

New York State Maple Confections Notebook



Making Quality Maple Confections & Value Added Workshop

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

Maple Confections Notebook

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Section 1

Maple Syrup—The Raw Product for Making Maple Confections

1.1 Chemistry of Maple Syrup

1.2 Quality Control For Maple Confectioners

1.3 Sugar Profiles of Maple Syrup Grades

1.1 Chemistry of Maple Syrup

by STEPHEN CHILDS

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

Maple syrup is primarily composed of a mixture of sugars, water, and minerals. In addition to these three components maple syrup will contain small amounts of various other organic compounds such as organic acids, amino acids, proteins, phenol compounds and even a few vitamins. Variation in the levels of these various components gives maple syrup the broad spectrum of flavors experienced with syrup from different producers and from different sap runs at the same location. As sap is concentrated into maple syrup some of the minerals may precipitate out of solution forming “sugar sand” in the bottom of the evaporator pan, caught in the syrup filters or precipitated on the bottom of the syrup container. When making any maple confection it is critical that the syrup have a good flavor as most off flavors will only be further concentrated resulting in poor tasting products. Once you have selected syrups with excellent flavor, selecting the syrups based on correct chemistry for the desired confection is second in importance. Third, you must select the cooking, cooling and stirring program that will give you consistently high quality confections.

In maple syrup at 66.0° Brix the sugar is completely in solution and it is a stable solution. When you continue to cook syrup, the concentration of sugar in the syrup continues to increase as temperature increases and as water is lost. The sugar remains in solution at the higher temperature even though much of the water boils away. When the syrup reaches the desired temperature for a particular confection and begins cooling, there is more sugar than can remain in solution at lower temperatures. The solution is said to be super-saturated. 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. The fact that sugar solidifies into crystals is extremely important in making confections. The amount of sugar that can be in solution in a given volume of water varies with the temperature of the solution. Hot solutions can contain more sugar and cool solutions less sugar. This is why accurate measurement of the temperature of heated syrup is so important.

It is this ability to increase the sugar concentration above the stable level that enables the production of maple confections. All maple confections depend on producing a syrup solution containing more sugar than can be retained in solution at room temperature (made by additional evaporation) and then either encouraging, controlling, or preventing the subsequent sugar crystallization process that occurs with cooling. When making a sugar glass (non-crystalline hard confection like suckers or hard candy) crystallization is prevented by managing temperature or syrup sugar chemistry. When making a crystallized confection, crystallization is controlled through such actions as regulating the rate and extent of cooling and the degree of agitation or stirring. The slower this crystallization process occurs, the larger the sugar crystals. The chemistry of the supersaturated syrup can be identical, but the products produced 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 can result in very different qualities of the final products.

The crystalline or grainy nature of the precipitated sugar is determined by a number of factors, all of which are influential in making the desired type of confection. These factors include the amount of excess sugar in solution, seeding, the rate of cooling, syrup chemistry and the speed, power and length of time of stirring. Large crystals, called rock candy, which represent one extreme, are formed when slightly supersaturated syrup (67° to 70° Brix) is cooled slowly and stored for a long time without agitation. A glass-like non-crystalline syrup represents the other extreme. This is formed when highly supersaturated syrup (the boiling point is elevated 18° F. or more above the boiling point of water) is cooled rapidly to well below room temperature without stirring, as when making sugar on snow. By pouring the warm syrup on snow or fine shaved ice the syrup suddenly becomes so viscous that it solidifies before crystals can form and grow. In contrast, if the hot supersaturated sugar solution is stirred while it is cooling, the tendency to form crystals increases. The mechanical shock produced by the stirring causes microscopic crystal nuclei to form. Continued stirring mixes the crystals throughout the thickened syrup, and they grow in numbers and in size. Different sizes of crystals are preferred in different kinds of confections. Granulated sugar for instance is best with a fairly large crystal that can easily be seen and felt with the tongue. To make granulated sugar the syrup is evaporated to the desired temperature and is not cooled only slightly or not at all before stirring is started. For maple cream the desire is to have a smooth creamy texture where no crystals can be felt with the tongue. Here the supersaturated syrup is allowed to cool without stirring until it is somewhere between 50 and 90° F. Both the temperature at stirring and the method of stirring have an effect on the size of the crystals formed in the cream and the stability of those crystals over time. The cooler the temperature when stirring begins the longer, in weeks and months, the crystals will stay the same size and resist growing. A fast powerful stir such as with a gear pump machine makes a smoother cream than when stirred on a turn table or candy machine when all other conditions are the same.

