selecting syrup for making a specific confection, but testing has shown a wide variation in invert levels in the different syrup color grades. A simple test using the common glucose meter used to monitor blood sugar levels is crucial to help select and blend syrups and to make consistent products. For complete information on testing for invert sugars in maple syrup see **Section 2.1**.

Why increase the finish temperature when there is more than one sugar in the mix?

As previously mentioned, the ratio of sucrose to invert sugars is key to making value-added products. Sucrose is the sugar that normally crystallizes when making a confection. Unless the syrup has been treated with invertase, sucrose is the only sugar with enough concentration to form crystals. Invert sugars in the syrup impair sucrose crystallization simply by getting in the way, but they also reduce the sucrose concentration in the solution. Therefore, additional cooking is required to reach the concentration of sucrose required to achieve the desired degree of crystallization.

To illustrate this concept, the table below prescribes the correct finishing temperature adjustment when making cream with varying levels of invert sugars. In this example, each syrup has an overall density of 80 °Brix. However, the concentration of sucrose decreases

as inverts make up an increasing portion of the total sugars. This table helps the maple producer understand why a higher finish temperature is needed to get the sucrose to the same concentration and achieve a similar crystallization result. You need the higher finish temperature to equalize the Brix of sucrose in the solution (the heated syrup).

Syrup °Brix	Sucrose °Brix	Invert °Brix	Finish temp (°F)*
80	80	0	23 above
80	79	1	24 above
80	78	2	25 above
80	77	3	26 above

*The number of degrees above the boiling point of water to heat maple syrup to for cream production.

1.2 Quality Control for Maple Confectioners

Quality control is an integral part of all confection production. The first phase of control begins with tests on the intended ingredients. Prior to use, test ingredients to ensure they meet your specifications. Sensory evaluations are to be done on characteristics such as appearance, color, odor, and flavor. Off flavors in the syrup or sugar will not make for great tasting maple confections. Other physical and chemical characteristics should be measured such as density, invert sugar levels, and solid particle size where a product other than syrup will be used. Manufacturers depend on these tests to ensure that the ingredients used will produce a consistent batch of the desired confections.

The next phase of quality control is evaluating finished products. This includes hardness or viscosity, crystalline characteristics (smoothness or graininess), appearance, and taste. A comparison method is a common method for evaluating quality. In this method, the newly made product is compared to an established standard. For example, the flavor of a randomly sampled confection may be compared to a standard product produced at an earlier time. If you are not particularly sensitive to taste, you should have another person work with you in evaluating the finished product. Choose someone in your business or family most likely to notice small differences in graininess, taste, and appearance properties. Instrumental tests that have been developed by the confectionery industry over the years may also be used.

What can you control?

- Flavor
- Invert sugar level
- Finish temperature
- Activation temperature – when to begin stirring
- Aggressiveness and type of agitation or stirring
- Post-production handling
- Production room conditions

1.3 Sugar Profiles of Maple Syrup Grades

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Although many analyses of the chemical composition of maple syrup have been conducted, relatively little information exists on the differences in composition of the individual syrup grades. For example, although it is generally accepted that the amount of invert sugar increases with decreasing syrup light transmission (from lighter to darker grades), the composition of sugars within different grades has not been adequately characterized.

Determination of the characteristic chemical composition of each grade will strengthen the existing basic knowledge of maple syrup chemistry and potentially provide a tool which can be used in the detection of syrup adultered by artificial decolorization. As a first step in acquiring this information we performed a study to determine the characteristic sugar composition of each maple syrup grade.

Methods

During 2004, we collected 55 unblended syrup samples from individual producers across a wide geographic area. Each sample was graded using a Hanna C219 maple syrup transmittance analyzer. The concentrations of glucose, fructose and sucrose in each sample were determined by a commercial food analysis laboratory via high-performance liquid chromatography (HPLC). The total percentages of sugars and invert sugar (glucose + fructose) as well as the ratio of glucose to fructose in each sample were calculated. For each grade, the mean and standard error of each sugar were calculated.

Results

Fancy[1] syrup contained relatively low amounts of fructose relative to the other grades (Table 1). However, in general, the different grades of syrup contained similar amounts of fructose, glucose, sucrose and total invert sugars. The ratio of glucose to fructose, however, appeared to vary between the grades, with commercial having the lowest and Fancy having the highest values.

Table 1. (*next page*) Mean (± standard error) percent glucose, fructose, sucrose, total sugars, total invert sugars and ratio of glucose to fructose for each syrup grade from 55 unblended syrup samples collected from a wide geographic area in 2004. n = the number of samples for each grade.

Grade*	n	%Fructose	%Glucose	%Sucrose	%Total sugars	%Total invert	Glucose:Fructose
Fancy	9	0.1±0.0	0.7±0.1	65.9±0.6	66.8±0.6	0.9±0.1	5.6±1.3
A Medium	12	0.7±0.1	0.6±0.1	65.1±0.5	66.3±0.4	1.2±0.1	3.1±2.4
A Dark	11	0.3±0.1	0.7±0.1	66.2±1.1	67.2±1.0	1.0±0.2	5.3±1.9
B	15	0.5±0.1	0.4±0.1	67.1±0.5	67.9±0.5	0.9±0.0	2.9±1.6
Comm.	8	0.6±0.1	0.6±0.1	65.4±1.3	66.5±1.1	1.1±0.2	1.5±0.7

There are two main highlights of these results. First, the amount of glucose and fructose in syrup is often assumed to be equal. However, the ratio of glucose to fructose in these syrup samples was highly variable between the grades and not consistently equal. This suggests that the level of glucose in syrup may not always be an accurate predictor of the total level of invert and that this may need to be taken into consideration when using commercial glucose tests to determine the invert level of syrup. In addition, the total level of invert is often assumed to be higher in darker than in lighter syrup. However, the total invert in these syrup samples was not consistently greater in darker than in light grades. In fact, the highest average invert levels were found in medium-amber samples. These results may reflect the natural variation expected to be found in a large group of samples collected from a wide geographic range. However, these results could also be indicative of the increased use of technology in syrup production, such as air injection, pre-heaters and reverse osmosis.

These processes might influence the chemical changes which occur during the production process, potentially leading to lighter-colored syrup produced from late-season sap, which is generally higher in invert level than early-season sap. Further investigation is necessary to determine if any relationship exists between invert levels and the use of production technology, and current research ongoing at PMRC will attempt to address this question. With the analysis of sugar composition complete, further work will characterize the mineral composition of each syrup grade.

Acknowledgements

Funding for this project was provided by the U.S. Department of Agriculture and by the North American Maple Syrup Council.

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[1] *This piece was published in 2006 when Vermont's color grading standards differed from today's internationally standardized grades. For reference, VT Fancy Grade had >75% light transmittance (Tc), Grade A Medium Amber 74.9–60.5% Tc, Grade A Dark Amber 60.4–44.0% Tc, Grade B 43.9–27.0% Tc, and Commercial Grade >27.0%. So roughly, Fancy correlates to modern day Grade A Golden, Medium and Dark both correlate to modern day Amber, B correlates to modern day Dark, and Commercial to modern day Very Dark.*

This note was added to this report by Ailis Clyne (2022).

Cornell Maple Program

Section 2

Adjusting Maple Products: Invert Sugar, Density, and Water Activity

2.1 Measuring Invert Sugar in Maple Syrup

Stephen Childs and Brian Chabot (2014), Cornell Maple Bulletin 203

Adapted from C.O. Willits and C.H. Hill 1976. Maple Syrup Producers Manual. USDA Agriculture Handbook No. 134 and North American Maple Syrup Producers Manual, 2nd ed., 2006

Invert Sugar

For an explanation of what effects invert sugar can have on making confections see **Section 1**.

Sucrose is common table sugar and is the only sugar in sap when it first runs from the tree. Some of the sucrose in sap is converted to invert sugar as a result of microbial fermentation during handling and processing. Microbial metabolism is temperature dependent and occurs to a greater extent in sap that is collected late in the season when temperatures are warmer.

Sucrose is sugar with twelve carbon atoms. Invert sugars are six carbon sugars, glucose and fructose. They have the same number of carbon, oxygen, and hydrogen atoms, but they differ slightly in how these atoms are arranged. The name "invert" refers to the way these sugars bend polarized light. They also are called "reducing sugars" referring to their chemical reactivity. The splitting of sucrose, commonly by the action of

microorganisms, acids, or invertase (an enzyme), produces invert sugars. Different levels of invert sugar in maple syrup are desirable for the production of different maple confections.

Why Test Invert?

Generally, all grades of maple syrup contain some invert sugar. The amount varies among different grades. Lighter colored syrups, particularly those made early in the production season, tend to have the least invert sugar. Darker colored syrups, particularly those made late in the production season, have the most invert sugar. The color grade of syrup can be helpful to begin selecting syrups for making confections, but testing has shown a wide variation in invert levels within each color grade and with overlap between the grades. This variability makes it necessary to test and adjust syrups for invert sugar levels to match the specific characteristics desired for a given confection. Testing syrup and adjusting to a proper invert sugar level can eliminate batch failures and help the maple producer make confections of consistent quality. For many years, the use of Clinitest tablets was suggested as the way to measure invert sugars in syrup. Now, a simple test using the common glucose meter used to monitor blood sugar is considered the standard for selecting and blending syrups to make the most consistent products. Testing syrups before they are purchased for the purpose of making confections assures you are getting syrup that will make the confections you want.

How to Test Invert Sugar

Dilution

Maple syrup cannot be tested directly with a glucose meter. It is too thick and will not properly enter the test strips. Also, the glucose concentrations in undiluted maple syrup are usually higher than the range that most meters will measure. To solve this problem, you must dilute the maple syrup with distilled water before testing. Since maple syrup and water have very different densities (mass / volume), the dilution must be done by mass (weight). This is best done using an accurate scale. Scales with a resolution of one tenth of a gram (0.1 g) and a range of 0 to 300 or 600 grams are now available at reasonable costs and are easily ordered on the internet. Some cell phones can also be used as a scale.

A one in ten dilution of syrup works well for most syrups; it is easy to calculate, and gives a reading on the glucose meter that has been translated into invert sugar levels in tables throughout this publication. Once you have a scale and are familiar with its operating instructions, follow these simple directions:

(Continued next page)

- Place an empty cup on the scale.
- Tare the scale to read 0.0 g with the cup in place.
- Carefully pour between 5 – 10 g of syrup into the cup.
- Multiply the number of grams of syrup in the cup by 10 and add warm water into the cup until that number is reached on the scale. For example, if the syrup in the cup weighs 5.6 g, add water until the scale reads 56.0 g. If the syrup in the cup weighs 7.7 g, add water until the scale reads 77.0. A few tenths of a gram above or below your target will still give you an accurate reading.
- Now you have a one in ten dilution ready for taking a diabetic glucose meter reading. Remove the cup from the scale and stir the water and syrup vigorously until completely mixed.

Table 2.1
Converting glucose meter readings to % invert sugar.

Reading	1 - 10 Dilution
mg/dL	% invert
20	0.4
30	0.6
40	0.8
50	1
60	1.2
70	1.4
80	1.6
90	1.8
100	2
110	2.2
120	2.4
130	2.6
140	2.8
150	3
160	3.2
170	3.4
180	3.6
190	3.8
200	4
210	4.2
220	4.4
230	4.6
240	4.8
250	5

Meter Use

You will need to become familiar with the basic operation of your glucose meter. Most meters operate with a similar procedure in that you remove a test strip from its protective foil and insert it correctly into the meter. Inserting the test strip will turn the meter on automatically. The meter will then give a notice of calibration, and ask for a sample. With most meters, follow these simple directions:

- Open a test strip being careful to only touch it in the middle.
- Slide the test strip into the meter. Follow the directions that come with the glucose meter to insure you put the correct end of the test strip into the meter and that the correct side of the strip is facing up. Otherwise, the meter will not give a reading.
- When the meter indicates that it is ready for a sample, dip the extended end of the test strip about ½ inch into the diluted syrup. Hold it in the solution for about 5 seconds or until the meter indicates that the sample has been activated.
- Move the meter to a horizontal position with the test strip in place and wait for the reading to appear on the screen.

The reading that appears on the screen will either be a number, or it may say "Hi" or "Lo". You will need to read the manual that came with the meter to know at what range that particular meter can read and understand what "Hi" and "Lo" represent. The reading on the screen should be given as mg/dL (milligrams per deciliter). Most meters are meant to read glucose in whole blood. Some meters convert this reading automatically to glucose in blood plasma which is 10-15% higher. Our recommendations are based on the whole blood readings.

The mg/dL readings on the meter will need to be multiplied by 0.02 to get the percentage of invert sugar. The tables throughout this publication, like **Table 2.1** (at left), have already made this conversion.

Watch: How to Test Invert Sugar in Maple Syrup
Cornell Maple Program produced video for visual instruction
https://www.youtube.com/watch?v=_CMrv3Bx2G8

Types of Glucose Meters

There are a wide variety of glucose meters available in drug stores, the pharmacy section of department stores, or on the internet. Most glucose meters should be useful for measuring invert levels in maple syrup, but some meters can read a wider range of glucose concentration. These meters can range in price from less than $15 to nearly $100.

There is also a wide range of prices for the test strips used in the various meters. Consider both the initial cost of the meter and the cost of test strips that are made for that meter when determining which brand to purchase. The more expensive meters can store readings; this function is not particularly useful to maple producers. The Cornell Maple Program has trialed several different brands and recommends the Accu-Chek Aviva for use with maple syrup samples.

Most meters use test strips where the fluid is drawn into the strip by capillary action and an enzyme converts glucose to another chemical that triggers an electrical signal which relates to the amount of glucose present. These meters specifically measure glucose and not other invert sugars (fructose). The enzymes/chemicals in the test strips deteriorate with time. Do not use test strips past their expiration date. If your meter gives you error messages, check the expiration date on the test strips as they may be the problem. The chemical reactions can be affected by room temperature, humidity, and altitude. These meters should be used at normal room temperatures and humidity. With some meters, the batch of test strips needs to be calibrated to the meter. This is done automatically in most cases, but follow the directions with your meter. Store your meter and test strips in a place protected from dust, fluids, and extremes of temperature and humidity.

Accuracy and Repeatability

Repeatability means that the meter will give the same reading when you sample the same solution again. Accuracy means how closely the meter reading is to the actual glucose amount.

The Food and Drug Administration regulates the quality and manufacture of blood glucose meters and test strips. However, the accuracy of affordable meters is 10-20%. This means that if you test your meter for repeatability, repeated readings can be very different and still be within the accuracy tolerances of the meters. For instance if the invert sugar level in the sample were exactly 1.0% and your meter read 50 mg/dL, it would be perfectly correct (see Table 2.1), but you should expect repeated readings from the same sample to vary between 45 and 55 mg/dL. At the low invert sugar levels found in most maple syrup, this

amount of variation is completely acceptable and gives a close enough estimate of invert sugar levels to make good blends and produce consistently high quality confections. However, understand that as the invert sugar levels increase, the % variation becomes a larger number. A 10% invert sugar solution (500 mg/dL) for example, could give a reading between 450 and 550 mg/dL.

You should check your meter periodically with repeat measurements on the same sample (with different test strips) to get an idea of what to expect from your meter. Be sure that the sample is well mixed before testing. If you need to test a suspect meter, you can obtain Test Quality Control Solutions from some pharmacies or from the meter manufacturer. Despite their limitations, these meters are a huge improvement over the Clinitest tablets.

Testing Barrels

Once the syrup is in a barrel, the invert sugar level will be stable unless a bacteria or yeast fermentation becomes active or the syrup is heated again. Invert sugar tests can be run on barrels or other storage units as they are filled, or a small sample can be retained from each barrel for testing and recording after the production season. Recording the invert levels in each barrel makes it easy to select syrups for confection making or blending without further testing being necessary. The reading should be recorded on the container or in an inventory log.

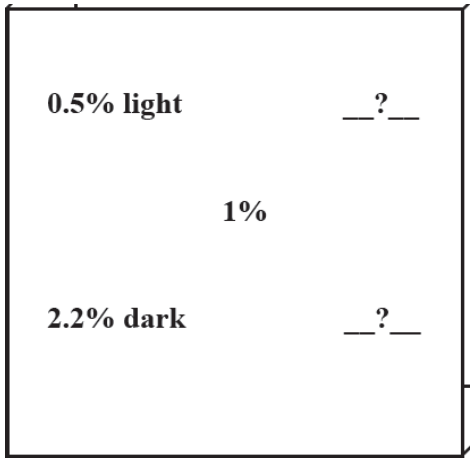
2.2 Adjusting Invert Sugar in Maple Syrup

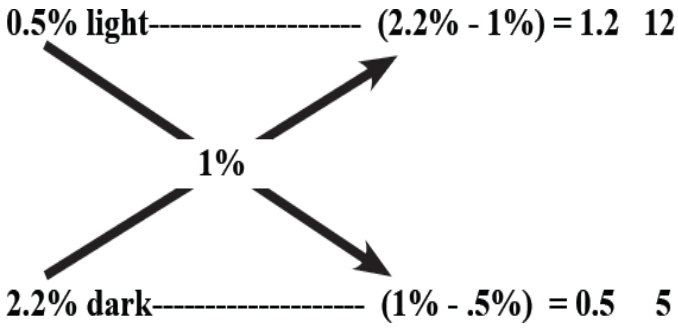
Cornell Maple Bulletin 203 (2014) continued

For your convenience, an "Invert Blending Calculator" has been made available on the Cornell Maple Program website, Maple Calculators page (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/). This section explains the mathematics behind the calculator. Determining the proportions of two syrups of known invert levels to obtain a blend with the desired invert sugar level can be done very simply and quickly using alligation. The method is best explained by example:

You have two syrups with invert sugar levels of 0.5% (the "light" syrup) and 2.2% (the "dark" syrup), and you want to obtain a blend with an invert sugar level of 1.0%. Alligation determines the proportions of each syrup needed by weight or by volume if both syrups have relatively similar densities. Two syrups within the legal syrup density range would be considered close enough for this calculation to work by volume.

Visualize alligation in a simple box diagram. In the upper and lower left-hand corners, write the % invert sugar of the two syrups to be blended. In the center of the diagram, write the % invert sugar desired:





Subtracting across the two diagonals provides the proportion of each syrup required to produce the desired invert sugar percentage. If a subtraction results in a negative number, just take the absolute value (ignore the negative). The resultant values of the subtractions can be thought of as "parts". In the above example, 1.2 parts of the "light" syrup and 0.5 parts of the "dark" syrup should be combined to achieve a 1.0% invert blend. This calculation can be simplified by multiplying by 10; 12 parts light syrup and 5 parts dark syrup. "Parts" can mean whatever is a convenient unit: cups, milliliters, gallons, pounds, etc. Notice that, though the subtractions are done diagonally, the resultant values correspond to the syrup located directly to the left in the diagram.

When blending syrups, be especially careful of strong flavors in the darker syrups. These flavors will become more pronounced in the final product.

Achieving High Invert Levels with Processing Aids

Invertase

Some confections require higher invert sugar levels than can be typically found in maple syrup. If syrup with a high enough invert sugar level is not available, it can be created using a "processing aid" that converts sucrose to glucose and fructose. To do this, one syrup is treated with the enzyme invertase which will convert all of the sucrose present into invert sugars; this solution is called inverted maple syrup. That inverted maple syrup is then blended with untreated syrup to achieve the desired invert level. Before using a processing aid, be sure you are in compliance with state or provincial law (**Section 11**).

To make inverted syrup, add 1 tablespoon (15 mL) invertase to 1 gallon (4.4 L) of standard-density maple syrup. Invertase may be purchased from confectionary and baking suppliers. Store invertase according to directions. For rapid conversion, stir the invertase into the syrup and hold the mixture at 120 – 150 °F for 24 hours. Where time is not a factor, stir the mixture thoroughly and allow it to stand at room temperature for 3 – 5 days. This will fully convert the sucrose in the maple syrup to invert sugars. The resultant syrup will have an invert sugar level equal to the brix of the syrup. For example, if 100% of the sucrose in converted to invert sugars in a 66.0 °Brix syrup, the syrup would have an invert sugar level of 66%. This is important to remember for blending purposes.

Very high levels of invert sugars are difficult to measure accurately with diabetic glucose meters. At a 1 in 10 dilution rate, the glucose concentration is out of range for these meters, and the accuracy of the meters decreases as the glucose concentration increases. It is best to wait for the full time period for full conversion rather than depend on a test, so plan ahead if you will be making confections that require very high invert levels.

Heating syrup treated with invertase above 170 °F will deactivate the enzyme and the sucrose conversion will cease. Heat-treat inverted maple syrup above 170 °F before adding to untreated syrup or the enzyme will continue to convert available sucrose in the untreated syrup.

Cream of Tartar

A less involved method for increasing invert levels that may be recommended in some candy recipes is using an acid salt such as cream of tartar. In this case, cream of tartar would also be considered a processing aid. Add ½ teaspoon (2.5 mL) cream of tartar to 1 gallon (4.4 L) of low-invert syrup just before boiling for candy, or add cream of tartar as directed in the candy recipe. This will cause sufficient inversion of sucrose via acid hydrolysis. Cream of tartar is available in the spice or baking sections of most grocery stores. One issue with this method is that testing can only be done after the syrup has been boiled and the candy making process therefore begun. This process is difficult to control and may not result in the exact level of invert sugars you were expecting.

For replacing corn syrup with inverted syrup in confections recipes, see **Section 7.15**.

2.3 Understanding Water Activity

Water Activity: Another Critical Factor for Safety of Food Products
Randy Worobo and Olga Padilla-Zakour

Small Scale Food Entrepreneurship: A Technical Guide for Food Ventures, 2nd ed. (p. 40-42)
New York State Food Venture Center, Cornell University

If you read federal or state regulations regarding microbial food safety, two values are frequently mentioned: pH and water activity. The pH of a food is a measurement of its acidity in terms of the concentration of acid ions (hydrogen ions). pH 4.6 is a defining limit in foods; any food with a pH below or equal to 4.6 is acidic or acidified, and any food with a pH above 4.6 is classified as low acid.

Water activity, a term most people are not familiar with, refers to the water in a food that is available for microbial growth. Water activity also effects chemical and enzymatic reactions, but these effects will not be covered in this article. Based on regulations, if a food has a water activity value of 0.85 or below, it is classified as non-hazardous; this is because there is not enough free water available to allow the growth of pathogens. This article will discuss what water activity is, how it is measured, how it relates to microorganisms, and the applications of this concept in food manufacturing.

Water Activity vs. Moisture Content

The value of water activity is different than the moisture content (% water) in a food product. The moisture content is the total moisture (the amount of bound plus free water) that is present in the sample. Water Activity is specific; it provides a measurement of the free moisture and is usually expressed as a_w or percentage Equilibrium Relative Humidity (% ERH). To perform the measurement, a sample of the food product is put in a small container that is then placed inside a chamber that seals the sample from the outside environment. A sensor inside the chamber measures the relative humidity of the air above the food. After a period of time, this relative humidity measurement remains constant due to the establishment of equilibrium between the air and the food. This final reading is then expressed either in percentages from 0 to 100% ERH or as Water Activity (a_w) with values between 0.0 and 1.0.

The laboratory determinations of water activity used to take hours to reach equilibrium. With modern technology, the measurement of water activity is simple, accurate, and fast. Readings can be obtained in minutes in most cases and in less than one hour for difficult samples. Meters that produce accurate readings are currently priced between $2,000 and $6,000 depending on the model and manufacturer.

Water Activity and Preservation

Microorganisms, like humans, require water for growth and reproduction. Water acts as an essential solvent that is needed for most biochemical reactions in living organisms.

Lack of water prevents microorganisms from growing, but it does not necessarily accelerate the death of microorganisms. An excellent example of this is baker's yeast. Yeast is purchased in dried form, and once water and a small amount of growth substrate (sugar) are supplied, the yeast begins to grow. The fact that microorganisms are unable to grow at low water activities can be used as a form of food preservation.

Water activity (a_w) is an index of the water that is available for utilization by microorganisms. Pure distilled water has a water activity of 1.0. Solutes (salt, sugar) that are dissolved or solids that absorb water can reduce the amount of available water. Salting was one of the early methods of preserving foods and is still used today. By adding high concentrations of salt, the a_w is lowered sufficiently to prevent the growth of most microorganisms. In a similar manner, sugar is used to produce food products such as candied fruits, jams, and jellies that are no longer susceptible to spoilage by bacteria and by most yeasts and molds. Perhaps the most common method of food preservation, dehydration, lowers a_w not by binding up the available water, but by removing it. Dried and dehydrated foods include meats, seafood, vegetables, spices, fruits, pasta, bakery, and dairy products. The final moisture content and water activity of each dehydrated product will depend on the characteristics of the food, distribution methods, storage temperature, packaging conditions, and expected shelf life. In general, most dried products will have a final a_w below 0.8. For meat products, USDA regulations require a minimum holding temperature during dehydration of 145 °F. The elevated dehydration temperature not only assists in the drying process, but also prevents the growth of pathogens and most spoilage organisms during that process. In some cases, the dehydrated food will be reconstituted, as in dried milk or vegetables, while in others, the products will be consumed in the dried form, as for beef jerky or croutons. Dried and dehydrated products must be kept in an environment with a relative humidity lower than the equilibrium relative humidity of the product (a_w x 100%). If the dried foods are exposed to higher relative humidity environments, the products will absorb the water present in the air, and thus, their a_w will increase. This increased a_w may become of concern for growth of spoilage organisms or pathogens. Therefore, proper packaging of dried or water activity controlled products is essential for safety and quality. Airtight containers, such as glass jars, cans, or sealed pouches, will prevent moisture exchange with the environment. Most plastic bags will provide good protection against moisture changes, as long as the bags are sealed well and undamaged.

The level of water activity reduction that will render food safe from spoilage and potential pathogens depends on the food and on what microorganisms are of concern. In general, most bacteria are inhibited at a_w of 0.85. This includes food pathogens as well as spoilage bacteria. Yeasts and molds are more tolerant of lower water activities and require an a_w of 0.60 to ensure food preservation. This is why bread spoils due to mold growth and not bacterial growth. The pH is another critical factor for microbial growth; if the minimum pH and a_w for inhibiting specific microorganisms are known, it is possible to design or adjust food products to control pathogens and extend shelf life. **Table 2.2** below summarizes critical values of a_w and pH; anything above these levels will support microbial growth.

Table 2.2 a_w and pH values critical for microbial growth.

Minimum a_w	Minimum pH	*Microorganism*
1.00	-	*Caulobacter*
0.985	5.3	*Campylobacter jejuni*
0.97	5.0	*Listeria monocytogenes*
0.96	5.0	*Clostridium botulinum (non-proteolytic)*
0.95	5.0	*Pseudomonas* species
0.95	4.6	*Yersinia enterocolitica*
0.95	4.4	*Eschericia coli*
0.95	4.0	*Salmonella* species
0.95	3.0 – 3.5	*Lactobacillus* species
0.93	5.0	*Clostridium perfringens*
0.93	4.6	*Clostridium botulinum (proteolytic)*
0.91	4.9	*Bacillus cereus*
0.86	4.0	*Staphylococcus aureus*
0.8 – 0.6	< 2.0	Many yeasts and molds

If the pH and water activity of food products are known and measured, then it is possible to study processing and packaging alternatives and formulation changes to render a safe, quality product. **Table 2.3** below shows examples of foods with typical water activities.

Table 2.3 Typical water activities for various foods and food products.

Water Activity	*Foods*
1.00 – 0.95	Fresh meat, fresh or canned fruit, and vegetables, butter, low-salt bacon
0.95 – 0.90	Processed cheese, baked goods, juice concentrate, high-salt bacon
0.90 – 0.80	Aged cheddar cheese, sweetened condensed milk, jams, margarine
0.80 – 0.70	Molasses, soft dried figs, heavily salted fish
0.70 – 0.60	Parmesan cheese, dried fruit, corn syrup, licorice
0.60 – 0.50	Chocolate, confectionary, honey, noodles
0.40	Dried egg, cocoa powder
0.30	Potato chips, crackers, cake mixes, pecan halves, peanut butter
0.20	Dried milk powder, dried vegetables, chopped walnuts

References

Marsili, R. 1993. Water activity: why it's important and how to measure it. Food Product Design, December issue

Rotronic Instrument Corporation. Technical flyer

Troller, J.A. and Christian, J.H.B. 1978. Water activity and food. Academic Press, Inc., New York.

2.4 Adjusting Density (°Brix)

Adjusting density is not only useful for blending off-density syrups, as described in the fact sheet below, but it can be used to calculate precise density or °Brix levels for various value added maple products, such as soft drinks (sodas), sports drinks, and more. There is currently both a "Density Blending Calculator" and a "Dilution Calculator" available for online use or free download on the Cornell Maple Program website, Maple Calculators page (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/).

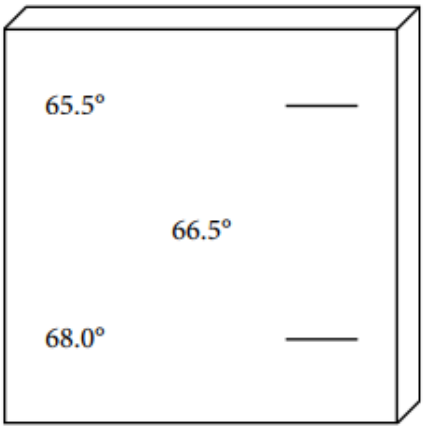
Appendix 3. Adjusting Off-Density Syrup by Blending with Syrup, Sap, or Water
Dr. Randall B. Heiligmann, Professor, The Ohio State University
Revised (2022): Ailis Clyne, Cornell Maple Program

Adapted from North American Maple Syrup Producers Manual, 2nd ed. (p. 300-302)

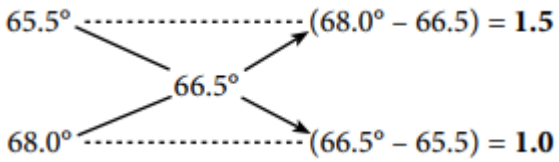
Blending Syrup with Syrup

Determining the proportions of two different syrups of known densities to blend to obtain a desired density can be done very simply, and quickly using a Pearson's Square, also known as alligation. This method if often used by winemakers to determine the proportions of two wines to blend to obtain a desired alcohol level. The method is best explained by example: Use two syrups with densities of 65.5 °Brix and 68.0 °Brix to obtain a blend with a density of 66.5 °Brix.

Visualize the method utilizing a diagram similar to the five side of a die. In the upper and lower left-hand corners, write the densities of the two syrups to be blended; in the center of the diagram write the desired density. In our example:



Subtracting across the two diagonals provides the proportion (by weight) of each syrup required to produce the desired density. Always subtract the smaller number from the larger, irrespective of its location. The proportion (by volume) of each syrup to be blended is the number located directly across from it in the diagram. In our example:



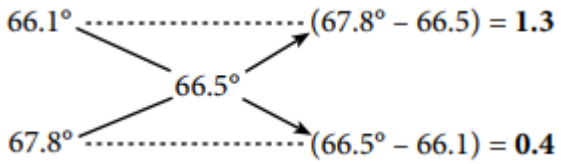
Blending 1.5 parts 65.5 °Brix syrup with 1.0 part 68.0 °Brix syrup results in a blend with a density of 66.5 °Brix. If we had 15 gallons (57 L) of 65.5 °Brix syrup and wished to raise its density to 66.5 °Brix, we would need to blend it with 10 gallons (38 L) of 68.0 °Brix syrup. To solve for more complicated ratios, calculate the amount of 68.0 °Brix syrup required by solving for "x" in the equation below, which assumes you have 6 gallons of 65.5 °Brix syrup:

$$\frac{1.5\ parts}{1.0\ parts} = \frac{6\ gallons}{x}$$

Solving for x yields 4 gallons of 68.0 °Brix syrup needed for the blend.

As noted above, the Pearson's square calculation calculates the mixing proportions on a volume basis. However, it can be used to calculate proportions on a weight basis with negligible error if the difference between the densities of the two liquids being blended is very small.

The following example of blending two syrups yields slightly messier results. Suppose you have 120 gallons of 66.1 °Brix syrup, and you would like to blend it with 67.8 °Brix to achieve a density of 66.5° Brix. Using the Pearson's square to determine the proportions to blend:



Solving the ratio as in the previous example, the amount of 67.8 °Brix syrup needed to blend with the 120 gallons of 66.1 °Brix syrup is determined as follows:

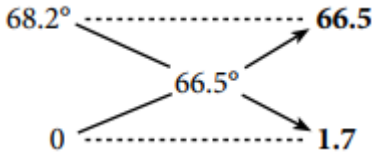
$$\frac{1.3\ parts}{0.4\ parts} = \frac{120\ gallons}{x}$$

Solving for x yields 36.9 gallons of the 67.8 °Brix syrup needed to produce about 157 gallons of 66.5 °Brix syrup. Remember, "parts" can be used to represent any unit of volume measure (e.g., cups, gallons, liters), or any unit of weight measure when the two liquids have about the same density.

Blending Syrup with Water or Sap

When blending syrup with water or sap on a volume basis, the proportions to mix can be determined using a Pearson's square calculation in the same way it was used when blending syrup with syrup. Blending by weight with different density liquids is much more complicated.

In the following example, suppose you have a 40 gallon barrel of 68.2 °Brix syrup, and you want to know how much water is needed to dilute it down to a density of 66.5 °Brix. First, determine the proportions to mix:



Then apply the ratio calculation to the proportions:

$$\frac{66.5\ parts}{1.7\ parts} = \frac{40\ gallons}{x}$$

Solving for x yields 1.0 gallons of water needed.

Using Percentages to Calculate Parts Needed for a Known Final Volume

The previous calculations determine how much liquid to add to a known volume of syrup to change its density. In this case, the final volume of the blended syrup is not controlled. Sometimes in confection making a producer will need to know how much of two liquids to blend to achieve a particular volume of a specific density. To calculate this, the "parts" from the Pearson's Square must be translated into percentages.

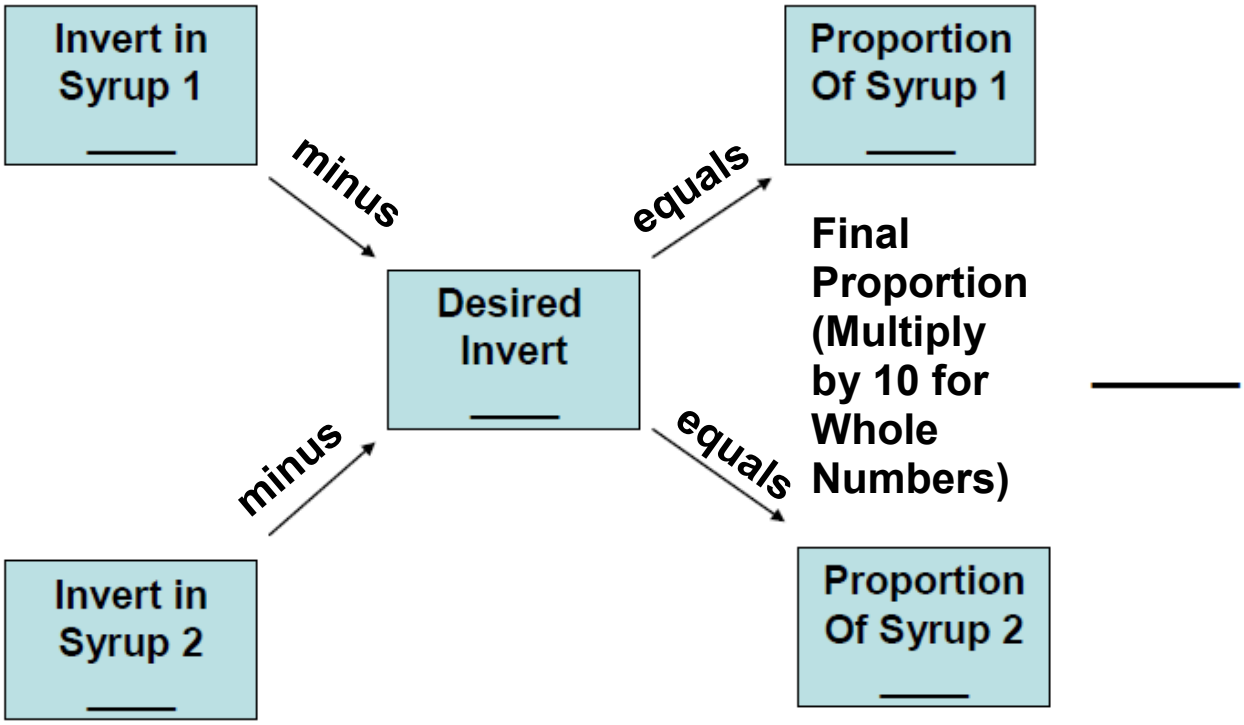
Take the previous example. To translate the parts into percentages, add the parts together to get the denominator of the fraction, and each part will remain as a numerator:

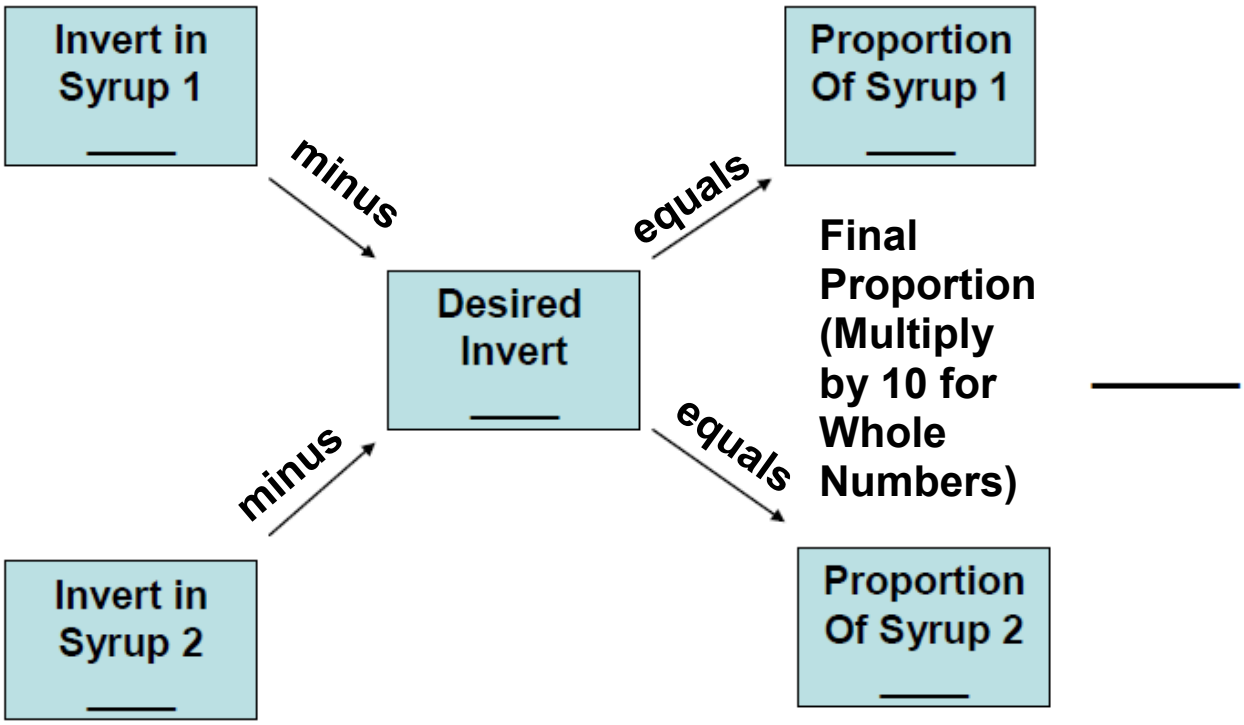
$$66.5 + 1.7 = 68.2$$

$$\frac{66.5}{68.2} = 97.5\%\ syrup \qquad \frac{1.7}{68.2} = 2.5\%\ water$$

These percentages can then be applied to any desired volume of 66.5 °Brix syrup. For

2.5 Practice Alligation Tables for Blending Densities



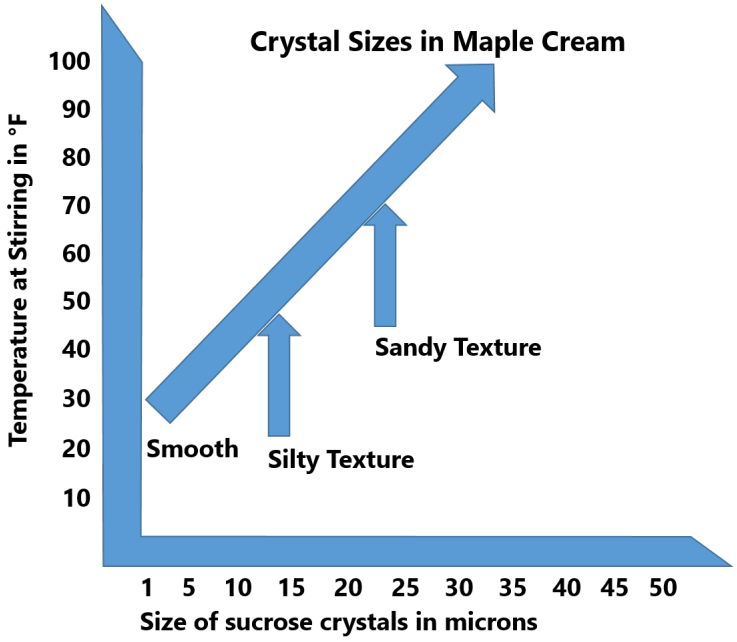


Crystallization

3.1 Factors that Influence Crystal Size in Maple Products

Stephen Childs, New York State Maple Specialist (2014)

Crystal size is a very important factor in making quality maple value added products because it determines the product's mouthfeel. For some products, such as granulated maple sugar, grainier texture is preferable. Conversely, for maple candy and maple cream, very smooth mouthfeel is preferred by most customers. Unfortunately, it is more difficult to achieve a smooth texture than it is to produce grainy candies and cream because of the extra steps and attention required during processing. There are several basic factors that will influence final crystal size. The first factor is the **temperature** at the onset of stirring. The graph to the right gives a very general idea of how stirring temperature may influence the texture of the cream. For candy, the ideal stirring temperature range is slightly broader and more forgiving.



If temperature at onset of stirring was the only factor determining crystal size, it would be simple to achieve any desired textural outcome. But, crystallization is not so simple; there are several other factors that may completely change the above graph. The second factor is the **invert sugar level** of the syrup. The higher the invert, the higher the temperature at

onset of stirring can be and still result in fine crystal size and smooth texture. However, this trend has a limit; when the invert sugar level is too high, the product may not solidify or set properly, resulting in soupy maple cream or sticky maple candy. On the other hand, if the invert level is too low, the resulting product can be grainy despite being stirred at very cool temperatures.

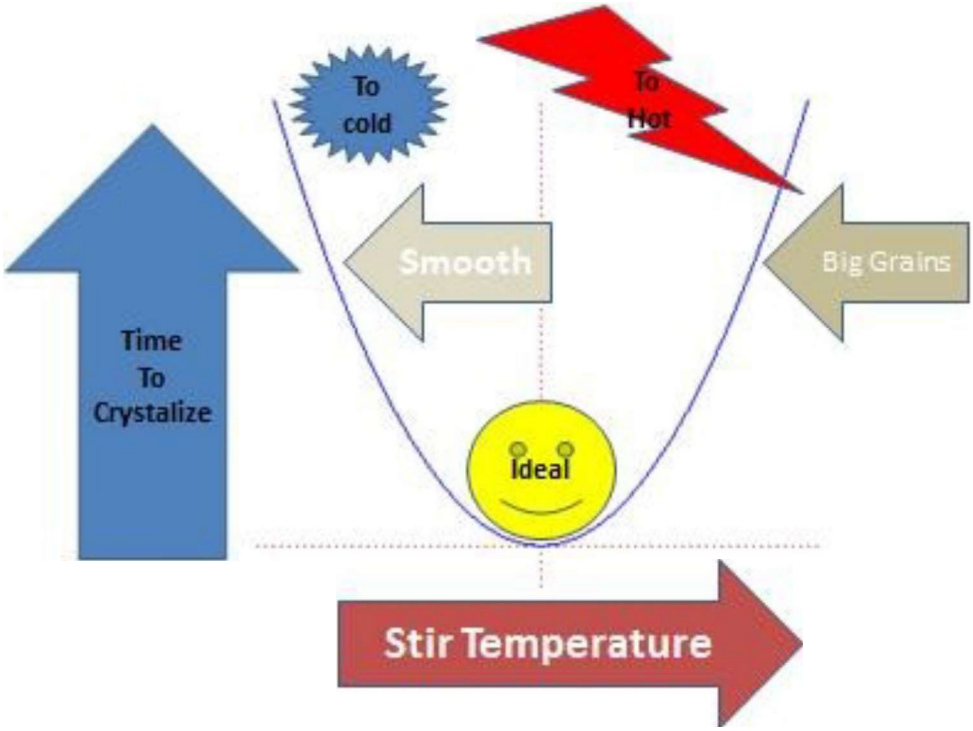
The **equipment** used for stirring is another important factor. The faster, more powerful the stir, the smaller the crystal will be. A gear pump machine, depending on speed, will usually make a smoother cream than a turn table or candy (sipple) machine. Hand stirring will always be slower and less powerful than machine stirring, regardless of how vigorously one stirs.