Controlling Crystallization

The formation of sugar crystals in many confections and recipes is controlled by the temperature and stirring procedures. However the syrup chemistry is also an important factor. Controlling the size of crystals or preventing crystals with crystal inhibitors is used in making many sugar confections and candies. Large crystals of sucrose have a harder time forming when molecules of invert sugars are present. Crystals form something like building blocks locking together. If some of the molecules are a different size and shape, they won't fit together, and a crystal doesn't form or grows with much more difficulty. The influence of invert sugars, common in natural maple syrup, on crystallization should be well understood by maple confectioners. Many times maple producers complain of batch failures when making confections because the natural mix of types of sugar in the syrup was outside of the normal range for the confection desired. The use of corn syrup to make maple suckers and hard candy or use of invertase to make shelf stable maple cream all are related to the higher concentration of invert sugars and their role in controlling growth of sucrose crystals. The influence of invert sugar on making maple confections is discussed in depth in the next section.

Crystallization inhibitors also can include various acids, fats and proteins. The addition of

acids, like cream of tartar, fruit juices or vinegar, inhibits crystal growth. Fats, like margarine, butter, cream, whole milk, or chocolate, also inhibit crystal growth, as does protein in the form of milk, egg white, and gelatin. Fat and protein inhibit crystallization by providing physical barriers, coating the crystal face and preventing one molecule from growing on another, thus keeping the crystals small or stopping crystallization altogether. Corn syrup or honey is often used in candy making since they promote super-saturation 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 crystals to orient themselves into a crystalline structure. Examples include caramels, taffies, brittles, hard candies, marshmallows, fluff, meringues, frostings and gumdrops. The excessive use of a fatty de-foamer in making crystalline confections may result in unexpected soupiness or lack of proper crystal formation.

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

One of the factors a maple producer who is making value added products may need to take into consideration is how the concentration of sucrose is effected in syrup that has invert sugars present. Sucrose is the sugar that normally is going to crystallize in making a confection. Unless the syrup has been treated with invertase, sucrose is the only sugar with enough concentration to form crystals. The invert sugar in the syrup reduces sucrose crystallization simply by getting in the way but it also reduces the sucrose concentration requiring more cooking to bring it to the level where it would act more like it would if no invert sugar were present. The chart below illustrates how if a maple producer is making maple cream with a syrup that has no or a very low level of invert compares in sucrose concentration with a syrup at the same brix level but with a higher invert level. This chart should help the maple producer understand why a higher finish temperature is needed to get the sucrose to the same concentration to get a similar crystallization result. You need the higher finish temperature to equalize the brix of sucrose in the mix.

- Syrup 80 brix - 80 brix sucrose – 0 brix invert, finish 23°F
- Syrup 80 brix - 79 brix sucrose – 1 brix invert, finish 24°F
- Syrup 80 brix - 78 brix sucrose – 2 brix invert, finish 25°F
- Syrup 80 brix - 77 brix sucrose – 3 brix invert, finish 26°F

Invert Sugar

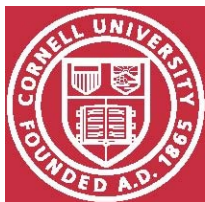
Sucrose is a twelve carbon sugar having the chemical formula $C_{12}H_{22}O_{11}$. Invert sugars are six carbon sugars, such as glucose (dextrose) and fructose (levulose), which are structurally different but both with the chemical formula $C_6H_{12}O_6$. You may also see them referred to as hexoses or reducing sugars. For purposes here I will refer to them independently as glucose and fructose or together as invert sugars. Invert sugars are produced in sap or syrup by the splitting of sucrose, commonly by the action of microorganisms, acids or the enzyme invertase. Sucrose is common table sugar and is the only sugar in sap when it comes from the tree. Some of the sucrose in sap is converted to invert sugar as a result of microbial fermentation during handling

and processing. This change occurs in all sap and is most common in syrup produced from sap that is collected late in the season when temperatures are warmer.

A small amount of invert sugar is desirable in maple syrup that is to be made into maple confections. Invert sugars are more soluble in water than sucrose at room temperature meaning more total sugar can be held in solution before crystallization occurs. This helps keep the product moist, and it also encourages smaller sugar crystals to form. Too little invert sugar in the syrup can cause the product to be grainy; too much may prevent formation of crystals. Other properties of invert sugar include an increase in sweetness compared to sucrose alone, reduced viscosity making it easier to spread creams or frostings, softening of a product's texture, reducing water activity making products more resistant to yeast, mold or bacteria fermentation, and depression of the freezing point so products stored in the freezer are less likely to crystallize or change in crystal structure.