Seeding can also have an important influence on the texture of the cream or candy. Remember that seeding means introducing a small amount of crystallized product with desirable texture to both get the crystallization reaction started sooner and "set" the crystal size by giving the sugar in solution a structure to build on. When cooling syrup is exposed to existing crystals, the crystals that follow tend to "copy" the size of those first crystals. Seeding can be accidental and detrimental or intentional and beneficial. Unwanted crystals can form on the surface of the cooked syrup as it cools or on the sides of the pan it was cooked in. These accidentally formed crystals can act as a seed. Typically, the crystals that form in those scenarios are large and make a poor seed that produces an undesirably grainy texture. Spritzing the surface of the cooked syrup with water can help prevent the formation of sugar crystals while cooling. Additionally, it is important to avoid disturbing the pot or vessel containing the syrup as it cools as even slight agitation can cause unwanted crystals to form. On the flipside, purposely seeding with a spoonful of smooth-textured cream can help create a smooth-textured finished product. This finished cream should be added at the onset of stirring. Candy and cream can both be seeded using smooth-textured cream.

Note that, while initiating stirring at very cool temperatures will produce a very smooth textured cream or candy, it can also make stirring very difficult for some stirring equipment. Cold, high-density syrup is very stiff and has been known to stall most any equipment available, so it may be wise to gradually experiment with cooler stirring temperatures in order to try to predict the limits of the equipment you are using.

Granulated Maple Sugar

When making granulated maple sugar, stirring hot tends to produce larger crystals and preferred texture. However, stirring right off the stove may lengthen the time it takes to crystalize. If stirring by hand, this length of stirring time can be of great importance as it may exceed your endurance. With most other machinery, length of stirring time is not a critical factor. The simple graph below illustrates that the time it takes from when you begin stirring to when you finish will change with the temperature of the cooked syrup at the onset of stirring.



This phenomenon is true for all maple confections, but is most often experienced with granulated sugar production because producers wanting large sugar crystals attempt to stir at hotter temperatures than are ideal for crystallization. As the graph illustrates, both too hot and too cold stirring temperatures will necessitate a longer stir time to complete crystallization. Somewhere in the middle is more ideal when it comes to how long stirring will take, but those temperatures are not necessarily ideal for achieving the desired texture of the final product. The graph illustrates that stirring hotter produces a grainier texture and stirring colder, a smoother texture, but there are diminishing returns at both ends of that spectrum.

Summary

In order to make quality maple confections consistently, the producer must:

- have a clear understanding of these factors influencing product texture
- give close attention to:
    - finish temperature (temperature the syrup is initially heated to)
    - stirring temperature
    - invert sugar levels
    - seeding
- operate as consistently as possible

3.2 Crystal Chemistry in Multi-Ingredient Confections

Revised (2022): Ailis Clyne

Overall, regardless of the type of crystal, the following factors will impact crystallization:

- the nature of the crystallizing substance
    - in confection making, this substance is usually sucrose, or ice in ice cream
- concentration of the crystallizing substance
- rate of cooling
- temperature at various points in the process
- degree of agitation (through stirring)
- size, type, and amount of nuclei or "seed"
- types and amounts of interfering agents (crystal inhibitors)

Multi-ingredient confections usually contain sucrose, water, and additional ingredients that may act as "interfering agents". Interfering agents are ingredients that interfere with the formation of sugar crystals, also known as "crystal inhibitors". Butter, milk, cocoa, and corn syrup are present in many confection recipes and act both as crystal inhibitors and flavoring agents. More on interfering agents at the end of this section.

Candy making usually begins with a supersaturated liquid, typically sucrose in water. Supersaturated means there are more solutes or particles in the liquid than the liquid can stably hold or keep dissolved. A maple syrup that forms crystals in the jug was cooked to a density (i.e., sugar content, °Brix) that supersaturated the solution. At warm temperatures, the solution can hold more solutes (in this case sugar molecules) than it can at room temperature. Since the solution can no longer hold all of these solutes when it cools to room temperature, they precipitate out of the solution in the form of crystals.

In maple confection making, supersaturation is important whether you want sugar crystallization (maple cream) or you want to avoid it (hard candy). Heating maple syrup is all it takes to create a supersaturated solution. By heating the syrup above the boiling point of water, the sugar concentration increases as water evaporates. At the high boiling temperature, the syrup can keep this high concentration of sugar dissolved. The syrup becomes supersaturated once it is allowed to cool undisturbed. Upon cooling, the sugar either recrystallizes into many small crystals (maple candy, cream) or forms one large amorphous (non-crystalline) mass (hard candies, lollipops).

For crystallization to occur, "nuclei" must form and solutes must organize or aggregate around these nuclei. Think of a crystal as simply a stable pattern by which the microscopic molecules of a substance are organized. In crystallization, a nucleus (plural: nuclei) can be thought of as any particle that the other molecules can then organize themselves around. These nuclei can form spontaneously when the molecules naturally aggregate on their own, but in candy making, they are often "seeded", or added on purpose, to initiate and

control crystallization. The size of the resulting crystals in the candy depends on the size of the nuclei (or crystal size of the "seed"), the rate and temperature of crystallization, the method of agitation, and the type and amounts of interfering agents in the solution.

Crystallization is a complex process with many interrelated factors. While the nature of the crystallizing substance is important for crystallization, this is not as important to understand for candy making because sucrose is almost always the crystallizing substance. The rate of crystallization is the speed at which nuclei grow into crystals. This rate is dependent upon the concentration of the solute (sugar) in the solution as a more concentrated (more supersaturated) syrup will crystallize more rapidly than a less concentrated syrup. At a high temperatures, the rate of crystallization is slow, becoming more rapid at a lower temperatures. Agitation distributes the crystal-forming nuclei and hastens crystallization.

Interfering agents in the solution usually delay crystallization, and in some cases, such as in caramels, may prevent crystal formation altogether. Fats and proteins decrease the number and size of crystals by physically obstructing the sucrose molecules. Corn syrup, due to its invert sugar content (mainly glucose), also plays this interfering role, and it additionally enhances the solubility of sucrose, thus decreasing its tendency to crystallize. Cream of tartar in a candy recipe indirectly to decreases the rate of crystallization as well as crystal size. It does this by hydrolyzing (breaking down) sucrose into its invert sugar components (fructose and glucose). The resultant invert sugars have greater solubility than sucrose, enhance the solubility of sucrose, and obstruct sucrose from crystallizing. Technically, maple syrup always contains interfering agents because it contains low levels of invert sugars, minerals, and other compounds. In some educational materials, these components are referred to as "impurities". These "impurities" do not make pure maple syrup less of a pure product, but they do make maple syrup more difficult to fully crystallize than a pure sucrose solution containing only sucrose and distilled water.

Maple Cream

4.1 Making Maple Cream

Stephen Childs (2007), Cornell Maple Bulletin 202 (2007)
Revised: Stephen Childs (2020), Ailis Clyne (2022)

Originally adapted from North American Maple Syrup Producers Manual, 2nd ed, 2006

Maple Cream (Maple Butter, Maple Spread)

Maple cream is a value added product that is made from pure maple syrup. Maple cream, also known as maple butter or maple spread, has a name that would imply that it contains dairy products, it does not. Maple cream is simply made by further concentrating maple syrup through evaporation, quick cooling, stirring, and then packaging at room temperature. The finished maple cream should be light colored and have a smooth, creamy texture. It is often spread on toast, bagels, muffins, pancakes, and doughnuts, and used in other confections and baked goods.

In recent years, the procedure for making maple cream has been developed further through research on shelf stable maple cream and the introduction of the gear pump maple cream machine. Now a maple producer has options. They can choose between making traditional maple cream or the higher invert sugar, shelf stable maple cream. Additionally, they can select a stirring method from several machines (the common turntable and paddle cream machine, the sipple candy machine, the gear pump cream machine), or choose to stir by hand. Each method has its advantages and disadvantages. In general, the faster, more aggressive the stir, the smoother the cream will be.

Traditional Maple Cream Procedure

(next page)

Selecting the syrup

Generally maple cream is made from Golden or Amber maple syrup, however guessing which syrups to use can result in poor quality maple cream or even batch failures. The range of invert sugar level recommended for making traditional maple cream is between 0.5% and 4% with 1.5% suggested as ideal. Syrups with different invert levels can be blended to fall within the ideal invert sugar range. Use the "Invert Blending Calculator" available for online use and free download on the Cornell Maple Program website, Maple Calculators page (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/).

The table at right shows the recommended range (light gray) for maple cream production of glucose meter readings on a solution of 10% syrup, 90% water (a 1 in 10 dilution), and their corresponding invert sugar levels. The ideal range is highlighted in dark gray.

Glucose Meter Reading	1 in 10 dilution of syrup
mg/dL	invert%
20	0.4
30	0.6
40	0.8
50	1.0
60	1.2
70	1.4
80	1.6
90	1.8
100	2.0
110	2.2
120	2.4
130	2.6
140	2.8
150	3.0
160	3.2
170	3.4
180	3.6
190	3.8
200	4.0
210	4.2
220	4.4
230	4.6
240	4.8
250	5.0

Selecting a finishing temperature and boiling

To prepare traditional maple cream, heat the selected syrup to a temperature of 22 – 28 °F (12 – 15 °C) above the boiling point of water. Boil to the higher end of this range on rainy or humid days or when your selected syrup has invert sugar levels between 3% and 4%. If the syrup has invert levels higher than 4%, a finish temperature higher than the suggested range will be necessary. Remember to establish the exact temperature at which water boils at the time the maple cream will be boiled; this temperature can change slightly depending on weather conditions (atmospheric pressure), and will differ at different elevations.

Watch the boiling syrup carefully as the temperature climbs. The temperature rises more rapidly as it approaches the finishing temperature and it can be easy to shoot past your target. A good digital thermometer, especially one that shows temperatures to one tenth of a degree, will help with accuracy. Many modern digital thermometers also have alarm functions that can be set to alert the user when the syrup is approaching the finishing temperature. For more on thermometers, see **Section 9.2**.

Cooling the concentrated syrup

As soon as the syrup reaches the desired finishing temperature, it should be removed from the heat and rapidly cooled. Spraying the surface of the batch with a fine water mist as soon as it is removed from heat can prevent crystals forming on the surface of the syrup or edges of the pan. If stirring by hand or using a paddle and turntable machine for a single batch run, cool the syrup directly in the pan that will be used for stirring. With hand stirring, the syrup can be chilled and stirred in the same pan it was boiled in.

Rapid cooling prevents premature crystallization. Cooling the concentrated syrup in large, shallow pans will facilitate quick cooling. Place the pans in refrigeration units or in troughs with circulating cold water (see photo at left). Small batches can be efficiently cooled in a sink of cold water. Ice can be added to the water to speed the process. Cooling under vacuum has the advantage of being very fast and maintaining uniform temperature throughout the entire batch.

Be careful when transporting the syrup to where it will be cooled. Be sure that the cooling syrup is kept still during this process. Do not stir the cooling syrup. Even small movements can cause enough agitation to encourage crystal formation, resulting in grainy maple cream. Using an infrared thermometer which does not need to touch the syrup to get a reading is best; sticking a thermometer into the syrup causes unnecessary agitation.

The cooler the syrup becomes before stirring, the smaller the sugar crystals will be that will form during stirring, and the longer these crystals will stay small during storage. Cooling to between 45 – 55 °F will make the finest textured cream that will maintain that fineness longer in terms of weeks and months. The problem with these cooler temperatures is that the syrup can be difficult to remove from the chilling pan, and it can be so thick that stirring by hand is impossible. This thicker, cooler concentrated syrup has even been known to stall various types of stirring machines. For good results with low-powered stirring, the syrup should be cooled to at least 75 °F (24 °C). Stirring the chilled syrup at warmer temperatures tends to produce a cream that separates quicker. If the cream will be consumed immediately, this temperature is not as critical as it is with cream made for long-term storage.

Stirring

When stirring the chilled syrup, expect to see the syrup warm up and become more fluid. This warming always happens when crystallization occurs. It is called the heat of crystallization and is not due to the room being too warm or the stirring being too vigorous. After this stage, it will gradually become thicker and lighter in color, losing its glossy appearance and becoming opaque. Eventually it will become smooth and paste-like in consistency. When this occurs, the crystallization process is complete enough for the cream to be transferred to retail containers.

If stirring is stopped too soon, the final product may become grainy due to the formation of larger crystals. Likewise, if the boiling process did not reach the correct finish temperature, some separation (presence of liquid syrup on top of the crystallized cream)

may occur during storage. Separation can be easily remedied by hand stirring.

Stirring the mixture too long may cause it to harden in the pan. If hardening has just begun, mist a small amount of hot water and stir it in to soften up the cream. If the cream fully hardens in the pan, there are a few methods that can remedy the situation: use a heat gun directly on the cream, or transfer the pan to a warm oven or hot water bath to warm the cream until it is workable again. Never heat maple cream above 120 °F and understand that this type of reheating can cause the finished product to become grainy and to separate more quickly. Another method is to store the stiffened cream covered tightly with plastic wrap (or in a Tupperware container) overnight, then attempt to stir the next day. If the maple cream is just slightly too stiff, add a small amount of distilled water to the batch until it reaches the desired consistency; adding water for this purpose instead of syrup seems to cause less separation over time.

Turn Table Cream Machine

If using a paddle and turntable stirring machine, adjust the paddles so that one gently scrapes the side of the revolving pan while the other is positioned about a third of the way from the edge of the pan. When the cream reaches the proper consistency, it can be scooped out as the pan turns by using a thumb-operated, 2-ounce portion control scoop. If the syrup solution becomes too stiff, it is possible to soften it by applying a gentle heat source to the outside of the revolving pan. An electric heat gun works well for this purpose. Never heat maple cream above 120 °F and understand that this type of reheating can cause the finished product to become grainy and to separate more quickly.

Hand Stirring

Stirring by hand must be done slowly; do not beat or whip the syrup. The objective is to slowly stir the solution until crystals start to form. This will require some time, strength, and endurance, especially if the syrup is cooled to below room temperature. This is usually a two-person operation; one person holds the bowl still while the other stirs.

Sipple / Candy Machine

Sipple or candy machines are convenient because they can be used for maple candy and maple cream. Additionally, the operator can fill the cream containers directly from the machine, and they can run multiple batches without stopping by simply continuing to add chilled, concentrated syrup to the trough.

When using a sipple machine, first start the “worm drive” or auger, then slowly fill the trough about half full with the chilled syrup, allowing the auger to stir until the syrup in the trough forms crystals, becomes opaque, and loses its glossy appearance. This can take from just a few minutes to 20 – 40 minutes depending on many factors. Seeding the trough good quality finished maple cream can dramatically speed up the process. There will be a few minutes before the syrup warms from the heat of crystallization when it will tend to bunch up at the far end of the trough. If you have filled the trough with too much syrup, it can easily over flow at this stage. When the cream looks finished, begin gradually adding more chilled syrup to the far end of the trough from the pan or “pig”, and gradually fill retail containers with finished cream directly from the trough spout.

Gear Pump Cream Machine

This is the fastest and easiest method for producing large amounts of maple cream. It is the most expensive option, but it is the best investment for high volume production.

When using the gear pump cream machine, first be sure that the valve is set to circulate the cream, and not dispense it. Start the pump and lightly mist the steel funnel with warm water before gradually adding the chilled syrup to the funnel. Add just enough chilled syrup until it begins to circulate through the machine. Too much chilled syrup at once may stall the pump or increase current draw, causing circuit breakers to pop.

This machine causes the syrup to crystallize rapidly; the syrup will lose its glossy appearance and become opaque in just a few minutes. Packaging can begin soon after starting the process; have retail containers ready before starting the machine. The cream can be dispensed directly from the machine into containers quickly and easily. Continually scrape down the sides of the funnel while filling retail containers. The gear pump cream machine allows for continuous operation with multiple batches. When switching to an additional batch, be sure to recirculate the newly added syrup so that it can crystallize properly before packaging. Do not try to rinse the funnel between batches as water will become trapped in the machine and alter the density of the next batch.

The ability to control the speed of the gear pump can give better control over the stirring and filling processes and significantly reduce air introduction into the cream in the last few containers filled. Gear pump speed can be controlled by using three phase electric, single phase electronic controls, or a transmission between the motor and gear pump.

Seeding Crystals

Regardless of stirring method, crystallization can be hastened by adding a small amount of "seed" crystal (finished maple cream) to the chilled syrup just before or during stirring. The introduction of one teaspoon of seed for each gallon of syrup provides small particles to serve as “nuclei” so that crystals will form more rapidly. For best results, use seed from the smoothest maple cream available; crystals that form after seeding will mimic the crystal size present in the seed.

Packaging

Maple cream can be packaged in food grade, moisture-barrier plastic or glass. Containers with wide mouths are easiest to fill. Care must be taken to prevent air bubbles during filling, especially when the maple spread is packaged in glass. Separated syrup can collect in air bubbles, creating an unpleasant appearance. Additionally, air bubbles create the impression that the package is under-filled and therefore unfairly priced.

During cream production, the maple syrup is heated to high temperatures that eliminate all pathogenic microorganisms, but the subsequent steps of rapid cooling and filling at room temperature occur in an open environment allow the maple cream to become re-contaminated. At the high sugar concentration of maple cream, pathogens cannot grow, but spoilage microorganisms, reportedly molds and yeasts, can slowly grow and spoil the product. That is why traditional maple cream is sold under refrigeration.

Because traditional maple cream, like maple syrup, contains no preservatives, it is susceptible to mold formation on the surface. For long-term storage (up to 1 year), it should be stored in a freezer where it will not mold and will show little or no separation. If stored at room temperature, traditional maple cream has a shelf life of less than 1 month. This product requires refrigeration to achieve an acceptable shelf life of 6 months. Separation may occur during this period; the product label can indicate this.

All cooking utensils, thermometers, and especially the stirring equipment should be thoroughly washed in hot water and be completely cleaned after each use to avoid contamination of future batches with bacteria and molds that can destroy the product quality. Make maple cream in a clean environment with easily sanitized surfaces.

Shelf-Stable Maple Cream/Spread

At room temperature, traditional maple cream does not have an acceptable shelf life. Separation is likely to occur and mold growth on the surface is probable before 1 month of storage. Significant research was conducted at the Cornell Food Venture Center to develop a process for making shelf stable maple cream, and slow the rate of separation in the cream. The Food Venture Center researchers, working with maple producers Chuck Winship and Lyle Merle, discovered that having higher invert sugar levels in the syrup used to make the cream could prevent separation during storage. To produce these invert levels, it is necessary to use the enzyme invertase which can be sourced from confectionary and baking suppliers. Additionally, the researchers found that potassium sorbate is a necessary additive for preserving the product at room temperature, preventing microbial spoilage. For detailed information on research results, the developed production procedure, and addition rates of different additives, see **Section 4.2**.

Summary

Syrup is treated with invertase and is fully inverted, meaning all of the sucrose present in the syrup has been changed into invert sugars (fructose and glucose). This inverted syrup is added to untreated syrup in proportions that would achieve an invert level of between 15-20% in the mixture. It is not practical to use a diabetic glucose meter to test invert sugar in this high-invert syrup mixture because the invert levels are out of reading range at 1 in 10 dilution rate. Most glucose meters give a "HI" reading on any syrup above 12% invert when used as directed in **Section 2.1**. Use the quick reference table below to determine the proportions of inverted and untreated syrups to use when making shelf-stable maple cream.

Proportions of ingredients for various batch sizes of shelf stable maple cream

Batch Size	Inverted Syrup*	Invertase	Untreated Syrup
1 Gallon	21 oz.	0.5 teaspoon	107 oz.
2 Gallon	42 oz.	1.0 teaspoon	214 oz.
3 Gallon	64 oz.	1.5 teaspoon	320 oz.

*Syrup must be inverted ahead of time; inversion takes 1 – 5 days depending on the temperature syrup is held at after being treated with invertase.

Cooking inverted syrup causes it to develop a strong and, to some, undesirable flavor. To reduce this, it is recommended to add the inverted syrup to the untreated syrup as it approaches the finishing temperature, rather mixing the inverted syrup in at room temperature and heating the mixture for the entire boiling time. Another method is to heat the untreated syrup to a higher finishing temperature to accommodate under-cooking the inverted syrup. For example: for a 3 gallon batch of maple cream, heat 2.5 gallons of untreated syrup to 36 – 38 °F above the boiling point of water, then add this hot syrup to ½ gallon of inverted syrup that has been warmed to 120 – 160 °F in the cooling pan. Warming the inverted syrup helps the two syrups combine when the untreated syrup is poured into the inverted syrup. This allows the syrups to mix without physically stirring. Stirring should be avoided at this time to avoid early crystallization.

The rest of the procedure follows that of making traditional maple cream. If using potassium sorbate, add it to the surface of the chilled, concentrated syrup prior to stirring.

In New York, invertase is considered to be a processing aid and does not need to be declared on the maple cream label. Adjusting the invert sugar levels alone greatly reduces separation of maple cream both at room temperature and with refrigeration. Producers can choose to make maple cream with inverted syrup to solve separation problems without raking the next step of mold prevention which requires the preservative, potassium sorbate. Mold can become a problem when maple cream is stored at room temperature for significant time.

To prevent mold growth on the surface of maple cream, potassium sorbate can be added. Potassium sorbate is a common food additive and can be sourced readily from wine making suppliers. Add potassium sorbate at the rate of 500 parts per million based on volume to the chilled, concentrated syrup prior to stirring. If the batch was made from 1 gallon (4.4 L) of syrup prior to cooking, add 0.3 tsp (1.5 mL) of potassium sorbate to the surface of the concentrated syrup. In New York, to incorporate potassium sorbate in maple cream, the product must be made in a facility certified with an Article 20-C Food Processing Establishment License from the Department of Agriculture and Markets (**Section 11.3**). Producers in other states should check their local food processing establishment laws.

Maple Fondant (Maple Nougat, Heavy Maple Cream, Ohio Maple Cream)

Maple fondant is a nougat-type candy produced in some areas of the maple region. While it is called "maple cream" in some regions because of its very fine crystalline structure, it should not be confused with traditional maple cream (maple spread). Maple fondant is made in the same manner as traditional maple cream except that the syrup is heated to 27 – 29 °F (15 – 16 °C) above the boiling point of water. The thickened syrup is then cooled to 100 °F (38 °C) and stirred. Because less water remains in the fondant, it will set up much more quickly to a soft solid, similar to cool butter. Remove the stiff cream from the pan in large chunks and knead it like heavy dough until it can be formed and cut into pieces of the desired size. It can also be packed into molds or dipped in chocolate. The invert sugar levels recommended for this product are the same as those recommended for traditional maple cream.

4.2 Shelf Life Extension of Maple Cream

Olga I. Padilla-Zakour, Randy W. Worobo, Kawaljit Tandon, and John Churey (2004)
Department of Food Science & Technology, Cornell University
Chuck Winship and Lyle Merle, Maple Syrup Farmers

Introduction

Maple cream, a value-added product, is manufactured from pure maple syrup by additional concentration by evaporation, quick cooling, stirring and then packaging at room temperature. Nothing is added to the pure maple syrup to make the maple cream product although the industry name implies there is cream in it. The finished product is light colored, smooth creamy textured, and is used as a spread on toast, bagels, muffins, pancakes, etc. From the marketing point of view, it is an all-natural product comprised mainly of sugars but it also has other important nutrients such as amino acids, proteins, organic acids, minerals (calcium and potassium being the most prevalent) and trace levels of vitamins (Koelling and Heiligmann, 1996).

During production, the maple syrup is heated to high temperatures (234 to 236 °F), which eliminates all pathogenic microorganisms, but the subsequent processing steps involve rapid cooling to produce the fine crystals, and packing at room temperature, all in an open environment where the maple cream is re-contaminated. At the high levels of sugar concentration of cream, pathogens cannot grow but spoilage microorganisms, reportedly molds and yeast, can slowly grow and spoil the product. That is why maple cream is sold under refrigeration, limiting the marketing potential for the product.

Pure maple cream has a shelf life of less than one month if stored at room temperature. The maple cream may mold and it may physically separate into liquid and solid components, resulting in a surface-layer of maple syrup, during this period. The current product requires refrigeration to achieve an acceptable shelf life of 6 months. This requirement significantly reduces marketability, distribution, and availability of the product to the consumer. The storage and handling requirements also increase the final cost to the consumer. As a result, production, consumption, and farmer profit is limited.

Project Goals

Our goal was to develop a process to attain a 6 month shelf life at room temperature. One major limitation is that pure maple cream requires packaging at room temperature and therefore can be contaminated with microorganisms present in the environment. To limit the molding problem that occurs on the surface, we evaluated: packaging under UV exposure, adding calcium carbonate as a processing aid, and flushing the headspace with nitrogen, carbon dioxide, and steam. In addition, we studied the standardization of the maple syrup to optimal sugar composition prior to cream preparation in order to minimize the physical separation during the product's shelf life. We evaluated the various proposed processes utilizing farmer capable equipment and applying accelerated shelf life testing techniques to prove the proposed preservation concepts.

Methodology

Mold spoilage: To address the mold problem, various techniques were investigated that included:

1. Addition of a food preservative (potassium sorbate) at low concentrations
2. Ultraviolet light decontamination of product surface before closing – 5 min exposure
3. Flame sterilization of product surface before closing using a Bunsen burner
4. Steaming of product headspace to create an anaerobic environment at closing using a cappuccino machine
5. Carbon dioxide headspace flushing by applying gas directly from a cylinder at low pressure
6. Nitrogen gas headspace flushing by gas directly from the cylinder at low pressure
7. Addition of 400 ppm sodium bicarbonate to the cream to generate carbon dioxide gas on the headspace of the closed container

The incidence of mold spoilage in maple cream is relatively low, so to more accurately assess the effectiveness of the various treatments, mold from spoiled maple cream samples was collected, cultured, and used as an inoculum on the various maple creams treated with the various treatments. A consistent inoculum of vegetative mold was added to each of the treatments. As a control, maple cream prepared under the same conditions was inoculated with the same level of vegetative mold spores. This procedure assured that all the samples were contaminated with mold to enable the evaluation of the various treatments.

A total of ten 8-ounce containers filled with freshly produced maple cream were used for each treatment. The mold was added to the jar and mixed with sterile mixing tools and then the various treatments were applied. For the potassium sorbate treatment, the mold was added after the addition of the preservative. An initial level of the mold spores was determined by plating onto acidified Potato Dextrose Agar (pH 3.5). The samples were placed at 86 °F (30 °C) and visually observed for mold growth on the surface without opening to avoid secondary contamination or destroying the treatment conditions. The incubation temperature is an accelerated shelf life study that results in a double of the actual holding time at room temperature 70 °F (20 °C). The samples were examined after 1 and 2 months of holding at 86 °F (30 °C). Observation of mold growth on the surface indicated a "positive" result and the number of positive mold samples for each treatment was recorded.

In a smaller trial, we also added a small amount of salt to the maple cream samples to determine whether this would produce a more stable product over time. Salt concentrations of 0.1, 0.25, and 0.5 were added to the samples.

The water activity of all the samples was measured to determine if a low number was achieved. This value indicates the amount of free water (water not bound to compounds) that is available for microbial growth. The water activity of a food is not the same thing as its moisture content. Although moist foods are more likely to have greater water activity

than are dry foods, this is not always so; in fact a variety of foods may have exactly the same moisture content and yet have quite different water activities. A reduced water activity will result in longer shelf life as mold will not grow or will grow very slowly. The water activity scale extends from 0 (total dryness) to 1.0 (pure water), but most foods have a water activity level in the range of 0.2 for very dry foods to 0.99 for moist fresh foods. For a food to have a useful shelf life without relying on refrigerated storage or preservatives, it is necessary to control either its acidity level (pH) or the level of water activity (aw) or a suitable combination of the two. This can effectively increase the product's stability and make it possible to predict its shelf life under known ambient storage conditions. Food can be made safe to store by lowering the water activity to below 0.85, which will not allow pathogens to grow. To render a product shelf stable at room temperature, the water activity should be 0.6 or lower, although most molds cease to grow or slow down at water activity levels below 0.8 (Worobo and Padilla-Zakour, 1999). Maple cream has a water activity of 0.8 to 0.85, and therefore, it is a safe product but allows the growth of mold.

To address the physical separation problem, the amount of invert sugar present in the maple syrup was studied. The concept was based on creamed honey, which is stable without refrigeration (Morse, 1983). To convert the sugar in the maple syrup (sucrose) to invert sugars (a mixture of glucose and fructose) an enzyme called invertase was used. This enzyme is commercially available for use by the confectionery and baking industry (DSM Food Specialties, USA). This is considered a processing aid and does not need to be declared on the product label. We added 0.1-0.25% enzyme solution to a batch of maple syrup, mixed well, and then maintained the syrup at 120 °F (50 °C) for 24-48 hours in a regular oven. The degree of inversion was monitored using the simple and inexpensive urine sugar test (Clinitest tablets by Bayer).

To determine the optimum invert level, small percentages of the inverted syrup solution were added to the maple syrup that was to be used for boiling into maple cream. The syrup mixture was then boiled to concentrate to approximately 85 °Brix (235-240 °F finish temperature). The syrup was then rapidly cooled to temperatures below 50 °F. To stir, a potter's wheel type stirring machine was used. Stirring was stopped when the cream lost its shiny appearance and developed a dull, flat look. The cream was then transferred to 6-ounce glass jars and stored. Samples with added inverted syrup were compared to the standard cream prepared by heating the syrup to a temperature of 22-24 °F above the boiling point of water.

Results

The results are presented in two sections to address the spoilage (mold) problem first, followed by the physical separation into liquid and solid layers in the second section.

Mold Spoilage

Initial studies comparing all the treatments listed under “Methodology” clearly indicated that only potassium sorbate and carbon dioxide provided promising treatments to control the growth of mold. These two treatments were further investigated to determine

effective control levels of potassium sorbate and longer carbon dioxide headspace flushing. Three different levels of potassium sorbate commonly used on food products were tested (250, 500, and 1000 ppm) on freshly prepared maple cream that was subsequently inoculated with the cultured maple cream mold spoilage organism. The samples were then incubated at 86 °F (30 °C) for 2 months which is equivalent to 4 months at room temperature. The results of this study further indicated that carbon dioxide headspace flushing provided no protection against mold spoilage, resulting in 100% spoilage of all samples treated with this method. In the case of samples with potassium sorbate added, no spoilage was observed at any of the levels tested (Table 1). The maple cream samples containing the various levels of potassium sorbate were evaluated for their organoleptic qualities (sensory evaluation). No differences from untreated maple cream were noted for samples treated with 250 or 500 ppm, but an off-flavor was detected in samples treated with 1000 ppm potassium.

Table 1. Microbiological results from maple cream samples inoculated with mold

Treatment	Number of samples with surface mold
Control	10/10
CO_2 headspace flushing	10/10
250 ppm potassium sorbate	0/10
500 ppm potassium sorbate	0/10
1000 ppm potassium sorbate	0/10

In summary, potassium sorbate, even at low levels of 250 ppm, was identified as a potential treatment to provide protection for up to 4 months against mold spoilage associated with maple cream. Further testing confirmed that to assure a 6-month shelf life at room temperature, a level of 500 ppm potassium sorbate is needed.

Physical Separation

Maple cream samples were produced by adding different concentrations of inverted maple syrup to each batch. The syrup mixture was concentrated to about 85 °Brix before the cooling step. A summary of preliminary trials results is shown in Table 2.

Table 2. Evaluation of maple cream samples produced with varying levels of inverted maple syrup and stored at room temperature.

% Inverted syrup	Observations
0 (control)	Very grainy, large crystals
10	Good consistency, good sweetness, and little grain
20	A bit grainier, some crystals
50	Good consistency, very sweet (too sweet)

From the preliminary trials (Table 2), it was clear that an invert level lower than 30 was necessary to maintain the typical maple cream flavor. A second round of tests was run to narrow down the concentration of invert syrup required to limit separation.

Table 3. Evaluation of maple cream samples produced with varying levels of inverted maple syrup and stored at room temperature.

% Inverted syrup	Observations
0 (control)	Grainy with crystals
15	Little separation, grainy
20	Little separation, grainy
25	Grainy, significant separation
30	Grainy, significant separation

From these secondary trials (Table 3), it was concluded that the procedure to make the cream had to be carefully controlled, as the texture was not consistent from one test to another. After further practicing and standardization, another test was run.

Table 4. Evaluation of maple cream samples produced with varying levels of inverted maple syrup and stored at room temperature.

% Inverted syrup	Observations
0 (control)	Grainy, separation
5	No separation, good consistency
10	No separation, good consistency
15	Separation
20	Separation
25	Separation
30	Separation

From the results shown in Table 4, we concluded that a 5-10% level of inverted syrup was best. We proceeded to perform a shelf life study with 10% inverted syrup and potassium sorbate added to assess the long-term stability of the treated maple cream (Table 5).

Table 5. Shelf life study of maple cream produced with 10% Inverted syrup and 250 ppm potassium sorbate, evaluated at 2 and 6 months.

Treatment	Storage Temperature	°Brix	Water Activity (a_w)	Observed Surface Mold		% Separation Syrup/Cream	
				2 month	6 month	2 mo.	6 mo.
Control 1	Room temp.	84.6	0.81-0.82	Mold	Mold	20%	23%
Control 2	Room temp.	84.6	0.79-0.81	No mold	No mold	21%	25%
Control 3	Room temp.	85.9	0.81-0.82	Mold	Mold	20.5%	23%
Control 4	Room temp.	83.8	0.81-0.82	No mold	No mold	22%	25.5%
Invert 1	Room temp.	83.5	0.77-0.79	No mold	No mold	5%	12%
Invert 2	Room temp.	84.3	0.78-0.79	No mold	Mold	5%	11%
Invert 3	Room temp.	85.0	0.73-0.78	Mold	Mold	6%	12%
Invert 4	Room temp.	82.4	0.75-0.78	Mold	Mold	5.5%	11%

Control 1	86 °F (30 °C)	86.4	0.80-0.82	No mold	No mold	21%	23%
Control 2	86 °F (30 °C)	84.1	0.78-0.82	No mold	No mold	20.5%	22%
Invert 1	86 °F (30 °C)	83.8	0.75-0.78	No mold	No mold	8%	12%
Invert 2	86 °F (30 °C)	83.1	0.73-0.78	No mold	No mold	9%	13%

The results in Table 5 show that the samples with added invert syrup (labeled "Invert" under the Treatment column) had slightly lower water activities, but that this was not sufficient to impede the growth of mold, even with the addition of potassium sorbate at 250 ppm. Select molds and yeasts are capable of growing at very low water activities (aw = 0.60-0.70) and are called "osmotolerant". The mold isolated from maple cream falls under this category. In all cases, the control samples were of hard texture and very low spreadability due to the additional concentration to achieve 85 °Brix. The samples with 10% inverted syrup had a creamy texture and were easily spreadable. The amount of separation was significantly reduced by the use of invert syrup as after 6 months, the invert samples had 12% or less of separation compared to 25% for the control samples.

The use of salt was investigated to evaluate if additional stability could be achieved by adding very small amounts to the cream. In this small study, each treatment was replicated three times. Results are presented in Table 6. Concentrations above 0.1% were not considered acceptable due to salty taste. The samples prepared with inverted syrup were very stable; no mold was observed and minimal separation occurred.

Table 6. Evaluation of maple cream samples produced with low levels of inverted maple syrup and added salt and stored at room temperature for 6 months.

Treatment					Observations at 6 months	
% Inverted Syrup	% Salt	°Brix	A_w	Initial Observations	Separation	Mold
5%	0%	84.4	0.68	Creamy texture, little separation	Minimal	None
10%	0%	81.8	0.76	Creamy texture, No separation	None	None
10%	0.1%	83.0	0.72	Creamy, no separation, hint of salty taste	None	None
10%	0.25%	83.0	0.70	Less creamy, no separation, a bit salty	None	None

Although the use of salt did not seem to offer advantages in the preliminary study, a more complete study was performed to confirm the results (Table 7). This study assessed the effect of salt *and* potassium sorbate with 5-10% invert syrup on maple cream shelf life. Each treatment was replicated two times.

Table 7. Evaluation of maple cream samples produced with low levels of inverted syrup, salt, and potassium sorbate and stored at room temperature for 6 months.

Treatment					Obs. at 6 months			
Inverted Syrup	Salt	Potassium Sorbate	°Brix	A_w	Separation	Mold	Texture	Taste
5%			80.4	0.76	None	None	Spreadable	Typical
5%	0.1%		80.2	0.76	None	None	Spreadable	Hint of Salt Acceptable
5%		250 ppm	80.0	0.72	None	None	Spreadable	Typical
5%	0.1%	250 ppm	80.0	0.72	None	None	Spreadable	Hint of Salt Acceptable
10%			80.4	0.74	None	None	Creamy & spreadable	Typical
10%	0.1%		85.2	0.54	None	None	Little grainy	Hint of Salt Acceptable
10%		250 ppm	82.7	0.62	None	None	Little grainy	Typical
10%	0.1%	250 ppm	82.3	0.71	None	None	Spreadable	Hint of Salt Acceptable

From all the shelf life studies, we concluded that an addition of potassium sorbate at 250 ppm might not be 100% effective, as some surface mold was observed sporadically (very small amounts). Therefore, an addition rate of 500 ppm is recommended. The separation problem was minimized by the use of 10% inverted syrup. This addition rate of inverted syrup resulted in an acceptable product with good consistency and very little or no separation. After 6 months, the samples remained stable and in good condition. Careful control of the process will be necessary, as in some cases, the maple cream samples were a bit grainy, most likely due to over concentration of the syrup.

It is also recommended that the maple cream jars be labeled "Best if used by ____" dated 6 months after production and "Refrigerate after opening" to allow the consumer to keep the product for longer periods of time.

Estimated Revenue Increase to Maple Syrup Farmers

It is estimated that a maple cream with room temperature shelf life of 6 months would benefit the Northeast Maple Syrup Industry by a $1.6 million annual increase in revenue. Note that total Northeast USA Maple Syrup revenue for the year 2000 was $28.2 million. This represents approximately 20% of North American production. The estimated increase was calculated with the following assumptions: retail value of maple syrup at $28 per gallon, retail value of maple cream at $60 per equivalent gallon (based on syrup used), and a typical dedication of 5-10% of annual maple syrup production to maple cream manufacturing for a given maple operation. With the assumption that currently 5% of maple syrup produced annually is dedicated to maple cream, then 5% of the 2000 crop year = $1.4 million if marketed as maple syrup, or $3 million if marketed as maple cream, i.e., a net increase of $1.6 million. If good manufacturing practices are developed for the

production of shelf stable maple cream and production and sale increase to 10% (conservative figure) of the annual maple syrup crop, then an extra $1.6 million in revenue will be earned by producers.

Economic Findings

The addition of potassium sorbate will increase the cost of production by less than $0.01 per pound of finished product. The cost of the enzyme used to increase the invert sugar content is approximately $0.05 per pound of finished product. These additions do not require any specialized equipment. Total increased cost of production is expected to be less than $0.10 per pound of finished product.

Maple Cream Extended Shelf Life Manufacturing Process

The following maple cream manufacturing process is copied from the "North American Maple Syrup Producers Manual", The Ohio State University Extension Bulletin 856, copyright 1996, page 119 with additions to the standard process that are a result of this work. Changes made to the standard process to produce the extended shelf life maple cream are in Italics:

"Maple spread (cream), a fondant-type confection, is prepared by elevating the boiling point of maple syrup to a prescribed level, then rapidly cooling the cooked syrup followed by stirring. This procedure results in the formation of very small crystals, which together have a "peanut butter consistency". Maple spread is a delectable topping for toast, muffins or other similar products. For best results, the syrup from which maple spread is prepared should be *Grade A Amber* or lighter. However, other grades of syrup can be used if they contain less than 4 percent invert sugar.

…Syrup that contains from 0.5 to 2 percent invert sugar will make a fine-textured spread that feels smooth to the tongue. Syrup with from 2 to 4 percent of invert sugar can be made into spread by heating it to 25 degrees F above the boiling point of water (instead of the usual 22 to 24 degrees F). Syrup with more than 4 percent of invert sugar is not suitable for making spread…

However, to prevent separation of maple cream into maple syrup during storage add a small amount of inverted syrup to the syrup which is to be converted to maple cream. This inverted syrup will be made by using an enzyme. The invert syrup is made by adding 0.1% to 0.25% by volume of the enzyme invertase to the pure maple syrup used for making maple cream. For a gallon of syrup to be converted to invert syrup add 1.5 teaspoons of invertase. Invertase is available commercially, as it is used by the confectionery and baking industry. This mixture is heated to 50 degrees C (120 degrees Fahrenheit) for 24 to 48 hours and then stored under refrigeration. The use of an oven or crock-pot is ideal for this purpose. This invert syrup solution is added to the maple syrup to be used for boiling to the higher temperatures needed to make maple cream. The invert syrup should represent 10% of the final quantity of syrup to be boiled to the normal temperature required of maple cream. If one is using a one gallon batch size for cream production, use 3.5 quarts of regular syrup and one pint of invert syrup mixed prior to boiling.

To prepare maple spread, syrup is heated to a temperature of 24 to 28 degrees F above the boiling point of water. It is important to consider the exact temperature at which water boils on the day maple spread is prepared since boiling temperature depends on atmospheric pressure. As soon as the boiling syrup reaches the desired temperature, it is removed from the heat and rapidly cooled. Rapid cooling is necessary to prevent premature crystallization. Quick cooling is facilitated by transferring the cooked syrup to large shallow pans. Refrigeration units or troughs with circulating cold water in which the pans are placed can be used. For best results, the syrup should be cooled to 50 degrees F or below. It is considered sufficiently cooled when the surface of the cooked syrup is firm to the touch.

Potassium sorbate is added after the boiling and cooling stages. Potassium sorbate is available at most stores that supply materials for wine making. Add potassium sorbate to the concentrated cooled product at the rate of 500 parts per million based on volume. If the cooled product is a result of one gallon of syrup prior to cooking, add 0.3 teaspoons (1.5 mL) of potassium sorbate to the surface of the concentrated syrup.

Following cooling, the chilled syrup is stirred under room-temperature conditions. Stirring can be done by hand or by mechanical stirring machines. Several different types are available commercially or they can be fabricated. While being stirred, the cooled syrup first tends to become more fluid (less stiff), following which it begins to stiffen and show a tendency to "set up". At this point it loses its shiny appearance and develops a dull flat look. When this occurs, the crystallization process is considered complete and the spread can be transferred to appropriate containers. If stirring is stopped too soon, the final product may become somewhat grainy due to the formation of larger crystals. Likewise, if the cooking process did not reach the correct temperature, some separation (presence of liquid syrup on top of the crystallized cream) may occur while in storage.

To hasten the crystallization process, a small amount of "seed" (previously made spread) can be added to the glass-like chilled syrup just before stirring. The addition of 1 teaspoon of seed for each gallon of cooked syrup will provide small particles to serve as nuclei so crystals will form more rapidly. The entire stirring process may require from 1 to 2 hours, depending on the size of the batch, but the use of seed will often shorten the time by half.

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Overview

This article provides guidelines for addressing issues commonly encountered when making maple cream. Maple cream is a thick, smooth, spreadable confection derived from maple syrup. Its peanut butter-like texture develops when small sugar crystals are formed and held in a supersaturated or concentrated syrup solution. The consistency and quality are controlled by water content and inverted sugar levels. The desired water content is 15 to 18% (Hartel, 2018). Boiling syrup to 25 °F above the boiling point of water (ABPW) yields a cream with approximately 15% water content, while boiling to 22 °F ABPW yields approximately 18% water content (Norish, 1967; Hartel, 2018).

The main factor determining which temperature is appropriate for making maple cream is the level of inverted sugars present in the maple syrup. Sucrose, the primary sugar in maple syrup, forms a stable crystal in maple cream. The invert sugars, glucose and fructose, help maintain moisture and reduce crystallization. The recommended range of invert levels for cream are 0.5 to 3% with 1.5% as ideal. For a detailed recipe, please refer to "Making Maple Cream" by Stephen Childs. More information on invert sugars and measurements can be found in the New York State Maple Confections Notebook.

Crystallization or Graininess

Large crystals can form at three points during the production process: prior to stirring the heated syrup (sugar solution), during stirring, or during storage. Crystal size must be controlled during production of maple cream, as formed crystals will continue to grow during storage. To reduce the formation of large crystals, follow the guidelines below.

Inhibit crystals prior to stirring. As the sugar solution is cooling, do not agitate the mixture. Any type of agitation can cause sugar crystals to form and grow. This will lead to large sugar crystals in the final maple cream. During heating, brush the sugar crystals from the side of the pot into the sugar solution using a water-wetted silicone brush. After the sugar solution has reached the desired heating temperature, a fine mist of water can be sprayed on the surface of the solution to prevent crystal formation – in this instance, heating the solution an additional 1 to 2 °F higher can help account for the added moisture.

Cool the sugar solution. Large crystals will form if the solution is stirred when warm, this is because the sugar crystals move more easily in a warm solution, thus increasing the likelihood of sugar crystals binding to each other. Stirring a cooled solution will produce a large number of small crystals and result in a smooth fondant. The ideal temperature range for stirring maple cream is below 70 °F and above 45 °F.

Control the crystal size with "seeding". Seeding is the process of adding sugar crystals of an ideal size to an un-crystalized solution. Stirring the sugar crystal "seeds" into the solution initiates the crystallization reaction. To accomplish this, add maple cream with desired crystallization to the cooled, unmixed sugar solution at 1 to 2 tablespoons per gallon of syrup used or 5% of the heated solution.

Stir sugar solution quickly. Stirring too slow or too fast will produce a fondant with larger crystals. If all other guidelines have been followed and graininess is still developing, alter your stirring speed.

Thick or Hard Cream

Cream viscosity (thickness) is dependent on two characteristics: water content, and sugar crystal concentration and distribution. The factors determining viscosity can be controlled during production or during storage.

Use higher levels of invert syrup. The invert sugars have two functions, glucose reduces the crystallization of sucrose and fructose acts as a humectant that softens maple cream. The recommended invert levels are 0.5 to 3% with 1.5% as ideal. A recipe with low-invert can harden. In this situation, it is recommended to increase the invert levels of unheated syrup. To slightly increase invert levels, add ¼ to 1 teaspoon of liquid or powdered invertase per gallon of maple syrup. Allow solution to sit at ambient temperature for 1 to 6 hours and monitor frequently. Once the desired invert level is measured, heat the solution to inactivate invertase activity.

Reduce finishing temperature. The finishing temperature (22 to 25 °F ABPW) is correlated with water content (approximately 15 to 18%) (Norrish, 1967). The higher the finishing temperature, the lower the water content. A thick or hard cream can be fixed by reducing the finishing temperature by 2 to 5 °F.

Add inverted syrup to heated sugar solution. An alterative method for producing maple cream is to add inverted syrup to the heated sugar solution. Since water content is a key characteristic to control, a low-invert syrup (0.5 to 1.0%) would be heated to approximately 35 to 38 °F ABPW. The fully inverted syrup would be heated slightly (to about 150 °F) and then added to the sugar solution once it has reached the finishing temperature. It is recommended to add 5 parts heated sugar solution with 1 part fully inverted syrup to yield a water content between 15 to 18%. The combined sugar solutions would then cool and procedures would continue as recommended in the "Making Maple Cream" article (Childs, 2007). In thick creams, the invert sugars, particularly glucose, will reduce crystallization during storage and thus reduce drying of the cream.

Add water to finished cream. Maple cream will harden during storage. This occurs due to the crystallization of sugars or drying of the product (Ozcan et al. 2019). The water content of fondants is typically 15-18%, but can be slightly lower or higher (Hartel, 2018). Packaging creams in water barrier packaging with a tight seal will reduce water loss during storage. However, if drying does occur, add approximately 2% water by volume of the cream (34 mL of water per 177 mL of cream). For reference, a half-pound jar of maple cream is about 177 mL.

Add invertase to finished cream. Invertase can soften hard creams during storage by reducing crystallization (Ozcan et al. 2019). However, invertase will not reduce graininess caused by large sugar crystals. Add invertase at 0.1 to 0.3% of the cream solution or 5 to 15 g per 5000 g of syrup and store cream at room temperature for 24 to 48 hours. For reference, a gallon of syrup is approximately 11 lbs or 4989 g.

Thin or Soft Cream

Similar to thick or hard cream, the viscosity of thin creams is dependent on water content and sugar crystals. Viscosity can be controlled during production or during storage.

Use lower levels of invert syrup. In maple syrup, the 66 °Brix consist of sucrose and invert sugars. Further, the invert sugar level is inversely correlated with sucrose levels. In a 66 °Brix solution with an invert level of 2%, the sucrose level will be 64%. If invert levels are too high and the sucrose content is too low, there will not be enough crystalline sugar to provide firmness. By using lower invert syrup, the sucrose sugars can crystallize and result in a firmer fondant. The recommended invert levels are 0.5 to 3% with 1.5% as ideal.

Increase finishing temperature. A lower finishing temperature results in a higher water content. The higher water content results in a softer, runnier fondant. To combat this, increase the finishing temperature by 2 to 5 °F.

Separation of Cream

Separation of maple cream occurs when the water content is too high or the invert level is too low. Cream separation does not occur until storage; however, its occurrence can be reduced during production or during storage.

Increase finishing temperature. Sugar crystals form a matrix in maple cream. When water content is high, some of the water is removed from the matrix and settles on top of the cream. By reheating the cream solution to a finishing temperature 2 °F higher than the initial finishing temperature or heating the initial sugar solution 2 °F higher, the solution will be thicker and less likely to separate. When reheating a finished cream,

add 500 to 750 mL of filtered water per gallon of syrup used. This will allow the sugar crystals to dissolve in the solution and is imperative to reduce development of a grainy texture.

Add inverted syrup to heated sugar solution. The methods for this recommendation can be found in the "Thick or Hard Cream" section. Invert sugars will draw in moisture and hold it in solution (Hartel, 2018), reducing separation. However, too high invert will result in a soft, thin cream that may be undesirable.

Add invertase to finished cream. Invertase breaks sucrose into fructose and glucose. In this process, a water molecule is used. This reduces the available water in the solution and consequently reduces separation. Add 5 drops of liquid invertase or a few granules of powdered invertase per 6 oz container of cream, stir, and store at room temperature for 24 to 48 hours. This will result in a softer cream.

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Citations

Childs, S. 2007. Making Maple Cream. Cornell Maple Bulletin 201. http://www.nnyagdev.org/maplefactsheets/CMB%20201%20Making%20Maple%20Cream1.pdf

Hartel, R.W., von Elbe, J.H., and R. Hofberger. 2018. Ch. 9. Fondants and Creams. In R.W. Hartel, J.H. von Elbe, and R. Hofberger (Eds), Confectionery Science and Technology (p. 245-272). Springer Nature. https://doi.org/10.1007/978-3-319-61742-8

Norrish, R.S. 1967. Selected tables of physical properties of sugar solutions, BFMIRA Scientific and Technical Surveys, Number 51.

Ozcan, O. Yildirim, R.M., Toker, O.S., Akbas, N., Ozulku, G., and M. Yaman. 2019. The effect of invertase concentration on quality parameters of fondant. J. Food Sci. Technol. 56(9):4242-4250. https://doi.org/10.1007/s13197-019-03894-4

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U.S. DEPARTMENT OF AGRICULTURE

Cornell Maple Program

Cornell University
College of Agriculture and Life Sciences
Department of Natural Resources

Traditional Maple Candy (Molded Maple Sugar)

5.1 Preparing Traditional Maple Candy

Revised (2022): Catherine Belisle, Ph.D.

Traditional maple candy (molded maple sugar) has become a popular maple value-added product. It can be made from any syrup with an invert sugar level between 0.5% and 1.5% with less than 0.7% being ideal. In general, maple candy is made by heating syrup to between 28 and 34 °F above the boiling point of water. The heated syrup is then allowed to cool to between 160 and 200 °F. Once cooled, the syrup is seeded with finished maple cream and then stirred until it forms small sugar crystals. As the syrup crystallizes during stirring, it becomes light in color and opaque. Once these visual changes occur and the mixture has reached a temperature between 150 and 175 °F, it is then deposited into molds and allowed to cool and solidify. This section provides detailed information for preparing, stirring, molding, crystal coating, packaging, and storing maple candy.

There are a few steps to consider when making traditional maple candy. The heating, stirring, and depositing temperatures can be determined once the syrup and desired candy texture are selected. A quick reference for temperatures can be found in Table 1.

Step 1. Choose the syrup

Maple syrup consists of two sugar types, table sugar (sucrose) and invert sugars (glucose and fructose). Sucrose forms crystals in maple candy, while invert sugars attract water and reduce crystallization. Balancing the ratio of sucrose to invert sugars is essential to produce quality maple candy.

Select a syrup with an invert level between 0.5 and 1.5%. Invert sugar levels are measured using a glucose meter with readings in milligrams per deciliter (mg/dL). The chart to the left shows glucose meter readings and the corresponding percent invert levels. The area highlighted in light gray indicates maple syrup with acceptable invert levels for making maple candy, with dark gray highlighting the optimal invert level (0.7%). In this table, 1.0% invert means that 1.0% of the total solution by weight is invert sugar. In a 66.0 °Brix syrup, the maximum % invert is 66.0%. More information on invert sugars and measurements can be found in **Section 2**.

Meter Reading (US)	1 in 10 dilution
mg/dL	% invert
20	0.4
25	0.5
30	0.6
35	0.7
40	0.8
45	0.9
50	1.0
55	1.1
60	1.2
65	1.3
70	1.4
75	1.5
80	1.6
85	1.7
90	1.8
95	1.9
100	2.0

Step 2. Choose the finishing temperature

Once the syrup is selected, a finishing temperature, the temperature that syrup is heated to, must be determined. Select this temperature based on the desired texture of the finished candy.

A candy that will be crystal coated or handled in bulk packages should be on the firmer side to protect its integrity. The crystal coating process will soften the candy, so starting with too soft a candy can result in an undesirable texture. Softer candy is recommended when doing demonstrations at fairs or farmers markets where the candy will be consumed immediately.

As shown in Table 1 below, a lower finishing temperature will result in a softer candy. The finishing temperature determines the percentage of water that will remain in the final candy. Finishing temperatures between 28 to 34 °F result in candy with 11 – 14% water content.

Table 1. Invert levels and processing temperatures with resultant maple candy properties

Candy Firmness	Invert Level (%)	Temperatures (°F)		Candy Texture Characteristics	Shelf Life[2]
		Finishing[1]	Stirring		
Soft	0.5	28 °F	<170 °F	Melt-in-your-mouth	< 2 weeks
	0.7	29 °F	<170 °F		
	1.5	30 °F	<170 °F		
Medium	0.5	30 °F	190 to 175 °F	Slowly melt-in-your-mouth	> 1 month
	0.7	31 °F	190 to 175 °F		
	1.5	32 °F	190 to 175 °F		
Firm	0.5	32 °F	>200 °F	Grainy	> 1 month
	0.7	33 °F	>200 °F		
	1.5	34 °F	>200 °F		

[1]Finishing temperature is measured in degrees above the boiling point of water. To accurately determine finishing temperature on the day of production, bring a pot of water to a hard boil and measure the boiling temperature. For example, if the water boils at 212 °F, 28 °F above the boiling point is 240 °F. The boiling point of water can change with atmospheric pressure and elevation.

[2]The shelf life values listed for medium and firm candies are referring to crystal coated candies. Without crystal coating, the shelf life is reduced to 1 to 3 weeks.

Heat the syrup on low and use a small amount of defoamer as needed. If sugar crystals form on the sides of the pot, brush the sides with a wetted silicone pastry brush; the water from the brush will run down the sides and carry the sugar crystals back into the syrup.

Step 3. Cool the syrup

After the syrup has reached the finishing temperature, immediately remove it from the heat and begin cooling. The syrup can be poured into a heat-resistant bowl at room temperature, into the candy machine, or into a vacuum cooling chamber. Pouring the hot syrup into the candy machine or room temperature bowl will expedite cooling, but the outside of the syrup will cool faster than the center. The cooling process can be sped up by using a cold water bath, but using this method requires that caution be taken to avoid getting any water into the syrup, and the vessel holding the syrup should be completely temperature resistant (not glass).

Vacuum cooling will drastically reduce cooling time, ensure that the syrup is evenly cooled throughout, and reduce the occurrence of unwanted crystal formation. Using this method, the syrup can be cooled from the finishing temperature to 150 °F in as little as 45 seconds up to about 8 minutes depending on the batch size, inches of vacuum, and the capacity of the vacuum pump. Syrup cannot be cooled below 100 – 110 °F with vacuum. Note that vacuum will remove additional water from the concentrated syrup; therefore, the finishing temperature must be lowered by 2 – 4 °F to account for this water loss.

An additional benefit of vacuum cooling is that the heat of the cooling syrup is expelled either into a condenser or through the vacuum pump and outside. This keeps the production area cooler and lower humidity than other cooling methods that leave hot syrup to slowly cool in open pans in the production area.

Stirring and Depositing Maple Candy

Once the syrup has been properly cooked and cooled to the desired temperature, it must be stirred. Stirring methods include: by hand with a spoon, using a drill with an impeller, using a high-speed mixer, a candy (sipple) machine, or a water-jacketed candy-cream gear pump machine. The lower the temperature of the syrup at the onset of stirring, the smaller the sugar crystals will be in the candy resulting in finer texture. Selecting the methods for stirring and depositing candy largely depends on the desired candy texture.

When stirring, the syrup solution must be watched carefully as it becomes lighter in color, somewhat thicker, and develops a creamy, opaque appearance. This visual change is the result of crystallization. Stirring will take less than five minutes before this change occurs. The tricky part is to learn the exact moment to deposit the crystallized syrup into the molds. If the syrup is stirred too long, the thickened syrup will "set up" or harden in the pan. It is best to err on the side of caution and deposit the syrup earlier in the stirring process. It can be very helpful to have a spray bottle of warm water at the ready to lightly mist syrup that becomes too hard in the trough of the candy machine or mixing pot. This

will soften the hardened syrup and allow the producer to continue filling the molds. However, be careful not to use too much water as this may risk the quality of the candy.

Step 4. Choose the stirring temperature

The temperature of the syrup at the onset of stirring is determined by the desired texture of the candy, regardless of stirring method. Refer back to Table 1 for a quick reference.

Harder candy is made by beginning stirring when the syrup has cooled to around 200 °F. While this firmness is not the most preferred by consumers as is, it is a good choice for a candy that will be crystal coated as the crystal coating process will soften the candy further. A firmer candy will be more resistant to breakage, and therefore, will hold-up better in bulk packaging and shipping. Additionally, filling the candy molds will be easier because the syrup will be hotter and more liquid when it is ready to be deposited if stirring is begun at a higher temperature.

Medium-firm candy can be made by beginning stirring when the syrup has cooled further, to 190 – 175°F. This medium hardness makes the candy durable for handling, suitable for crystal coating, and acceptable to the consumer.

Allowing the syrup to cool to below 170 °F before beginning to stir makes a fairly soft candy. This softer candy is by far the most preferred by consumers. However, it can be soft enough to be squashed or broken with handling, and is less suitable for crystal coating, possibly dissolving during the coating process. It may be possible to crystal coat this candy successfully if the crystal coating solution is relatively cool (see **Section 5.2**). Furthermore, filling the molds to make softer candy is the most difficult. The syrup can be very thick and come out in globs that may need to be pressed into the molds with a knife. Candy that was stirred cooler may also lack some of the mold details compared to candy that was deposited into the molds at hotter temperatures.

Step 5. Choose stirring and depositing methods

The temperature range for depositing candy into molds is 150 to 175 °F. The precise temperature will depend on the stirring method. When hand stirring or using the sipple machine, deposit candy closer to 175 °F to avoid premature setting of the candy. When using the water-jacketed machine, deposit candy closer to 150 °F to avoid additional crystallization in the candy. Preliminary studies have shown that a temperature of 160 °F results in desirable texture for candy made from syrup with the three invert levels listed in Table 1.

A. Hand stirring, using a drill with impellor, or using a high-speed mixer

These methods are appropriate for small batches of maple candy. Once the syrup has cooled to the desired temperature (Table 1), begin stirring. Continue stirring as the syrup crystallizes. Once the syrup has transitioned into a light brown color, pour it into clean molds and use a bench scraper to evenly fill the mold cavities and remove excess. Scraping must be done immediately and rapidly in one motion; the syrup can harden very quickly in the molds. The more aggressive the stir, the less grainy the candy will be.

B. Sipple candy machine (also known as “worm drive” machine)

The sipple candy machine is suitable for making medium to large batches of maple candy. It can be used continually for several batches. The metal pan that holds the boiled syrup on this candy machine is called a "pig" because of its shape and the pouring “snout” at the front. To use, make sure that the “snout” valve is completely closed before placing the pig on the candy machine shelf and tipping it up into the locked position. Make sure the trough valve through which the candy will be deposited into molds is completely closed before adding any syrup to the trough from the pig. The pig can be used as the syrup heating pan and the cooling pan, or the heated syrup can be transferred from its heating pan into the pig immediately upon reaching the finishing temperature.

https://leaderevaporator.com/sipple-sugar-making-machine/

Open the pig snout valve slightly and allow the cooled syrup to flow into the trough. The depth of the syrup in the trough should reach no more than 0.5 inches. Close the pig snout valve when appropriate depth is reached, turn on the motor, and the coil or “worm drive” will slowly rotate. Watch carefully at the front of the trough by the deposition valve. When it is ready to deposit, the syrup will begin to crystallize turning lighter color, becoming slightly thicker, and taking on a creamy, opaque appearance. Stirring should take less than three minutes.

Open the trough valve and allow the opaque, partially crystallized syrup to flow out into the mold. Do not wait too long to complete this step because the syrup may harden in the valve end of the trough. It is better to open the trough valve a bit too soon and have only semi-crystallized sugar flow out for the first few molds; they will harden in time.

At the same time as depositing, open the pig snout valve slightly to allow more syrup to flow into the trough. The goal here is to have a low, continuous flow of fresh, hot syrup from the pig into the trough while the stirring coil continually crystallizes the syrup, all while keeping a low level of crystallization to allow for easy deposition into molds. Try to balance the flow of liquid into the trough with the out-flow into the molds while maintaining a depth of 0.25 – 0.5 inches of syrup in the trough. This will reduce the likelihood of the sugar hardening into a solid mass in the trough.

If the syrup crystallizes in the trough valve stopping the flow, a small knife can be used to clear out the clog. Be careful of the turning coil. Misting the trough with a fine spray of warm water can also cure a clog if addressed quickly. Usually, very little mist is needed. With some experience, it will be possible to make perfect candy in a continuous operation.

C. Water-jacketed maple candy-cream machine

The water-jacketed gear pump candy-cream machine manufactured by Sunrise Metal Shop was built for efficient production of traditional maple candy. It is similar to a water-jacketed cream machine, but with a temperature-controlled water jacket. It is recommended that the water jacket temperature be kept at 148 – 152 °F for quality candy less likely to form white spots. One advantage of the water jacket is that the candy can be stirred cooler which makes for very smooth, soft candy that easily melts in your mouth. This machine comes with a single spout for filling molds, but can be adapted with different heads that have two to four spouts for much more rapid mold filling.

https://businesscorral.com/wp-content/uploads/2020/10/1022_2020-Numbered-Sunrise-Metal-Evaporator-Catalog-WebVersion.pdf

Step 6. Removing Candy from Molds

Multi-spout mold filler (depositor)

Once candy molds have been filled, place them on a drying rack at room temperature and allow to cool for 20 – 45 minutes. Once cooled, remove the candies from the mold cavities either by hand or using a maple mold popper. Maple candies can be stored in cool, dry conditions for a few weeks.

The maple mold popper is a custom built grid of stainless-steel bars set up to match the spacing of the maple candy mold cavities. When the mold is properly placed on the grid, a rolling pin is rolled across the back of the mold to allow the candies to fall into a waiting tray. This takes about one tenth of the time it takes to remove the candies individually by hand.

The maple sugar candy mold popper

5.2 Crystal Coating and Packaging

Revised (2022): Catherine Belisle, Ph.D.

Crystal Coating

Maple candy is sensitive to humidity, drying out in low humidity environments and attracting water in high humidity. To reduce this sensitivity, it is recommended to crystal coat the candies. The coating, a layer of crystalline sucrose, seals the maple candy from its environment, protecting it from changes in humidity and preserving its quality.

To crystal coat, first allow the candies to dry for 24 hours. Next, prepare the crystal coating solution by heating low-invert maple syrup to 9.5 – 11 °F above the boiling point of water. This supersaturated syrup should have a density of 70 – 73 °Brix when measured at 68 °F. One gallon of standard-density syrup (66 – 68.9 °Brix) will make seven pints of crystal coating solution (70 – 73 °Brix). The invert sugar level in the syrup used to make the crystal coat should be between 0% and 1%; the lower the level the better. The table at right highlights syrups with acceptable glucose meter readings for crystal coating (light gray), with the optimal invert level (0.4%) highlighted in dark gray.

Meter Reading (US)	1 in 10 dilution
mg/dL	% invert
20	0.4
30	0.5
40	0.6
50	0.7
60	0.8
70	0.9
80	1.0
90	1.1
100	1.2

If crystal coating on a humid or rainy day, reduce the humidity in the workspace with a dehumidifier to ensure proper drying. If the candies are not thoroughly dried, the crystal coating can dissolve when it is packaged.

The heated syrup must be allowed to cool to 90 – 100 °F undisturbed. The syrup can be cooled either in the pan it was heated in, or in pans that will be used for crystal coating if it is transferred to these pans immediately after reaching the finishing temperature. As the syrup cools, crystals can form on the surface. To reduce surface crystals, cover the surface of the syrup with damp cheesecloth or spray the surface with a fine mist of warm water. Remove any surface crystals before crystal coating to achieve the desired appearance.

Mesh basket and crystal coating pan.

Once the supersaturated syrup has cooled, evenly space the maple candies in a mesh basket or other slotted container. Do not allow the candy pieces to touch.

Fully submerge the maple candies in the crystal coating solution and, again, cover the syrup with damp cheesecloth or mist. Leave the candies in the solution at a temperature of 65 – 80 °F for at least 6 hours or

overnight. Most of the crystal coating forms on the candies during the first few hours; therefore, the length of time the candy is left in the crystal coating solution beyond a six-hour period is not critical.

When sufficient sugar coating has been deposited on the candies (the outside of the candies should feel like fine sandpaper), remove any covering and lift the mesh baskets out of the crystal coating solution. Allow excess syrup to drain back into the pan, then transfer the candies to a drying rack to drain completely following one of the methods listed in the next paragraph. Failure to completely remove excess syrup will result in areas having a glazed surface that will not protect the candy from environmental humidity. During storage, this will cause white spots in low humidity or wet spots in high humidity.

There are three ways of removing excess crystal coating solution. 1) Evenly spread the coated candies on a sheet of paper and turn every 1 – 4 hours. 2) Wipe each piece of candy with a clean, slightly damp sponge or cloth to remove any moist syrup. 3) Evenly spread candy pieces on a drying rack or thin screen, then after 1 – 4 hours, gently place a rack or screen on top of the sugar pieces and turn them all over. Rotate as needed. This third method is the most time efficient, but must be executed carefully to prevent damage to the candy pieces.

Once excess syrup is removed, set the candies on racks and allow them to air dry at room temperature for 4 – 7 days. This process can be expedited with a fan or dehumidifier. After drying, the sugar is ready for packaging. Crystal coated maple candy has a longer shelf life than uncoated candies by several months.

A single batch of crystal coating solution can be used six to eight times before it becomes too high in invert sugar to sufficiently coat the candy pieces (repeated heating causes inversion). The used solution should be re-boiled each time to maintain consistent density.

If coarse crystals develop on the maple candy, lower the finishing temperature of the crystal coating solution by 2 – 4 °F. The lower finishing temperature will result in a supersaturated syrup with lower density (°Brix) and higher water content. The ideal density of the syrup used to crystal coat is determined by trial and error.

Packaging and Storage

Maple candy will gradually absorb moisture or dry out depending on packaging material and storage environment. Maple candy that is not crystal coated is more susceptible to these changes than is crystal coated candy. Issues due to humidity can be identified by appearance: a dried-out candy will show white spots and become firm over time, where a candy that has absorbed moisture will show moist areas or water droplets on its surface. These water droplets will contain sugar and present ideal growing conditions for mold.

The humidity of the packaging room and candy storage area should be kept relatively low. Use a dehumidifier or air conditioner when the situation warrants.

Packaging for maple candy serves two functions: attractive presentation and preservation of product quality. Cellophane packaging, candy boxes, and paper candy cups are ideal because the showcase the product in an attractive way. These packaging options also

allow some air exchange. In general, confections are stored in high moisture barrier packaging, such as low-density polyethylene (LDPE or LLDPE) or PET. For maple candy, this type of packaging would lead to moisture accumulation. To extend shelf life, store maple candy in a cool room (50 – 70 °F) at 50 – 60% relative humidity.

When selling maple candy, the net weight of the candy pieces must be stated on the outside of the package. For information on taxation of this product, see **Section 11.5**.

Granulated Maple Sugar

Granulated Maple Sugar is the most versatile product that can be made from maple syrup. When stored in low moisture environments or with proper packaging, it is indefinitely shelf stable. It can be used in recipes as a 1:1 replacement for brown or white sugar. It can also be reconstituted into maple syrup of any density or converted into any of the other maple confections. It can be an easier product than syrup to market to chefs because of its storability and versatility. The flavor of food products is enhanced by using maple sugar in place of white sugar, and it can be marketed to consumers as more natural, more sustainable, and depending on where it's being sold, more local.

Proper personal protective equipment is essential when making maple sugar. Protective gloves, protective apron, long pants, closed-toe shoes, and eye protection should be worn at all times.

Step 1. Choose the syrup

Maple syrup consists of two sugar types, table sugar (sucrose) and invert sugars (glucose and fructose). Table sugars form the crystals in granulated maple sugar, while invert sugars attract water and reduce crystallization.

Select or blend syrup to **less than 2% invert sugar** for maximum yield and efficient processing. While it is possible to produce granulated sugar from maple syrup with >2% invert, processing will be more difficult and yield will be reduced because the sugars will only partially granulate. However, because higher invert syrups tend to have more robust flavor, the resultant sugar can be worth the effort if intense flavor is required. Always choose syrup with superior flavor to make sugar as any poor flavors will become concentrated in the final product.

A quart (0.95 L) of <2% invert syrup will yield about 2 pounds (907 g) of granulated sugar.

Figure 1. Granulated sugar prepared by heating syrup of various invert levels (from left to right: 1.4%, 2.2%, 3.9%, 5%, 10%, 15%, and 30%) to 50 °F above the boiling point of water.

Within the recommended invert level range (0.4 – 2.0%), the invert level selected will affect the character of the final product. A lower invert syrup will result in a courser sugar, more similar to common brown sugar, while a higher invert syrup closer to 2% will result in a finer, more powdery sugar. Additionally, lighter, lower invert syrup tends to make a drier finished product than darker, higher invert syrup.

Table 1. (at right) Glucose meter readings (mg/dL) and corresponding invert levels. Area highlighted in gray indicates recommended readings for maple syrup to be made into granulated maple sugar.

Reading mg/dL	1 - 10 dilute invert %
20	0.4
30	0.6
40	0.8
50	1
60	1.2
70	1.4
80	1.6
90	1.8
100	2
110	2.2
120	2.4
130	2.6
140	2.8
150	3

Step 2. Choose the finishing temperature

Granulated maple sugar is prepared by heating maple syrup to 50 – 70 °F above the boiling point of water. A higher finishing temperature should be used for syrups higher in invert (closer to 2%), while a lower finishing temperature should be used for syrups with low invert sugar.

3. Choose the stirring temperature and method

After the syrup reaches the finishing temperature, the syrup can either be stirred immediately or allowed to cool to about 200 °F before stirring. Crystal size in the finished sugar is impacted by several factors related to stirring. Stirring hot will create larger sugar crystals, while letting the syrup cool before stirring will create smaller crystals resulting in a more powdery sugar (Figure 2). Stirring speed also impacts the crystal size; stirring aggressively (by machine) tends to make smaller sugar crystals, while slow, even stirring (by hand) tends to make coarser sugar that is very similar to common brown sugar. Continue stirring until most of the moisture has escaped from the cooked syrup and crumbly, granulated sugar remains.

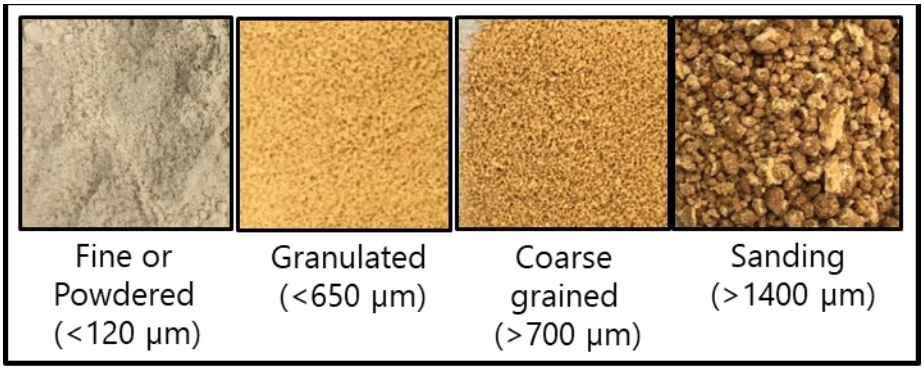

Figure 2. Various granule sizes present in maple sugar. Maple syrup with 4.6% invert sugar was heated to 50 °F above the boiling point of water and stirred immediately. The sugar was then passed through a set of sieves with screens of variable sizes.

Note that the syrup will suddenly become much hotter and can give off a burst of steam during the stirring process. This is called the heat of crystallization and is something to be cautious of when working a machine or when hand stirring.

Recommended machines for making maple include large-capacity commercial stand mixers (such as Hobart) and the turntable and paddle "maple cream" machine. Home quality stand mixers are not recommended because the motors are likely to burn out after just a few uses. When using the turntable machine, it is recommended that the outside paddle be moved away from the pan wall because the sugar will bunch up around the paddle and can spill over the side of the pan when it starts to granulate. Over filling some turntable machines can cause them to stall when the sugar begins to crystallize and becomes very thick.

If the finished sugar is too moist, the sugar can be dried in a dehydrator or oven. To dry sugar crystals, spread sugar in a thin even layer and heat at 110 – 150 °F. Stir the sugar every 15 minutes to prevent burning. An alternative method for drying sugar is to set the sugar in a low relative humidity environment for 24 hours. This method is slower and will result in less moisture reduction than methods that involve heating the sugar.

Step 4. Sifting and packaging the sugar

Before packaging, finished sugar should be sifted. It can be passed through a course screen, such as 1/8-inch or 3mm hardware cloth, to make a more uniformly sized product. Some producers reserve the large sugar lumps that do not pass through the screen and sell them as a specialty sugar for hot drinks (similar to sugar cubes). Stainless steel sieves with handles and various sizes of commercial sifters are available through restaurant and laboratory suppliers. A set of sieves and sieve shaker can allow for a greater degree of sorting of granule sizes to be used in and marketed for different applications. Examples of various sieve sizes are shown in Figure 3.

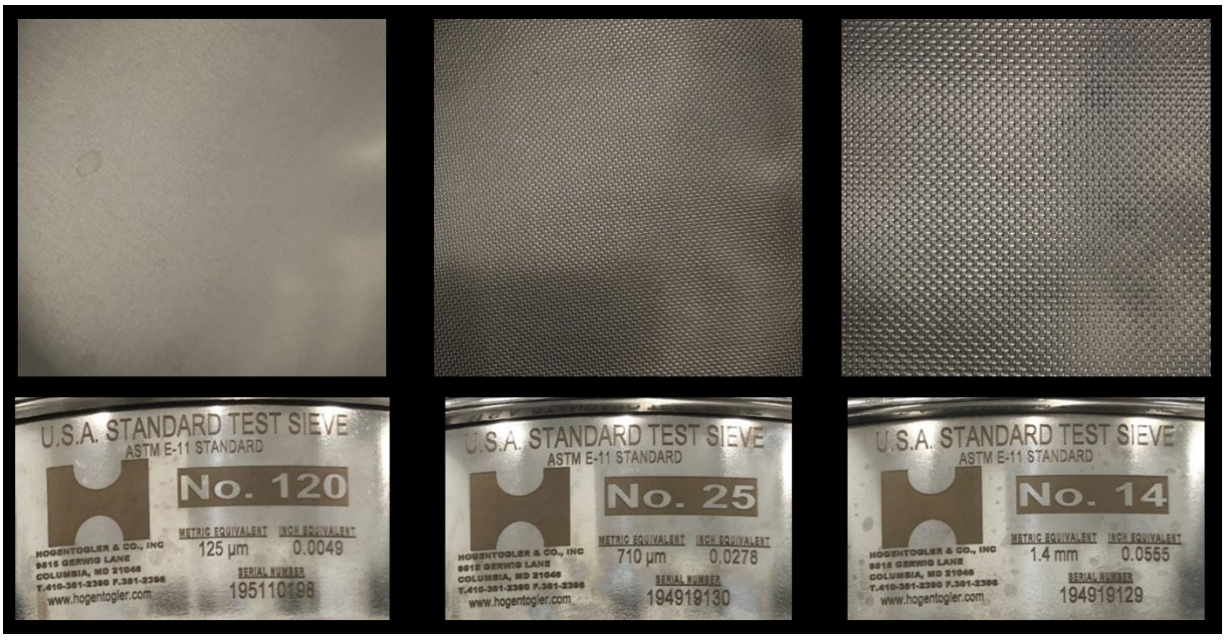

Figure 3. U.S.A. standard test sieves for fine (No. 120; 125 µm), medium (No. 25; 710 µm), and coarse granulated sugar (No. 14; <1.4 mm)

Once the sugar is sifted, allow it to cool to room temperature in a low relative humidity (25 – 60%) environment before packaging. Storage in an environment with relative humidity above 75% will result in clumping.

Store sugar in airtight, high moisture barrier packaging. The same packaging that can be used for fine or powdered sugar can also be used for coarse sugar or sugar lumps. However, the larger sugar crystals have a lower surface area to volume and thus will maintain shelf life longer than smaller sugar crystals. Clear packaging, or packaging with a translucent window is ideal for consumers to see the product prior to purchasing.

Other Maple Confections and Value-Added Products

Adapting Recipes for Maple – Substitutions

7.15 Replacing Corn Syrup with Inverted Maple Syrup

7.16 Replacing Table Sugar with Maple Syrup

Introduction to Section 7 Other Maple Confections and Value-Added Products

Catherine Belisle, Ph.D. and Ailis Clyne (2022)

Selling Value-Added Products

To sell value-added products, it is essential to adhere to state and federal regulations. In the state of New York, no licenses or permits are required to produce pure maple products for sale, including any confections that are made with 100% maple. However, to sell products that include ingredients besides maple, you must obtain one of the three authorizations listed below.

For sale of certain non-hazardous foods only within the state of New York:

- Home Kitchen Exemption from the NYS Dept. of Agriculture and Markets

For pre-packaged foods to be sold at fairs, farmers markets, grocery stores, online, etc.:

- Article 20-C Food Processing Establishment License from the NYS Dept. of Agriculture and Markets

For onsite preparation of foods to be sold at events such as state fairs and farmers markets (<14 consecutive days):

- Temporary Food Service Establishment Permit from the NYS Department of Health

For more information, contact a local Agriculture and Markets inspector or contact the NYS Department of Health. Depending on the product, it may be necessary to obtain a process approval from a processing authority. The Cornell Food Venture Center offers process approval services which detail the necessary procedures to ensure a safe product, record keeping requirements, and information on licenses and registrations required to produce said product. For more detailed guidance on safe and legal production, please refer to **Section 11 Regulations**.

The Cornell Maple Program continuously explores new products that can incorporate maple and improves upon the information available for existing products. Visit the New Product Development webpage at www.cornellmaple.com for current research and extensive production guidelines. You will find recently developed recipes, troubleshooting guides, preservation and packaging information, regulatory guidance, and other details on products that are beyond the scope of this section.

7.1 Maple Lollipops/Suckers and Hard Candy

Research on increasing maple syrup content in maple lollipops

Olga Padilla-Zakour, Cheryl Leach, Herb Cooley, Belen Baviera, NYS Food Venture Center, Cornell University

Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program

As a coordinated effort of the NYS Food Venture Center and the Cornell Maple Program, several value-added maple products were developed or optimized to offer marketing alternatives to maple producers. This project was funded by the New York Farm Viability Institute.

Research Objective

Our goal was to develop hard candy with 100% maple or with as much maple syrup as possible. Typical lollipop formulations include corn syrup or invert sugar in order to achieve the desired hard candy texture. Corn syrup and inverted maple syrup both contain invert sugars which help prevent crystallization by obstructing sucrose molecules. These ingredients help to produce an amorphous solid with a glossy appearance.

We evaluated the use of corn syrup, honey, and inverted maple syrup to determine the appropriate proportions and cooking temperatures. We are not recommending the use of honey at this time; results with honey in concentrations as low as 10% were deemed unacceptable due to overly strong honey flavor and loss of brittleness over time.

Recipes

Ingredients

Pure Maple Lollipops (10% Inverted)	**Maple Lollipops with 25% Corn Syrup**
450 g Amber maple syrup	375 g Amber maple syrup
50 g Inverted maple syrup[1]	125 g Corn syrup

[1]To invert maple syrup, add 0.2% of invertase enzyme to the syrup, or about 1.5 teaspoon invertase per gallon syrup. For rapid conversion, hold maple syrup with invertase at 120 – 150°F for 24 hours. Where time is not a factor, stir the solution thoroughly and store at ambient temperature for 3 – 5 days.

Procedure

1. Weigh the syrups and add them to a saucepan. Mix thoroughly.

2. Heat on low, stirring until the mixture boils. Add a drop or two of defoamer if needed to prevent foaming over. Do not stir the mixture from this point forward.

3. Monitor the temperature with a candy thermometer and let the syrup continue to boil undisturbed until the temperature reaches **305 °F for pure maple**, or **280 °F for 25% corn syrup**. Lower the heat for the final stage.

4. When the temperature reaches **305 – 315 °F for pure maple**, or **300 °F for 25% corn syrup**, remove from heat and allow to stand until all bubbles have disappeared.

5. Pour into molds. Allow to cool for 30 seconds before inserting sticks for proper placing.

6. Once cooled, package in air-tight bags to avoid moisture absorption from the environment.

Considerations

Finished candy should be clear and brittle, not sticky. Serving size is one lollipop of approximately 15 g or several hard candies to match 15 g.

For the pure maple lollipops, if the color is too dark for your preference, try adding the inverted syrup when the untreated syrup just begins to boil, rather than before beginning to heat. Additionally, try boiling more rapidly.

Cooking maple syrup under vacuum when making lollipops can achieve the necessary high density without cooking at the high temperatures that can cause a scorched flavor.

About Maple Lollipops/Suckers: Making and Marketing

Stephen Childs, New York State Maple Specialist, Cornell Cooperative Extension

Revised (2022): Ailis Clyne

A maple sucker is a non-crystalline (amorphous) confection often referred to as a glass. Crystallization is prevented by using high levels of invert sugar in the form of corn syrup, glucose syrup, honey, or inverted maple syrup, and cooking to a high temperature without stirring or agitating the hot syrup. Because suckers are made by cooking to a high temperature, be sure to take proper precautions by wearing appropriate protective clothing when handling the hot syrup (see **Section 9.1**).

Lollipops or suckers made with maple syrup can be a popular product at special events, fairs, farmers markets, and roadside stands. Maple suckers can be made using a number of different recipes; I will describe three options below.

Recipe 1 provided at the 2006 North American Maple Syrup Council Meetings:

Ingredients

12 oz Golden or Amber maple syrup

4 oz (25%) light corn syrup

Butter the size of a pea

Procedure

Coat molds with Pam. Heat mixture to 270 °F, then pour into the molds. Re-spray molds with Pam after every 4 batches. Store suckers in the refrigerator for up to one month in an air-tight container.

Tips: Use a heat-safe glass measuring cup to pour hot syrup into the molds so that if the syrup becomes too cool and thick, you can reheat the cup and syrup in a microwave and continue filling the molds. A light weight pan is suggested to avoid over cooking from residual heat.

This recipe makes approximately 50 suckers. These are sold for $0.50 each at a Farmers Market with sales of about 200 units per day.

Recipe 2 sourced from The Maple Syrup Producers Manual:

Ingredients

1/3 Dark or Amber maple syrup

1/3 light corn syrup

1/3 white sugar

Procedure

Mix the maple syrup can corn syrup and bring to a boil. Add the white sugar only after the other two ingredients are boiling. Bring sugar mixture to 295 °F. Allow to cool to 250 °F. Use a glass measuring cup to pour into molds.

Note. This recipe should be measured by volume, not mass.

Recipe 3 100% Maple:

Ingredients

1/3 maple syrup

1/3 inverted maple syrup

1/3 maple sugar

Procedure

Mix the sugar and untreated maple syrup together and heat until the mixture reaches 250 °F. Then add the inverted syrup. Continue to boil until the mixture reaches 305 °F. Allow the hot syrup to cool to 250 °F undisturbed and pour into molds.

Notes: Adding the inverted syrup to the mixture before heating can make the suckers darker and stronger flavored.

The maple sugar can be replaced one for one (measured by volume) with maple syrup; it will simply take longer to reach the finish temperature.

Not all candy molds can be used to make maple suckers; the high temperatures can cause some molds to melt. Be sure to use molds made to tolerate at least up to 250 °F.

Using Golden or Amber syrup tends to make a sucker that seems to be preferred by most customers over a darker colored, stronger flavored sucker. Experiment to find your customers' preferences.

If suckers are sticky when using a finish temperature of 305 °F, then you may need to

increase the finish temperature an additional 5 – 10 °F with reduced burner heat.

Cooking maple syrup under vacuum when making lollipops can achieve the necessary high density without cooking at the high temperatures that can cause a scorched flavor.

Marketing Information

So why do most the sucker recipes suggest using corn syrup or glucose syrup? The invert sugars (glucose and fructose) in corn syrup act as an "interfering agent" (e.g., a crystal inhibitor) in suckers and in many other candy recipes. These invert sugars obstruct the sucrose molecules in the lollipop, preventing them from crystallizing. Without this interference, the sucrose would crystallize resulting in grainy, opaque candy instead of the standard clear, glassy lollipops consumers expect. Including too little invert sugar in a maple sucker recipe can make the sucker rough-textured, and possibly even sharp. Too much invert sugar in the maple sucker can make it too soft and sticky.

Inverted maple syrup (maple syrup treated with the enzyme invertase) can effectively take the place of corn syrup in this and other recipes, allowing many products to be sweetened with 100% pure maple. This will add to the cost of production, as maple syrup is more expensive that corn syrup, but it will also add to the value of the product. When setting your market price for 100% maple suckers, you will have to consider the higher costs of your ingredients. The fact that the product is 100% maple should be included in your promotion and signage.

Sucker molds sticks and bags come in a variety of shapes, sizes and colors. These can be used to enhance the marketing appeal. Samples and attractive displays can add significantly to sales.

Lollipops/suckers are subject to New York State sales tax. Suckers made with 100% maple do not require a Food Processing Establishment license or Home Processor Exemption, while suckers made with additional ingredients (corn syrup, glucose syrup, cane sugar) do require a processing license from the Department of Agriculture and Markets or a food service establishment permit from the Health Department (see **Section 11**).

For further information on replacing corn syrup with inverted maple syrup, see **Section 7.15 Replacing Corn Syrup with Inverted Maple Syrup**.

7.2 Maple Taffy

Maple taffy is a non-crystallized form of maple sugar. The syrup is heated to a temperature of 23 – 26 °F (13 – 14 °C) above the boiling point of water. Then it is allowed to cool for a few minutes without disturbance, before being poured into serving containers. A very light misting of water helps eliminate bubbles on the surface. The product should be cooled as quickly as possible which can be accomplished by placing the serving containers gently into a freezer, being careful not to agitate the syrup which could cause crystals to form. Maple taffy should be served at room temperature and can be eaten with a fork or wooden taffy spoon. Individual servings can be packaged in small plastic cups with snap on covers. The taffy will last indefinitely when frozen.

Ingredients

2 cups maple syrup

3/4 cup light corn syrup, or 1 cup inverted maple syrup

2 tablespoons cornstarch

2 tablespoons butter

Directions

1. Butter a 15x10x1 inch baking pan. Combine the ingredients in a pot or saucepan equipped with a candy thermometer. Cook over medium heat until it reaches a boil.

2. Cook over medium-low heat, without stirring, until it reaches 265 – 285 °F depending on the invert level of your choice of maple syrup*.

3. Once the desired finish temperature is reached, immediately remove from heat. Allow to cool for a few minutes, then pour the mixture into the prepared baking pan. Cool mixture in a freezer until it can be handled easily.

3. Once the mixture reaches a safe handling temperature, use buttered hands to twist and pull the candy until it turns a creamy color and is stiff and quite difficult to pull.

4. Pull into strands about 1/2 inch thick. If you prefer, cut each strand of taffy into bite-size pieces with buttered scissors or a knife. Wrap each piece in clear plastic wrap or place on parchment paper. Consume the taffy once finished or store in a cool dry place in a tightly covered container. Taffy can be stored indefinitely in a freezer.

*A note on finish temperature

Temperature will need to be adjusted based on the invert sugar level in your choice of maple syrup. Cook to a higher finish temperature if the syrup is high in invert sugar (>2%), or a lower finish temperature if the syrup has low invert sugar levels (>2%).

If the taffy is too hard, reduce the finish temperature for your next batch. If it is too soft, increase the finish temperature. Temperature adjustments should be gradual (2 – 5 °F).

7.3 Maple Sugar-on-Snow

Stephen Childs and Ailis Clyne (2022)

Sugar-on-Snow is a perennial favorite of guests at sugarhouses during the sugaring season. It is a great option for demonstrations that evokes simpler times and is especially popular with young children. This confection is intended to be consumed immediately. It is suitable for preparation at open houses, maple weekend, winter farmers markets, festivals, and other special events.

As when making maple cream, syrup is heated to 22 – 27 °F (12 – 15 °C) above the boiling point of water. As soon as the syrup reaches the desired temperature, pour it immediately without stirring, onto packed, clean snow or crushed ice. Pour the syrup in thin straight strips. The syrup should stay on the surface of the snow and form a chewy layer. If the syrup "tunnels" into the snow when poured, allow the syrup to cool before continuing to pour. Keeping the pan in snow while you wait will help it cool faster, but be careful not to agitate the syrup which would encourage crystal formation.

Because it cools so quickly, there is not sufficient time for the high-sugar solution to crystallize, and instead, a thin, shiny, taffy-like sheet is formed. One way to serve this confection is to use popsicle sticks, lollipop sticks, or even the handle of a spoon in a pinch, to roll the strip of syrup into a "taffy-pop". Start by placing the stick at one end of the strip, making sure it sticks to the syrup, and roll the stick up the syrup strip like you would roll up a cinnamon bun. Some people choose to eat the syrup straight off the snow with a fork or spoon.

The final syrup temperature for making sugar-on-snow depends on individual preference. To make a stiffer product, boil the syrup a few degrees higher; for a chewier, softer product, a few degrees lower. If you are experienced with the method, this simple confection is a good candidate for using the cold water test. The finish temperature is within the soft ball stage, or the firm ball stage for a stiffer product. Utilizing this method can help ensure that you achieve the desired texture.

7.4 Maple Coated Nuts

About the nuts

The following procedure works for any kind of roasted nut. You can store the nuts in the freezer until you are ready to use them. However, make sure to bring the nuts are to room temperature or warmer before attempting to coat them with syrup. If they are cold when you begin the coating process, the syrup will set up so fast that it will not have sufficient time to grow crystals. Additionally, the cold nuts can become wet with condensation; this moisture can prevent the syrup from adhering properly. Using high quality nuts makes a big difference in the quality and consistency of the coating. When using freshly roasted nuts, make sure to let the nuts rest for a couple of days to give sufficient time for the oils that have risen to the surface to soak back in. Otherwise, the oil can similarly prevent the syrup from adhering.

About the syrup

Use 7 ounces of Very Dark or Dark maple syrup per pound of nuts. Use 8 ounces of syrup per pound of nuts for batches under 2.5 pounds (1134 g). See charts below for quick reference ingredient measures.

Darker syrups with robust flavor work best to match the intensity of flavor of most nuts. However, in order to crystallize properly, the syrup should have an invert sugar level of 1.5% or less. The table at right highlights the invert levels and corresponding glucose meter readings that are suitable for coating nuts in gray. Maple syrup with higher invert levels is unlikely to crystallize properly on the nuts, resulting in a sticky coating. To achieve the proper invert level while using darker syrups, you may need to blend with some lighter, low-invert syrups. An **invert blending calculator** can be found on the "Maple Calculators" page of the Cornell Maple Program website (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/).

Glucose Meter Reading	1 in 10 dilution of syrup
mg/dL	invert%
20	0.4
30	0.6
40	0.8
50	1.0
60	1.2
70	1.4
80	1.6
90	1.8
100	2.0
110	2.2
120	2.4
130	2.6
140	2.8
150	3.0

Ingredients Quick Reference Charts

Batches measured in imperial units

Nuts:	1 lb	2 lb	3 lb	4 lb	5 lb	10 lb	15 lb	20 lb
Syrup:	8 oz	1 lb	1 lb 5 oz	1 lb 12 oz	2 lb 3 oz	4 lb 6 oz	6 lb 9 oz	8 lb 12 oz

Batches measured in metric units

Nuts:	1 kg	2 kg	3 kg	4 kg	5 kg	10 kg	15 kg	20 kg
Syrup:	500 g	875 g	1 kg 313 g	1 kg 750 g	2 kg 188 g	4 kg 375 g	6 kg 563 g	8 kg 750 g

Procedure

1. Heating maple syrup to the selected finish temperature

Select the finish temperature range based on the preparation method you would like to use, and how soon after production you intend for the maple coated nuts to be consumed. There are pros and cons with each method:

Method	Finish temperature (above the boiling point of water)	Oven drying?	Shelf-life	Pros	Cons
A	32 – 36 °F	No	Consume immediately	Skip oven drying step	Becomes soggy with storage
B	32 – 36 °F	Yes	1-2 weeks	Can store nuts with ideal sugar coating texture	Must dry finished nuts in an oven
C	40 – 45 °F	No	1-2 weeks	Skip oven drying step	Sugar breaks off nuts more easily
C	40 – 45 °F	Yes	Several months	Long storage time	Sugar breaks off nuts more easily

In general, higher finish temperatures allow for longer storage time because there is less moisture remaining in the sugar. With lower finish temperatures, the remaining moisture will migrate from the sugar into the nuts making them soggy. This can be prevented by oven drying the nuts after coating, allowing a 1 – 2 week storage time. However, if the nuts are to be consumed immediately onsite, this drying step is unnecessary. Additionally, the higher finish temperature results in a sugar coating that has a tendency to break off from the nuts more easily than with the lower finish temperature.

2. Stirring the nuts into the syrup

After the syrup is boiled to the desired finish temperature, combine the nuts and syrup and stir. A variety of mixing equipment is available for stirring the syrup onto the nuts. The turntable cream machine works for this purpose. For the simple "one pan" method (hand stirring), be sure to cook the syrup in a pan with the capacity of five times the volume of syrup used. This will permit boiling the syrup and stirring in the nuts to be done in a single pan. Use a heavy duty spoon to stir. Continue stirring until the syrup crystallizes and coats the surface of the nuts. Stirring will be easy at first, then become much more difficult for a short time, and finally, when crystallization is nearly complete, stirring will become easy again. Stop stirring when sugar is completely crystallized and the coated nuts are dry to the touch. If using two pans or equipment for stirring, warming the stirring pan prior to adding the hot syrup to the nuts will reduce syrup sticking to the pan.

3. Oven drying and storing

Maple coated nuts can be eaten immediately or packaged and stored. Storage time can be extended with oven drying. To dry, bake the finished coated nuts for at 110 – 130 °F for 2 – 3 hours. Always store coated nuts in a sealed container.

While these instructions are suitable for coating large volumes of nuts with maple syrup, the following recipe makes it simple to coat small volumes of nuts with maple sugar.

Maple Sugar Coated Nuts Recipe

Ingredients

1 pound nuts

1 cup maple sugar

1 egg white

1 tablespoon water

Directions

1. Preheat oven to 250 °F (120 °C). Grease a baking sheet.

2. Whisk together the egg white and water until frothy.

3. Add nuts to the egg white mixture and stir to coat the nuts evenly.

4. Place the maple sugar in a large mixing bowl. Add the egg white coated nuts to the sugar mixture and stir until coated evenly with sugar.

5. Spread the nuts on the prepared baking sheet.

6. Bake at 250 °F (120 °C) for 1 hour, stirring every 15 minutes.

7. Remove and cool.

8. Break into individual pieces and store in re-sealable plastic bag, jar, or tin.

Nuts and Allergen Regulations

Food products that contain any of the 8 major allergens must declare so on the packaging. While not required, products made in the same facility where major allergens are processed, should carry a precautionary notice on the label to that effect. The eight major allergens are: milk, eggs, fish, shellfish, tree nuts, peanuts, wheat, and soy.

7.5 Maple Coated Popcorn

There numerous ways to coat popcorn with maple. This section contains four different recipes: Maple Kettle Corn, Maple Caramel Corn, Baked Maple Caramel Corn, and Maple Popcorn Balls. The first two recipes require popcorn specific equipment, while the last two can be made using simple kitchen tools. In these recipes, "caramel" refers to the way the popcorn is coated, not the ingredients.

Maple Kettle Corn (Using Popcorn Machine)

The mix for maple kettle corn as it is made and marketed at the New York State Maple Producers Association (NYSMPA) fair booth at the New York State Fair is listed below. This popcorn is made in a commercial popcorn machine (maker, popper). If one is available, use a low temperature setting on the machine. With this recipe, it is important to pour out the popper before all of the corn has popped. Waiting until the very last kernels pop will likely result in a scorched flavor to the entire batch of kettle corn.

There are many recipes that will produce a good maple kettle corn. Some maple producers add maple syrup to the popper instead of a maple sugar mix. This will delay the popping time somewhat, but seems to make an acceptable kettle corn product. The reason white sugar is included in the maple sugar mix shared below is that it was observed to reduce the scorched flavor in the kettle corn. Compound-S is a product made by Gold Medal, the maker of popcorn machines used at the NYS Fair. The product is intended to help reduce carbon build-up in the machine when popping with sugar.

Ingredients for a 6 oz machine

1 cup popcorn

2 oz popcorn oil

1/4 cup (heaped) of granulated mix (see chart below)

1 tsp Compound-S

Granulated Mix Proportions for different batch sizes

	Large Batch	Medium Batch	Small Batch
Granulated maple sugar	20 lb	5 lb	1 lb
White cane sugar	4 lb	1 lb	3.2 oz
Dark maple syrup	2 1/2 cup	5/8 cup	1/8 cup (1 oz)

Maple Caramel Corn (Using Popcorn Caramelizer)

Maple caramel corn differs from maple kettle corn in that the entire surface of the popcorn is coated with a maple glass. This coating of hard syrup locks up the movement of moisture into and out of the popcorn, greatly extending its shelf-life.

Instructions

To make the maple coating from 100% maple, use proportions of 2/3 untreated and 1/3 inverted maple syrup. Alternatively, you can use corn syrup in place of the inverted syrup if desired.

Follow instructions on the caramelizer to determine how much syrup to add. Caramel mixes typically come in powdered form that are measured in ounces and come with instructions to add water. Maple syrup already contains water, so to determine the equivalent weight of syrup needed for a proper coating, multiply the weight of the recommended amount of caramel powder by 1.5. For example, Cretors brand caramel mix comes in 42 oz bags. An equivalent amount of maple syrup to use would be 63 oz.

Set the temperature control on the popcorn caramelizer to 285 °F and add the untreated maple syrup first. Allow it to cook until it has almost reached the finish temperature before adding the inverted maple syrup. Then allow the mixture it to come to 285 °F.

When the finish temperature has been reached, add the pre-popped corn and have the caramelizer go through the mixing stage. When all the popcorn is completely coated with syrup, pour it out onto the drying table and stir until the coated popcorn is free flowing.

Maple Popcorn by Hand

There two simple methods for making maple popcorn by hand. Both begin with heating the syrup to the proper finish temperature. Then coat by either: stirring the hot syrup into the popcorn directly, or baking it onto the popcorn in an oven while stirring frequently.

Baked Maple Caramel Corn

Ingredients

2 cups maple sugar

1 cup butter

1/2 cup maple syrup

1 tsp salt

1 tsp vanilla

1/2 tsp baking soda

1 cup un-popped corn to make 6 qt popped corn

Directions

1. Make the popped corn; place it into a lightly buttered bowl. Pre-heat oven to 250 °F.

2. Melt butter, then add maple syrup, maple sugar, and salt and combine well. Bring the mixture to a boil and without stirring, boil for 5 minutes.

3. Remove from the syrup mixture from heat. Stir in the baking soda and vanilla.

4. Pour the syrup mixture slowly over the popped corn and combine well.

5. Transfer the coated popcorn into a large roasting pan and bake for 1 hour, stirring every 15 minutes. Remove from oven and cool.

Maple Popcorn Balls

Ingredients

2 cups maple syrup

Popped popcorn

Directions

Boil maple syrup in a 2-quart saucepan to 260 °F. Then pour the syrup over a batch of popped corn and stir to coat. Allow the syrup to cool to a safe handling temperature before shaping the syrup coated popcorn into balls with buttered hands.

Yields 12 – 15 popcorn balls.

7.6 Maple Granola

Ingredients

1 large box (42 oz) old fashioned oatmeal

1 cup each: chopped walnuts, pecans, almonds, coconut

1 cup each: chopped dates, cranberries, raisins

1/2 cup wheat germ

1/2 cup oat bran

1/2 cup wheat bran

1 cup canola oil

1 cup maple syrup

1 cup molasses

1 cup honey

3 Tbsp vanilla

1 Tbsp cinnamon

1 tsp salt

Directions

Preheat oven to 350 °F. In a large roasting pan, combine oatmeal, wheat germ, oat bran, wheat bran, cinnamon and salt. Mix in the chopped nuts, but reserve the dried fruit. Stir in oil, maple syrup, molasses, honey, and vanilla until dry ingredients are evenly coated. Bake for 30 minutes, stirring every ten minutes to cook evenly. Add in the dried fruits after removing from the oven.

Increase or reduce oil and sugars according to your personal tastes.

Granola can be stored frozen in freezer bags. Yields 32 servings.

7.7 Maple Jelly

Olga Padilla-Zakour, Cheryl Leach, Herb Cooley, Belen Baviera, NYS Food Venture Center, Cornell University

Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program

As a coordinated effort of the NYS Food Venture Center and the Cornell Maple Program, several value-added maple products were developed or optimized to offer marketing alternatives to maple producers. This project was funded by the New York Farm Viability Institute.

Background

Maple jelly is made by boiling syrup and a specific gum called carrageenan (instead of pectin) to form a gel. Carrageenan is sold under the name "Genugel" by maple equipment suppliers. We tested the traditional recipe that has been used by many producers but found out that the final sugar concentration was below 65 °Brix, which is the standard of identity to call a product jelly.[1] We reworked the traditional recipe to comply with the standard of identity and therefore to have the product under the non-hazardous food category.[2]

[1](2022) The federal standard of identity referred to in this piece is specific to *Fruit* Jelly. See 21 CFR § 150.140 (https://www.law.cornell.edu/cfr/text/21/150.140#c). This federal standard of identity currently specifies which fruits can be made into a "fruit jelly", and does not list maple. It is unclear at this time whether the product outlined in this article can legally be called a "jelly", and under which law(s) it is regulated.

[2](2022) The non-hazardous food category referred to here is the New York State list of non-hazardous foods that qualifies the producer for a Home Processor Exemptions (see **Section 11.4**). However, this list currently specifies, "Fruit jams, jellies, and marmalades made with high acid/low pH fruits". Due to this specification, it is likely that the product outlined in this article does *not* qualify as a non-hazardous food that can be produced by a Home Processor. The type of product outlined in this article does not appear in the restrictive list of approved non-hazardous foods by the New York State Department of Agriculture and Markets (https://agriculture.ny.gov/food-safety/home-processing).

Recipe

Ingredients (1 kg batch)

833 g maple syrup

165 g water

2 g Genugel

Procedure

1. Whisk the Genugel in the water until dissolved. This might take a few minutes.

2. Add the dissolved Genugel to the syrup and combine.

3. In a large pot, heat the mixture to 219 – 220 °F. Add a few drops of defoamer as necessary to minimize foaming. This finishing temperature should result in a 65 – 66 °Brix solution. You may use a refractometer to monitor the °Brix, but be aware of the acceptable temperature range for the sample that your tool is intended to measure.

4. Meanwhile, preheat glass jars in boiling water. Do not towel dry.

5. Hot pack the mixture into the clean, preheated glass jars. Fill temperature in the jar must be at least 185 °F. Immediately cap the jars and invert for 3 minutes.

5. Return jars to upright position for proper gelling. Let cool at room temperature.

Considerations

If the hot-fill temperature drops below 185 °F (a problem with very small jars), process the capped jars in a boiling water bath for 5 minutes to pasteurize.

If the consistency of the final product is too soft, increase the amount of Genugel to 0.25% of the total recipe (2.5 g for a 1 kg batch).

Due to observations of surface darkening in this product with prolonged storage, it is recommended to store in cool temperatures (40 to 65 °F) to extend shelf-life.

Serving size is 1 tablespoon.

7.8 Maple Syrup Sticks/Straws

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Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program

As a coordinated effort of the NYS Food Venture Center and the Cornell Maple Program, several value-added maple products were developed or optimized to offer marketing alternatives to maple producers. This project was funded by the New York Farm Viability Institute.

Research Objective

This product is modeled after honey sticks/straws which are often marketed as a snack or "to-go" sweetener. Maple syrup sticks/straws can be prepared in a similar manner, but without proper processing, mold can grow. We evaluated pasteurization methods to produce a shelf-stable product.

Results

The following procedure should be used for shelf-stable maple syrup sticks/straws:

1. Fill food grade plastic sticks/straws with room temperature maple syrup.

2. Heat seal both ends of the plastic.

3. Process sealed sticks/straws in a boiling water bath for five minutes.

Pasteurized, shelf-stable maple syrup sticks/straws can be stored indefinitely at room temperature.

7.9 Maple Cotton Candy

Stephen Childs, New York State Maple Specialist

Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne

Marketing Maple Cotton Candy

Maple cotton candy has become a very popular maple product that sells well at high population events such as fairs, festivals, farmers markets, and open houses. At the New York State Fair, the NYSMPA first introduced maple cotton candy to their sales booth in 1998. In ten years, this product grew to account for 25% of all their sales, resulting in revenue of over $20,000 during the 2008 fair.

Because maple cotton candy takes up a lot of space and is easily crushed, it is recommended to make the product fresh onsite at the event locations as opposed to pre-packaging and transporting it. Note that onsite food preparation requires a temporary food service establishment permit from the local Health Department. Onsite preparation is also a great way to draw prospective customers' attention, and providing free samples can help to earn new customers. Maple cotton candy can also be sold through retail locations (see **Packaging** below). If producing at home or in the sugarhouse, this product requires either an Article 20-C License or Home Processor Exemption. Cotton candy is subject to sales tax in New York State. For more regulatory information, see **Section 11**.

Maple Cotton Candy Mix Economics

Maple cotton candy mix is made with a combination of maple sugar and cane sugar. The most common mix ratios are 1:3 and 1:4 maple sugar to cane sugar. The higher the proportion of cane sugar, the cheaper the cotton candy is to produce. The weight of maple cotton candy per retail unit, whether that retail unit is packaged in a bag, on a stick, or in a sealed container, will determine the price it should be sold for. With current prices (2022), the ingredient cost is about $0.29 / oz for a 1:4 mix ratio, and about $0.36 / oz for a 1:3 mix ratio. See cost comparisons with different mix ratios and retail unit sizes below.

Ingredient cost per retail unit maple cotton candy

	1:3 ratio, 4 oz bag	1:4 ratio, 4 oz bag	1:4 ratio, 5 oz bag
Cost maple sugar[1] / unit	$1.30	$1.04	$1.30
Cost cane sugar[2] / unit	$0.12	$0.13	$0.16
Total cost / retail unit	$1.42	$1.17	$1.46

[1](2022) Current retail price of maple sugar is about $1.30 / oz ($7.79 / 6 oz retail unit).

[2](2022) Current retail price of cane sugar is about $0.04 / oz ($2.69 / 4 lb retail unit).

Realistically, due to the nature of onsite production and pace of sales at high volume events, the product will not typically be weighed before being packaged or served. Estimating the other costs involved in producing and selling maple cotton candy, can be

helpful for setting prices and estimating profitability. Other costs to consider include packaging, equipment, labor, booth rental, advertising, and staff travel.

Additionally, Michael Farrell, previous director of the Uihlein Maple Research Forest in Lake Placid, NY, developed a maple cotton candy pricing tool. This and other useful "Maple Calculators" are available for online use and free download on the Cornell Maple Program website (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/).

Packaging

There are three common methods for presenting and packaging maple cotton candy: paper cones, plastic bags, and hard plastic containers. These three options are listed in order from both shortest to longest shelf-life, and lowest to highest cost.

The first two options are best suited to sale for onsite consumption, such as at fairs and festivals. Paper cones ($0.03 / unit, Gold Medal 2022) should be used when preparing the product onsite for immediate consumption. Food grade plastic bags ($0.06 / unit, Gold Medal 2022), also known as "balloon bags", can be closed with either twist ties or adhesive tape, and the cotton candy can hold up in these bags for at least several hours depending on environmental conditions. It is possible to use these bags for pre-packaging cotton candy and transporting it to an event, provided that the bags are kept in a cool location and are not compressed.

Finally, hard plastic containers are best suited to long-term storage and shipping. These containers should have tight-fitting lids and be made from either LDPE or PP plastic, or PET plastic with a heat sealant coating. These containers may maintain cotton candy quality for several months and are well-suited to retail sale. Half ounce containers are currently selling for $0.37 / unit, or $0.78 / unit for tamper-evident lids (Gold Medal 2022).

Weather Issues

Humidity can be a major problem when making maple cotton candy. Maple sugar can contain invert sugars which absorb water readily. This absorption will result in a sticky cotton candy that is difficult to handle. To avoid this, it is recommended to use a 1:4 ratio of maple sugar to cane sugar on humid days.

In an outdoor setting, wind can blow the spun cotton candy right out of the machine or blow the sugar mix away as it is poured into the spinner head. A good cotton candy machine cover, known as a "bubble", is an essential piece of equipment to combat wind. Additionally, pre-packaged bags can blow away if they are not securely fastened to a stable structure. There are several types of stands available for securing bags.

Cotton Candy Machines

When purchasing a cotton candy machine, pay attention to the voltage and plug type, and the servings per minute. Lower capacity machines (2-3 servings per minute) typically come with 120 voltage and your standard 5-15P plug. These are more portable and more versatile machines for setting up at various locations and easily finding a power source. For selling at high volume locations, a powerful, large capacity (6-7 servings per minute)

machine will be necessary. These usually require higher voltage and amperage have different plug types such as 5-30P or 6-20P. For these machines, be sure that you have access to 220 voltage and 20 to 30 amp breakers at the location you intend to sell at. This should be readily available at concession stands, fairs, stadiums, and the like.

An undersized machine with slow output will demand a lot more time and attention and may result in waiting customers. One fulltime person can usually keep up with two small machines if they are only making and bagging the product, and leaving the sales handling to another operator.

When cleaning the machine, always follow the manufacturer's instructions.

Maple-Specific Machine Accessories for Making a Better Product

Two machine accessories have been developed to aid maple cotton candy production. First, the traditional ribbons on cotton candy machines are designed to accommodate cane sugar. Maple sugar contains finer sugar granules that can slip through the ribbon, bypassing the heating element and resulting in gritty cotton candy. At the request of maple producers, The Gold Medal Products Company developed a maple-specific ribbon (55441) which has two extra windings per inch, narrowing the space where the sugar passes through. Second, the traditional spinner head without a spacer between the two heating elements was allowing melted maple sugar to end up in the cotton candy, weighing it down. A maple spinner head with a spacer allows the liquid sugar to cool and be spun properly, resulting in higher quality, lighter cotton candy. The Popcorn Supply Company in Syracuse makes these accessories to order to fit your machine.

The maple-specific ribbon (left) and spinner head with spacer (right) are pictured below.

Production and Machine Operating Notes

Maple cotton candy should only be handled with sanitary food service gloves. For the protection of the operator and bystanders, the machine must be covered in a "bubble" or a display stand that protects bystanders from sugar that can be thrown from the spinner head when over filled with sugar. The operator should be aware that the spinner head has

flow control leather straps that cannot be easily seen while spinning; these straps can deliver a painful slap if the operator's hands to get too close to the spinner.

Flow control leather straps on spinner head to be aware of when operating. Image from: https://www.manufacturedfun.com/store/p505/Paragon_Cotton_Candy_Spinning_Head_%23519066.html

Selecting Maple Sugar for Maple Cotton Candy

When selecting or making granulated sugar for making maple cotton candy, choose sugar that has larger crystals. During sugar production, crystal size can be controlled through the stirring temperature and method. Larger crystals form when the syrup is stirred slowly and continuously starting when it is still very hot. Smaller crystal should be avoided because they can more easily slip through the heaters and the grill of the spinner without melting, resulting in grainy cotton candy and sugar build-up around the edges of the machine pan. Sugar can be sieved through different size screens to obtain the preferred crystal size. It is always recommended to make granulated maple sugar from low invert syrup for cotton candy production. For more information on granulated maple sugar production, see **Section 6**.

7.10 Maple Meringues

Olga Padilla-Zakour, Cheryl Leach, Herb Cooley, Belen Baviera, NYS Food Venture Center, Cornell University

Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program

As a coordinated effort of the NYS Food Venture Center and the Cornell Maple Program, several value-added maple products were developed or optimized to offer marketing alternatives to maple producers. This project was funded by the New York Farm Viability Institute.

Background

Meringue cookies combine the airy texture of whipped egg whites with cane sugar. We developed a recipe that replaces the cane sugar with maple syrup, evaluating different formulations, baking procedures, and packaging to obtain consistent results.

Recipe

Ingredients

490 g maple syrup (98%)

10 g powdered egg whites (2%)

Procedure

1. Pre-heat oven to 200 °F.

2. Dissolve the powdered egg whites in maple syrup. Stir by hand until combined.

3. Whip the mixture in a stand mixer on highest speed for 7 minutes.

4. Drop the whipped mixture in small, consistent portions (1 teaspoon - 1 tablespoon) on a parchment paper lined baking sheet.

5. Bake for 1.5 - 2 hours (depending on cookie size).

6. Turn off the heat and leave the cookies to dry inside the oven overnight.

7. Package the meringues in air-tight containers for up to 6 months.

Note

The resulting dried cookies will have very low moisture content (water activity of 0.2), and will therefore have a long shelf-life if stored properly. Without proper packaging, the cookies will absorb moisture from the environment and become sticky.

Suggested retail unit is 8 - 10 cookies or 1 serving of 30 g.

Ingredient declaration: maple syrup, dried egg white. Note that egg is one of the 8 major allergens which must be clearly listed on product packaging.

7.11 Maple Marshmallows

Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program, Cornell University

For more information on this product, see the **Basics of Maple Marshmallows** bulletin (2022), available on the Cornell Maple Program website, New Product Development page.

Recipe

Ingredients

12 Silver Gelatin Sheets

330 g Granulated Maple Sugar

328 g Inverted Maple Syrup[1]

118 g (½ cup) Water

Pinch of salt (optional)

Powdered Maple Sugar or Confectioner's Sugar

[1]To fully invert maple syrup, add 1 teaspoon of invertase per gallon of syrup. For rapid conversion, hold maple syrup with invertase at 120 – 150 °F for 24 hours. Where time is not a factor, stir the solution thoroughly and store at ambient temperature for 3 – 5 days.

Directions

1. Submerge gelatin sheets in cold water until softened (10-15 minutes).

2. While gelatin is rehydrating, use a neutral-flavored oil to lightly coat two 8" x 8" baking pans, plastic wrap to cover the marshmallows while they set, and a rubber spatula. Remove excess oil with a paper towel.

3. Squeeze rehydrated gelatin sheets to remove excess water, and place them into a double boiler. Heat on low until the gelatin is liquid (2 - 3 minutes), taking care not to overheat

4. Transfer liquid gelatin into a stand mixer with whisk attachment. Gelatin will gel as it cools and liquefy again as the hot syrup is added to the stand mixer.

5. In a medium saucepan, add the granulated maple sugar, inverted maple syrup, water, and salt. Heat to 245 °F. Immediately remove from heat and allow to cool to <200 °F.

6. Once the syrup has cooled, turn the stand mixer on low. Slowly add the cooled syrup to the gelatin by pouring it down the side of the mixing bowl. Be careful not to allow hot syrup to hit the moving whisk attachment as it can spatter and cause burns.

7. Increase stand mixer speed to high and continue to mix for 10 – 12 minutes.

8. Working quickly, use the rubber spatula to deposit the marshmallow mixture into the baking pans and spread evenly. Gently cover and press the oiled plastic wrap onto the exposed surface of the marshmallow to avoid formation of a crust. Allow the

marshmallows to set at room temperature for 6 – 24 hours.

9. Coat a cutting board with Powdered Maple Sugar. Use lightly oiled hands to release the edges of the marshmallow from the baking pan onto the cutting board. Using a lightly oiled knife, cut the marshmallows into squares

10. As each marshmallow is cut, coat completely with Powdered Maple Sugar. Shake excess powdered sugar off of the marshmallows using sifter.

11. Store marshmallows in an air-tight container for up to 3 weeks.

Recipe yields approximately 725 g.

Dehydrated Mini Maple Marshmallows

These dehydrated mini marshmallows can be eaten as a snack, used as an ice cream topper, or added to cold cereal, hot beverages, or trail mix.

Recipe

Note that this recipe differs slightly from the fresh maple marshmallow recipe to produce higher quality dehydrated marshmallows.

Ingredients

12 Silver Gelatin Sheets

385 g Granulated Maple Sugar

245.5 g Inverted Maple Syrup

118 g (1/2 cup) Water

Pinch of salt (optional)

Powdered Maple Sugar or Confectioner's Sugar

Directions

1. Follow **steps 1 – 8** for fresh maple marshmallows (previous page). Note that the sugar ratio for dehydrated marshmallows is slightly different than that of fresh marshmallows.

2. Remove the set marshmallows from the baking pan and place onto a cutting board coated with powdered maple sugar. Using a lightly greased knife, cut marshmallows slightly smaller (10 – 20 %) than desired size; they will expand in the dehydrator.

3. As they are cut, coat each marshmallow with powdered maple sugar on all sides.

4. Dehydrate marshmallows using a vertical or lateral flow dehydrator for approximately 5 hours at 130 °F. Rotate marshmallows periodically.

Store dehydrated marshmallows in an air-tight, moisture barrier container for up to 1 year.

7.12 Maple Ice Cream

Catherine Belisle, Ph.D. (2022)

Background

The volume of syrup used in the following recipes is the maximum amount of sugar that can be added to the mix without causing significant textural changes to the ice cream. Sugar decreases the freezing point of ice cream and thus slows the rate of ice crystallization. If a higher concentration of maple syrup is added to the ice cream mixture, the solution will not freeze properly or the finished ice cream will melt very quickly.

Ice cream machines incorporate air while they freeze the ice cream mix. This incorporation of air causes an increase in volume known as "overrun". Overrun is increased by the presence of nonfat dry milk solids, egg yolks, and emulsifying agents. Fat decreases the percent overrun in ice cream, especially when present as large fat globules or clumps.

Hard Maple Ice Cream

Ingredients

½ gallon Cornell Dairy hard ice cream mix (no added vanilla, 12% fat)

2200 mL Dark maple syrup (approximately ½ gallon)

Directions

1. Combine ice cream base and maple syrup. Mix well until homogenous.
2. Add mixture into an ice cream machine and allow ice cream to aerate and form.
3. Deposit ice cream into containers and freeze for 24 hours before serving.

Recipe yields 1.5 gallons of hard ice cream.

Sensory Evaluation

The quality of frozen desserts is evaluated by the texture (mouthfeel), consistency (hardness or softness), and body. A good quality frozen dessert will have a smooth, creamy texture, a consistency that is neither too hard nor too soft, and body that is not too watery and compact nor too viscous and spongy when the product begins to melt.

This hard maple ice cream recipe was evaluated by 95 panelists at the Cornell Sensory Evaluation Center. Overall, 64% of panelists liked the ice cream moderately to extremely and 45% of panelists “would purchase” the ice cream. This ice cream was noted for its creaminess and strong maple flavor.

Soft Serve Maple Ice Cream

Ingredients

½ gallon Cornell Dairy soft serve ice cream mix (with vanilla, 10% fat)

2200 mL Dark maple syrup (approximately ½ gallon)

Directions

1. Combine ice cream base and maple syrup. Mix well until homogenous
2. Add mixture into a soft ice cream machine and allow ice cream to aerate and form.
3. Follow manufacturer's instructions on the soft ice cream machine to serve.

Recipe yields 1.5 gallons of soft serve ice cream.

Sensory Evaluation

The quality of frozen desserts is evaluated by the texture (mouthfeel), consistency (hardness or softness), and body. A good quality frozen dessert will have a smooth, creamy texture, a consistency that is neither too hard nor too soft, and body that is not too watery and compact nor too viscous and spongy when the product begins to melt.

This soft serve ice cream recipe was evaluated by 95 panelists at the Cornell Sensory Evaluation Center. Overall, 74% of panelists liked the ice cream moderately to extremely and 51% of panelists "would purchase" the ice cream. This ice cream was noted for its creamy texture, reduced melting speed, and balanced flavor. Some panelists noted that the maple flavor was weak (27.4%), but that the ice cream was too sweet (44.2%).

7.13 Maple Slushies and Popsicles

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Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne, Cornell Maple Program

As a coordinated effort of the NYS Food Venture Center and the Cornell Maple Program, several value-added maple products were developed or optimized to offer marketing alternatives to maple producers. This project was funded by the New York Farm Viability Institute.

Background

This maple slushie recipe is intended to be prepared onsite for immediate consumption at festivals and similar events or in stores. Several different factors were evaluated during the development of this recipe including syrup grade, syrup concentration, and presence or absence of dairy. Amber syrup is recommended for maple slushies. Ideal syrup content was identified as 20–30% (17–27 °Brix) for non-dairy slushies, and 25% for slushies containing nonfat dry milk powder for a creamier taste and added nutritional value.

Recipes

Ingredients

Nondairy Maple Slushie (20% syrup)

100 g maple syrup

400 g ice

Nondairy Maple Slushie (30% syrup)

150 g maple syrup

350 g ice

Maple Milk Slushie (2% milk)

125 g maple syrup

10 g nonfat dry milk powder

365 g ice

Maple Milk Slushie (3% milk)

125 g maple syrup

15 g nonfat dry milk powder

360 g ice

Procedure

Prepare the slushies by crushing ice, syrup, and milk powder (optional) in a blender until smooth. Serving size is 8 ounces.

Popsicles

The above formulations can be used to prepare maple popsicles by substituting water in place of the ice. Combine the ingredients well, pour into popsicle molds, and freeze.

7.14 Maple Soft Drink

Stephen Childs, New York State Maple Specialist (retired), Cornell Cooperative Extension

Revised (2022): Catherine Belisle, Ph.D. and Ailis Clyne

Producing a maple soft drink for onsite consumption can be a fairly easy and profitable use for Dark and Very Dark maple syrup. For guidance on small scale beverage carbonation, refer to "A Guide to Carbonating Beverages at Small Scale" (Song, et al. 2020) (https://edis.ifas.ufl.edu/publication/FS379). For information on bottling maple sodas, including co-packing, shelf-stability, marketing and flavor variations (lemon ginger, orange, orange cream), see the "Maple Soda Guidelines Fact Sheet" by Ailis Clyne (2019), accessible on the Cornell Maple Program website, New Product Development page.

For a pure maple soft drink, preparation can be as simple as adding maple syrup to bottled carbonated water. Table top carbonators (such as Soda Stream), corny kegs, or commercial soft drink dispensers can also be used for this product. Mix ratios for this product were determined by comparing the sweetness levels of commonly available soft drinks. Soft drinks on the market typically contain either 25 g sugar / 8 oz serving (about 11% sugar), or a little over 30 g sugar / 8 oz serving (about 14% sugar). Maple syrup typically contains 66% sugar and 34% water; the water content must be considered when calculating the mix ratio. Table 1 below shows sugar and maple syrup mix rates for typical soft drink sweetness levels.

Table 1. Mix Rate for Maple Soft Drink, Maple Sugar or Maple Syrup by Mass

Sweetness	Maple Sugar		Maple Syrup		Total Soft Drink	
	Ounces	Grams	Ounces	Grams	Ounces	Grams
11%	0.9	25	1.3	38	8	227
11%	1.3	38	2.0	57	12	340
11%	2.2	63	3.4	95	20	567
11%	3.9	110	5.9	167	35.3	1000
14%	1.1	31	1.7	47	8	227
14%	1.7	47	2.5	71	12	340
14%	2.8	78	4.6	130	20	567
14%	4.8	137	7.3	208	35.3 oz	1000

If using store-bought bottled carbonated water: add 180 g (~½ cup) maple syrup to 1 L carbonated water for 11% sweetness, or 230 g (~¾ cup) maple syrup for 14% sweetness.

Procedure

If mixing the carbonated water and syrup by hand, always add syrup to carbonated water, not the other way around. The colder the water, the more carbonation it can hold. Use a sanitized food grade tube or straw to add the syrup to the bottom of a sealable, wide mouth container holding the chilled carbonated water. Quickly cap the bottle, gently rotate to combine, and chill. This technique will prevent excessive carbonation loss.

Cost Calculations

Current (2022) retail price of maple sugar is about $1.30 / oz or $0.05 / g. This price would be much lower if the maple sugar was sourced in bulk or produced at the sugar house. Current bulk prices for maple syrup are $2.20 / lb ($0.14 / oz) for Dark syrup and $1.30 / lb ($0.08 / oz) Very Dark syrup. That is equivalent to $0.05 / g for maple sugar, $0.005 / g for Dark syrup, and $0.003 / g for Very Dark syrup. When calculating the cost per unit for maple soft drink, include the costs of carbonated water, cups, straws, lids and any production equipment.

Examples:

Cost per 8 oz unit	Dark / 11%	Very Dark / 11%	Dark / 14%	Very Dark / 14%
Syrup	$0.18	$0.10	$0.24	$0.14
Carbonated water	$0.05	$0.05	$0.05	$0.05
Cup, straw, lid	$0.10	$0.10	$0.10	$0.10
Total	**$0.33**	**$0.25**	**$0.39**	**$0.29**

Market Testing

Market tests were held for this product during development. Preliminary trials were held with 31 participants tasting the 11% sweetness maple soft drink. 30 rated the drink “very good”, with 1 participant rating it “too sweet”. A larger market test was held at the 2007 Empire Farm Days with 548 participants tasting the 14% sweetness maple soft drink. 94% of participants like the product with 70% responding that they liked it “extremely” or “very much”, and 24% responding that they liked it “moderately” or “slightly”. 10 participants indicated that, even though they liked the product, they thought it was too sweet, while 1 participant indicated that the product was not sweet enough. Many respondents compared the flavor of the product to cream soda or root beer.

Note

This product should not be stored for extended periods of time. It can spoil rapidly and is intended only for immediate consumption. Keeping this product cold is essential for quality. To produce this product for sale onsite, a food processing establishment license from the local Health Department is required.

7.15 Replacing Corn Syrup with Inverted Maple Syrup

Stephen Childs, New York State Maple Specialist (retired), Cornell Maple Program

When maple syrup is treated with invertase, the sucrose in the syrup is converted into the invert sugars: glucose and fructose. Inverted maple syrup behaves like corn syrup recipes and therefore can be substituted for corn syrup in many maple value added products. Making this substitution allows the finished product to be marketed as "made from 100% maple" or "made with 100% maple sugar" (for multi-ingredient confections). When making this substitution, there are several things to consider.

Water Content

First, compare the water content of inverted syrup to that of corn syrup. The percentage of water in inverted maple syrup is 31-34% while in corn syrup it is usually 28-30%. In recipes where the sugars are boiled to a specific temperature, this difference in moisture content is not important; the boiling process may take a slightly different length of time, but the finish temperature is directly correlated to the final water content. However, in recipes where the ingredients are heated but not boiled to a finishing temperature, adjusting for moisture content is important. For each cup of corn syrup substituted with inverted maple syrup, reduce water from other sources in the recipe by two teaspoons.

Invert Sugar Levels

Second, invert sugar levels can differ greatly between inverted maple syrup and corn syrup. This difference is important because the ratio of invert sugars to table sugar (sucrose) in a recipe determines the crystallization levels and thus the texture, structure, and moisture of the final product. Fully inverted maple syrup has an invert sugar level of 66-69%. Corn syrup typically has an invert sugar level of 20-40% but can have as high as 70%. The source and processing methods allow for this large variation in invert levels. Additionally, in corn syrup, most of the invert sugar is glucose where as in inverted maple syrup, the invert sugar is roughly 50:50 glucose and fructose. Fructose tastes sweeter than glucose, so this can alter the perception of sweetness in the final product. Despite these differences, the Cornell Maple Program uses a 1:1 substitution when adapting recipes that call for corn syrup. Some experimentation may be necessary to get the product just right.

Ingredient Costs

Replacing com syrup with inverted maple syrup will increase the ingredient costs as maple syrup is more expensive than corn syrup. The fact that the final product does not contain corn syrup and is made from 100% maple should be promoted on the product label; this will help to justify a higher product price to the consumer.

Inverting Maple Syrup: Procedure

The procedure for inverting maple syrup is fairly simple. Add 0.1% to 0.25% by volume of the enzyme invertase to pure maple syrup. For a gallon (4.4 L) of syrup, add 1.5 teaspoons (8 mL) invertase or follow the manufacturer's instructions. Invertase performs optimally at a temperature 120 °F, and is rapidly deactivated at temperatures greater than 170 °F. For rapid conversion, the treated syrup should be held at 120 – 150 °F for 24 hours and then stored under refrigeration, or a freezer for extended periods of time. Overheating the treated syrup will stop the conversion process. A crock-pot or oven with low temperature settings is ideal for this treatment. For a slower conversion, stir the treated syrup thoroughly and let stand at room temperature for 3 – 5 days. Both methods will produce fully inverted maple syrup.

Invertase is available from confectionary and baking suppliers and must be kept refrigerated between uses or it will lose its effectiveness. In New York, invertase is considered a processing aid and does not need to be declared on the label.

When selecting syrup for inverting, it would be wise to use a syrup that is already high in invert sugar. A syrup with a glucose meter reading of 100 or lower can be used to make a variety of crystalline maple value added products and should be saved for those purposes. A syrup with a glucose meter reading of over 100 can be inverted and used to replace corn syrup in non-crystalline value added products. This will significantly increase the value of the high invert syrup by enabling it to be used in a value added product rather than being limited to sale as syrup. However, some high-invert syrups have too strong of flavor for the end product; in this case you may need to use a lighter, lower invert syrup to achieve a more delicate flavor. Always select syrups with excellent flavor when making value added products, even for syrup that will be inverted.

The gray area in the table at right highlights the suggested invert levels of syrups that would make ideal candidates for full sugar inversion using invertase enzyme. For further information on measuring invert sugar in maple syrup see **Section 2.1**.

Glucose Meter Reading	1 in 10 dilution of syrup
mg/dL	invert%
20	0.4
30	0.6
40	0.8
50	1.0
60	1.2
70	1.4
80	1.6
90	1.8
100	2.0
110	2.2
120	2.4
130	2.6
140	2.8
150	3.0
160	3.2
170	3.4
180	3.6
190	3.8
200	4.0
210	4.2
220	4.4
230	4.6
240	4.8
250	5.0

Cornell Maple Bulletin 205 (2007)

7.16 Replacing Table Sugar with Maple Syrup

by STEPHEN CHILDS

Revised (2022): CATHERINE BELISLE, Ph.D., and AILIS CLYNE

Balancing Ingredients

Balancing ingredients

Replacing granulated cane or beet sugar in recipes with maple syrup should be a growing trend. Guidelines about sugar replacement are different in different sources. It is easy to understand this confusing situation when you realize there are actually two ingredients that need to be balanced. When replacing granulated sugar in a recipe with maple syrup, you should consider both the sugar balance and the liquid balance of the recipe. Some recommendations say to replace 1 cup of cane sugar with 1¼ cup of maple syrup; others say to replace 1 cup of cane sugar with ¾ cup of maple syrup. One is trying to balance the liquid in the recipe, the other the sweetness. The most straightforward approach is to simply replace 1 cup of cane sugar with 1 cup of maple sugar. In this case, you gain the extra flavors from maple while the sugar content stays in balance. I would especially suggest this replacement method for recipes that contain milk or another liquid which you will be able to reduce to keep the liquids in balance, as long as those liquids do not perform an important function in the recipe that water would not accomplish.

Liquid vs. Dry

Liquid vs. Dry

One cup of maple syrup at a density of 66 ºBrix provides about 200 grams of sugar and 100 grams of water. One cup of cane sugar weighs about 200 grams. The same amount of sugar in a cup of maple syrup is found in a cup of granulated sugar. The air space around the cane sugar granules is about equal to the space taken up by the water in the cup of maple syrup. Substituting one cup of maple syrup for one cup of granulated sugar adds an extra 1/3 cup (100 grams) of water to the recipe; to balance the liquids in the recipe, you then need to reduce other liquids in the recipe, typically water or milk, by 100 grams or by 1/3 cup for each cup of granulated sugar replaced with maple syrup.

Replacing Brown Sugar

Replacing Brown Sugar

If you were to substitute maple syrup for brown sugar, you would need to go through similar calculations depending whether the recipe calls for packed brown sugar or loose brown sugar. One cup of loose brown sugar contains about 149 g of sugar per cup. Since a cup of maple syrup contains just 200 g of sugar per cup, you would replace one cup of loose brown sugar with ¾ cup of maple syrup (~150 g sugar). This syrup would contribute about 50 grams or about ¼ cup of extra water which would need to be reduced from other liquids in the recipe to make the liquids balance.

When replacing one cup of packed brown sugar (227 g of sugar per cup) with maple syrup (200 g of sugar per cup), you would need to use one cup plus 2 tablespoons of maple syrup to balance the sugar in the recipe. To balance the liquids in the recipe, reduce the milk or water content in the recipe by about 110 grams or 1/3 cup plus 2 teaspoons.

Powdered Sugar

Powdered Sugar (also known as Confectioner's Sugar)
Replacing powdered sugar with maple syrup would be very similar to replacing granulated sugar, but powdered sugars often perform some specific function in the recipe or confection that may be accomplished by the maple syrup. This is due both to fine crystal size (<50 microns) and the presence of 2-5% corn starch or other anti-caking agent in powdered sugar. Additionally, powdered sugar is often called for in recipes that are very sensitive to liquids and therefore not suitable for substituting maple syrup, such as cream cheese frosting for example. However, it is possible to include maple in recipes that call for powdered sugar by processing granulated maple sugar into "powdered maple sugar". Find instructions in the Maple Marshmallow fact sheet (Section 7.10).

These recommendations are based on average weights for various sugar products. Maple syrup varies in density, and granulated and brown sugars vary in size of granule and in moisture content. These factors may result in some variation in how your recipes turn out.

Temperature and Volume

Temperature and Volume
Be aware that fluid volume changes with temperature. These conversions are based on ingredients being at room temperature. Also, the volume of measuring cups intended for dry ingredients (cups that have a fixed volume without a scale) have slightly larger volumes than measuring cups designed for liquid ingredients (these measuring cups usually have a scale for different volumes). Professional chefs get around these sources of variation by developing recipes based on ingredient weight.

» Conversion Facts

At 66 ºBrix:
1 cup of maple syrup = 240 mL = 300 g of syrup (density of 1.25 g/mL)
1 cup of maple syrup provides 200 grams of sugar and 100 grams of water
One gallon of maple syrup at 66 ºBrix weighs about 11.2 pounds

Granulated sugar - the conversions vary from 195 to 220 g for 1 cup

One pound brown sugar = 3 cups loose
One pound brown sugar = 2 cups packed
One pound granulated sugar = 2 1/8 cups

1 cup of water = 8 fluid ounces = 16 tablespoons = 237 grams

Based on these values:
1 cup of granulated sugar = 1 cup of maple syrup, and this will add 100 grams of water

The influence of maple flavor on the recipe is most closely related to the grade of the syrup used. Grade A Golden or Amber syrups will add a mild, vanilla maple flavor to the recipe. Grade A Dark syrup will add a deeper, more caramel maple flavor. Grade A Very Dark will add the most robust maple flavor. Which grade you use should depend on your flavor preference and what other flavors maple would be competing with.

Measuring Methods

Measuring Methods

Use dry measures (measuring cups and spoons) for dry ingredients and liquid measures (glass or plastic graduated containers) for liquids. When measuring liquids, place the cup on a level surface and get at eye-level to determine the liquid amount.

Dry measures are designed to be able to level the sugar with a flat blade, such as a spatula or knife. It is hard to get correct measures of dry ingredients in a liquid measure or liquid ingredients in a dry measure.

Measure loose brown sugar by scooping the dry measure into the sugar and leveling it off without packing. Packed brown sugar should be packed into the measuring cup to fit as much as possible, and the final level amount can be determined with a flat blade.

Weight measures are more accurate and repeatable than volume measures. Weight measures are preferred where exact proportions matter in recipes. The advantage of volume measures is that they can be faster and more convenient.

Cornell Maple Program

Section 8

Pricing Maple Products

8.1 Pricing Value Added Products

Revised (2022): Ailis Clyne

Understanding Costs to Factor into Pricing

There are several factors to consider when determining what price to sell a maple value added product for. These factors are:

- Cost of Syrup and Shrinkage
- Cost of Other Ingredients
- Packaging
- Labor
- Energy
- Capital Investment (Equipment)
- Margins

The cost of syrup refers to current bulk prices. Bulk prices change constantly, but have remained relatively stable in recent years. The bulk prices on 10 April 2022 were: $2.60/lb. for Golden and Amber, $2.50/lb. for Dark, $2.20/lb. for Very Dark, $1.30/lb. for processing grade, and $0.75 for ropey syrup. For current bulk syrup prices, call Bascom Maple Farms. Shrinkage refers to volume difference between syrup and either cream, candy, or sugar. Shrinkage rates for the different pure maple products are included in the tables below.

The cost of each non-maple ingredient used should be accounted for to determine the cost to make a product. Many ingredient distributors offer heavy bulk discounts for purchasing in large volumes. Packaging is similarly most cost-effectively sourced in large volumes. OpenTip and ULINE are two online distributors of retail packaging.

Labor refers to the cost per hour for hired help who produce the product. Be sure to include the cost of your own time when calculating labor costs.

Capital investment refers to the cost of equipment used to make a product. The cost of the equipment is divided by the anticipated number of uses it will have over the course of its lifetime, and that cost per use is applied to each batch of product made. Energy costs will vary by type of equipment used, and the energy source or fuel supply.

Margins are the difference between the price the product is sold for and the cost to make that product. The salesperson decides what their margins will be. Grocery stores, for example, have notoriously low margins. Look into what the typical margins are for the type of product you intend to sell. Products that are sold in high volumes typically have low margins, while small-batch, artisanal goods sold in low volumes typically have high margins. When selecting your margins, compare the retail prices for other similar products on the market; items labeled artisanal, handmade, gourmet, small batch, all-natural, and local are a good place to start investigating going prices. These types of products are what maple products will typically be competing with in-store. Maple syrup is a unique and beloved ingredient that is well known to be more expensive to use than cane sugar or corn syrup, so the use of maple in a product should be prominent in the packaging concept and marketing in order to justify the product cost to the consumer. Get creative and think about what might encourage a conscious consumer to pay top dollar for your product rather than attempting to compete with mass-produced goods that utilize cheaper ingredients and have a much greater economy of scale.

A few factors to consider that are not accounted for in this list include: marketing costs, marketing labor, product delivery/shipping, product loss, and samples. While these factors are important to figure into your pricing, they are highly variable and will not be covered in this section.

Michael Farrell developed a set of Excel spreadsheets for pricing maple products called the Maple Products Pricing Guide. It includes interactive spreadsheets for pricing: syrup, candy, cream, granulated sugar, cotton candy, and soda. These spreadsheets are available for online use or for free download on the Cornell Maple Program website, Maple Calculators page (https://blogs.cornell.edu/cornellmaple/cornell-maple-calculators/).

Understanding Shrinkage

Shrinkage refers to the change in volume from the syrup started with to the end product (cream, candy, or sugar). This volume change is due to water loss during the production process in which the sugar concentration is increased through cooking and evaporation of water. °Brix is defined as the percentage of solids in a solution by mass, g sugar / g water for example. At 66 °Brix, 34% of the mass of a solution is water, so in a 100 g sample of syrup, there are 34 g of water, or in a 1 lb. sample, there are 5.44 oz. of water. If that syrup is boiled up from 66 to 88 °Brix (typical for cream), it has gone from containing 34 g of water in a 100 g sample to 9 g of water in a 75 g sample. The mass was reduced by 25% through water loss which is how the sugar content was concentrated and °Brix increased. The table below shows the change in mass from syrup to other higher °Brix products:

Mass of Syrup used (66 °Brix)	Mass of resulting Cream (88 °Brix)	Mass of resulting Candy (93 °Brix)	Mass of resulting Sugar (100 °Brix)
1 lb. (16 oz.)	12.00 oz.	11.36 oz.	10.56 oz.
100 g	75 g	71 g	66 g

Using the values in this table, you will find that the resultant mass of maple cream is 75% of the mass of the initial syrup used. For candy, that value is 71%, and for sugar it is 66%. These shrinkage rates are only precise if the syrup used has 66.0 °Brix, but they will be close enough to make good estimates for syrup of any °Brix.

Now let's use shrinkage rates to determine the value of syrup used to make pure maple value added products. Determine the amount of syrup needed to make a given amount of product by dividing the mass of the product by the shrinkage rate percentage. For example, 1 lb. of maple cream divided by 0.75 equals 1.33 lb. of maple syrup to make that cream. Using the going bulk rate of $2.60 / lb. for Golden and Amber syrup, it takes $3.46 worth of syrup to make 1 lb. of maple cream. For 1 lb. of maple candy, 1.41 lb. of maple syrup worth $3.66 is required. To produce 1 lb. of maple sugar, 1.52 lb. of maple syrup worth $3.95 is required

Labor

The cost of labor will depend on the volume of product being made. A good estimate is one hour of work per gallon of syrup converted. One gallon of syrup weighs about 11 lb. 11 lb. of syrup can make 8.25 lb. of cream, 7.81 lb. of candy, or 7.26 lb. of sugar. If the laborer's wage is $15 per hour, the labor cost per lb. of finished product is $1.82 for cream, $1.92 for candy, and $2.07 for sugar.

Packaging, Energy, and Capital Investment

The cost of these factors also depend on the volume of product being made. For this example, we will estimate $1.50 per 1 lb. container on average for cream jars, candy boxes or sugar containers, $0.05 for energy costs to convert one gallon of syrup into value added products, and $0.50 for equipment per pound of value added product processed.

Margins (3 Examples)

Cost to Produce Cream per Pound

Syrup and Shrinkage	$3.46
Labor	$1.82
Packaging	$1.50
Energy	$0.05
Capital Investment	$0.50
Total Cost:	$7.33

Pricing Cream per Pound

Margin %	Margin $/lb.	Retail Price
33%	$2.42	$9.75
50%	$3.67	$11.00
100%	$7.33	$14.66

8.2 Maple Enterprise Business Summary

Please fill out the following form with as accurate values as possible. You may use an estimate when a number is not available.

Please use only financial data related to the maple enterprise. Do not include information from other enterprises, businesses, or personal information

Stephen Childs (retired)
Cornell Cooperative Extension

Part 1. Basic Information for the Last Years Maple Summary

Name_____

Farm Name_____

Date_____

Address_____

City_____ State_____ Zip Code_____

Phone Number_____ Fax_____

Email_____

Other information_____

Part 2: Income Statement

Number of taps _____ Gallons of syrup produced _____

Syrup purchased for resale or processing _____gallons, or _____pounds

Revenue	**Value**
Retail syrup sales	
Wholesale syrup sales	
Bulk syrup sales	
Bulk sap sales	
Retail confections sales	
Wholesale confections sales	
Other maple products	
Other income (maple related only)	
Maple equipment sold	

Expenses (reminder - maple related only - not other enterprise, business or personal)

Fuel - gasoline & oil	
Fuel - evaporate & finish	
Utilities - electric	
Utilities - gas & other	
Fuel pre-purchased for use next season	
Maintenance	
Repairs	
Supplies	
Purchased sap	
Purchased syrup	
Purchased pre-made confections	
Other products purchased for resale	
Insurance	
Interest	
Taxes	
Rent & leases	
Bank charges	
Tap or woods rental	
Advertising	

Special containers	_____
Booth rental	_____
Other marketing	_____
Wages	_____
Payroll taxes	_____
Contract labor	_____
Charitable contributions	_____
Delivery expenses	_____
Dues and subscriptions	_____
Office expenses	_____
Permits and licenses	_____
Postage	_____
Telephone	_____
Travel	_____
Vehicle expenses	_____
Other	_____

Value of operator's unpaid labor (estimated) _____

Value of operator's other family members unpaid labor _____

Value of non-family members unpaid labor _____

General questions about making and marketing maple value added products:

1. Did you participate in a NYS Maple Confections Workshop? ___
2. Following the workshop did your production of confections increase?
3. If yes to #2, by how much? _____
4. Do you expect to make and market more maple confections next year?

If yes, estimate how much. _____

Cornell Maple Program

Section 9

Equipment Information

9.1 Choosing and Using Thermometers

Brian Chabot, Cornell Maple Bulletin 200
Revised (2022): Ailis Clyne

Thermometers are essential tools for producing maple confections. There are several different types of thermometers available and each has advantages and disadvantages. Generally, you want a thermometer to be accurate, have a fast response to temperature changes, and to be easy to read and use without getting your hands or face close to steam or hot liquids.

Types of Thermometers

Mercury-in-glass thermometers have high accuracy and a long history of use. However, they pose a number of disadvantages. They can break and mercury is toxic. They also respond slowly to temperature changes. For accurate reading, your eye needs to be level with the top of the mercury column and, often, close to the thermometer. If the liquid in the thermometer is silver in color, assume it is mercury, unless labeled "mercury-free".

Liquid-in-glass thermometers are similar to mercury-in-glass thermometers in terms of use, but the liquid inside is non-toxic. These have become more widely available as mercury is phased out due to toxicity. The liquid in these thermometers is usually a type of organic alcohol compound that is dyed red for easy reading. These are called "spirit-filled" liquid-in-glass thermometers. They are considered less accurate than mercury thermometers, and are more prone to having the liquid-column split. A simple way to rejoin the liquid column is to gently flick the thermometer or tap the back of the thermometer on the palm of your hand until the liquid runs down the glass column. Be careful to avoid breaking the glass while attempting this.

Bimetallic thermometers, most of which have a dial with a pointer, also have a long history of use. They can respond faster than mercury thermometers, but this depends on the size of the metal tip and the size of the internal bimetallic sensor. If the dial is large enough, some can be read accurately at greater distances than liquid-in-glass thermometers.

Digital thermometers are coming into increasing use. Many have large, clear numbers that can be easily read from a distance. Some have the sensing unit on the end of a flexible cable so that the readout can be some distance from the point of measurement. Many reach a stable temperature faster than liquid-in-glass thermometers.

The sensing unit in digital thermometers is either a thermocouple or a thermistor. A thermocouple consists of two different metals that, when in contact, generate an electric current or voltage that can be interpreted as a specific temperature. A thermistor has a resistance to electricity that is then associated with the temperature readout. Both work well and differ mainly in the cost of the electronics needed to measure the change in electric current.

Infrared thermometers are designed to measure temperature at a distance by measuring the infrared energy given off by a surface. Steam interferes with the measurement, and when boiling syrup for confections, you really need the internal temperature of the syrup. They can be useful for measuring the temperature of a product without opening it, measuring a cooling liquid that is not giving off steam, and for specific confectionary applications, such as tempering chocolate, for which an instant read is desirable.

This thermometer should be held as close as possible to the substance being measured, and at perfectly perpendicular angle for accurate reading. Holding the thermometer far away or at an off-angle increases the size of the area being measured. This means, the area being read could include the cold bowl holding hot syrup, or even a cold stainless steel countertop. The thermometer reads the average temperature of the area being measured so this could drastically alter results, and impact the quality of confections. Note that the red laser is not a sensor, but just a visual guide for where the sensor is pointed.

Candy thermometers can be any of the above types of thermometers, except infrared. They are designed to be left in boiling syrup and the best ones come with a clip to attach them to the side of a pot. Some digital candy thermometers come with an alarm setting that will provide an audible alert when a particular temperature is reached.

Performance

There are several aspects to consider when buying any thermometer, but especially digital units. One is resolution, which is the smallest unit of measure the instrument is capable of detecting and displaying. You need a minimum resolution of 1 °F, e.g. 200 °F. A higher resolution thermometer might read tenths of a degree (0.1 °F), e.g. 200.3 °F. Higher resolution than this is wholly unnecessary for making confections. A second factor is the designed accuracy of the unit, which is described as ± (plus or minus) a certain number of degrees. This reflects the quality of the electronics. An accuracy of ±2 °F means that the difference between the reading and the true temperature of what is being measured may

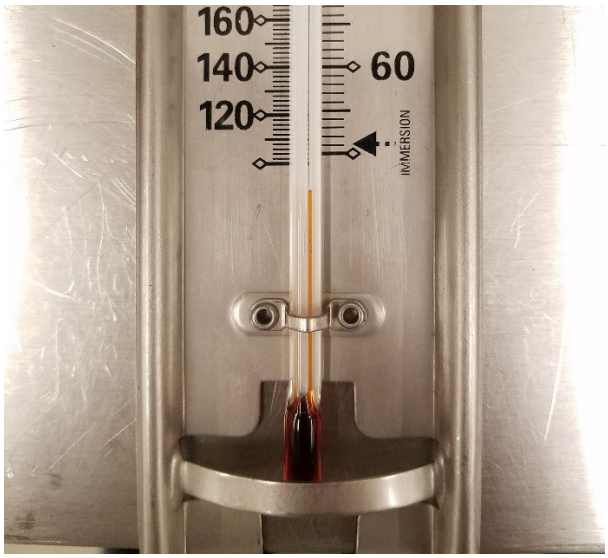
be up to 2 °F (also described as an “acceptable error” of up to 2 °F). A thermometer may have high resolution, but low accuracy. Look for both of these performance measures in the technical specifications of a unit. Ideally, you want a thermometer with higher accuracy than its resolution; a thermometer that reads out in tenths of a degree with an accuracy of ±0.05 is a very good thermometer (and probably more expensive).

Speed of Response

A third issue to consider is how fast the thermometer reaches a final temperature. Some digital thermometers can reach a final temperature in as little as 3 seconds, though 15 seconds is a more typical response rate. Compare this to several minutes for liquid-in-glass thermometers. Fast response thermometers are often called "instant read" thermometers and are favored by professional chefs who use a single thermometer to quickly get the temperature of different foods being prepared. Not all digital thermometers have a fast response. A thermometer with a small measuring tip will give a faster reading than one with a large measuring tip. In digital thermometers, the electronics determine the speed of response; thermocouple sensors are faster than thermistors. Note that read out speed may be faster than response speed; a digital thermometer may update its display with new readings faster than it can reach a final temperature.

Immersion Depth

All thermometers are calibrated so that a certain length of the measuring stem must be immersed in the liquid being measured. Most thermometers have some indication of where that measuring depth is. Many people assume that only the red bulb of a candy thermometer needs to be immersed for an accurate reading, but this is not always the case (see pictures below). Incorrect immersion depth will produce incorrect readings. There may be situations where the liquid is too shallow to properly immerse the measuring tip without the thermometer touching the bottom of the pan. In this case, you must use a smaller diameter pan, or frequently tilt the pan to fully immerse the thermometer’s measuring tip and get an accurate reading. Foam or bubbles on top of maple syrup can make it hard to see if the thermometer stem is properly immersed.



Accuracy and Calibration

No thermometer can be trusted to be absolutely accurate. Some thermometers can be purchased with a calibration certificate which states how the actual reading compares with the true temperature. Usually these thermometers are quite accurate to start with and calibration serves as a quality check.

There are two ways to calibrate a thermometer. One way is to measure the "ice point" which should be 32 °F or 0 °C. The ice point is the temperature of a mixture of water and crushed ice. For best results, both the water and ice should be sourced from distilled water, but tap water and ice can get you close. The best way to calibrate thermometers for confection making, however, is to measure the boiling point of water (usually 212 °F or 100 °C). Bring water to a hard boil and immerse the measuring tip in the center of the water. This method is better suited to confection making because with confections you are typically dealing with high temperatures. Not all thermometers can be calibrated. For thermometers that cannot be calibrated, simply keep a record of the temperatures they read at the boiling and/or ice points. Adjust readings by the number of degrees off they are from these calibration points.

Furthermore, thermometers should also be tested for repeatability. Repeatability is a measure of how consistently an instrument can read a known calibration point. If the thermometer has low repeatability, beyond the accuracy "error bars" in the design, it should be replaced with a new unit.

Example Technical Specifications for a Digital Thermometer

Range	-58 to 572°F (-50 to 300°C)
Accuracy[1]	±1.8°F (±1.0°C) from -4 to 248°F (-20 to 120°C) ±3.6°F (±2.0°C) from -58 to -4°F (-50 to -20°C) / 248 to 392°F (120 to 200°C) ±5.4°F (±3.0°C) from 392 to 572°F (200 to 300°C)
Time Range	Countdown settable to 99 hours, 59 minutes
Alert Volume	92dB
IP Rating[2]	IP65 (excluding probe connector)
Operating Range[3]	32 to 122 °F (0 to 50 °C)
Resolution	0.1°
Units	°C/°F switchable
Sensor	Thermistor
Battery	2 x AAA, 5000 hours
Dimensions	5.94 H x 2.75 W x 0.75 D inches

[1]Note that the accuracy varies for different temperature ranges. For maple confection making, it would be important to note that the error changes from ±1.8° to ±3.6° at 248°F.

[2]The first digit of an IP rating indicates dust resistance, while the second indicates moisture resistance. Here, 6 means totally dust-tight, while 5 means protected from low pressure jets of water (water resistant), but not submersible.

[3]Operating range refers to the acceptable temperatures of the room the thermometer being used in – not the temperature of the substance being measured.

9.2 Calculating Invert Sugars

Catherine Belisle, Ph.D. (2022)

Information for how to measure glucose using a diabetic meter (glucose meter), including how to dilute syrup before measuring, types of glucose meters, and accuracy of glucose meters can be found in **Section 2.1**. This section reviews the procedure for calculating the conversion from glucose meter reading to invert sugar level (% glucose and fructose) and is followed by a conversion chart for quick reference (**Section 9.3**).

To calculate mmol/L:

The millimole/liter or mmol/L is a unit of measure used to calculate the invert sugar levels based on the molecular weights of glucose and fructose sugars.

$$Invert\ \% = \frac{(L\ \times \frac{mole}{1000\ mmol} \times \frac{liter}{1000\ mL} \times M \times V_{sol})}{V_{syrup} \times PS_{syrup}} \times 100$$

Where:

M = Molecular mass of glucose (180 g/mol) and fructose (180 g/mol)

L = Output of the blood glucose monitor (mmol of glucose / L of solution)

V_{sol} = Volume of the solution (mL)

V_{syrup} = Volume of syrup used (10 mL is considered a constant value)

PS_{syrup} = Specific mass on the syrup at 66 °Brix, meaning 1.3248 g/mL

By substituting the constant values, we obtain:

$$Invert\ \% = 27.174\ \times\ 10^{-4}\ \times\ L\ \times\ V_{sol}$$

To convert mmol/L into mg/dL:

Some glucose meters report values in mmol/L. To convert mmol/L to mg/dL, multiply the mmol/L value by 18. For example, a 10 mmol/L reading is equivalent to 180 mg/dL reading.

$$\frac{10\ mmol}{L} \times 18 = \frac{180\ mg}{dL}$$

In this example, the diluted syrup has 180 mg of glucose per deciliter of syrup and water mixture. For reference, 100 mL is equivalent to 1 dL.

To convert mg/dL to glucose (%):

To measure mg/dL of sucrose in maple syrup, 10 g of syrup is diluted in 90 g of water. This is a 1 in 10 dilution or a 10 % dilution. Therefore, to convert a reading in mg/dL to glucose percentage, we must first multiply the mg/dL reading by 10 % or 0.1. For reference, one mg/dL is equivalent to one g/L.

$$\frac{20\ mg}{dL} \times 0.1 = \frac{2g}{L}$$

Now that we have accounted for the dilution, we can calculate the percent glucose. Percent is a unit of measurement for density; 1 percent is equal to 10 g/L. Therefore, we can multiply the g/L by 0.1. The resulting value is the percentage of glucose.

$$\frac{2\ g}{L} \times\ 0.1 = 0.2\ \%\ glucose$$

To convert glucose (%) to invert (%):

When sugar is inverted, each sucrose molecule "inverts" or separates to form one glucose molecule (180 g/mol) and one fructose molecule (180 g/mol). In the previous calculation, we calculated the glucose percentage; since glucose and fructose have the same molecular mass, to get the total percentage of glucose *and* fructose we can multiply the glucose percentage by 2. The resulting value is referred to as the invert percentage. This percentage represents the amount of invert sugar present in the solution, with a maximum of 66% in a 66 °Brix syrup.

$$0.2\ \%\ glucose\ x\ 2 = 0.4\ \%\ invert$$

9.3 Glucose Meter Readings Conversion Chart

(Europe) mmol/L	(US) mg/dL	mg/L	1 in 10 Dilution Glucose (%)	1 in 10 Dilution Invert (%)
1.1	20	200	0.20	0.4
1.7	30	300	0.30	0.6
2.2	40	400	0.40	0.8
2.8	50	500	0.50	1.0
3.1	55	550	0.55	1.1
3.3	60	600	0.60	1.2
3.6	65	650	0.65	1.3
3.9	70	700	0.70	1.4
4.2	75	750	0.75	1.5
4.4	80	800	0.80	1.6
4.7	85	850	0.85	1.7
5.0	90	900	0.90	1.8
5.3	95	950	0.95	1.9
5.6	100	1000	1.00	2.0
5.8	105	1050	1.05	2.1
6.1	110	1100	1.10	2.2
6.4	115	1150	1.15	2.3
6.7	120	1200	1.20	2.4
6.9	125	1250	1.25	2.5
7.2	130	1300	1.30	2.6
7.5	135	1350	1.35	2.7
7.8	140	1400	1.40	2.8
8.1	145	1450	1.45	2.9
8.3	150	1500	1.50	3.0
8.6	155	1550	1.55	3.1
8.9	160	1600	1.60	3.2
9.2	165	1650	1.65	3.3
9.4	170	1700	1.70	3.4
9.7	175	1750	1.75	3.5
10.0	180	1800	1.80	3.6
10.3	185	1850	1.85	3.7
10.6	190	1900	1.90	3.8
10.8	195	1950	1.95	3.9
11.1	200	2000	2.00	4.0
11.4	205	2050	2.05	4.1
11.7	210	2100	2.10	4.2
11.9	215	2150	2.15	4.3

(Europe) mmol/L	(US) mg/dL	mg/L	1 in 10 Dilution Glucose (%)	1 in 10 Dilution Invert (%)
12.2	220	2200	2.20	4.4
12.5	225	2250	2.25	4.5
12.8	230	2300	2.30	4.6
13.1	235	2350	2.35	4.7
13.3	240	2400	2.40	4.8
13.6	245	2450	2.45	4.9
13.9	250	2500	2.50	5.0
14.2	255	2550	2.55	5.1
14.4	260	2600	2.60	5.2
14.7	265	2650	2.65	5.3
15.0	270	2700	2.70	5.4
15.3	275	2750	2.75	5.5
15.6	280	2800	2.80	5.6
15.8	285	2850	2.85	5.7
16.1	290	2900	2.90	5.8
16.4	295	2950	2.95	5.9
16.7	300	3000	3.0	6.0
17.2	310	3100	3.1	6.2
17.8	320	3200	3.2	6.4
18.3	330	3300	3.3	6.6
18.9	340	3400	3.4	6.8
19.4	350	3500	3.5	7.0
20.0	360	3600	3.6	7.2
20.6	370	3700	3.7	7.4
21.1	380	3800	3.8	7.6
21.7	390	3900	3.9	7.8
22.2	400	4000	4.0	8.0
22.8	410	4100	4.1	8.2
23.3	420	4200	4.2	8.4
23.9	430	4300	4.3	8.6
24.4	440	4400	4.4	8.8
25.6	460	4600	4.6	9.2
26.7	480	4800	4.8	9.6
27.8	500	5000	5.0	10.0
28.9	520	5200	5.2	10.4
30.0	540	5400	5.4	10.8
31.1	560	5600	5.6	11.2
32.2	580	5800	5.8	11.6
33.3	600	6000	6.0	12.0

Cornell Maple Bulletin 204 (2007)

9.4 Exercise Caution When Making Maple Confections

by STEPHEN CHILDS

Revised (2022): CATHERINE BELISLE, Ph.D. and AILIS CLYNE

Background

Although maple sugar, maple cream, and any number of other maple confections taste great and offer greater income opportunities for maple producers, getting injured in the process of making them is no treat. Making maple confections involves handling very hot and very sticky sugar solutions. This combination of hot and sticky can lead to very painful and debilitating injury in the event of an accident. As we work towards having maple producers making and marketing more maple value added products, we want to also ensure that people are not injured in the process. This article will outline worker safety information to help maple producers avoid costly mistakes. The food service industry experiences the highest number of burns of any employment sector - about 12,000 each year. Cooks, food handlers, and kitchen workers are all listed among the top 50 occupations at risk for on-the-job burn injuries.

Likely Causes of Burns

Burns in the food service industry usually occur when:

- Safety rules or standard operating procedures (SOPs) have either not been developed or are being ignored.
- Shortcuts are taken in the interest of saving time or expense.
- Persons become too familiar with their job and take unnecessary risks.
- Workers are ill, tired, or otherwise compromised and unable to concentrate.

Burn injuries to maple producers can result from contact with:

- Hot syrup or liquids.
- Steam from cooking.
- Steam that arises from the crystallization reaction when stirring sugar.
- Hot finished products, such as syrup, candy, or granulated sugar.
- Hot surfaces, e.g., stoves, ovens, pans, open flame, thermometers, utensils.

Protecting Yourself

Clearly there are a number of ways burns can result. Fortunately, there are a number of ways to avoid these potentially dangerous situations. So what can you do to protect yourself and your workers? It is important to insist that each operator follow a safety dress code.

Some suggestions for dress code are as follows:

- Wear protective gloves or mitts, a non-absorbent apron, and eye protection when moving containers of hot syrup.
- Wear substantial non-slip, close-toed shoes or boots.
- Wear long pants that fully cover the legs.

Setting Up a Safe Environment

In addition to protecting yourself and your employees with personal protective equipment (PPE), it is important to create and maintain a safe work environment. There are several things you can do to ensure a high level of safety in the workspace.

Exercise Caution When Making Maple Confections

Suggestions for a Safe Environment:

- Avoid reaching over hot surfaces and burners. Use barriers, guards, or enclosures to prevent contact with hot surfaces.
- Read and follow directions for proper use of gas and electrical appliances.
- Keep pan handles out of walkways and away from heat or flames of burners.
- Open lids away from you to let steam escape safely.
- Have a water source nearby to immediately cool skin exposed to hot products.
- Have a phone immediately available in the event of an emergency.
- Be familiar with basic first aid actions to take in the event of an accident.
- Have a current first aid kit readily available as well as emergency phone numbers.

Burn injuries can result in large losses of time and money, in addition to tremendous pain and suffering. If you have employees working on maple confections, be sure to increase employee awareness of the dangers through thorough orientation and ongoing safety training. Employers have the primary responsibility for protecting the safety and health of their workers.

Precautions in Using Electrical Equipment

When using a mixer, blender, or other power equipment in making maple confections, please remember to follow these rules:

- Never put a hand or any other inappropriate object other than food into a blender, mixer, or other power equipment.
- Unplug and turn off equipment when not in use.
- Do not wear loose clothing or jewelry that has the potential to catch in any piece of equipment. Special care needs to be taken with apron strings.
- Make sure long hair is tied back securely and out of the way.

In the event of a burn, your *first priority* is to *stop the burning process* and *cool the burned area quickly*. Hot syrup should be removed immediately from the skin by removing any syrup soaked clothing and immersing skin in cool or tepid running water. Never apply ice or ice water to a burn. The faster you stop the burning and cool the skin, the better. This will limit injury and reduce pain.

Burns and Scalds

The three types of burns:

- *First-degree burn*: In minor burns and scalds, the skin becomes red.
- *Second-degree burn*: If blisters form, the burn is more serious. Seek medical attention.
- *Third-degree burns*: In the most severe burns, the skin may be burnt away. Skin may appear white or charred. If nerve endings are damaged, there may be little pain. Call 911 for emergency service, and call for a family member or friend who may be nearby for assistance. The victim should be rushed to hospital.

Consult with a physician for treatment methods.

Emergency response training for at least one regular staff member is recommended.

Cornell Maple Program

Section 10

Marketing Maple Products

Introduction to Section 10 Marketing Maple Products

Ailis Clyne (2022)

The following four fact sheets were published in 2007, and while the basic wisdom around marketing doesn't age, these fact sheets do not go into detail about online marketing tools. **Section 10.5** is a new addition to this Notebook and covers some of the basics of using social media for marketing purposes. Social media is becoming increasingly important as a marketing tool. For an in-depth learning experience, Cornell Small Farms offers the course, *BF 205: Social Media & Online Marketing* .

Additionally, it may be helpful to develop a farm website, especially if you intend to make online sales. Etsy is free and easy to set up, but 5% of every transaction is charged for hosting your online shop. Squarespace, Wordpress, and Shopify are three very popular website building and hosting companies that make it easy to conduct e-commerce (online transactions). They each have different pricing plans, some of which have 0% transaction fees. Instead, you may choose to work with a web developer to build your website from the ground up, and/or with a web designer who can make your website stand out and communicate your brand image.

Make sure to create a free business listing with Google Maps, or "claim your business" if a listing already exists so that you can edit your hours, services, and more. Wherever you list your hours, whether that be Facebook, your farm website, or elsewhere, be sure to keep them up to date.

There is so much to learn when it comes to online marketing and sales. Look out for learning opportunities with Cornell Cooperative Extension and Cornell Small Farms.

Cornell Maple Bulletin 100 (2007)

10.1 Developing Your Brand

by TARA GUSTAFSON and BRIAN CHABOT

What is a Brand?

What does a brand mean to you? What are some of the most prominent brands that come to mind? A brand ultimately serves to create an image in a consumer's mind. With an image, comes a consistent recognition on the part of the consumer. And with that recognition comes added value. The American Marketing Association defines a brand as "a name, term, symbol, or design, or a combination of them, intended to identify the goods and services of one seller or group of sellers and to differentiate them from those of competition."

Vermont maple producers have worked hard over many decades to connect "Vermont" with high quality pure maple products. Vermont has become a preferred brand for maple products in the minds of many consumers.

The brand image you develop will embody everything your product is – it will portray your product in just the right way to your target consumer. A brand is more than the name of your company. The values that you build into your brand can be a major way to distinguish your products from those of other maple producers. As such, over time and with continued perseverance, the brand image you develop could do more for your business than you may have ever thought possible.

Why Develop a Brand?

Competition is typically the driving force in creating a brand image for your business. How do you stand out next to other maple syrup brands? However, competition is not always the only reason to develop a brand. For example, it may be in your best interest to create a brand that promotes your industry. In doing this, you may want to establish in the mind of your customers an association between quality maple syrup and New York, the Adirondacks or the Catskills. In both cases, your brand would not only promote your position amongst your competition, but also promote the maple industry as a whole. "Pure maple syrup" is a brand protected by federal and state laws. As more people begin to recognize the quality differences in your syrup and that generic syrup down the aisle in the retail grocery store, you should begin, with time, to see profits rise as a result of your clear brand image and increase in loyal customers.

A brand is your reputation. Even if you only sell syrup in bulk, you should pay attention to the reputation you develop with bulk purchasers. Also, use of generic packaging can make your products susceptible to what other producers who use the same packaging are doing. Having your own brand is a mark of quality that you control.

Brand Equity

A brand name is important to a business or a product because it creates brand equity. This means that a brand contributes something to your product beyond what the actual product itself offers. Brand equity includes all of the values you expect consumers to find in your products or business. It is worth repeating that a brand is more than a name. Thus, a brand image provides you with both a competitive advantage and also puts your product at an advantage in the marketplace because consumers are often willing to pay more for a product with brand equity.

How to Create Brand Equity

How to Create Brand Equity

Brand equity is the result of a great deal of careful thought and action.

1) First, you must develop brand awareness in your customers. The consumer should have a positive association with your product. This is the start of a truly successful brand identity.

2) Next, you need to give the product a brand identity. For example, maybe your syrup is renowned for its outstanding flavor, or the area in which it is produced, or the family business you have developed around it. Whatever makes your syrup special to your customers is probably what you will choose to emphasize in creating a brand identity for your product.

3) Now, you want to change consumer behavior. This is the point at which consumer's change their behavior and respond to the identity and meaning of the brand now associated with your product. To achieve this point, you must have effectively conveyed a positive association with your product. With this change in consumer behavior, you can, with time, reach the fourth step.

4) Ultimately, your goal is to establish an intensely loyal consumer-base. Usually, a deep psychological bond is established in this step between the consumer and the brand, and this is the foundation for the loyalty found in consumers of your brand. Maybe, as a child, a person develops a strong connection with your syrup and the brand that you have developed. Maybe your syrup, and the brand image you've developed, reminds the child of family values, rich flavorful syrup, or the outdoors. Whatever it is, your brand sticks in their mind, and the positive associations they have developed with your product have formed in the mind of the child and are now still present in the mind of the adult. It is your job to promote this – to establish those positive connotations in the consumer's mind that withstand time and last, hopefully, for decades into the future.

Creating the Brand

Now you understand the process and reasons for creating a brand and its implications for your business over time. But how do you establish those positive connotations in the mind of the consumer? One of the first steps in doing this is to choose an appropriate and effective brand name.

Qualifications of a Good Brand Name

Qualifications of a Good Brand Name

1) Keep it simple, easy to pronounce and remember

2) The name should convey positive values and images to the consumer. For example Finger Lakes Finest, Sugarbush Hollow, and Sprague's Maple each convey a different image or set of values.

3) The name should be appropriate for the product. Everyday Syrup does not convey a gourmet image. Manhattan Maple seems out of place.

4) The name should follow legal guidelines. It can't be pure maple or organic if it doesn't meet the legal requirements for use of these terms.

If you include in your brand name "New York" or a region within New York and other producers do the same, you gain the advantage of everyone working together to create brand equity that you can benefit from. This is what Vermont has done successfully. New York is already better known nationally and internationally than is Vermont, though not for maple products. This can change by working together. New York has some place names

that already have significant equity in the public mind: Adirondacks, Catskills, Hudson Valley, Finger Lakes, etc. When you adopt a well-known place name, some of the work of developing brand equity has already been accomplished.

Describing Brand Values

Describing Brand Values

Beyond choosing a brand name, you need to consider what values you want to build into that name because you will need to describe these values to your customers in advertising your products. We will be covering this and related topics in more depth in other articles, but some examples here may help to further understand what the concept of a brand involves.

Wegman's is a successful New York-based food retailer. Wegman's is the family name of the founder and current owners. Wegman's has become known for high quality and diverse products and a particular shopping experience from the displays, organization, and services in their stores. This is the customer experience part of the Wegman's brand. They also treat their employees well and have become known for this by their customers. Slogans "Food You Can Feel Good About," "Everyday You get Our Best," and "Making Great Meals Easy" that appear frequently are intended to convey and reinforce all the values the company has developed.

Candy Man has two stores in the Adirondacks selling candy, coffee, and specialty food products. Their logo, Candy Man Hand Made Adirondack Chocolates, describes well the main focus of the company. Their reputation for high quality products is spread through direct customer experience in store locations that attract many tourists.

Ultimately, brand value rests on the experience that customers have with your products and your business. Your company name, slogans, word and picture images all serve to reinforce and remind customers of favorable experiences with your business and its products.

Cornell Maple Bulletin 103 (2007)

10.2 Creating a Logo

by TARA GUSTAFSON and BRIAN CHABOT

What is a Logo?

A logo is a graphic design that customers use to quickly identify your products and that you use to convey some of the values of your products or business. It represents your brand, but is not a brand by itself.

Logos can be simple or complex. Sometimes a logo is only the company name using a particular style of font or color lettering. Examples would be Coca-Cola or Xerox. Sometimes a graphic design becomes the major company logo, as in the Mercedes circle and star or the apple with a bite missing for Apple Inc. The Cornell University logo consists of an emblem and the Cornell name in particular font style.

I Need a Logo: Now What?

Unless you are skilled as a graphic artist, I recommend that you work with someone who has experience in designing logos. The information in this bulletin is to give you some background for interacting with the designer.

It can be difficult, in the beginning, to decide what you need to represent in your brand. For starters, what will your business name be? What font should the name be? Perhaps you are wondering if color would add much, and if so, what color should you use? Here, we will describe to you some of the basics in designing *a logo*.

Your logo should be able to be used in many ways and not designed with one use in mind. For example, could your logo be placed in a black and white newspaper ad? Would it be functional as a letterhead on paper? This does not mean that your logo must fit all contexts, but instead you should decide what exactly it is that *you would like to do* or *might need to be able to do* with your logo.

Goal

Goal

The goal is to create a logo that is appropriate for the product, uniquely recognizable, memorable, and flexible in various contexts.

You are creating a logo that conveys everything that you want your brand to represent in the consumer's mind. It is part of positioning your brand in the consumer's mind and helping them to remember your business and its products.

What Goes Into a Logo?

Parts of a Logo

1) Logotype – This usually is the name of your company or brand shown in a font (letter) style. The font style will be used consistently whenever the company name appears on a label, in an ad, or on letterhead. Some logos use only the company name.

2) Icon – This is a graphic design of some sort. Maple leaves, sugar house, and forest scenes are common maple logos. Whatever you decide your icon is, the most important thing to keep in mind is it is your own and should not closely resemble other similar products' logo. It should be unique and distinctive. Distinctive icons, such as the Nike "schoosh" can represent a brand with no words at all.

3) Slogan – This is usually your pitch and can be optional. What makes your product special? What did you decide you wanted the consumer to associate with your brand? Quality? Friendly service? Organic? Location? This would be the brief statement you have designed to encompass these aspects of your product – for example, "Quality so great you'll just *KNOW* it comes from the Adirondacks." Even if you have a slogan, it is not always necessary to include it.

Considerations

Now you have decided on a name for your brand and understand the components of a good logo, but now what? Do you simply use that name, surround it with some graphic, slap on a slogan and call it a logo? NO. There are various elements of good design that you should consider in designing your logo.

Font, color, size, and placement, for example, are all important aspects of a logo that contribute to the appropriateness of the logo. Some colors, for example, may already be positioned in the consumers' minds. Yellow and red (combined), for example, may remind consumers of the fast-food chain McDonalds, and thus these colors may bring up associations in the consumer's mind of a certain type of food, speedy service, or a corporate business. As you can see, considerations such as these are important in designing your logo.

Font Considerations

Font for Logotype

It is important that the font for the name is appropriate and fits nicely with the icon you design to represent your brand. The logotype should be distinctive and appropriate for the

products, but should not distract from the icon and the product itself. The font should be clear and easily readable.

As mentioned earlier, it is important that the font is flexible and can be used in a variety of media. This means it should easily lend itself to being placed on a product, in a newspaper ad, on an internet website, or perhaps even on a T-shirt or some other marketable product that you may develop in the future. Thus the font itself, its size, color, and placement should be quite flexible. If you are printing your own labels from a computer, you will have a more limited font selection than will a commercial printer.

The font should correspond to how you and your consumers view your company and its products. Informal? Luxurious? Crisp and clean? However you have decided you would like your brand to be viewed, your font should reflect this – a personality of sorts. Perhaps caps should be used or all lowercase letters or a mixture. Maybe italics or bold type fits your brand. In general, simple, clean fonts will work better for maple products. For example: **Maple**, Maple, **MAPLE**. Delicate fonts with flourishes or dramatic style, for example *Maple*, Maple, **Maple**, may be less representative of a traditional food product.

Cornell University settled on Palatino as the font style to be used on letterhead, signs, and diplomas. Palatino was chosen for its classical, conservative, dignified characteristics.

Ultimately what is important in choosing a font for the logotype is that it works over *time*. This requires some foresight to ensure that the logotype will not become outdated by changes in what your customers prefer.

Color Considerations

Color in Logos

Both the logotype and the icon may incorporate color. But how much color should you incorporate? And what colors are appropriate? Forest green and brown relate well to the woods and to the maple product, but can seem subdued and dull and won't stand out on the shelf. Bright colors, especially reds and yellows attract attention. Colors can affect behavior. Reds and yellows in a restaurant cause people to be in a happier mood and they eat more and faster. Colors used in a certain ratio can become part of the signature of the business. McDonalds uses more red than yellow, Kodak and DHL use more yellow than red. The UPS brown with yellow lettering is closely integrated into the company image because this color combination is not so common. This allows UPS to ask in its advertising: "What can brown do for you?"

Cornell red, as in Big Red, is a particular shade of red on the Pantone color system. This differentiates Cornell red from Ferrari red and Harvard crimson. It is the red we have to use with the Cornell logo and what we chose to link these bulletins with the institution.

From warm colors to bold colors to pastel colors and tinted colors – the range of color choices is essentially endless, and it is up to you to choose a color that fits well with what you are trying to convey. Again, like font, color choices should be appropriate not just for *that time* (a currently popular color fad), but instead *over time*. These are all aspects of color that should be taken into consideration, but use of color is a complex topic about which you should get advice from your designer.

Icon or Graphic

Size of Entire Logo
The size of your entire logo should be flexible. This means that your logo should adapt well to being amplified and displayed on a larger scale or to being shrunk down to fit appropriately into an advertisement or business card. By making your logo flexible, this allows you the opportunity to expand what you do with your brand and its placement in the marketplace.

Placement of Logotype and Icon
The size of the logotype and the icon (and optionally a slogan as well) should be proportional to one another in perceived importance. For example, you should think carefully before making the logotype too large compared to the icon. This does not mean that the icon must be the same relative size as the logotype or vice versa. Instead, the sizes can vary depending upon what you would like to emphasize and be memorable to the customer. It takes effort to get customers to link an icon with your company. In the beginning and maybe for the long run it is best to emphasize your company name.

Perhaps the words in your logotype are more prominent and recognizable than the icon you have created to accompany it. It is also possible that the icon may be what should be emphasized, in which case it may be in your best interest to downplay the logotype size and prominence. Whatever you choose, it is simply important that some thought is put into considering the various sizes of various elements in your logo design.

Review

A Review:
So just to review, here is a list of some key things to keep in mind when designing your logo:

1) Unique
2) Appropriate
- Font
- Color
- Size
- Placement / Arrangement

3) Effective
- Various parts of the logo can work alone
- Memorable

4) Flexible
- In context
- In size
- In color (black & white, partial color, etc.)

» Logo Examples

» Example: Cornell University

For many years Cornell University used as its logo a shield along with Cornell University. The font style and a particular color of red were required. A style manual was created to illustrate all the approved uses of the logo. Then a company was hired to create a new logo. The shield was replaced with a red box with "Cornell" inside it. This lasted only a few years because many businesses from JC Penny to the Copenhagen Airport also adopted a box with the company name. The new Cornell logo was not distinctive and was related to non-university businesses. It was replaced with a slightly modified version of the earlier logo.

» Example: Cornell Pure Maple Syrup

Lew Staats created the first design used on containers for syrup produced at the Uihlein and Arnot Forests. It showed researchers standing at a sap tank and at trees with some other graphics showing research tools and a data graph. Cornell University was in fine print. All of these designs and graphics had little relevance to our major customers, who were visitors to campus. We redesigned our container label using a maple leaf outline to represent the product and Cornell's clock tower as an icon of the university with the university name displayed more prominently. Our main customers like the change.

Cornell Maple Bulletin 105 (2007)

10.3 Brand Awareness

by TARA GUSTAFSON and BRIAN CHABOT

Defined

What is Brand Awareness?

The ultimate goal of most businesses is to increase sales and income. Ideally, you want to attract new customers to your products and encourage repeat purchases. Brand awareness refers to how aware customers and potential customers are of your business and its products. Within a week after its introduction, surveys found that more than 90% of US consumers had heard about the iPhone as a result of advertising and news reports. This is exceptionally high brand awareness. Ultimately, achieving successful brand awareness means that your brand is well known and is easily recognizable. Brand awareness is crucial to differentiating your product from other similar products and competitors.

The Plan

Brand Awareness Plan

The major components of a plan to develop brand awareness are:

- Identifying and understanding your target customers
- Creating a company name, logo, and slogans
- Adding value through packaging, location, service, special events, etc.
- Advertising
- After-sale follow-up and customer relations management

Targeting the right audience is crucial to your success. Of similar importance is understanding that you need a plan along with specific actions that increase awareness of your brand amongst your consumers. Throughout the entire process of creating a brand, it is of utmost importance to consider how what you do will increase brand awareness.

Why is Brand Awareness Important?

You may be asking yourself, is brand awareness really all that important? You may be saying to yourself, I have plenty of customers and sales are decent, why bother? The answer is: There are few things more worthwhile than investing time in your brand's awareness. It can play a major role in purchasing decisions. The reality is, the more aware consumers are of your product and your brand, the more likely they are to buy from you.

Among the challenges faced in selling pure maple products are:

- Do potential customers know you exist?
- Why pay more for Pure Maple vs. an artificial syrup?
- Isn't Vermont maple syrup better?
- Why pay more for your products rather than from a less expensive alternative?

In the future, and for the sake of your business, it is in your best interests to take action to increase awareness of your brand.

The Goal

The Goal

Thus, it is a good idea to draw up a brand awareness strategy that you can continue to update throughout the development of your brand. To begin, for example, you can do preliminary

research to determine how aware the consumers of your brand are prior to any changes. Then, decide what you think and perhaps what others suggest that you might do to increase awareness and public recognition. Next, compose a strategy for how you would like to go about this. For example, perhaps your focus may be on your name, or perhaps the colors people associate with your brand, or even the way in which you promote and sell your products. Finally, decide upon how you would like to execute these changes and increase your brand awareness. Ultimately, you should be able to see a change in how consumers perceive your brand and the level of recognition your brand has acquired. For example, perhaps your consumer base expands to include nearby towns or attract a different core consumer.

Truly successful brand awareness often takes time to develop. First there is the time required to develop an effective awareness effort. Then there is the time required for your message to reach potential customers. A few customers will respond early, but most will take time to hear about your products, make a decision to try them, and even later return for more. Establishing customer loyalty takes the most time, as it requires extended experience with your business and products.

As a result of specific actions, positive brand awareness is promoted. Brand awareness is essentially the impression people have of your brand. Do they know your brand as reliable high quality? As well established and distinctive? As a bargain? How is it that they have formed these perceptions? Perhaps from your logo? Or maybe from the way your products are displayed or priced? These opportunities to make a good impression are what are influencing your consumers' awareness of your brand.

How to Begin Creating Brand Awareness

How to Begin Creating Brand Awareness

How do *you*, over time, establish positive brand awareness that promotes the possibility of purchase of your product in the future? There is always the initial impression of your brand that is of utmost importance. Beyond this, however, are all of the future impressions that may be formed regarding your brand.

In deciding how you will go about creating brand awareness, you need to consider and to be aware of how your product value becomes know to the consumer and the importance of consistency:

1) The message of what a brand is offering to the consumer should be consistent.

Wegmans, for example, offers fresh, high-quality foods for purchase and advertises the advantages, such as home-cooked meals, that their goods can provide for you. The layout of their perishable goods, the organization of complementary condiments and staple products, and the stands offering sample recipes to be cooked at home are all evidence of the company attempting to present a consistent message of what they are all about to the consumer. The presentation of Wegmans as a prominent player in providing quality foods for quality home-cooked meals is evident in each of the aforementioned examples. The company does not, for example, attempt to convey quality in its store layout and offerings and then convey cheap alternative in the mailings sent out. The impressions you hope to make on consumers and potential consumers should be consistent across various mediums, situations, and promotional attempts.

2) Images you present should also be consistent in order to increase brand awareness.
It is important that you are consistent in your use of images so that you maximize recognition and positive impressions. Wegmans logo, for example, can be found on its storefront, on the products it produces itself, on the receipt consumers receive after purchase, on the bags customers carry out of the store, and in many of its distributed informational material.

3) Slogans and taglines should also be consistent throughout mediums and material.
Once again, consistency is important in conveying a message that promotes awareness of your brand in a organized, recognizable manner. Wegmans' tagline, "Helping you make great meals easy", is consistent throughout its promotional materials, website, and logo, to name a few.

Consistency cannot be emphasized enough. It presents the consumer with an image that in the future the consumer can continue to associate with your products. For example, if the materials you distribute, the set-up of your sale table, the packaging of your product, and the logo and tagline are not all relatively similar, regularly consistent, and repeatedly recognizable over time, it is likely you will get nowhere with your brand. Creating brand awareness, through a collaborative, well-developed overall image, is essential to developing a successful brand that achieves maximum benefits.

Maintaining Brand Awareness

Maintaining Brand Awareness
It is important to keep working at the issues and activities identified above. Pay attention to how customers are responding to products, packaging, displays, and messages. Look for ways to improve the image you are trying to get across. Ask your customers for suggestions.

Work to maintain a consistent presence in the market place. This can mean a location and regular times where customers can reliably expect to find you. The NY Maple Producers booth at the State Fair has been in a prime location for many years. They need to move to gain more sales space and will have to have a plan to help customers find their new location. If your business is wholesaling maple products to retail locations, you need to stay in regular and reliable contact with your customers. They should not have to come looking for you when they need to re-stock or they will turn to suppliers that make it easier for them to operate their businesses.

Purchasing Decision Process

Purchasing Decision Process
Understanding the decision-making process helps you to better understand how to structure your brand awareness process. What makes them buy your product? Do they decide, upon an impulse, to purchase your product? Do they need several hours to mull over the possibility of making the purchase? To what extent does product type, price, and environment affect the purchasing decision. Marketing specialists recognize five stages to a purchasing decision.

The first stage in making a purchase decision is to perceive a need. The range, complexity, and severity varies in regard to this need. It could range, for example, from a need to purchase a gift for a friend's birthday to a need to eat something sweet to a need to drink something refreshing. It is easy to see how different containers would appeal to someone thinking about

a gift vs. buying syrup for personal use. Messages with your product display about possible uses can prompt a need-based decision.

The second stage in making purchasing decisions is to seek information. This may be simply reading an ingredient list to an internet search to an inquiring call. Providing information about your products and their value can be important to making a sale. Why is "pure" or "local" important? What flavor experience or possible uses await the purchaser? Might the history and tradition of maple products be important to some consumer decisions?

The third stage is where the potential customer evaluates alternatives to your brand or product. This, obviously, is the stage in which your product is compared to those of competitors. It may also include other products that you may have to offer or other products they remember from the past. Essentially the potential buyer is assessing the qualities of your product that might make it worth the purchase. If the signage, slogans, and literature does not address the more obvious questions, then you need to be ready to do so when asked. If you want to sell at the premium end of the price range then type of products, packaging, display, and product messages must be consistent with the price.

The fourth stage involves an assessment of the buying value. Is the product worth the price? Do the values it possesses make it a worthwhile purchase? This is the culmination of the previous stages and results in a decision to either buy or pass up on an offer.

The fifth and final stage involves an assessment of the purchase decision. This can occur a day, a month, or a year or more after the sale. Essentially, the customer is either reaffirming or doubting their purchasing decision. For example, seeing other people enjoying the product reaffirms their decision or makes them wish they had bought more. Testimonials from satisfied customers may help to shape these after-purchase expectations. Or perhaps they discover an off-taste or crystallized sugar in the syrup, in which case it may be more likely that the person would doubt that they made the correct decision in making the purchase. If the consumer decided not to make the purchase, they may later regret such a decision if the value of that product to them, for example, were to increase.

Understanding that the stages of a purchasing decision vary both in time and whether the stages really are distinct, one can better assess where they might be able to have an influence on someone's decision to purchase. For example, it may help to offer the person more information or to tell them about all the other people that have been really impressed with your product.

Advertising

Obviously advertising is an important way to have your brand and products become known to consumers. This topic is covered more in CMP Bulletin 106 (Section 10.4). Some of the topics covered in this bulletin may be valuable ingredients in external advertising. But the messages conveyed at the place of purchase are equally important and should leave your targeted customers with a consistent impression of your business and its products.

Cornell Maple Bulletin 106 (2007)

10.4 Making Your Brand Known

by TARA GUSTAFSON and BRIAN CHABOT

Background

Here is where you use your brand to hold on to existing customers and to attract new customers. You now have a firm understanding of what a brand is and some background on how to create a solid brand. You also should know who your target audience is for your products. Finally, for your brand to be truly successful, you need to foster positive brand awareness. The question is: How do you create brand awareness? How do you get the word out about your brand?

Public relations (PR) covers all activities used to make your target audience better aware of your business.

The Goal

The goal is to develop a public relations plan for your brand that will increase customer awareness to increase sales and profits.

Beyond advertising and use of the media, public relations includes, for example, the things you do within the *community* to increase awareness of your brand. Maybe it's a charity function that you hold or that is sponsored by your business and brand, or perhaps it's the pancake breakfast that you host to celebrate the end of sugaring. It also includes *all communications* that you have as a representation of your brand – communication with customers, employees, involved family members, other businesses, etc. For example, communication with *employees* can be crucial. Happy and knowledgeable employees are the first step in providing quality service and increased customer satisfaction. This often reflects well upon both the business and the brand you have built. Other businesses, for example motels or bed-and-breakfasts, and visitor's bureaus can inform their guests about your business. Public relations can span a wide range of people and organizations. It's up to you to recognize who these people and groups are that they can be used in your PR plan.

Developing a Public Relations Plan

Who do you begin with? Your target audience is the starting point for developing your public relations plan. In PR, your audience may be broader to include not just your customers, but also all those involved in the business (employees, for example) and others who influence purchasing decisions. For example, school teachers, youth group leaders, newspaper reporters, and radio personalities can influence people to try maple products or to visit your business. PR can encompass others in the industry. Establishing good relations with people in the industry that might be able to offer you help, or perhaps even with your competitors, can also be an asset to you in establishing a good reputation. Media relations, of course, are also of utmost importance. It is these groups that you may need most in promoting your brand and getting your name out there.

What's the plan? The public relations plan involves the methods you will use to get the message about your brand and products out to your target audiences. The methods include use of media (print, radio and TV for paid advertising or news coverage), printed materials (brochures, flyers, posters), signs (permanent and mobile), sponsorships and special events (ex. Maple Weekend, school tours). Advantages and limitations of each of these methods is

covered below. The method should relate to how your target audience usually learns about your business. Bulk syrup sales involve other producers, dealers and wholesalers who keep in touch through industry newsletters and mailing lists. Reaching consumers in metropolitan areas usually requires newspapers, radio, or TV. Reaching a very specific audience, for example public school teachers, may require some research.

Who, What, Where, and When. At this point you should know *who* you are targeting and have an idea of *what* you would like to do and *where*. Now, you need to decide *when* you would like to begin various communication events. Many producers take advantage of the sugaring season to attract customers. Finding out how their food is made is becoming an increasing interest of consumers and news media typically run stories about maple production at this time of year. Special events connected to other seasons (fall harvest, winter woods walks) can be developed. Participating in community festivals and craft shows limits your advertising costs. If you only have weekends available for maple sales, your advertising needs to make this an attractive time for the customers to stop by. Establishing a calendar for the events you plan to attend or create is a crucial step in your PR plan and also helps to assure that you will not slip on continuing to be aware of your reputation amongst various groups.

Advertising and Promotion

Advertising and Publicity

Advertising and publicity are the primary tools used to get knowledge of a brand out to the public. Advertising are messages that you create and distribute. Publicity involves a broader set of methods that include news stories and secondary referrals.

Advertising needs to be *forthright* in conveying information about your brand to a target audience. A good advertising campaign is clear, accurate, attention-grabbing, informative, and often emotional. Ultimately, the hope is to create an emotional attachment to the brand that is both memorable and recognizable.

It is crucial, as has been mentioned before, that you remain very *consistent* throughout everything that you do with your brand, and advertising is no exception. It is important in organizing and creating an advertising campaign that you continue to be consistent in what you are presenting. The message, image, logo, service, and appearance of your place of business and product displays should all convey a consistent image to your customer.

Things to Think About

You should have an idea of how your target audience views your brand right now, and how would you like to be viewed. With advertising, you have the opportunity to change how the public views your brand. This must be done carefully, of course. You need to consider how well you can foster a new view amongst your customers. Is it realistic? Is it likely your customers will respond in the way you want them to? Customers will respond differently to the same message. Emphasizing gourmet qualities, or local, or traditional will attract some customers and not others. Major retailers frequently test several different messages to gauge customer response before they decide on the one they will use. They look at response rate and who responds to different messages.

Once again, it is still important that you maintain consistency in the image you project

throughout everything you do. Also, it is often useful to be able to gauge how successful your advertising campaign is at increasing brand awareness in a positive way. Increased sales is the best indicator. You also could ask people upon purchase or inquiry how it is that they heard about you. You could have a brief questionnaire or encourage customers to share their opinion about your publicity and your business. These methods can give you a feeling for how successful your attempts are at reaching your target audience.

Getting the Word Out

Advertising is defined as a method through which groups or individuals attempt to persuade others of something (an idea, item, business, etc.) through various mediums of communication. These mediums include television, radio, magazines, movies, newspapers, out-of-home media (such as billboards), and the Internet, to name the major modes of communication. Advertisements are often paid, however there are cases in which advertisement space can be provided for free.

Publicity Methods

There are benefits and consequences to each of the various publicity methods. You need to decide which methods best meet your needs and do the most for your brand. Before committing to a particular method, you should get advice from people connected with each media outlet about who their typical readers are and what are the most effective ways to reach the readers or listeners. Pay attention to how other businesses are using these outlets. Print media are prime cases where a logo or ad design can attract attention.

Brochures and information cards can be very cost effective and their distribution can be flexibly targeted to places where potential customers are likely to find them. There are companies that will take responsibility for placing your brochures in hotel and restaurant information racks over a broader region than you could reach yourself.

Newspaper advertisements vary in their *reach*. They can, for example, reach a small local crowd in the local town newspaper such as the *Ithaca Journal* or the national crowd as a whole in papers such as *USA Today* or the international crowd in various shared papers around the world. Newspaper ads are generally not very expensive and as such are often a viable advertising medium for small business. Also, there is often not too much planning required for newspaper ads due to quick production cycles. This medium is reserved primarily for reaching adults since it is adults that often subscribe to and read newspapers. Local Pennysavers and Shoppers are also very common places to advertise and are especially targeted to small towns and rural areas.

Newspapers also provide opportunities for free publicity if you have a newsworthy event or work with reporters responsible for stories relating to food, agriculture, and natural resources use. It pays to become known to reporters as someone willing to work with them.

Magazine advertisements, on the other hand, are much more *targeted*. This is primarily because magazines themselves are often much more specific to their topic and the people that choose to subscribe to them are often much more specified than the broad reach of newspapers. This often results in much higher costs than for newspaper ads. Often, a bit more planning is necessary to place an ad in a magazine since production cycles are often

longer for magazines than those for newspapers. Magazine ads are often a good way to establish a firm, credible reputation.

As in the case for newspapers, magazines have possibilities to include something about your business as part of news items or articles. County and regional tourism guides may be useful advertising sites for certain businesses and special events.

Radio stations have a target audience and cover a defined geographic area. You will need to decide whether the customers you want have a preference for music, news, religious themes, or other themes that stations use to appeal to particular audiences. It does not usually cost too much to advertise on radio, but this depends on the time that you are advertising. The potential negative to radio is that you simply hear the ad rather than reading it or stumbling over it several times as when reading a newspaper or magazine. Visual logos have no role here, but slogans or sound logos (sap dripping in a pail, leaves rustling) can be useful. For this reason, it is often necessary to run the ad several times before the material becomes memorable.

Television advertisements provide another medium, however, the costs are much higher than most other methods. Like radio, variations in price depend both on the time of the advertisement and the number of expected people watching. Also like on radio, it is often necessary for ads to be run several times before they are remembered. Television provides advertisers with a good opportunity to really *show off* what they are advertising in a very visual way.

Online advertising is seeing increased use. Ads on websites, in directories, and within search engines are all viable options, but the list of approaches continues to grow as new developments are made in how people use online information. Usually the costs are relatively low, but they do vary, and most are based upon the number of viewings of the ads (i.e. the number of clicks on a banner). This is a medium that varies in its reach. Ads placed on specific web sites generally reach a targeted audience whereas those on search engines may reach a much broader crowd. Connecting with the NYSMPA webpage, county extension, or a county tourism website can increase exposure at a reasonable cost.

Mailing lists can be very effective. These are the most targeted advertising as the names usually are those who already have shown an interest in your business. Electronic mailing is the most cost-effective and is seeing increased use though you will need to deal with spam filters. Some producers keep in touch with customers through newsletters sent to their mailing list.

Signs can be placed in a large variety of locations from your vehicle and clothing to roadside signs and billboards. These are targeted geographically but not by interests of your target audience. Cost can vary widely for both the service, location and the creation of the ad itself.

Special events both create opportunities to advertise the event and to bring people to a location where you can deal with them directly. Maple Weekend is one example. Maple producers can have open houses throughout the year demonstrating how products are made,

forest walks, or special meals. Newspapers, radio or TV can pick up some special events as news items for some free advertising. Consider collaborating with other local businesses, for example the Culinary Bounty group of restaurants featuring local products. There seem to be an increasing number of craft fairs. Farmers Markets will sometimes sponsor special events where maple can be featured.

Examples

Examples of Getting the Word Out About the Brand/Business

Sugarbush Hollow in Springwater NY is developing the concept of a "community sugarhouse." Located in a very rural area south of Canadaigua Lake, Chuck Winship maximizes his use of "free advertising." He encourages an increasing group of customers to stop by through an expanding series of programs. Special programs include woods walks for forest management, wildlife ecology, and identifying and photographing wildflowers. Food-based events include cooking with leeks, End of Sap Season Ham and Leeks Celebration, and pancake breakfasts. He is advertising these events and his products through mailing lists, a website, word of mouth, and brochures. He sells product and distributes flyers and brochures at farmers markets, craft shows, and high traffic events such as the Rochester Lilac Festival. Chuck gets publicity from making himself available to radio and TV stations for interviews and he provides these outlets with press releases. He uses school tours to connect with kids and parents and provides syrup for local pancake breakfasts in exchange for recognition.

Schoolyard Sugarbush - Sells maple products at the sugarhouse, at Ithaca Farmers Market, and through some special events done jointly with other businesses. Organic sells in the Ithaca market so they have gone through organic certification. They work with an informal cooperative of organic maple producers to help each other with syrup supply and marketing. They have developed an attractive logo and are developing a customer base through direct experience with their product and word of mouth.

Critz Farms near Cazenovia advertises itself as "the place to come for family fun." It is a diverse enterprise with a café and playground, which and sells maple products, dug and cut trees, and other farm products throughout the year. Educational and family recreation activities are advertised through a well-designed website, a large mailing list, newspaper ads, and word of mouth. They keep in touch with customers through newsletters sent four times a year. Matthew and Juanita use TV ads in very selective, targeted ways for fall harvest and Christmas events. They monitor the effectiveness of different advertisements to ensure they bring in customers, not just visitors.

Sprague's Maple Farm draws many new and repeat customers to their integrated restaurant and maple production facility in southwestern NY. The restaurant, advertised with "It's Not Just Breakfast, It's an Adventure!" and "All Season Fun!" is a big draw. They have a very attractive website for visitor information and internet sales which along with a brochure and roadside signs are their most effective methods for continuous advertising. They use a company to help distribute the brochure around the region. They

also use newspaper and radio advertising around special events that will have high enough customer flow to cover the advertising costs. Some special events get picked up as news items for free advertising. Though the business is well-established, Randy Sprague feels that advertising is essential to keep existing customers coming and to connect with potential customers.

10.5 Social Media Strategies for Producers

Lauren Olson, CCE St. Lawrence, 4 August 2021

This piece was originally published on *Fruition*, a blog site by Cornell Cooperative Extension of St. Lawrence County, and is reproduced here with the author's permission. Accessed 8/15/22: https://blogs.cornell.edu/fruition/2021/08/04/social-media-producers/

Social media can be a great tool to use to communicate and interact with current and potential customers. You can post farm updates in real-time with your followers and share what is available for purchase. About 1 in 4 social media users use social platforms to discover, learn, purchase, or recommend products or brands, so it's important to have an online presence.

Here's our tips for best practices to keep your customers engaged online, with examples from area farms and food businesses in the north country.

Post with Consistency

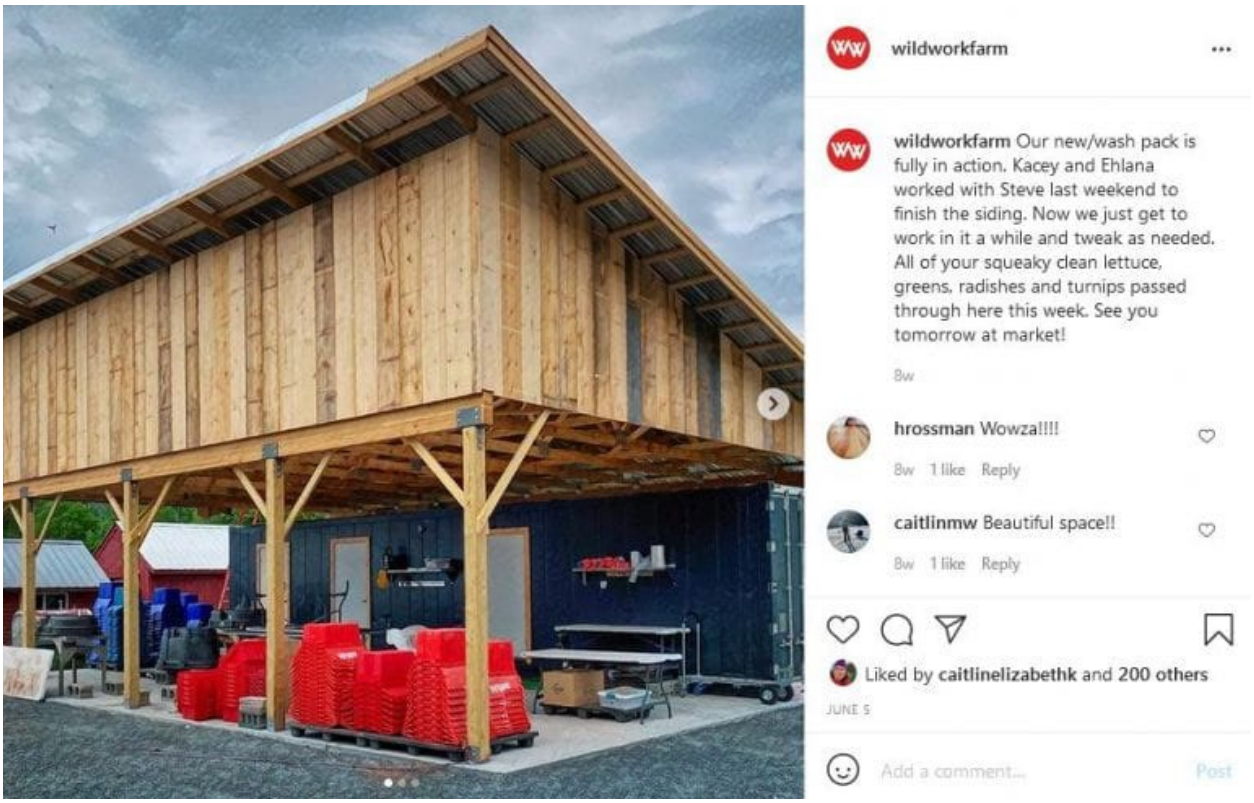
Be active on your account, your followers will notice when there have not been any updates in a while. Share current happenings on your farm or what projects you have

been working on. Having a lack of posts or interaction on social media can be the reason your followers and other potential customers are not seeing your content. With consistent regular posting, you can have customers look forward to seeing you and your farm updates. Try setting goals on posting consistency each week, maybe aim for 2-3 posts to start and then adjust accordingly based on your available time.

Visuals Matter

Use effective Visuals. You have less than 10 seconds to capture the attention of your audience, and photos are a great way to do that. Aim to show something from around the farm, or from your life. Choose images that relate to your messaging and aim for high-quality photos with good lighting. Schedule time during the week to grab images from around the farm that you can stockpile for later use. If you decide to use images from the internet, make sure you are allowed to, there are free stock image sites online.

The post below from Wild Work in Keene Valley, frames their wash/pack building from a striking angle while also tying it's completion into the value it will have for customers. While it's clearly a work space, it's tidy and organized which emphasizes their message of high quality products.



Shoot for Product Sales

The goal of using social media for your agricultural business is to increase your sales, not necessarily to gain lots of followers. Make it clear how customers can purchase goods from you, clearly state hours, locations, and specials that you have to offer. Make sure you communicate this often with consumers within posts you make and in the interactions you have online.

Here's a post from Big Spoon Kitchen in Potsdam. Their Facebook post reminds you to check the online menu this week and when you can pick up or get your order delivered.

Develop Your Online Voice

When presenting yourself and your business online, use the voice that you think best represents why you do what you do. Keep your farm identity strong and show that in your social media content. Sharing your farm values and why you produce things the way you do can help in developing your brand voice. According to social media polls, consumers agree that brands need a strong social media presence to succeed in the long run. Loyalty is really important for retaining customers and getting the word out about your products.

In this post from Little Farmhouse Flowers in Keene, she uses a light friendly tone, while still providing concrete details about how they harvest and the way a customer can order for shipping.

Professionalism

Focus on providing clear information to your customers. According to polls, consumers expect a business to respond to their questions within 24 hours, so be timely with responses to inquiries. Respond to consumers with facts, keep it positive and remember to check your grammar.

Tags, Hashtags, Analytics

Use the features of the social media platform:

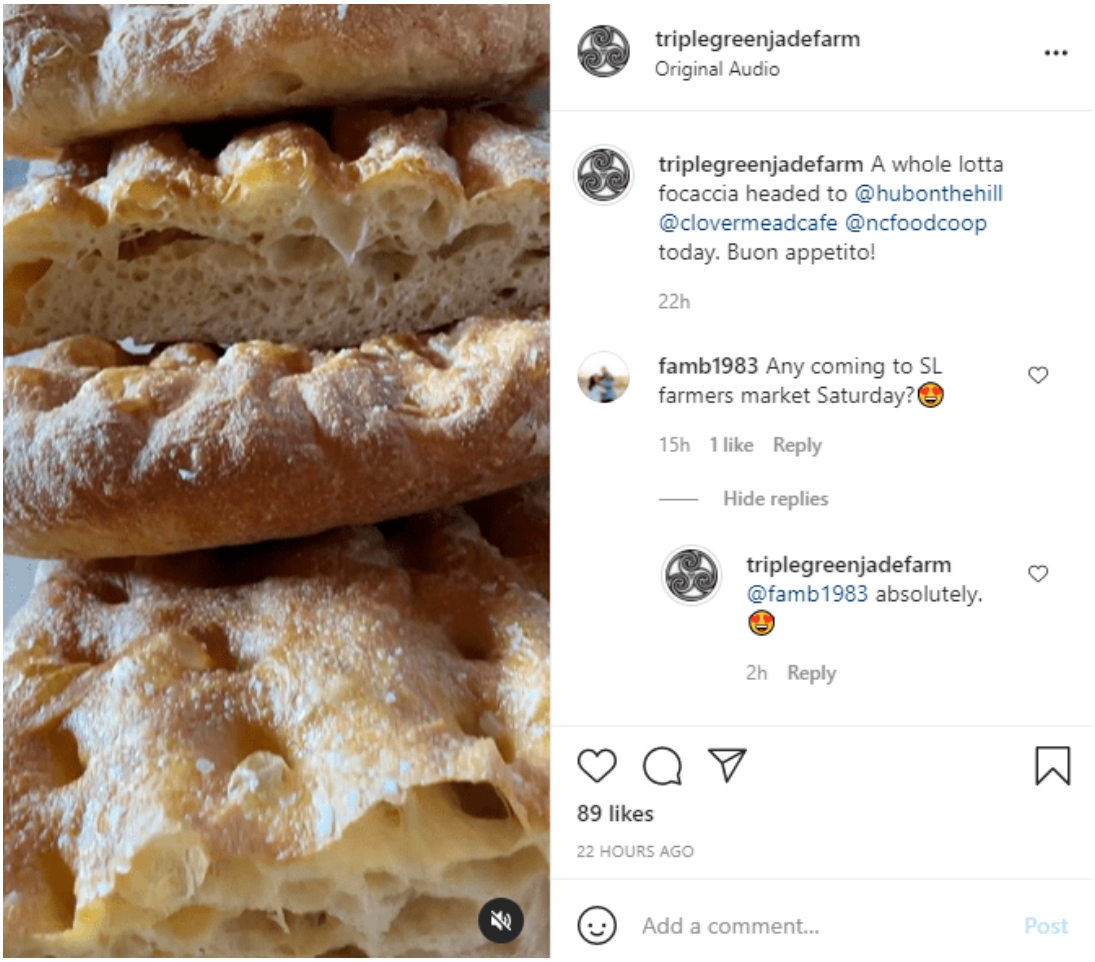
Tagging posts (@): The more the better, do this with community businesses you are at an event with or have collaborated with, and don't forget to tag when you are visiting or dropping products off at a retail location.

Hashtags (#): good for people searching for new things online, think about using hashtags that are not the most obvious and a little more specific. Example – instead of #nyfarm think #nothernnyveggiefarm.

Stories (Facebook and Instagram): posts that will only be up for 24 hours, best for event logistics and live updates or content you don't need on your timeline or grid.

Analytics: check to see how your posts perform and see the views and what content people search for.

Triple Green Jade Farm shares a video about their focaccia bread heading to local retail outlets, and tags the locations.



Engage with the Community

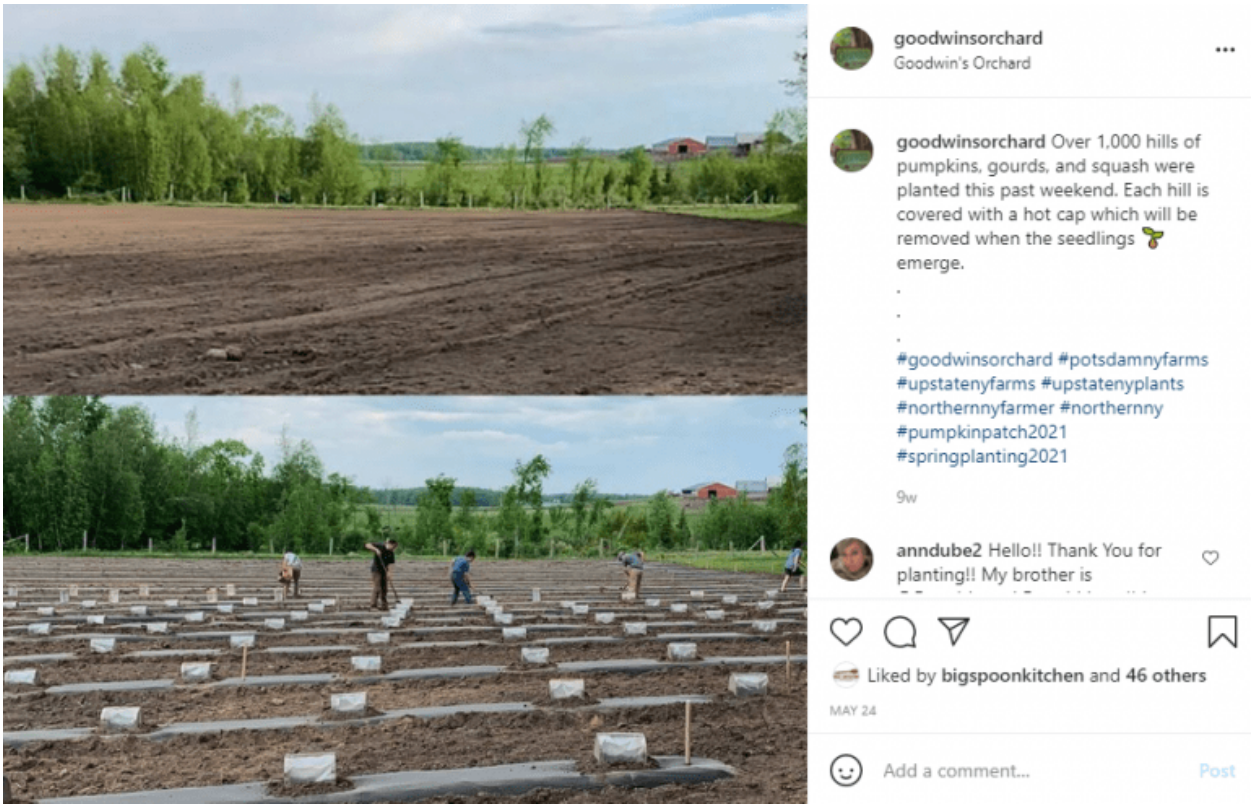
Along with connecting and interacting with current and future customers, it is also important to engage with other producers and organizations within your community. It only takes a few minutes to share other organizations events and add a nice note to the post. It's mutually beneficial and allows you to interact with a potentially new audience that might have some overlapping interests and values. The more that you tag and support other local businesses, the more goodwill generated amongst the group.

The post above from Hidden Pastures Dairy in Glenfield is an excellent example of supporting other local agricultural businesses. It has a peppy introduction, multiple tags, a photo of the cheese curd and a call to action!

On-Farm Content

Show what you do! Video, photos, livestream. Working on a farm provides lots of interesting content, and some of this might be new information to your followers. Share your process of growing or producing food, this lets your customers understand the labor that goes into providing food.

This Instagram post from Goodwins Orchard in Potsdam shows and explains how they plant their squash.



Management Responsibilities

Try setting up just one person to manage the social media accounts, as this will help with keeping the post voice consistent and also help with the timeliness of responses. You can also try having people sign off on each post if you do have multiple people using the account.

Be aware!

- Be aware of platform guidelines and policies – they do change from time to time so stay updated.
- Be aware of who you are posting about and if you have their consent to share their info or photo.
- Stay away from negative comments and complaining. Don't call out competitors, keep it professional and classy.
- What you post online never really goes away, so be aware when posting that it will be up to view for an indefinite amount of time.

References:

Burkett, Kevin, et al. "10 Tips for Farm Social Media." *Land-Grant Press | Clemson University*, South Carolina, 2 June 2021, https://lgpress.clemson.edu/publication/10-tips-for-farm-social-media/

Harris Insights & Analytics LLC, 2020, Sprout Social, https://media.sproutsocial.com/uploads/Sprout-Social-The-State-of-Social-Media-Investment.pdf?email=click&utm_medium=Email&utm_content=GuideTrigger&mkt_tok=NTAxLVBUVy05MzgAAAF-kpzzPRpAnbwIB0QT9tWcAVEdviEvdQ9OyGEuGRSCrtv9eRTk5WuuT6jnca69DRqmGsofDkqKaIt7JyHmEjg5a8A3fZs_365CXfXjZLGu_w

Urquhart, Kristina Mercedes. "Build Your Farm's Brand through Social Media." *Hobby Farms*, 3 Nov. 2020, https://www.hobbyfarms.com/build-your-farms-brand-through-social-media/

Section 11

Regulations

Introduction to Section 11 Regulations

Ailis Clyne (2022)

Section 11 has been significantly updated for the 6th Edition. New federal grading standards have been in effect since 2015 (**Section 11.1**). Producers in all US states must adhere to these federal standards, but each state may have additional standards of their own (i.e., Vermont density standards enforce a narrower range of densities than federal standards). Updated New York State regulations from the Department of Agriculture and Markets are included in **Section 11.2**. The laws reproduced here were sourced from the Cornell University Law School Legal Information Institute whose website provides free public access to laws and regulations for all 50 U.S. states.

In New York, all food processing establishments require a 20-C License, *unless* the type of food being processed qualifies for an exemption. Pure maple products are one such exemption. If you intend to make any products besides pure maple in your facility, you will need a 20-C license (**Section 11.3**). However, depending on the types of products you intend to make and where you intend to sell them, you may qualify for a Home Processor Exemption (**Section 11.4**).

Section 11.5 covers NY sales tax for pure maple products. The tax bulletins relating to this issue have been updated since the last edition. If you have had questions regarding taxation for traditional maple candy (also called: molded maple sugar, maple shapes, etc.), this section is for you.

United States Department of Agriculture

Marketing and Regulatory Programs

Agricultural Marketing Service

Fruit and Vegetable Program

Specialty Crops Inspection Division

United States Standards for Grades of Maple Syrup

Effective March 2, 2015

Voluntary U.S. grade standards are issued under the authority of the Agricultural Marketing Act of 1946, which provides for the development of official U.S. grades to designate different levels of quality. These grade standards are available for use by producers, suppliers, buyers, and consumers. As in the case of other standards for grades of fresh and processed fruits, vegetables, and specialty crops these standards are designed to facilitate orderly marketing by providing a convenient basis for buying and selling, for establishing quality control programs, and for determining loan values.

The U.S. grade standards and inspection instructions for all fresh and processed fruits, vegetables, and specialty crops are available on the internet and upon request at the address below. These documents provide detailed interpretations of the grade standards and provide step-by-step procedures for grading the product.

Grade standards are issued by the U.S. Department of Agriculture (USDA) after careful consideration of all data and views submitted during rulemaking. The Department welcomes suggestions for improving the standards in future revisions. Comments may be submitted to, and copies of standards and inspection instructions obtained from:

Director, Specialty Crops Inspection Division
Fruit and Vegetable Program,
USDA, Agricultural Marketing Service
1400 Independence Avenue, SW, STOP 0240
Washington, D.C. 20250

Authority: 7 U.S.C. 1621-1627.

Note: Compliance with the provisions of these standards shall not excuse failure to comply with the provisions of the Federal Food, Drug, and Cosmetic Act, or with applicable State laws and regulations.

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§52.5961 Product description.

Maple syrup is the liquid food derived by concentrating and heat treating sap from the maple tree (Acer) as defined in the U.S. Food and Drug Administration (FDA) Standards of Identity for Maple Sirup (21 CFR 168.140) issued under the Federal Food, Drug, and Cosmetic Act. The solids content of the finished maple syrup shall not be less 66 percent by weight (Brix).

§52.5962 Grades.

(a) **U.S. Grade A** is the quality of maple syrup that:

(1) Not more than 68.9 percent solids content by weight (Brix);

(2) Has good uniform color;

(3) Has good flavor and odor, and intensity of flavor (maple taste) normally associated with the color class;

(4) Is free from off flavors and odors considered as damage;

(5) Is free from cloudiness, turbidity, sediment, and is clean;

(6) No deviants for damage shall be allowed in Grade A.

(b) **Maple syrup for processing (Processing Grade)** means any maple syrup that does not meet Grade A requirements, but meets the requirement of Processing Grade for use in the manufacturing of other products. Maple syrup for processing must be packed in containers of 5 gallons or 20 liters or larger. Processing Grade maple syrup cannot be packaged in consumer-size containers for retail sales (containers of less than 5 gallons).

(1) May be any color class and any light transmittance; and not more than 68.9 percent solids content by weight (Brix);

(2) May contain off flavors; and odors;

(3) May have a very strong taste.

(c) **Substandard** is the quality of maple syrup that fails to meet the requirements of Processing Grade maple syrup.

§52.5963 Recommended Fill of Container.

The amount that a container is filled is not a requirement since the fill of a container is not a quality factor. It is, however, recommended that each container be filled with

syrup as full as practicable and that the product occupy at least 90 percent of the volume of the container.

§52.5964 Color.

General. The color class of maple syrup is determined by:

(a) The percent of light transmission through the syrup as measured with a spectrophotometer using matched square optical cells having a 10mm light path at a wavelength of 560 nm. The color value is expressed as percent of light transmission as compared to analytical reagent glycerol fixed at 100 percent. Percent transmission is symbolized by "%Tc."

(b) Any method that provides equivalent results.

When certifying the color of a sample that has been officially drawn and which represents a specific lot of maple syrup, if the number of color deviants exceeds the acceptance number in the appropriate sampling plan, the lot should be designated as mixed color.

§52.5965 Classification Requirements.

(a) "Grade A" classification.

(1) Possesses a good maple flavor (taste) characteristic of the color;

(2) Is clean, free from turbidity or cloudiness, and free from off flavors and odors;

(3) Has good uniform color, which means the syrup color is bright and typical of maple syrup.

"Grade A" Maple syrup has four color and flavor classes

Color classes are associated with specific **%Tc** values as follows:

Grade A Color Classes	Taste	Light Transmittance (% Tc)
U.S. Grade A Golden	Delicate	≥ 75.0
U.S. Grade A Amber	Rich	50.0-74.9
U.S. Grade A Dark	Robust	25.0-49.9
U.S. Grade A Very Dark	Strong	< 25.0

(b) **"Processing Grade" classification.** 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.

(c) **Substandard classification.** Maple syrup that fails to meet the requirements of paragraph (b) of this section shall not be graded above Substandard.

§52.5966 Explanation of Terms.

(a) **Brix** is the percentage by weight concentration of total soluble solids (mainly sugar), of maple syrup when tested with a refractometer calibrated at 68 degrees Fahrenheit and to which any applicable temperature correction has been made; **or** by any other method which gives equivalent results.

(b) **Buddy flavor** or buddiness (classified as damage), is a disagreeable flavor characteristic of syrup when sap is collected from maple trees as they come out of dormancy. This flavor can be described as tasting chocolaty to bitter chocolaty.

(c) **Clean** means that the syrup is free from foreign material such as pieces of bark, soot, dust, or dirt.

(d) **Damage** means any defects that materially affect the appearance, edibility, or quality of the syrup. Badly scorched syrup, buddy syrup, fermented syrup, or syrup that has any off flavors or odors shall be considered as damage.

(e) **Fermentation** (classified as damage), means the chemical breakdown of a substance by bacteria, yeasts, molds, or other microorganisms.

(f) **Light Transmittance (Tc)** means the ability of a liquid to transmit light as determined optically by means of a spectrophotometer.

(g) **Off-flavor** or **off-odor** (classified as damage), means any specific and identifiable or unidentifiable flavor or odor defect that is not normally found in Grade A maple syrup. These flavors or odors may be related to natural factors (e.g., woody or buddy), to manufacturing practices (e.g., burnt, chemical, fermented, scorched), or caused by the presence of any disagreeable flavor or odor that may have developed during handling or storage.

(h) **Taste** means the **intensity** of maple **flavor.** The descriptors for the taste of **Grade A** Maple Syrup are as follows:

(1) **Delicate** means mild maple taste.

(2) **Rich** means a full-bodied maple taste of medium intensity.

(3) **Robust** means stronger maple taste than the lighter colors.

(4) **Strong** means a maple taste that is stronger than robust.

(i) **Turbidity** or **cloudiness** means the presence, in the suspension, of fine particles of mineral matter such as malate of lime, niter, sugar sand, calcium malate, or other substance that detract from the clearness of the syrup.

(1) **Malate of lime** means fine particles of mineral matter in maple syrup.

(2) **Sugar sand** or **niter** generally means a harmless gritty substance naturally found in maple syrup, and is often referred to as cloudiness.

(3) **Calcium malate** results from high calcium and malic acid concentrations in the syrup and is one of the least soluble salts in the syrup.

§52.5967 Determining the Grade of a Lot.

The grade of a lot of maple syrup covered by these standards is determined by the procedures in the **Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Processed Food Products** (7 CFR 52.1 through 52.83).

§52.5968 Reserved.

11.2 NYS Regulations Regarding Maple Syrup

Ailis Clyne (2022)

In this section you will find information from New York State Department of Agriculture and Markets as well as verbatim NYS laws sourced from Cornell University.

The following is an excerpt from NYS Dept. of Agriculture and Markets website accessed 8/1/2022 (https://agriculture.ny.gov/food-safety/maple-syrup-and-honey-processing#):

Regulations

All food processing establishments subject to regulation under article 20-C of the Agriculture and Markets Law shall be subject to the current good manufacturing practices of Part 261 of this Title unless exempted by said article 20-C or by this Part.

Section 276.4 Exemptions

1. Maple syrup and honey. Processors of maple syrup or honey who do not purchase maple syrup or honey from others for repackaging, and who do not combine maple syrup or honey with any other ingredients capable of supporting the growth of infectious or toxigenic organisms, shall be exempt from the licensing requirements of Article 20-C of the Agriculture and Markets Law, provided that:
    1. Such establishments are maintained in a sanitary condition and manner, and to this end the following requirements shall be complied with:
        1. Every practicable precaution shall be taken to exclude birds, insects (except those involved in the production of the product), rodents, and other vermin and animals from the premises of the operation.
        2. The use of insecticides, rodenticides and other pest control items in such establishments shall be permitted only under such precautions and restrictions as will prevent the contamination of the product.
        3. Rooms, compartments, places, equipment, and utensils used for preparing, storing, or otherwise handling the product, and all other parts of the operating premises, shall be kept in a clean and sanitary condition.
        4. There shall be no handling or storing of materials which may create insanitary conditions in any place or places where the product is prepared, stored or otherwise handled. (v) All equipment and utensils used in processing or handling of the product shall be maintained in good repair to assure sanitary conditions in the operation.

5. All finished product containers must be clean, sanitary and properly labeled in compliance with the requirements of Part 259 of this Title.

2. Exemptions from licensing requirements of article 20-C of the Agriculture and Markets Law under this section are conditioned on continued compliance with the requirements of this section.

Processors of maple syrup or honey who do not purchase maple syrup or honey from others for repackaging, and who do not combine maple syrup or honey with any other substance, shall be exempt from the licensing requirements.

NYS Standard of Identity for Maple Syrup

"Grade A golden color and delicate taste" maple syrup has a uniform light golden color, a delicate to mild taste, and a light transmittance of 75% Tc or more.

"Grade A amber color and rich taste" maple syrup has a uniform amber color, a rich or full-bodied taste, and a light transmittance of 50% - 74.9% Tc.

"Grade A dark color and robust taste" maple syrup has a uniform dark color, a robust or strong taste, and a light transmittance of 25% - 49.9% Tc.

"Grade A very dark and strong taste" maple syrup has a uniform very dark color, a very strong taste, and a light transmittance of less than 25% Tc.

Processing Grade Maple Syrup means maple syrup that does not meet the requirements for Grade A maple syrup set forth in paragraph (2) of this subdivision. Processing Grade Maple Syrup may not be sold, offered for sale or distributed in retail food stores or directly to consumers for household use.

Maple Syrup Labeling

The name of the food defined in paragraph 2 of subdivision (b) of this section is "Grade A Maple Syrup". The name "Grade A Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "golden color and delicate taste", "amber color and rich taste", "dark color and robust taste", or "very dark color and strong taste", as appropriate, must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

2. The name of the food defined in paragraph (3) of subdivision (b) of this section is "Processing Grade Maple Syrup". The name "Processing Grade Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "For Food Processing Only" and "Not for Retail Sale" must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

The following are the relevant titles and sections from the New York Compilation of Codes, Rules, and Regulations (NYCRR) which are referred to on the NY Dept. of Agriculture and Markets website. These were sourced from Cornell University Law School Legal Information Institute (LII) (https://www.law.cornell.edu/regulations). These codes, rules, and regulations, current as of 4/6/2022, are subject to change. The LII provides free public access to laws and regulations for all 50 U.S. states.

Title 1 - Department of Agriculture and Markets
Part 276 - Food Processing Establishments

Tit. 1 § 276.1 - Good manufacturing practices*

All food processing establishments subject to regulation under article 20-C of the Agriculture and Markets Law shall be subject to the current good manufacturing practices of Part 260 of this Title unless exempted by said article 20-C or by this Part.

Tit. 1 § 276.3 – Codes

(a) Each container of potentially hazardous food, as defined hereinafter, shall be marked with an identifying code which shall be permanently visible to the naked eye.

(1) Where the container does not permit the code to be embossed or inked, the label or other similar marking device may be legibly perforated or otherwise marked, provided that such label is securely affixed to the product container in a manner satisfactory to the commissioner.

(2) The required identification shall identify in code the establishment where packed and the period during which packed.

(3) The packing period shall be changed with sufficient frequency to enable identification of lots during their sale and distribution.

(4) Packing period codes may be changed on the basis of one of the following: intervals of every four to five hours; personnel shift changes; or batches, provided the containers comprising such batch do not extend over a period of more than one personnel shift.

(b) Definitions.

(1) Potentially hazardous food shall mean any perishable food which consists in whole or in part of milk or milk products, eggs, poultry, fish, shellfish or other ingredients capable of supporting rapid and progressive growth of infectious or toxigenic microorganisms.

(2) Perishable food shall mean any food of such type or in such condition as may spoil.

(3) Home processed food within the context of this Part shall mean any food processed in a private home or residence using only the ordinary kitchen facilities of that home or residence which are also used to prepare food for the owner thereof, his family, nonpaying guests and household and farm employees who reside therein, but shall exclude potentially hazardous foods as defined in this Part or thermally processed low-acid foods packaged in hermetically sealed containers as covered by Part 277 of this Chapter and acidified foods packed in closed containers, including but not limited to pickles and relishes prepared from low-acid fruits, vegetables, poultry, meat, meat products, fish or seafood.

Tit. 1 § 276.4 - Application of general certification standards

(a) **Maple syrup and honey**. Processors of maple syrup or honey who do not purchase maple syrup or honey from others for repackaging, and who do not combine maple syrup or honey with any other ingredients capable of supporting the growth of infectious or toxigenic organisms, shall be exempt from the licensing requirements of Article 20-C of the Agriculture and Markets Law, provided that such establishments are maintained in a sanitary condition and manner, and the following requirements shall be complied with:

(1) Every practicable precaution shall be taken to exclude birds, insects (except those involved in the production of the product), rodents and other vermin and animals from the premises of the operation.

(2) The use of insecticides, rodenticides and other pest control items in such establishments shall be permitted only under such precautions and restrictions as will prevent the contamination of the product.

(3) Rooms, compartments, places, equipment and utensils used for preparing, storing or otherwise handling the product, and all other parts of the operating premises, shall be kept in a clean and sanitary condition.

(4) There shall be no handling or storing of materials which may create insanitary conditions in any place or places where the product is prepared, stored or otherwise handled.

(5) All equipment and utensils used in processing or handling the product shall be maintained in good repair to assure sanitary conditions in the operation.

(6) All finished product containers must be clean, sanitary and properly labeled in compliance with the requirements of Part 259 of this Title.

Standards of Identity
Part 270 – Maple Syrup

Tit. 1 § 270.1 - Maple syrup: identities; label statements

(a) Definitions. For the purpose of this section, the following terms shall have the following meanings, unless the context clearly indicates otherwise:

(1) Light transmittance means the fraction of incident light at a specified wavelength that passes through a representative sample of a particular sub-grade of Grade A maple syrup.

(2) Soluble solids, expressed as a percentage, means the proportion of maple sap solids in the applicable solvent.

(3) Tc means the percentage of light transmission through maple syrup, measurable by a spectrophotometer, using matched square optical cells having a 10-millimeter light path at a wavelength of 560 nanometers, the color values being expressed in percent of light transmission as compared to A.R. Glycerol fixed at 100 percent transmission.

(b) Standards of identity.

(1) Maple syrup is the liquid made by the evaporation of pure sap or sweet water obtained by tapping a maple tree. Maple syrup contains minimum soluble solids of 66.0 percent and maximum soluble solids of 68.9 percent. Maple syrup includes, and is either, Grade A Maple Syrup or Processing Grade Maple Syrup, as defined in paragraphs (2) and (3) of this subdivision.

(2) Grade A maple syrup means maple syrup that is not fermented, is not turbid, and contains or has no objectionable odors, off-flavors or sediment. Grade A maple syrup must fall within one of the color and taste sub-grades of Grade A maple syrup set forth in subparagraph (i), (ii), (iii), or (iv) of this paragraph.

(i) Grade A golden color and delicate taste maple syrup has a uniform light golden color, a delicate to mild taste, and a light transmittance of 75 percent Tc or more.

(ii) Grade A amber color and rich taste maple syrup has a uniform amber color, a rich or full-bodied taste, and a light transmittance of 50 percent - 74.9 percent Tc.

(iii) Grade A dark color and robust taste maple syrup has a uniform dark color, a robust or strong taste, and a light transmittance of 25 percent - 49.9 percent Tc.

(iv) Grade A very dark and strong taste maple syrup has a uniform very dark color, a very strong taste, and a light transmittance of less than 25 percent Tc.

(3) Processing grade maple syrup means maple syrup that does not meet the requirements for Grade A maple syrup set forth in paragraph (2) of this subdivision. Processing Grade Maple Syrup may not be sold, offered for sale or distributed in retail food stores or directly to consumers for household use.

(c) Nomenclature label statement.

(1) The name of the food defined in paragraph (b)(2) of this section is "Grade A Maple Syrup". The name "Grade A Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "golden color and delicate taste", "amber color and rich taste", "dark color and robust taste", or "very dark color and strong taste", as appropriate, must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

(2) The name of the food defined in paragraph (b)(3) of this section is "Processing Grade Maple Syrup". The name "Processing Grade Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "For Food Processing Only" and "Not for Retail Sale" must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

***Note.** New York State has adopted federal standards for **Good Manufacturing Practices**. Code of Federal Regulations (CFR) Title 21 Part 117 can be read at: https://www.law.cornell.edu/cfr/text/21/part-117

11.3 Article 20-C Food Processing Establishment License and Application

Ailis Clyne (2022)

In this Section, you will find information on the Article 20-C Food Processing Establishment License from New York State Department of Agriculture and Markets. A current application form can be found at the end of the Section. A 20-C License is required for any food processor who does not fall under an exemption. Exemptions include Maple Syrup Processors (Section 11.2) and "Home Processors" (Section 11.4). For the full legislation of Article 20-C, visit https://www.nysenate.gov/legislation/laws/AGM/A20-C.

This license is connected to the processing facility, not the proprietor. It requires that a person in a management position at that facility has a certificate of completion from an approved food safety education program. The facility will have to pass an inspection to be licensed, will be inspected on regular basis following licensure, and must keep thorough records of sanitation practices for the inspector. Contact your regional NYS Dept. of Agriculture and Markets office, Division of Food Safety and Inspection for more information; contact information is included in this section.

Additionally, all 20-C licensed facilities must adhere to **Current Good Manufacturing Practices**. New York State has adopted federal standards for Good Manufacturing Practices. Code of Federal Regulations (CFR) Title 21 Part 117 can be read at: https://www.law.cornell.edu/cfr/text/21/part-117

The following is an excerpt from NYS Dept. of Agriculture and Markets website accessed 8/1/2022 (https://agriculture.ny.gov/food-business-licensing):

Food Processor

Article 20-C Food Processing Establishment licenses apply to food manufactures, processing plants, wholesale bakeries, and retail food establishments (i.e. grocery stores) that conduct any type of food preparation including but not limited to meat and cheese slicing, heating foods, sandwich making, operating beverage dispensing machines, and preparing sushi, salad bars, or other ready-to-eat exposed food packaging activity.

If your establishment processes food through one of the methods below, you need an Article 20-C Food Processing Establishment license. Note: this list is not exhaustive.

- Cooking, boiling, broiling, frying, grilling, freezing, drying, roasting, heating, or reheating food
    - Note: this includes cooking fish or other seafood; cooking or re-heating pretzels, lasagnas, pizza, nachos, soups, or meat pies; popping popcorn; melting chocolate; coating chicken wings; or cooking meat products, hot dogs, meat loaf, sausage, or eggs
- Blending spice, herbs, or seasonings at retail or wholesale
- Mincing/grinding/slicing/curing/brining poultry, meat, cheese, fish, vegetables, fruit, bagels, bread, etc.
- Grating cheeses
- Using a cappuccino machine
- Baking bread, rolls, pastries, pies, cookies, etc.
    - Note: this includes wholesale or retail in-store bakery operations, including bake-off operations
- Preserving fruits or vegetables, including jams, jellies, chutneys, salsa, sauces, etc.
- Canning or pickling fruits, vegetables, meats, etc.
- Bottling oils or drinks including soft drinks, shakes, fresh fruit juices, coffee, teas, apple cider, etc.
- Repacking uncooked foods or ready-to-eat foods, salads, fruit, dried fruit, dried vegetables, cereals, granola, nuts, yogurt cups, exposed candy, cheese curds, cooked or dry pasta, ready-to-eat vegetables, etc.
- Roasting meats, coffee, nuts, or barbecue chicken, ribs, or beef
- Preparing or mixing ready-to-eat salads, such as tuna, chicken, egg, mixed foods, meats, pasta dishes, etc.
- Stuffing sausage into casings
- Smoking fish, meat and meat products, cheeses, etc.
- Pickling or marinating fish, herrings, meat, poultry, vegetables, cabbage, fruit, olives
- Dehydrating fruit, vegetables, beef, chicken, pork, jerky, fish, herbs, and spices
- Catering off-site service of foods prepared at establishment
    - Note: off-site preparation may require a local health department permit
- Freezing foods, including frozen dessert machines, ice cream, yogurt, slush, ice milk, shaved ice, serving dish or cone hard ice cream, retail ice production, and packaging

Note: If you have a food service operation (such as a restaurant, café, pizza shop), contact your local health department.

Contact Your Regional Office

Albany Office
(Serving Albany, Clinton, Columbia, Essex, Fulton, Greene, Hamilton, Montgomery, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, and Washington Counties)
(518) 457-4492
10B Airline Drive
Albany, New York 12235

Buffalo Office
(Serving Cattaraugus, Chautauqua, Erie, Genesee, Niagara, Orleans, and Wyoming Counties)
(716) 847-3185
Electric Tower Building, 2nd floor, Suite 203
535 Washington Street
Buffalo, New York 14203

Hauppauge Office
(Serving Suffolk County)
(631) 952-3079
Suffolk State Office Building, Room 13A, 4th Floor
250 Veteran's Memorial Highway
Hauppauge, New York 11788

Metro New York and Long Island Office
(Serving Bronx, Kings (Brooklyn), Nassau, New York (Manhattan), Queens, Richmond (Staten Island), and Suffolk Counties)
(718) 722-2876
55 Hanson Place – 3rd Floor – Room 378
Brooklyn, New York 11217-1583

New Windsor Office
(Serving Dutchess, Orange, Putnam, Rockland, Ulster, Westchester, and Sullivan Counties)
(845) 220-2047
103 Executive Drive, 3rd Floor, Suite 300
New Windsor, New York 12553

Rochester Office
(Serving Allegany, Cayuga, Chemung, Livingston, Monroe, Ontario, Schuyler, Seneca, Steuben, Tioga, Tompkins, Wayne, and Yates Counties)
(585) 427-2273
1530 Jefferson Road
Rochester, New York 14623

Syracuse Office
(Serving Broome, Chenango, Cortland, Franklin, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, Otsego, and St. Lawrence Counties)
(315) 487-0852
New York State Fairgrounds
Art & Home Center
581 State Fair Boulevard
Syracuse, New York 13209

For all unlisted counties, please contact the Albany Office.

FSI-303 (03/22/2021)

NEW YORK STATE OF OPPORTUNITY. Agriculture and Markets

APPLICATION FOR FOOD PROCESSING ESTABLISHMENT LICENSE – ARTICLE 20-C

NYS Department of Agriculture and Markets
Attn: Food Safety License Unit
10B Airline Drive, Albany, New York 12235

PROJECTED OPENING DATE: __ __ / __ __ / __ __

Office Use Only
County Code- Est. No.

Entity No. _____
Receipt No. _____
Verification No. _____

LICENSE FEES (CHECK WHERE APPROPRIATE) :

☐ **$0 No Fee** ★
Production in a Incubator/Shared Kitchen for First-time applicant for the **first** Two (2) years

☐ **$175.00**
Small-Scale Processor, is NOT a Chain Store/Franchise and employs **NO** more than **Ten**(10) Full Time Employees

☐ **$400.00**
ALL OTHERS

★ **NOTICE Regarding Fees**

The commissioner shall waive the license fee for two years for **a first-time applicant that processes food in a kitchen incubator food processing facility**, which for the purposes of this section is a food processing facility used by multiple small and emerging food processing businesses, including both full-time facility tenants and businesses that rent space on a temporary basis.

INSTRUCTIONS

Read and complete both sides of this application. An original signature of owner or corporate officer or LLC managing member is required in Section (8). Non-Refundable Application Fee. Please ensure that you are applying for the correct license.

This application is only for those establishments that prepare or process food at the location listed below. Inspections are scheduled after applications are received and reviewed. No license will be issued until an establishment receives a satisfactory inspection.

(1) Individual Owner Name, Partnership (name all partners) or Full Name of the Corporation:		County:	
Trade Name:		Business Telephone Number: ( )	
Processing Facility Address			
Street:	City:	State:	Zip:
E-mail Address:	Bank Name:		

(2) Optional Mailing Address:

Street:	City:	State:	Zip:

(3) Identification Number:

Federal ID Number:	***OR***	Social Security Number:

(4) Please list sole proprietors and all officers of a corporation or cooperative. If applicant is a partnership, LLC or LLP, list partners/members (attach list if necessary). If applicant is a non-public corporation, list shareholders (attach list if necessary).

Name (Please Print)	Title	Contact Address (Street & No., City, State, Zip)	Date of Birth

(4a.) Principal Office Address: _____

(4b.) In what state incorporated? _____ **(4c.)** Date of Incorporation_____

(4d.) Are you a foreign or out-of-New-York-state individual, partnership, or corporation? (Check One) Yes ☐ No ☐

(4e.) For foreign or out-of-New-York-state corporations:
Date of filing in New York State? _____

(4f.) If out-of-New-York-state, the applicant agrees to accept service of process by first class mail to the designated individual at the said address below which shall constitute good and proper service of process.

Designated:_____ Address: _____

(PLEASE COMPLETE REVERSE SIDE)

(5) List all food preparation or processing activities and the food prepared or processed at this location to be covered by this license. **For example**: cook or heat foods, grind meats, slice cold cuts, cheese, fish, fruit, etc., cappuccino machine, repack ready-to-eat foods or ice.

_____

_____

_____

(6) Retail Food Stores applying for food processing establishment licenses must submit a copy of its certificate indicating that an individual in a position of management or control assigned to the store has successfully completed an approved Food Safety Education Program Course for each location. A list of approved courses can be found on the Department website www.Agriculture.ny.gov under Food Safety link.

The following retail food stores are exempt from this requirement:

a. Food stores that have as its only full-time employees the owner or the parent, spouse or child of the owner, or in addition not more than two full-time employees.

b. Food stores that had an annual gross income of less than $3 million in the previous calendar year, excluding petroleum products, unless the food store is part of a network of subsidiaries, affiliates or other member stores, under direct or indirect control, which, as a group, had annual gross sales of the previous calendar year of $3 million or more.

Check one of the following:

☐ An exemption from this requirement is requested for the following reason(s) _____

_____

☐ A copy of our Food Safety Education Program (FSEP) Certificate is enclosed with this application

(7) Workers Compensation Law requires that businesses seeking state issued permits demonstrate that they have appropriate Workers Compensation Insurance (WCI). Indicate your WCI status:

☐ Insured with _____ OR ☐ Exempt from WCI
Name of Insurance Provider

(8) The undersigned applies for a license pursuant to Article 20-C of the Agriculture and Markets Law of the State of New York to conduct the food processing operations listed above, at this location only. New or additional food processing activities are to be reported to this Department for approval prior to the start of the processing operation.

Any false statements made, in addition to being the possible basis for a revocation on any license issued as a result of this application, may be punishable under the provisions of Section 210.45 of the Penal Law of the State of New York.

NOTE: Your application for a license is subject to denial and/or revocation, if, after a hearing, it is determined that the applicant, licensee, officer, director, partner or share/stockholder, has been convicted of, or has pled guilty to, a felony in any court of the United States or any State or territory thereof, with respect to an offense involving; food safety, food adulteration or food misbranding.

****PLEASE ENSURE ALL QUESTIONS AND FIELDS ARE ANSWERED/COMPLETED BEFORE PROCEEDING****

Any unanswered questions will result in the **denial** of your application which PROHIBITS you from operating your business in the State of New York. If your application is denied you must complete and re-submit your application **again**. Your original application and check **will be** returned. Please allow 60 days for application processing and once received **post** your license in a conspicuous place.

Providing your signature below acknowledges your understanding of requirements listed herein and that you agree to comply with the requirements of Article 20-C.

ORIGINAL SIGNATURE OF OWNER, PARTNER OR CORPORATE OFFICER	TITLE	DATE

AUTHORIZATION AND PURPOSE

Disclosure of your federal employer identification numbers is mandatory and is authorized by Section 5 of the New York State Tax Law. This information is collected to enable the Department of Taxation and Finance to identify individuals, businesses and others who have been delinquent in filing tax returns or may have understated their tax liability and to generally identify persons affected by the Tax Law administered by the Commissioner of Taxation and Finance administering the Tax Law and for any other purpose authorized by the Tax Law. The authority to solicit the information requested above is found in Section 16 of the Agriculture and Markets Law in the sections relating to the specific license you are seeking. This information is collected to enable the Department to evaluate your application, to determine if it should be issued and to assist in the enforcement and administration of the Agriculture and Markets Law.

If you have questions about the information requested, call (518) 457-7139; e-mail agr.sm.foodlicense@agriculture.ny.gov; or write to: NYS Department of Agriculture and Markets; Attn: Food Safety License Unit; 10B Airline Drive; Albany, NY 12235.

One Time Credit Card Payment Authorization Form
Not to Be Completed by Those Processors Listed as Fee Exempt on Page 1 of the
APPLICATION FOR FOOD PROCESSING ESTABLISHMENT LICENSE – ARTICLE 20-C

Sign and complete this form to authorize The NYS Department of Agriculture and Markets to make a one-time charge to your credit card listed below. Please mail to the address below.

By signing this form, you give us permission to charge your account for the amount indicated on or after the indicated date. This is permission for a single transaction only and does not provide authorization for any additional unrelated debits or credits to your account.

Please complete the information below:

I _____, authorize the NYS Department of Agriculture and Markets to charge my credit card account in the amount of:

☐ $175.00 Small-Scale Processor OR ☐ $400.00 Food Processor

This payment is for a:

FOOD PROCESSING LICENSE

Billing Address _____ Phone#_____

City _____ State _____ Zip _____

Email _____

Account Type: ☐ Visa ☐ MasterCard ☐ AMEX ☐ Discover

Cardholder Name _____

Account Number _____

Expiration Date _____

CVV2 (3 digit number on back of Visa/MC, 4 digits on front of AMEX)_____

FOR OFFICE USE ONLY

Estab No.: _____

License No.:_____

SIGNATURE _____ DATE _____

I authorize the NYS Department of Agriculture and Markets to charge the credit card indicated in this authorization form according to the terms outlined above. This payment authorization is for a Food Processing License, for the amount indicated above only, and is valid for one time use only. I certify that I am an authorized user of this credit card.

***** Non Refundable Application Fee*****
Please be sure you are applying for the correct license.

11.4 Home Processor Exemption and Application

Ailis Clyne (2022)

In this Section, you will find information on the Home Processor Exemption from New York State Department of Agriculture and Markets. A current application form to register as a Home Processor can be found at the end of the Section. A Home Processor Exemption allows a small business to produce non-hazardous foods for sale in New York State using their home kitchen, provided that the kitchen meets certain criteria, including but not limited to, doors separating the kitchen from living spaces, and municipal water or well water that has been tested for Coliform bacteria.

Foods permitted under this license are typically considered non-hazardous because they include a "control step" which is a pathogen-killing processing step such as heating to high temperatures. Biscotti is a good example: the biscotti cookie is processed in a hot oven and is considered non-hazardous; however, a chocolate dip is prohibited because the chocolate, melted at low temperatures, does not go through a control step and has potential to cause food borne illness. Additionally, some foods are considered hazardous because the nature of the product itself promotes microbial growth. For example, high moisture content (water activity) foods support microbial growth unless they are controlled with acids, preservatives, refrigeration, and/or other techniques. To produce potentially hazardous foods for sale in New York, or any foods for sale across state lines, the state requires that the facility be inspected and licensed and comply with more stringent regulations to ensure a safe product (see Section 11.3 Article 20-C License).

This exemption is connected to the kitchen, not the producer, so a new application must be submitted with a change in location. It is currently free to register as a Home Processor. For more information, including frequently asked questions, visit the Home Processing page of the NYS Dept. of Agriculture and Markets website (link below).

The following is an excerpt from NYS Dept. of Agriculture and Markets website accessed 8/1/2022 (https://agriculture.ny.gov/food-safety/home-processing):

Overview

If you plan to make foods such as certain baked goods, jellies, or snack mixes, you may qualify for a Home Processor Exemption. This will allow you to prepare food in your home kitchen for wholesale or retail sale at agricultural farm venues. You will be exempt from Article 20-C licensing.

The information on this page will help you to determine whether or not you qualify as a home processor, and what the requirements are for registration.

In general, these rules apply to home processors:

- All items are for marketing products at wholesale and/or retail, including agricultural venues such as farms, farm stands, farmers markets, green markets, craft fairs and flea markets, via home delivery, or via the internet.
- All items must be sold within New York State and must be pre-packaged in the home and properly labeled. Packaging of food items at an agricultural event (craft fair, farmers' market, etc.) is not permitted.

Be sure to consult with your local zoning officials for approval before commencing any home-based business.

Approved Home Processed Foods

The home processor license exemption is limited to foods where there is not a history of food borne illness and the nature of the product makes the possibility of illness less likely.

In order to protect public health and to minimize the potential of food product adulteration, this exemption is restricted to the following **approved** non-potentially hazardous home processed foods.

- Breads
    - Breads containing fruits and/or vegetables are not allowed
- Rolls and/or cinnamon rolls
- Biscuits
- Bagels
- Muffins
- Doughnuts
- Cookies
- Baklava
- Biscotti
    - No chocolate or candy melts allowed for topping
- Cakes
- Cake pops
    - No chocolate or candy melts allowed for topping
- Cupcakes
- Brownies
- Double-crust fruit pies

- Scones
- Fruit jams, jellies, and marmalades made with high acid/low pH fruits
    - i.e. Apple, apricot, blackberry, blueberry, cherry, clementine, cranberry, currents, elderberry, grape, grapefruit, lemon, lime, nectarine, orange, peach, pear, pineapple, plum, raspberry and strawberry
- Repacking/blending of commercially dried spices or herbs
- Repackaging dried or dehydrated vegetables.
- Repackaging dried soup mixes
- Repackaging dried fruit
- Repackaging of dried pasta
    - The manufacturing and drying of pasta is prohibited
- Repackaging dry baking mixes
- Seasoning salt
- Fudge
- Popcorn/caramel corn
- Peanut brittle
- Rice Krispies treats
- Granola and trail mix (using commercially roasted nuts)
- Granola Bars (using commercially roasted nuts)
- Repacking candy (excluding chocolate)
    - Melting and/or repacking of exposed chocolates or chocolate-like candies is not allowed
- Waffle cones and Pizzelle
- Toffee/caramel apples
    - Candy melts are not allowed
- Confections
    - Includes toffees, caramels, hard candies
- Vegetable chips
    - Includes potato chips
- Crackers
- Pretzels

Any finished food product that requires refrigeration is **not** allowed to be produced as a Home Processor.

Prohibited Foods

Items where there are legitimate food safety concerns, including products where there is no pathogen kill step, products which have been implicated in outbreaks, products

considered Temperature Controlled for Safety (TCS), or potentially hazardous food, among others, are **not** allowed to be made in an unlicensed and uninspected facility.

Some examples of **prohibited** items include, but are not limited to:

- Homemade buttercream/cream cheese frosting containing dairy or eggs
- Breads containing fruits or vegetables
- Products containing alcohol
- “No-bake” products (all products must be baked to ensure product stability)
- Pickles, relishes, or sauerkraut
- Sauces, salsas, marinades, mustards, ketchups
- Pepper jellies, wine jellies, vegetable jellies, flower jellies, chutneys, fruit syrups
- Cooked or canned fruits or vegetables
- Vegetable oils, blended oils, salad dressings
- Cheesecake, cream filled pastries, cream pies, meringue pies
- Tempered chocolate/candy melt/almond bark for dipping/coating/drizzling (i.e. cocoa bombs, chocolate candy, chocolate/candy melt covered fruits, etc.)
- Any products containing raw nuts
- Cheese, yogurt, fluid dairy products, butters
- Meat, fish, or poultry products
- Beverages
- Roasted coffee beans
- Nut butters
- Freeze-dried foods
- Compotes
- Spreads
- Quiche
- Fudge/caramel sauces

Labeling

Product labels are required to contain the following information: common/usual name of the product, ingredient list in predominance by weight, net quantity of contents, processor name, and full address. All allergens (eggs, milk, fish, shellfish, soybeans, peanuts, tree nuts, wheat) must be clearly identified in the product ingredient statement.

We recommend that processors add a phrase like “Made at Home by XYZ,” or “Made in the Home Kitchen of XYZ,” or “Made in a Home Kitchen,” to their label in addition to the label requirements outlined below. The font size for this phrase should be 1/16th inch or larger.

Example

Chocolate Chip Cookies

Ingredients: enriched flour (wheat flour, malted barley flour, niacin, iron, thiamin mononitrate, riboflavin, folic acid), butter (cream, salt), semisweet chocolate (sugar, chocolate, cocoa butter, milkfat, soy lecithin, natural flavors), brown sugar, granulated sugar, eggs, vanilla extract (vanilla bean extract, alcohol, sugar), baking soda, salt (salt, calcium silicate)

NET WT 1 lbs (453g)

XYZ Cookie Company

123 Chocolate Chip Way

Cookietown, New York 12345

Contains: milk, eggs, wheat, soy

Made in a Home Kitchen

Contact the Home Processor Registration team

Phone: (518) 457-4492

Email: agr.sm.HPRegistrations@agriculture.ny.gov

Mailing Address:

New York State Department of Agriculture and Markets
Food Safety and Inspection
10B Airline Drive
Albany, New York 12235

FSI-898c (Rev. 03/20)

NYS Department of Agriculture and Markets
Division of Food Safety and Inspection

NEW YORK STATE OF OPPORTUNITY. Agriculture and Markets

HOME PROCESSOR REGISTRATION REQUEST

	Date
Owner Name	County
Trade Name	
Street Address	City / Zip Code
Phone Number	E-mail Address

LIST COMMON OR USUAL NAME (I.E. COOKIES, CAKES, ETC.) OF THE PRODUCTS THAT YOU PROPOSE TO MANUFACTURE. IF NECESSARY, INCLUDE A BRIEF DESCRIPTION OF THE PRODUCT.

1. _____ 2. _____

3. _____ 4. _____

5. _____ 6. _____

7. _____ 8. _____

9. _____ 10. _____

*Products are subject to approval and approval must be obtained for any added products after initial registration

---

Please check one

Water supply is a ☐ (public/municipal supply) ☐ (private well)*

For private wells, attach a copy of the most recent acceptable water analysis (no more than three months old)

Product labels are required to contain the following information: common/usual name of the product, ingredient list in predominance by weight, net quantity of contents, and processor name and full address.

I understand that my product labels must comply with the listed requirements. _____ (**initial**)

By signing this form, I acknowledge that I have read and understand the provisions of the 20C Exempt Home Processing registration (https://agriculture.ny.gov/food-safety/home-processing). I agree to these provisions and limitations of the exemption particularly as it concerns products that may be produced. I further understand that violations of this agreement will result in revocation of my home processing registration and I may be subject to civil penalties.

Signature of Home Processor

For office use only	Date Reviewed:	Approved: ☐ Yes ☐ No	Reason not approved:
Reviewers Signature			

11.5 Sales Tax and Maple Products

Stephen Childs, Cornell Cooperative Extension Maple Specialist (retired)
Revised (2022): Ailis Clyne

Sales tax can be confusing for small businesses and large businesses alike. In New York, the law makes clear that pure maple syrup and pure maple sugar are sales tax exempt, but traditional maple candy – another pure maple product – is written about in such a way that leaves its tax status up to interpretation.

In 2019, *PUB-880* was replaced with *Tax Bulletin ST-525* which outlines which types of products are taxed and which are exempt. This newer document, along with *Tax Bulletin ST-103* can be found in this Section. Published in 2014, *TB-ST-103 Candy and Confectionery* contains the most relevant information in the maple candy taxation debate. The most useful excerpt for maple producers from this document is:

> ### *Packaging and marketing can determine tax status*
>
> *In determining whether a product is taxable as candy or confectionery, or exempt as food, a number of factors are considered, including how the product is labeled, packaged, advertised, displayed, and sold. For example, pure maple sugar products are exempt as food unless displayed, labeled, or advertised as candy or confectionery. They are not candy merely because they are molded in the shape of a maple leaf or sold in individual quantities.*

This means that, for pure maple products, candy is defined by its marketing – not by its size, shape, or retail unit size. Therefore, maple syrup heated, stirred, and poured into molds (traditional maple candy) is not inherently a taxable product, but labeling it or marketing it as "candy" violates its exempt status. Therefore, to avoid sales tax on this item, it must be sold under a different name than "candy" such as "molded maple sugar". In this case, it should be sold as a specialty sugar that can be used as an ingredient, for example as a sweetener for coffee or tea.

However, is this the best marketing strategy? Will it be better for sales in the long run if maple producers have a unified name and marketing strategy for this product? The Cornell Maple Program advises maple producers to collect sales tax and utilize the name "candy" to enhance marketing of the product. "A well-marked candy shelf in your retail display would likely be less confusing and more attractive to consumers than other names given to these products. This could also eliminate the risk of a confrontation with a sales tax inspector or auditor whose interpretation differed from yours.

Note also that "Syrups" and "Sugar" can be found on the list of exempt foods and beverages in *TB-ST-525*, while "Maple sugar candy" is listed as taxable.

It is not very difficult to register as a sales tax vendor, but being registered does require extra record keeping. To register as a sales tax vendor in New York, visit:

https://www.tax.ny.gov/bus/ads/webdtf17.htm. Applications are now conducted online. The following is a helpful webpage for navigating the application process: https://www.tax.ny.gov/e-services/elcoa/#checklist.

When a business is newly registered as a tax vendor, new expectations arise. Records must be kept for at least three years of every sale, the amount paid, and the sales tax that is due, if any. If a written receipt or other evidence of sale is given to the purchaser, the vendor must retain a copy. All cash sales must be recorded daily in a daybook or similar journal. Records must be made available to the Tax Department upon request.

If a producer wants to completely avoid sales tax collection but still sell maple candy, they can sell the candy wholesale to a retailer who will collect sales tax on their end. In this case, the retailer must provide a *Form ST-120 Retail Certificate*. The following is an excerpt from *TB-ST-103*: "Candy and confectionery may be purchased for resale without payment of tax provided the purchaser gives the seller a properly completed Form ST-120, Resale Certificate. Sales tax is collected when the product is resold at retail."

In summary, maple syrup, sugar, cream, condiments (mustard, salad dressing), ice cream, cookies, seasonings, and marshmallows (see specifics in *TB-ST-103*) are not taxable unless sold for onsite consumption. These products fall under exempt foods. Taxable maple products include maple coated nuts, maple fudge, maple cotton candy, any maple candy or confection that includes ingredients other than pure sugar, pure maple sugar sold as candy, any maple related breakfasts or meals, and any item sold for onsite consumption, not sealed in a retail container, such as maple ice cream cones.

While these tax bulletins contain useful information on interpretation of the law, they are not the law itself which is subject to change. The following Tax Law was sourced in 2022 from Cornell University Law School Legal Information Institute (LII) (https://www.law.cornell.edu/regulations). The LII provides free public access to laws and regulations for all 50 U.S. states.

Title 20 – Department of Taxation and Finance

N.Y. Comp. Codes R. & Regs. Tit. 20 § 528.2 - Food and beverages

Tax Law, § 1115(a)(1)

(a) Food and food products.

(1) Food and food products, except candy and confectionery, when sold for human consumption, are exempt from sales and compensating use tax. See section 528.27 of this Part for exempt purchases of candy and confectionery when purchased with food stamps.

(2) The terms food and food products as used in this section mean edible commodities whether prepared, processed, cooked, raw, canned or in any other form, which are generally regarded as food. This category includes, but is not limited to:

meat and meat products
milk products
cereals and grain products
baked goods
vegetables and vegetable products
fruits and fruit products
poultry
fish and seafood
frozen entrees and desserts
jellying agents
fats, oils and shortenings
condiments
spices
sweetening agents
food preservatives
food coloring
frozen dinners
snacks (except candy and confections)

A list of taxable and exempt food and food products is available upon request at any district tax office or directly from the bureau's main office in Albany.

(3) The phrase *sold for human consumption* means that the items sold are, in their normal use, regarded as being for human consumption. Pet foods, which are packaged, labeled or advertised as such, are not deemed sold for human consumption.

(4) Candy and confectionery include, without limitation, candy of all types; chocolate (plain or mixed with other products); glazed or sugar-coated fruits, nuts, peanuts, popcorn or other products; chewing gum; mints; lollypops; fruit flavored sticks; fruit drops; licorice; pastilles; cotton candy; marzipan; halvah and any similar product regarded as candy or confectionery based on its normal use or as indicated on the label or in the advertising thereof.

(5) Items advertised and sold for use in cooking and baking, such as chocolate morsels and glazed fruit, are exempt from tax.

(b) Beverages, other than water.

(1) Beverages sold for human consumption are exempt from sales and compensating use tax, except for:

(i) fruit drinks which contain less than 70 percent of natural fruit juices;

(ii) soft drinks, sodas and beverages, such as are ordinarily dispensed at soda fountains (other than coffee, tea or cocoa);

(iii) beer, wine and other alcoholic beverages.

(2) A beverage is a drink, whether sold in liquid form or otherwise.

Cross-reference:

See section 528.27 of this Part for exempt purchases with food stamps of otherwise taxable fruit drinks, soft drinks, sodas and beverages.

(3) Fruit juices are exempt beverages. Fruit drinks, aides, nectars and cocktails which contain less than 70 percent natural fruit juices, are taxable.

(4) Soft drinks and sodas include carbonated and noncarbonated beverages, carbonated water, dietetic beverages and cocktail and other alcoholic drink mixes.

(5) Vegetable juices, whether made of a single vegetable, or a combination of vegetables, or a combination of a vegetable and other food product are exempt beverages.

Example:

A juice composed of tomato juice and clam extract is exempt.

(c) Dietary foods and health supplements.

(1) A dietary food is a food for a special dietary use for humans and which bears on the label a statement of the dietary properties upon which its use is based in whole or in part.

(2) Products which are intended to substitute for the ordinary diet, or supplement the ordinary diet, or substitute for natural foods are exempt, when sold for human consumption. Among these are liquid diet products, artificial sweeteners and vitamins.

(d) Nothing contained within section 1115(a)(1) of the Tax Law or this section shall be construed as exempting food or drink from the tax imposed under subdivision (d) of section 1105 of the Tax Law. (See section 527.8 of this Title.) However, see section 528.27 of this Part for exempt purchases of eligible food and drink when purchased with food stamps.

NEW YORK STATE | Department of Taxation and Finance

Tax Bulletin
Sales and Use Tax
TB-ST-525
August 8, 2019

Listings of Taxable and Exempt Foods and Beverages Sold by Food Stores and Similar Establishments

Introduction

Most food is exempt from sales tax. The exemption for food includes:

- food products;
- dietary foods;
- health supplements; and
- certain beverages.

Food must meet these conditions to be exempt from tax:

- it must be sold for human consumption;
- it must be sold unheated; and
- it must be sold in the same form and condition, quantities, and packaging as is commonly used by retail food stores.

These foods and beverages, however, are not exempt from tax:

- candy and confectionary;
- alcoholic beverages;
- soft drinks, fruit drinks, sodas, or similar beverages;
- heated or prepared meals (sandwiches, salad bars, etc.); and
- food or beverage sold for on-premises consumption.

Taxable food and beverage items may be purchased for resale without payment of tax if the purchaser gives the seller a properly completed Form ST-120, *Resale Certificate*. The purchaser will collect tax when the items are resold. If a purchaser does pay sales tax on a purchase, it may later take a credit on its sales tax return for the amount of tax it paid to the original seller. See Tax Bulletin *Sales Tax Credits* (TB-ST-810).

Additional resources relating to sales of food and beverages (e.g., sales by restaurants, sales from vending machines, or sales of candy or sandwiches) are listed at the end of this bulletin.

Listings of taxable and exempt food and beverages

The charts below list some examples of taxable and exempt foods and beverages sold at retail food markets and similar establishments. (**Note:** Any brand name product shown in italics is included as an example and is not to be construed as an endorsement of the product.)

Exempt foods and beverages

*Arnold Palmer Half & Half*È
Artificial sweeteners
Baby food
Bakery products
Baking products
*Beefamato*È
*Boost*È
Bouillon cubes
Bread
Brownies
Butter
Cereals
Chicory
Chocolate (for cooking purposes only)
*Clamato Juice Cocktail*È
Cocoa
Coconut
Coffee
Coffee creamers
Condiments (e.g., salt, pepper)
Cookies
Crackers
Cupcakes
Dehydrated fruit
Dehydrated vegetables
Diet foods (but not diet candy)
Diet substitutes
Diet supplements
Doughnuts
Dressings
Eggs and egg products
*Ensure*È
Fats
Fish and fish products
Flavorings (e.g., vanilla or almond extract)
Flour
Food coloring
Frozen desserts
Frozen dinners
Fruit
Fruit juices containing 70% or more of natural fruit juice (unless carbonated)
*Fruit Rollups*È
Game (e.g., partridges, rabbits, wild turkeys)
Grain products
Granola bars
Gravies
*Great Shakes*È
Health bars
Health food
Health supplements
Herbs
Honey
Ice cream (prepackaged)
Iced coffee
Iced tea (frozen or liquid)
Iced tea mix
Instant breakfast mix
Jams (fruit preserves)
Jelling agents
Jellies
Ketchup
Lard
Leavening agents
Liquid diet products
Mayonnaise
Meats and meat products
Milk and milk products
Mustard
Non-stick cooking sprays
*Nutrament*È
Nuts and nut products (but not chocolate- or candy coated or honey-roasted nuts)
Oils (cooking, salad)
Oleomargarine
Olives
*Ovaltine*È
Peanut butter
Peanuts
Pepper
Popcorn
Potato chips
Poultry
Poultry products
Preservatives
Pretzels
*Quik*È
Relishes
Salad dressing mixes
Salad dressings
Salt
Sandwich spreads
Sauces
Seafood
Seasonings
Sesame seeds (for baking)
Sherbet
Shortening
*Slim-Fast*È
Soup
Spices
Starch (for cooking)
*Start*È
Sugar
Sugar substitutes
Sunflower seeds (sold for human consumption)
Syrups
*Tang*È
Tea
Vanilla extract
Vegetables
Vegetable juices
Vegetable oils
*V8 Juice*È
Vitamins
Yeast

Taxable foods and beverages

*5-Hour Energy*È
Beer
Bottled water
Candied apples
Candy and confectionery
Caramel-coated popcorn
Caramels
Carbonated beverages
Carbonated water
Chewing gum
Chocolate candy
Chocolate-coated nuts
Chocolate-coated pretzels
Coated candy
Cocktail mixes
Collins mixer
Cranberry juice cocktails
Dietetic candy
Dietetic carbonated beverages
Dietetic soft drinks
Fountain drinks (e.g., sodas, milkshakes, etc.)
French burnt peanuts
Fruit drinks [i]
Fruit nectars [i]
Fruit punch [i]
Fudge
*Gatorade*È
Glazed fruit
*Hi-C*È
Honey-roasted nuts
Ice
Ice cream cones (made to order)
Ice cream sodas
Ice cubes
Jordan almonds
*Kool-Aid*È
Lemonade
Licorice
Maple sugar candy
Mineral water
*MiO Liquid Water Enhancer*È
*Monster Energy Drink*È
Nuts (chocolate or candy coated)
*Orange Crush*È
Pet foods [ii]
*Powerade*È
*Red Bull*È
*Rockstar Energy Drink*È
Seltzer (water)
Soft drinks
*smartwater*Ê
Vegetable plants (used to grow food)
Vegetable seeds (used to grow food)
Vichy water
*vitaminwater*Ê
*Yoo Hoo*È

Coupons and food stamps

For information about foods and beverages purchased with coupons or food stamps, see Tax Bulletin *Coupons and Food Stamps* (TB-ST-140).

Note: A Tax Bulletin is an informational document designed to provide general guidance in simplified language on a topic of interest to taxpayers. It is accurate as of the date issued. However, taxpayers should be aware that subsequent changes in the Tax Law or its interpretation may affect the accuracy of a Tax Bulletin. The information provided in this document does not cover every situation and is not intended to replace the law or change its meaning.

References and other useful information

Tax Law: Sections 1105(a); 1105(d); and 1115(a)(1)

Regulations: Sections 527.8 and 528.2

Publications:
Publication 750, *A Guide to Sales Tax in New York State*
Publication 840, *A Guide To Sales Tax For Drugstores and Pharmacies*

Memoranda: TSB-M-18(1)S, *Summary of Sales and Use Tax Changes Enacted in the 2018-2019 Budget Bill*

Bulletins:
Beverages Sold by Food Stores, Beverage Centers, and Similar Establishments (TB-ST-65)
Candy and Confectionery (TB-ST-103)
Coupons and Food Stamps (TB-ST-140)
Dietary Foods and Health Supplements (TB-ST-160)
Food and Beverages Sold from Vending Machines (TB-ST-280)
Food and Food Products Sold by Food Stores and Similar Establishments (TB-ST-283)
Purchases by Restaurants, Taverns, and Similar Establishments (TB-ST-695)
Sales by Restaurants, Taverns, and Similar Establishments (TB-ST-806)
Sales Tax Credits (TB-ST-810)
Sandwiches (TB-ST-835)
Recordkeeping Requirements for Sales Tax Vendors (TB-ST-770)

[i] If product contains less than 70% real fruit juice.
[ii] Pet food purchased for guide, hearing, and service dogs is exempt. See Tax Bulletin *Exemptions Relating to Guide, Hearing, and Service Dogs* (TB-ST-245).

Candy and Confectionery

Introduction

Most sales of candy and confectionery are subject to sales tax. This bulletin outlines items that are considered candy and confectionery for sales tax purposes, as well as items that are not.

Candy and confectionery

Candy and confectionery includes candy of all types, and similar products that are regarded as candy or confectionery based on their normal use or marketing. *Candy and confectionery* also generally includes preparations of fruits, nuts, popcorn, or other products in combination with chocolate, sugar, honey, candy, etc. Some examples of candy and confectionery include (**note:** any brand name product shown in italics is included as an example and is not to be construed as an endorsement of the product):

- Åcandy bars;
- Åchocolates;
- Åfruit, nuts, and popcorn covered with caramel, chocolate, honey, sprinkles, or other similar coatings;
- Åhoney-roasted nuts;
- Åchewing gum;
- Åfudge;
- Åmaple sugar candy;
- Åcandy or chocolate covered marshmallows in decorative shapes (for example, *Peeps*È);
- Åmints;
- Åpeanut brittle;
- Åcotton candy;
- Ålicorice;
- Ådietetic candy; and
- Åcandied apples.

Products that are not considered candy and confectionery

Candy and confectionery does not include:

- Åbaked goods, including cupcakes, cookies, pretzels, donuts, and pastries, or any similar products such as granola or cereal bars;
- Åbaking or cooking ingredients, such as candied fruitcake ingredients, chocolate chips or bars, and marshmallows of any size (other than the candy or chocolate covered marshmallows described above);
- Åmaple sugar products, unless labeled *candy* or *confection* or advertised as *candy*; and
- Ådried fruit, including *Craisins*È, *Fruit Roll-Ups*È, or other similar snacks (unless coated or covered in candy, etc., as described above).

Packaging and marketing can determine tax status

In determining whether a product is taxable as candy or confectionery, or exempt as food, a number of factors are considered, including how the product is labeled, packaged, advertised, displayed, and sold. For example, pure maple sugar products are exempt as food unless displayed, labeled, or advertised as candy or confectionery. They are not candy merely because they are molded in the shape of a maple leaf or sold in individual quantities.

Candy purchased with coupons and food stamps

For information about sales tax on candy and other taxable foods purchased with coupons or food stamps, see Tax Bulletin *Coupons and Food Stamps* (TB-ST-140).

Exempt sales

Sales of candy and confectionery are not taxable if:

- the purchaser is exempt from sales tax and gives the seller a properly completed exemption certificate, or
- the candy or confectionery is sold from a vending machine for $1.50 or less.

Purchases for resale

Candy and confectionery may be purchased for resale without payment of tax provided the purchaser gives the seller a properly completed Form ST-120, *Resale Certificate*. Sales tax is collected when the product is resold at retail.

Note: A Tax Bulletin is an informational document designed to provide general guidance in simplified language on a topic of interest to taxpayers. It is accurate as of the date issued. However, taxpayers should be aware that subsequent changes in the Tax Law or its interpretation may affect the accuracy of a Tax Bulletin. The information provided in this document does not cover every situation and is not intended to replace the law or change its meaning.

References and other useful information

Tax Law: Sections 1105(a)(1); 1115(a)(1); 1115(ff); and 1132(c)(1)

Regulations: Section 528.2

Memoranda: TSB-M-14(7)S, *Increase in the Exemption for Vending Machine Sales of Certain Food and Drink*

Publications: Publication 750, *A Guide to Sales Tax in New York State*

Bulletins:

Beverages Sold by Food Stores, Beverage Centers, and Similar Establishments (TB-ST-65)
Coupons and Food Stamps (TB-ST-140)
Food and Beverages Sold from Vending Machines TB-ST-280)
Food and Food Products Sold by Food Stores and Similar Establishments (TB-ST-283)
Listings of Taxable and Exempt Foods and Beverages Sold by Food Stores and Similar Establishments (TB-ST-525)
Recordkeeping Requirements for Sales Tax Vendors (TB-ST-770)

11.6 NYS Food Labeling

Ailis Clyne (2022)

The regulations relevant to product labeling of maple commodities in New York can be found in Part 221 of Title 1 Department of Agriculture and Markets – Commodities. For food labeling regulations of foods regulated by the FDA, the Code of Federal Regulations, Title 21, Part 101 – Food Labeling is most relevant (https://www.law.cornell.edu/cfr/text/21/part-101/subpart-A).

Selected New York regulations are reproduced below as sourced from the Cornell Law School Legal Information Institute in 2022.

N.Y. Comp. Codes R. & Regs. (NYCRR) Tit. 1 § 221.3 – Declaration of Identity

(a) Consumer package. A declaration of identity on a consumer package shall appear on the principal display panel and shall identify the commodity in the package by its common or usual name, description, generic term, or the like. Such declaration shall appear generally parallel to the base on which the package rests as it is designed to be displayed.

(b) Nonconsumer package. A declaration of identity on a nonconsumer package shall appear on the outside of a package and shall identify the commodity in the package by its common or usual name, description, generic term or the like.

NYCRR Tit. 1 § 221.4 – Declaration of Responsibility

(a) Any packaged commodity, kept, offered or exposed for sale, or sold, shall specify conspicuously on the label of the package, the name and address of the manufacturer, packer or distributor. The name shall be the actual corporate name, or when not incorporated, the name under which the business is conducted. The address shall include street address, city, state and ZIP code; however, the street address may be omitted if this is shown in a current city directory or telephone directory. The requirement for inclusion of the ZIP code shall apply only to labels that have been developed or revised after July 1, 1969.

(b) If a person manufactures, packs or distributes a commodity at a place other than his principal place of business, the label may state the principal place of business in lieu of the actual place where the commodity was manufactured or packed or is to be distributed, unless such statement would be misleading. Where the commodity is not manufactured by the person whose name appears on the label, the name shall be qualified by a phrase that reveals the connections such person has with such commodity, such as "manufactured for and packed by. . . . .," "distributed by. . . . .," or any other wording of similar import that expresses the facts.

NYCRR Tit. 1 § 221.5 – Declaration of quantity; consumer packages

(a) General. Units of the metric system of weights and measures and units of the customary system of weights and measures are jointly recognized, and units of either one of these systems may be used in a declaration of quantity. However, customary equivalents to metric sizes must be presented on commodities until such time as the Federal Fair Packaging and Labeling Act is amended and the commissioner deems the consumer is adequately prepared for the sole use of metric declarations.

(b) Largest whole unit. Where this regulation requires that the quantity declaration be in terms of the largest whole unit, the declaration shall, with respect to a particular package, be in terms of the largest whole unit of weight or measure, with any remainder expressed in:

(1) common or decimal fractions of such largest whole unit; or

(2) the next smaller whole unit, or units, with any further remainder in terms of common or decimal fractions of the smallest unit present in the quantity declaration.

(c) Net quantity. The principal display panel of a package shall bear a declaration of the net quantity of the commodity in the package, exclusive of wrappers and any other material packed with such commodity.

(d) Use of "net weight". The term "net weight" or its abbreviation "net wt" shall be used when stating the net quantity of contents in terms of weight.

(e) Lines or print or type. A declaration of quantity may appear on more than one line of print or type.

(f) Terms--weight, liquid measure or count. The declaration of the quantity of a particular commodity shall be expressed in terms of liquid measure, if the commodity is liquid, or in terms of weight, if the commodity is solid, semisolid, viscous, or a mixture of solid and liquid, or in terms of numerical count. However, if there exists a firmly established general consumer usage and trade custom with respect to the terms used in expressing a declaration of quantity of a particular commodity, such declaration of quantity may be expressed in its traditional terms, if such traditional declaration gives accurate and adequate information as to the quantity of the commodity.

(j) Customary units--weight, measure. A declaration of quantity:

(1) in units of weight shall be in terms of the avoirdupois pounds or ounces; except, that solder and brazing alloys containing precious metals when packaged and labeled for retail sale are exempted hereunder, provided, the net quantity declaration is stated in terms of the troy pound and ounce and the term "Troy" is used in each declaration;

(2) in units of liquid measure shall be in terms of the United States gallon of 231 cubic inches or liquid-quart, liquid-pint or fluid ounce subdivisions of the gallon, and shall express the volume at 68° F, except in the case of petroleum products, for

which the declaration shall express the volume at 60° F, and except also in the case of a commodity that is normally sold and consumed while frozen, for which the declaration shall express the volume at the frozen temperature and except also in the case of a commodity that is normally sold in the refrigerated state, for which the declaration shall express the volume at 40° F;

(5) in units of dry measure shall be in terms of the United States bushel of 2,150.42 cubic inches or peck, dry quart, and dry pint subdivisions of the bushel;

(k) Symbols and abbreviations.

(1) Any of the following symbols and customary units, and none other, shall be employed in the quantity statement on a package of commodity: avoirdupois avdp cubic cu feet or foot ft fluid fl gallon gal inch in liquid liq ounce oz pint pt pound lb quart qt square sq weight wt yard yd

(2) There normally are no periods following, nor plural forms of, symbols and abbreviations. For example, "oz" is the symbol for both ounce and ounces. Both upper and lower case letters are acceptable.

(l) Units with two or more meanings. When the term "ounce" is employed in a declaration of liquid quantity, the declaration shall identify the particular meaning of the term by the use of the term "fluid"; however, such distinction may be omitted when, by association of terms (for example, as in "1 pint 4 ounces"), the proper meaning is obvious. Whenever the declaration of quantity is in terms of the dry pint or dry quart, the declaration shall include the word "dry".

(n) Prescribed units--customary system.

(1) Less than one foot, one square foot, one pound, or one pint. The declaration of quantity shall be expressed in terms of:

(iii) in the case of weight of less than one pound, ounces and fractions of ounces;

(iv) in the case of fluid measure of less than one pint, fluid ounces and fractions of fluid ounces;
Provided, that the quantity declaration appearing on a random package may be expressed in terms of decimal fractions of the largest appropriate unit, the fraction being carried out to not more than two decimal places.

(2) Four feet, four square feet, four pounds, one gallon, or more. The declaration of quantity shall be expressed in terms of the largest whole unit in the case of:

(iii) weight of four pounds or more; or

(iv) fluid measure of one gallon or more.

(3) Dual quantity declaration.

(i) Weight. On packages containing one pound or more, but less than four

pounds, the declaration shall be expressed in ounces and, in addition, shall be followed by a declaration in parentheses, expressed in terms of the largest whole unit; provided, that the quantity declaration appearing on a random package may be expressed in terms of pounds and decimal fractions of the pound carried out to not more than two decimal places.

(ii) Fluid measure. On packages containing one pint or more, but less than one gallon, the declaration shall be expressed in ounces and, in addition, shall be followed by a declaration in parentheses, expressed in terms of the largest whole unit.

(q) Conversion of units. In all conversions for the purpose of showing an equivalent metric or customary quantity, the number of significant digits retained should be such that accuracy is neither sacrificed nor exaggerated.

(r) Supplementary declarations.

(1) Supplementary quantity declarations. The required quantity declaration may be supplemented by one or more declarations of weight, measure, or count, such declaration appearing other than on a principal display panel. Such supplemental statement of quantity of contents shall not include any terms qualifying a unit of weight, measure, or count that tends to exaggerate the amount of commodity contained in the package (e.g., "giant" quart, "larger" liter, "full" gallon, "when packed", "minimum", or words of similar import).

(2) Combined metric and customary declarations. An equivalent statement of the net quantity of contents in terms of either the customary or metric systems is not regarded as a supplemental statement and such statement may also appear on the principal display panel; provided, that it conforms to both subdivision (h) and subdivision (m) of this section.

(3) Qualification of declaration prohibited. In no case shall any declaration of quantity be qualified by the addition of the words "when packed", "minimum", or "not less than", or any words of similar import, nor shall any unit of weight, measure, or count be qualified by any term (such as "jumbo", "giant", "full", or the like) that tends to exaggerate the amount of commodity.

(s) Character of declaration; average. The average net quantity of contents in the packages of a particular lot, shipment, or delivery shall at least equal the declared net quantity and no unreasonable shortage in any package shall be permitted, even though overages in other packages in the same shipment, delivery, or lot compensate for such shortage.

NYCRR Tit. 1 § 221.6 – Prominence and placement; consumer packages

(a) General. All information required to appear on a consumer package shall appear thereon in the English language and shall be prominent, definite and plain, and shall be conspicuous as to size and style of letters and numbers and as to color of letters and numbers in contrast to color of background. Any required information that is either in hand lettering or hand script shall be entirely clear and equal to printing in legibility.

(b) Location. The declaration or declarations of quantity of the contents of a package shall appear in the bottom 30 percent of the principal display panel, or panels. For cylindrical containers, see also section 221.8(g) of this Part for additional requirements.

(c) Style of type or lettering. The declaration or declarations of quantity shall be in such a style of type or lettering as to be boldly, clearly, and conspicuously presented with respect to other type, lettering, or graphic material on the package, except that a declaration of net quantity blown, formed, or molded on a glass or plastic surface is permissible when all label information is blown, formed, or molded on the surface.

(d) Color contrast. The declaration or declarations of quantity shall be in a color that contrasts conspicuously with its background, except that a declaration of net quantity blown, formed, or molded on a glass or plastic surface shall not be required to be presented in a contrasting color if no required label information is on the surface in a contrasting color.

(e) Free area. The area surrounding the quantity declaration shall be free of printed information:

(1) above and below, by a space equal to at least the height of the lettering in the declaration; and

(2) to the left and right, by a space equal to twice the width of the letter "n" of the style and size of type used in the declaration.

(f) Parallel quantity declaration. The quantity declaration shall be presented in such a manner as to be generally parallel to the declaration of identity and to the base on which the package rests as it is designed to be displayed.

(g) Calculation of area of principal display panel or panels for purpose of type size. The square-inch area of the principal display panel shall be:

(1) in the case of a rectangular container, one entire side which properly can be considered to be the principal display panel, the product of the height times the width of that side;

(2) in the case of a cylindrical or nearly cylindrical container, 40 percent of the product of the height of the container times the circumference; or

(3) in the case of any other shaped container, 40 percent of the total surface of the container, unless such container presents an obvious principal display panel (e.g., the

top of a triangular or circular package of cheese, or the top of a can of shoe polish), the area shall consist of the entire such surface; provided, that determination of the principal display panel shall exclude tops, bottoms, flanges at tops and bottoms of cans, and shoulders and necks of bottles or jars.

(h) Minimum height of numbers and letters. The height of any letter or number in the required quantity declaration shall be not less than that shown in Table 1 with respect to the area of the panel, and the height of each number of a common fraction shall meet one-half the minimum height standards; provided, that in the case of the symbol for milliliter (mL), the "m" shall meet one-half the minimum height standard.

(i) Numbers and letters; proportion. No number or letter shall be more than three times as high as it is wide.

TABLE 1 MINIMUM HEIGHT OF NUMBERS AND LETTERS

Square-inch area of principal display panel	*Minimum height of numbers and letters*	*Minimum height of label information blown, formed, or molded into surface of container*
5 square inches and less	1/16 inch	1/8 inch
>5 square inches and <25 square inches	1/8 inch	3/16 inch
>25 square inches and <100 square inches	3/16 inch	1/4 inch
>100 square inches and <400 square inches	1/4 inch	5/16 inch
>400 square inches	1/2 inch	9/16 inch

NYCRR Tit. 1 § 221.9 – Exemptions

(c) Small confections. Individually wrapped pieces of "penny candy" and other confectionery of less than 15 grams or one half ounce net weight per individual piece shall be exempt from the labeling requirements of this regulation when the container in which such confectionery is shipped is in conformance with the labeling requirements of this regulation. Similarly, when such confectionery items are sold in bags or boxes, such items shall be exempt from the labeling requirements of this regulation, including the required declaration of net quantity of contents, when the declaration of the bag or box meets the requirements of this regulation.

(d) Individual servings. Individual-serving-size packages of foods containing less than 15 grams or one half ounce or less than 15 milliliters or one half fluid ounce for use in restaurants, institutions, and passenger carriers, and not intended for sale at retail, shall be exempt from the required declaration of net quantity of contents specified in this regulation.

(p) Small packages. On a principal display panel of five square inches or less, the declaration of quantity need not appear in the bottom 30 percent of the principal display panel if that declaration satisfies the other requirements of this regulation.

Cornell Maple Program

Section 12

Identifying Off-Flavors and Judging Maple Products

12.1 Identifying Off-Flavors in Maple Syrup

Stephen Childs, Cornell Extension Maple Specialist (retired)

All maple syrup is not created equal. The flavors of maple syrup vary significantly from producer to producer, from various production systems, from different production areas, from year to year, and even from specific woodlots. One only needs to serve as a maple syrup judge at a fair or maple meeting to experience the range of flavor diversity. These flavor distinctions can be part of developing customer loyalty. Sometimes the flavors are less pleasing, leading to difficulty keeping customers. Noticeable and even severe flavor problems can often be identified and the cause corrected. Furthermore, a syrup with off-flavors cannot be marketed as Grade A. It can only be sold as Processing Grade, meaning, it cannot be sold to consumers for household use or packaged in retail containers.

Henry Marckres with the Vermont Agency of Agriculture, Food & Markets has pulled together some excellent information on maple syrup off-flavors, their likely causes, and tips for avoiding them. The following information has been adapted from material he has written:

Chlorine (Sodium) – A solution of chlorine and water is commonly used to clean sap tubing systems and storage tanks. When these systems are not fully rinsed afterwards, the chlorine solution can leave a residue inside the tubing. The first sap run of the following season picks up this residue, resulting in varying amounts of sodium into the finished syrup. A chlorine off-flavor often destroys the maple flavor and may taste salty.

Detergents – The only detergents that should be used in syrup production are ones that are approved for food use. Mistakenly using products that are designed for home use can damage the flavor of the finished maple product. A detergent flavor in syrup may taste soapy, or have a perfume odor or flavor, depending on the type of detergent used and

how much rinsing was done.

Paints – In the past, many producers painted the inside of galvanized sap buckets and holding tanks to prolong their useable life. These paints often contained a fish oil base. This type of paint should never be used on any surface that is in direct contact with sap or syrup. The flavor derived from this material may have an oily taste. It is especially prevalent if the paint was not cured completely before using the bucket or tank.

Metallic – This off-flavor is usually the result of prolonged storage in metal syrup cans or storing bulk syrup in poor quality metal barrels. Always check the interior condition of galvanized and epoxy coated barrels, and do not use barrels with obvious rust or cracked epoxy. The recommendation for metal syrup cans is to only pack what will be sold within a three-month period. If the exposure has been prolonged, the product may have a greenish tinge to it and it may taste "tinny".

Plastic – The type of material that causes this off-flavor is most often a non-food grade plastic or a plastic not meant for exposure to hot syrup. Using the wrong type of pail to move syrup from the evaporator to the filter or packaging syrup in containers not designed for hot filling creates a bitter flavor or syrup that tastes how some plastics smell.

Filters – There are several off-flavors that can be attributed to the way filters are manufactured or the methods used to clean and store them. New cone or flat filters for gravity filtering can sometimes pick up and retain a slight chemical odor and flavor during the manufacturing process. Before use, they should be boiled in clear water and dried thoroughly. Otherwise they will impart a chemical flavor to the syrup. Used filters should never be washed with any detergent; they may pick up detergent residue in the fibers. After the season is over, filters should be washed in water and dried thoroughly before storing in a dry location free of contaminating odors. Filters not dried thoroughly will mold, creating a musty off-flavor when hot syrup is filtered through them the following season. Never store filters with mothballs; this will create a chemical off-flavor.

Defoamers – Many different products are used to reducing the foaming of the boiling sap during evaporation. Commercially available vegetable fat derivatives, either liquid or powdered, butter, milk, or vegetable oil is often used to “de-foam”. Only a small amount is needed to control foaming; too much will create an off-flavor in the syrup. A defoamer off-flavor may taste like whatever was used as a defoamer or have a rancid taste.

Chemicals – The technology used in producing syrup today often requires the use of powerful cleaners. It is very important to follow the manufacturer's recommendations carefully and rinse thoroughly before continuing use. This off-flavor usually relates to the smell of the chemical used.

Lubricants and Fuels – Care should be taken to avoid contaminating sap or syrup with exhaust fumes or by improperly operating equipment. Only food grade lubricants should be used in any pumps or equipment that comes in contact with sap or syrup. This type of contamination will produce a taste and odor like the contaminant smells.

Musty – This off-flavor can become present in the syrup in two ways: from putting hot syrup through filters that contain mold or from poorly sealed containers. The musty off-

flavor tastes yeasty or moldy and usually has a moldy odor.

Ferment – Fermented syrup usually develops from one of two problems with the product. If the syrup has not been boiled enough to reach the correct sugar density, then it is likely to ferment. Sometimes even correct density syrup can ferment, usually because it is stored in barrels that have not been properly cleaned. Even barrels that have been previously steam cleaned may have moisture in them that encourages yeast, mold, and bacteria growth. Syrup that is fermented will have a sickeningly sweet flavor. Depending on the type of fermentation, it may have an alcoholic, fruity, or honey-like taste. Severely fermented syrup may have a foamy appearance.

Sour Sap – As the weather warms near the end of the sugaring season, sap stored in a tank too long can warm and spoil. Syrup made from this sap has a ropey appearance when poured. The flavor is very sour.

Burnt Niter – When sap is boiled, minerals that are in the raw sap precipitate out of the solution and form niter that collects in the compartment in the front pan where the syrup is being drawn off. To prevent this from becoming a problem, the producer switches draw-off sides as needed, or changes front pans if the evaporator is constructed in a manner that allows. If this is not done, a build-up occurs in the pan, creating a combination off-flavor. The syrup will have a burned taste from the niter rising off the front pan and the syrup burning, and it will also have a niter flavor, which has a slightly fizzy affect like baking soda on the tongue.

Scorch – This off-flavor is a burned flavor in the syrup. Operating the evaporator with too shallow depth of syrup in the front pan will burn the syrup.

Earthy Flavor – Tapping into punky wood, dark colored or stained areas in the tree, or cracked wood produces syrup with this off-flavor. The flavor tastes and smells like garden soil. Care should be taken while tapping to avoid the potential for this problem.

Metabolism – This is an off-flavor that is attributed to changes in the metabolism of the tree due to an unseasonal warming of temperatures. This can occur at any time during the sugaring season. A metabolism off-flavor robs the product of most of its maple flavor. The resulting flavor has been described as woody, peanut buttery, or popcorn-like. An almost cardboard-like flavor may be present. A chocolaty smell may be detected.

Buddy – Buddy syrup is usually produced late in the production season. The trees' buds begin to swell and "break", the sap chemistry changes, and the syrup takes on a distinctive quality. Buddy syrup usually tastes chocolatey, often described as "tootsie roll". If very strong, it may take on bitter notes. The flavor cannot be detected in the sap by tasting.

The Maple Syrup Grading Schools often provide the opportunity to sample many of the off-flavors known to affect the maple syrup. Learning to identify these off-flavors will be helpful for recognizing and remedying the source of a production problem.

12.2 Judging Maple Products (IMSI)

NORTH AMERICAN MAPLE CONTEST GUIDELINES

Approved by the International Maple Syrup Institute
For Distribution

JUDGING MAPLE PRODUCTS

May 2016

CONTENTS

INTRODUCTION

There continues to be interest in showing maple products at the North American Maple Syrup Council/International Maple Syrup Institute Annual Meeting, at the Royal Agricultural Winter Fair in Toronto, and at local fairs across North America. Maple contests are a great way for Maple Syrup Producers to compare their maple products against maple products produced by others. Contests are fun and the winners can post ribbons in their sugarhouse and be recognized among their peers through newsletters, the media and word of mouth. They can be justifiably proud of their winnings and this will help them to promote and market their maple products.

Now that a new North American-wide grading and classification system for maple syrup has been adopted, it is timely and appropriate to follow with uniform contest rules that reflect the new grades and classification standards for maple syrup. Uniform judging rules will also help provide maple producers with the assurance that their products will be judged in a consistent and fair manner.

All maple judges are strongly encouraged to participate in the International Maple Syrup Institute Grading School, Maple Grading Schools hosted by Centre Acer and other related training sessions offered by state and provincial maple associations.

This document provides judging outlines for Maple Syrup, Maple Sugar (hard and soft), Stirred Maple Sugar, Maple Butter/Maple Cream, Maple Jelly and Innovative/New Maple Products. Sample score sheets are provided for both individual and combined contest entries. All consumer labels (product name, color class, volume, etc.) should be removed from containers entered for judging.

SUGGESTED MATERIALS AND SUPPLIES NEEDED

- Tags or matching self-stick ID labels for each submitted sample*
- Rubber bands
- Stapler
- Yellow legal pads or similar
- Pens/pencils
- Aluminum foil
- Masking tape
- Clean drinking glasses
- Plain bottled water
- Ice
- Plastic spoons
- Paper towels
- Glass or plastic tasting receptacles†
- Very good source of natural daylight or florescent light‡
- Kim Wipes (delicate task wipers)
- Syrup refractometer

* To be used on glass jar decanted entries and original entry containers – Sharpie markers may also be used to discreetly mark on the containers

† Some paper cups may exhibit an off-flavor

‡ Recommended when assessing the color class of samples. This may not be necessary if a reliable digital comparator is used.

- Distilled water (for calibration of digital refractometers)
- Syrup hydrometer and cup (optional)
- Small thermometer
- Lovibond Color Comparator or a reliable digital comparator◊
- Good clean, new glass containers (if decanting is to be done)
- Disposable vinyl gloves (keep glass clean)
- Hair nets
- Disposable plastic pipettes, plastic straws or droppers
- A judge is advised to use a palate cleanser (e.g. water, apple slices, etc.) when tasting a number of different maple samples.

◊ No temporary kits, they can vary

PREPARING MAPLE PRODUCT SAMPLES FOR JUDGING AND SOME IMPORTANT JUDGING CONSIDERATIONS

1) All syrup entered in the contest should be hot packed at 82.2-93.3°C (180-200°F).
2) All entries of maple syrup must be assigned a color class by the owner and the owner must ensure that their name and address is correct on the entry form for all maple products entered.
3) All entries of maple syrup should be numbered consecutively according to color class in accordance with the new North American Grading and Color Classification Standard (Start with #100 for Golden/Delicate (100, 101, etc.), #200 for Amber/Rich, #300 for Dark/Robust and #400 for Very Dark/Strong.
4) Fill out hand tags or other sample identifiers, fold up and staple to hide the owner's ID. Attach with a rubber band to the original container as submitted. Also place a self-stick label with the correct number that corresponds with the entry number from a master list on the original container, as well as on any other glass containers used to decant samples.

   If not using hand tags, make a listing of entries and put duplicate stickers with the same entry number from the list on the original container and the sample (decanted or not) to be judged.
5) Make one original list with the sample owner's name, address, and entry number. Seal this list in an envelope.
6) Fill out score sheets with entry numbers for the judge's use.
7) Not more than one entry per class should be accepted from a maple product exhibitor.
8) Use masking tape or aluminum foil to cover the identity of the original container for maple candy and maple cream/butter products.
9) When syrup bottles are first opened by a judge, they should be observed for any foaming or unusual appearance and sniffed in order to detect any odors that would indicate fermentation or contamination. These are more apparent when the bottle is first opened than when the lid has already been removed. Any observations should be noted on the judging form.

STANDARDIZATION OF MAPLE AT FAIRS AND OTHER EVENTS

Some Fairs have had classes for maple syrup and other maple products for many years. Visitors to the Fairs and Show Events like to see the product. If maple syrup is packed in a metal or plastic container, the syrup cannot be seen and the container might as well be empty.

An entry in a *maple syrup* class should consist of a 250ml (8.5oz) Kent bottle, or where the syrup entries are decanted, an equivalent volume of syrup packed in another suitable container type.

Entries in the other maple product classes should include:

Hard Sugar - 2 or more 125g blocks
Soft Sugar - 2 x 125g boxes of small pieces
Maple Butter - 2 x 250 ml (8.5oz) short cylinder jars
Stirred Sugar - 2 x 250 ml (8.5oz) short cylinder jars

JUDGING MAPLE SYRUP

There are four criteria used in judging the quality of maple syrup. These are density, color, clarity and flavor. *The score includes: 30 points for density, 20 points for color, 10 points for clarity, and up to 40 points for flavor – for a total of 100%.* For uniformity in judging, the standard maple syrup container for exhibition recommended is the 250ml (8.5oz) Kent glass bottle. If the syrup is decanted, then the type of container entered in the contest may vary, so long as the color class and volume entered is the same. Before judging begins, samples of syrup should be shaken to equalize density throughout the sample and mix up any sediment.

DENSITY (30%)

Density is a very important factor to be judged, and the easiest, with the proper equipment. Maple syrup must fall within the range of 66°Brix to 68.9°Brix (66% to 68.9% sugar content) in accordance with federal regulations in the United States and Canada. In other words, maple syrup with more than 34% water is not legally maple syrup. The optimal density for maple syrup is 66.5 to 67.0°Brix. Maple syrup that falls within this range should be given 30 points. Entries that have densities of 66.0 to 66.4°Brix and densities of 67.1 to 68.9°Brix should be given 25 points. Maple syrup that tests less than 66.0°Brix, or higher than 68.9°Brix will be disqualified from the competition.

The sugar content should be carefully checked with a Brix hydrometer, or a refractometer. The advantage of the refractometer is the fact that only a drop of syrup is required. The hand refractometer may be used, but most of them are only accurate to decimal two (0.2). A bench refractometer is the best as the density may be determined to one-tenth of one degree. To minimize any potential for errors, judges should check the calibration of their refractometers following the manufacturer's specifications for their specific instrument before and after a day's batch of measurement is carried out.

Both the refractometer and the hydrometer are calibrated at either a temperature of 16° Celsius (60° F) or 20° Celsius (68° F), depending on the instrument used. The temperature of the syrup when using the hydrometer must be established and a correction made to the observed readings to obtain the true density. A correction thermometer attached to the refractometer greatly simplifies the task of determining corrections. Many of the current refractometers are automatically temperature corrected or compensated and adjustment to the reading is not required. Digital refractometers are now widely used.

CORRECTIONS TO BE APPLIED TO OBSERVED BRIX READINGS OF MAPLE SYRUP TO COMPENSATE FOR EFFECTS OF TEMPERATURE

Temperature of Syrup in Hydrometer Cup or Air Temperature When Using A Refractometer		**Correction to Subtract from (-) or Add to (+) Observed Brix Reading of 60.0°Brix - 69.9°Brix**
°C	**°F**	
0 – 1.0	32 – 34	-1.4
1.5 – 3.0	35 – 38	-1.3
3.5 – 5.0	39 – 41	-1.2
5.5 – 6.5	42 – 44	-1.1
7.0 – 8.0	45 – 46	-1.0
8.5 – 9.5	47 – 49	-0.9
10.0 – 10.5	50 – 51	-0.8
11.0 – 11.5	52 – 53	-0.7
12.0	54	-0.6
12.5 – 13.5	55 – 56	-0.5
14.0 – 15.0	57 – 59	-0.4
15.5 – 16.5	60 – 62	-0.3
17.0 – 17.5	63 – 64	-0.2
18.0 – 19.5	65 – 67	-0.1
20.0	68	0
20.5	69	+0.1
21.0 – 21.5	70 – 71	+0.2
22.0 – 24.0	72 – 75	+0.3
24.5 – 25.5	76 – 78	+0.4
26.0 – 26.5	79 – 80	+0.5
27.5	81	+0.6
28.0 – 28.5	82 – 83	+0.7
29.0 – 29.5	84 – 85	+0.8
30.0 – 31.0	86 – 88	+0.9
31.5 – 32.0	89 – 90	+1.0

COLOR (20%)

Assess the color class immediately following the assessment of density. If possible, have two judges assess the color. If samples are entered in the correct color class, the full 20% is awarded. Reject all entries that are found to be in the wrong color class.

The classes of maple syrup to be assessed include:
Golden/Delicate - Color not less than 75% Tc (light transmittance)
Amber/Rich - Color 50-74.9% Tc
Dark/Robust - Color 25-49.9% Tc
Very Dark/Strong - Color less than 25% Tc

It is the entrant's responsibility to see that their sample is entered in the correct class and section. A sample wrongly entered will be disqualified.

CLARITY (10%)

Clarity of maple syrup is another factor in judging for quality. This will be assessed immediately following the assessment of color. Syrup that has been properly filtered should be crystal clear. Syrup that has been improperly filtered will have sugar sand in suspension. Syrup with sugar crystals indicates that the syrup is too thick and the sugar will not remain in solution.

Clarity is readily checked by holding a printed sheet of paper behind the glass container of syrup. The clearer the syrup, the more easily the printing can be read.

Cloudy samples contain significant amounts of sediment or foreign matter. Assess clarity from the lightest to the darkest class in a systematic manner. Very slight cloudiness or minor amounts of sediment will not be grounds for rejecting an entry but rather a reduction in points.

Syrup containing any foreign material (hair, dirt, bark, insects, etc.) will be disqualified.

Points for clarity can also be lost for dirty containers. Containers covered in syrup or fingerprints should be penalized.

Score for clarity:
Best Crystal Clear: 10 points
2nd Best: 8 points
3rd Best: 5 points
4th Best or Lower: 0 points

FLAVOR (40%)

Flavor will be assessed once density, color and clarity of the entries have been assessed.

Flavor is the most important characteristic to be judged and perhaps the most difficult, as it depends (to some extent) on the personal preference of the judge. When maple syrup is offered for sale, it should have that characteristic maple flavour that only comes from the sap of the maple tree and only when that sap is properly handled and processed.

For tasting, begin with the lightest color class (Golden/Delicate) and work through to the darkest class. As the syrup is judged, the better tasting entries will be moved forward in each color class to eliminate entries with inferior taste. Ideally, at least two judges should taste each sample and the winning samples should be selected on a consensus-basis. A new tasting cup should be utilized for each sample tasted. The judges should regularly cleanse their palate with pure potable water. Normally the best tasting syrup is identified for each color class and the overall best tasting syrup is identified by the judges.

The score can only show the difference between the best, most characteristic maple flavoured sample for the color class and the poorest flavored sample. Off-flavored syrups (i.e. scorched, buddy, musty, salty, smoky, or unspecified) will be disqualified.

Score for Flavor:
Best: 40 points
2nd best: 35 points
3rd best: 30 points
4th best: 25 points
(Deduct 5 points with each subsequent placing)

Sometimes it is not possible to detect any difference in flavor in a number of samples. These samples would all receive the same score for flavor.

JUDGING MAPLE SUGAR

FLAVOR (40%)

As with maple syrup, flavor is the most important factor in judging maple sugar. Sugar with a characteristic, distinctive, maple flavour will receive the top score. Sugar with more caramel flavour and with slight off-flavours will be downgraded. Any sugar with off-flavours such as buddiness, moldiness or fermentation will be eliminated from the competition.

It is up to the judge to select a uniform point spread which is appropriate and fair for the particular competition, taking into account the number of entries and to ensure that small differences in taste do not unduly penalize individual entries. If several samples are similar in flavor, they will receive the same number of points.

***Score for Flavor*:**
Best: 40 points
2nd best: 35 points
3rd best: 30 points
4th best: 25 points
(Deduct 5 points with each subsequent placing)

TEXTURE (30%)

For hard and soft sugar, texture has been divided into three characteristics:
Hardness: **10 points**
Crystallinity: **10 points**
Surface (smooth): **10 points**

Hardness refers to the condition of the sugar. Soft sugar should fracture easily, but hard sugar is broken with difficulty.

Crystallinity refers to the condition of the individual sugar crystals. The smaller the crystalline structure, the better. Coarse crystals may be detected when the sugar is broken and by their sandy feel when eaten.

The ***surface*** should be smooth and free of holes. The best surface need not be absolutely smooth in the case of crystal coated soft sugar, as this sugar usually has a rough surface.

APPEARANCE (20%)

	Soft Sugar	Hard Sugar
1) No white areas	5	5
2) Form good	10	5
3) Color	5	5
4) No separation	-	5

1) White areas are the result of drying or of pouring the sugar into the molds too hot. The larger the white area, the lower the score.
2) Sugar pieces should be completely in the form of the mold, with no broken corners or pieces having come off during the unmolding process.
3) The highest points are usually given to sugar with the lightest color but that are not almost white.
4) Separation refers to dark and light layers in hard sugar blocks.

PACKAGE (10%)

The package is judged based on the two categories of *Sanitation* and *Attractiveness*:
Sanitation: **5 points**
Attractiveness: **5 points**

Hard sugar should always be wrapped in transparent film to protect it from dirt and microbial contamination. Soft sugar pieces should be in a box and covered with plastic film for the same reasons.

Both sugars will score better in an attractive package which need not be expensive. Neatness and originality will be scored higher than the nature of the package.

JUDGING STIRRED (CRUMB) MAPLE SUGAR

FLAVOR (40%)

Same standards as other maple sugars.

TEXTURE (35%)

Only size of crystals is important and the smaller the crystalline structure, the better.

APPEARANCE (15%)

The creep test is used to rate stirred sugar. A small amount of the sugar is placed on a piece of paper in a conical mound. The more the sugar creeps towards the paper, the better. The more the creep, the drier the product. However, powdery sugar should be penalized.

PACKAGE (10%)

Stirred sugar is best shown in glass 250ml (8.5oz) short cylinder jars. Points are lost for dirty containers, messy used containers and rusty lids.

JUDGING MAPLE BUTTER/MAPLE CREAM

FLAVOR (40%)

Characteristic maple flavor is again the criterion. Point spread applied in the same manner as maple sugar samples.

TEXTURE (30%)

Maple butter should have a smooth creamy texture, but not tacky. A soft, spreadable texture is best. Texture points include *Hardness* and *Crystallinity*.

1) ***Hardness (15%)***
   Maple cream/maple butter should be uniformly soft.

2) ***Crystallinity (15%)***
   Samples with small crystals are preferred over the coarse crystals with a sandy taste.

APPEARANCE (20%)

Appearance of Maple Butter/Maple Cream is judged based on *Color*, *No Separation*, and *Air Bubbles*.

1) ***Color (5%)***
   Very light colored maple butter receives the highest points.

2) ***No Separation (10%)***
   Maple butter should be a creamy mass with no syrup showing. Uniformity of color is desirable. When syrup does separate out, it is an indication that the maple butter was made from maple with a high invert sugar content. Usually the darker syrup, the more invert sugar it contains, so maple butter should be made from Golden or very light Amber maple syrup.

3) ***Air Bubbles (5%)***
   The presence of air bubbles in maple butter lowers the score.

PACKAGE (10%)

Maple butter is best shown in glass 250ml (8.5oz) short cylinder jars. Points are lost for dirty, messy, used containers, and rusty lids.

JUDGING MAPLE JELLY

APPEARANCE (15%)

Appearance is awarded based on: color (amber); clarity; no air bubbles; no separation; free of foam on surface.

TEXTURE (15%)

Shakes slightly; retains shape; smooth; not gummy, sticky or rubbery.

FLAVOR (40%)

Pleasing maple flavor – not strong or bitter.

PURITY OF PRODUCT (20%)

Made with pure maple syrup and Genugel only.

PACKAGE (10%)

Packaged in a glass 250ml (8.5oz) short cylinder jar.

INNOVATIVE MAPLE CATEGORY

INNOVATION (40%)

Originality and purity of the product.

The entrant must include a listing of the real maple and any non-maple ingredients in the product.

FLAVOR (40%)

Maple flavor evident.

PRESENTATION (20%)

Visual appearance, creativity.

MAPLE SYRUP - SCORE SHEET

Entry No. _____ Class _____

☐ **DENSITY (30%)** Brix measured: _____

☐ Disqualified (below 66.0°Brix or above 68.9°Brix)

☐ **COLOR (20%)**

☐ Meets color class entered

Measured Color Class:

☐ Golden/Delicate

☐ Amber/Rich

☐ Dark/Robust

☐ Very Dark/Strong

☐ Disqualified (does not meet color class entered)

☐ **FLAVOR (40%)**

Best flavor: 40 points

2nd best: 35 points

3rd best: 30 points (deduct 5 points with each subsequent placing)

☐ Disqualified (off-flavor, i.e. scorched, buddy, moldy, chemical taste, etc.)

☐ **CLARITY (10%)**

Best crystal clear: 10 points

2nd best: 8 points

3rd best: 5 points

4th best or lower: 0 points

☐ **TOTAL**

Judges' Comments

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

MAPLE SYRUP - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Density (30)		Color (20)	Flavor (30)	Clarity (10)	TOTAL POINTS	Disqualified	Comments
	Brix	Points						

HARD MAPLE SUGAR - SCORE SHEET

Entry No. _____ Class _____

☐ **PACKAGE (10%)**

Attractiveness 5 _____

Sanitation 5 _____

☐ **APPEARANCE (20%)**

No White Areas 5 _____

Good Form 5 _____

Color 5 _____

No Separation 5 _____

☐ Disqualified (Mold)

Judges' Comments

☐ **TEXTURE (30%)**

Hardness 10 _____

Crystallinity 10 _____

Surface (smooth) 10 _____

☐ **FLAVOR (40%)**

☐ **TOTAL**

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

HARD MAPLE SUGAR - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Appearance (20) NWA Form Color Sep 5 5 5 5	Texture (30) Hard Cryst. Surface 10 10 10	Flavor (40)	Pkg. (10) Attr. Sani. 5 5	TOTAL POINTS	Disqualified	Comments

SOFT MAPLE SUGAR - SCORE SHEET

Entry No. _____ Class _____

☐ PACKAGE (10%)

Attractiveness	5 _____
Sanitation	5 _____

☐ APPEARANCE (20%)

No White Areas	5 _____
Good Form	10 _____
Color	5 _____

☐ Disqualified (Mold)

☐ TEXTURE (30%)

Hardness	10 _____
Crystallinity	10 _____
Surface (smooth)	10 _____

☐ FLAVOR (40%)

☐ TOTAL

Judges' Comments

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

SOFT MAPLE SUGAR - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Appearance (20) White Form Color 5 10 5	Texture (30) Hard Cryst. Surface 10 10 10	Flavor (40)	Pkg. (10) Attr. Sani. 5 5	TOTAL POINTS	Disqualified	Comments

STIRRED (CRUMB) MAPLE SUGAR - SCORE SHEET

Entry No. _____ Class _____

☐ PACKAGE (10%)

Attractiveness 5 _____

Sanitation 5 _____

☐ APPEARANCE (15%)

☐ Disqualified (mold, foreign matter, etc.)

☐ TEXTURE (35%)

☐ FLAVOR (40%)

☐ TOTAL

Judges' Comments

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

STIRRED (CRUMB) MAPLE SUGAR - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Appearance Creep Test (15)	Texture (35)	Flavor (40)	Pkg. (10) Attr. 5 Sani. 5	TOTAL POINTS	Disqualified	Comments

MAPLE BUTTER/MAPLE CREAM - SCORE SHEET

Entry No. _____ Class _____

☐ PACKAGE (10%)

Attractiveness 5 _____

Sanitation 5 _____

☐ APPEARANCE (20%)

Color 5 _____

No Separation 10 _____

Air Bubbles 5 _____

☐ Disqualified (mold, foreign matter, etc.)

Judges' Comments

☐ TEXTURE (30%)

Hardness 15 _____

Crystallization 15 _____

☐ FLAVOR (40%)

☐ Disqualified (off-flavor: e.g. scorched, buddy, moldy, chemical taste, etc.)

☐ TOTAL

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

MAPLE BUTTER/MAPLE CREAM - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Appearance (20) Color 5	No Sep. 10	Air Bubb. 5	Texture (30) Hardness 15	Cryst. 15	Flavor (40)	Pkg. (10) Attr. 5	Sani. 5	TOTAL POINTS	Disqualified	Comments

MAPLE JELLY - SCORE SHEET

Entry No. _____ Class _____

☐ APPEARANCE (15%)

Color (Amber) 3 _____

Clarity 3 _____

No Air Bubbles 3 _____

No Separation 3 _____

No Foam 3 _____

☐ Disqualified (mold, foreign matter, etc.)

Judges' Comments

☐ TEXTURE (15%)

(shakes slightly; retains shape, smooth; not gummy, sticky or rubbery)

☐ FLAVOR (40%)

☐ Disqualified (off-flavor, e.g. scorched, buddy, moldy, chemical taste, etc.)

☐ PURITY OF PRODUCT (20%)

☐ PACKAGE (10%)

☐ TOTAL

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

MAPLE JELLY - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Appearance (15)	Texture (15)	Flavor (40)	Purity (20)	Package (10)	TOTAL POINTS	Disqualified	Comments

INNOVATIVE MAPLE CATEGORY - SCORE SHEET

Entry No. _____ Class _____

Ingredients: _____

_____

☐ INNOVATION (40%)

☐ FLAVOR (40%)

☐ Disqualified (off-flavor, e.g. scorched, buddy, moldy, chemical taste, etc.)

☐ PRESENTATION (20%)

Judges' Comments

☐ TOTAL

After scoring the sample, complete below:

NAME: _____

ADDRESS: _____

DATE: _____

INNOVATIVE MAPLE CATEGORY - COMBINED SCORE SHEET

Class No. _____ Date: _____

Location: _____

Entry No.	Innovation (40)	Flavor (40)	Presentation (20)	TOTAL POINTS	Disqualified	Comments

REFERENCES

1) Basic Instructions for Judging Maple Syrup, North American Maple Syrup Council, 2015.
2) Judging Maple Products, Ontario Ministry of Agriculture, Food and Rural Affairs and the Ontario Maple Syrup Producers' Association, Revised 2009.
3) Royal Agriculture Winter Fair Guidelines, Revised 2015.
4) E-mail and Verbal Communications, Maple Judges, United States and Canada, 2016.