Invert sugar is one of the ingredients of the Maillard browning and Caramelization reactions. Maillard Browning happens then you have invert sugars, amino acids and heat. It is one of the chemical reactions that happens when heating syrup and can lead to darker color and stronger flavor. Caramelization happens at different temperatures with the different sugars. At 365°F sucrose will caramelize, glucose at 295°F and fructose at 219°F. When cooking syrups for confections, producers should recognize that high invert levels may increase the darkening particularly where invertase or acids have been used to create a very high level of invert sugar. Converting too much of the sugar in maple syrup to invert sugar can alter the taste so that it becomes more like the characteristic honey flavor.

In general, all grades of maple syrup contain some invert sugar, and the amount varies among different grades. Lighter 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 colors. A simple test using the common glucose meter used to monitor blood sugar levels can be very helpful in selecting and blending syrups to make the most consistent products. This can be especially valuable if syrup is being purchased for the purpose of making confections. For complete information on testing for invert sugars in maple syrup see the fact sheet titled "Invert Sugar in Maple Syrup".



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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, you the technician must 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 also be tested 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 done on the finished products. This includes hardness or viscosity, crystalline characteristics (smoothness or graininess) appearance, and taste testing. During production, the quality control technician (usually you) check physical aspects of the process, mainly temperatures. A comparison method is typically used. 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 find another to work with you in evaluating this important aspect of making maple confections. Locate the one 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.

Temperature (°C) Result

122°C/260°F	Granulated sugar
120°C/248°F	Very hard sugar
118°C/244°F	Hard sugar
114.5°C/238°F	Maple soft sugar
113°C/235°F	Maple on snow
111.5°C/234°F	Maple cream or spread
104°C/219°F	Maple Syrup
100°C/212°F	(Water boils)

Making maple confections from a standard temperature chart like this one is NOT ACCEPTABLE if a consistent product is desired. Finish temperatures must be adjusted to conditions!

These factors include

- Degree of super-saturation or finish temperature
- Blend of sugars present
- Rate of cooling
- Rigor and length of stirring
- Temperature at stirring
- Seeding
- Presence of crystal growth inhibitors

Quality Control -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 adulterated 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 syrup contained relatively low amounts of fructose relative to the other grades (Table 1). However, in general, the different grades of syrup contained

Table 1. 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

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+/-0.41	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

from a wide geographic area in 2004. n = the number of samples for each grade. 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.

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

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Section 2

Invert Sugar

- 2.1 Measuring and Adjusting Invert Sugar in Maple Syrup**
- 2.2 What is Sugar**
- 2.3 Water Activity: Another Critical Factor for Safety of Food Products**
- 2.4 Substituting inverted maple syrup for corn syrup in maple value added products.**
- 2.5 Adjusting off Density Syrup**
- 2.6 Practice Alligation Tables for Blending Maple Syrup**

2.1 Measuring and Adjusting Invert Sugar in Maple Syrup

Stephen Childs and Brian Chabot

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 the bulletin titled "Chemistry of Maple Syrup".

Sucrose is common table sugar and is the only sugar in sap when it comes 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 (dextrose) and fructose (levulose). They have the same number of carbon, oxygen and hydrogen atoms, but they differ slightly in how these atoms are assembled. 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, produces invert sugars. A certain amount of invert sugar is desirable in maple syrup that is to be made into a maple confection.

Need to test

In general, all grades of maple syrup contain some invert sugar. The amount varies among different grades. Lighter colored syrup, particularly that made early in the production season, generally has the least invert sugar. Very dark colored syrup, particularly that made late in the production season, has the most invert sugar. The color grade 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 grade classifications. This variability of invert sugars in syrup makes it necessary to test and adjust the 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 the 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 can be very helpful in 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.

Diluting Syrup to Measure Glucose

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 from undiluted maple syrup usually would be higher than the range of most meters. To solve this problem you must dilute the maple syrup

with water before testing. Since maple syrup and water are of very different weights it is best not to make the dilution by volume. The most accurate and easy method is to dilute by weight. This is best done with a scale. Scales with one tenth of a gram (0.1 g) accuracy and a range of 0 to 300 or 600 grams are now available at reasonable costs and are easily ordered on the internet. A one in ten dilution of syrup seems to work well for most syrups, it is easy to calculate on a scale, and gives a reading on the glucose meter that is in the range for invert sugar concentrations required for most confections. Once you have a scale and are familiar with it's operating instructions, follow these simple directions:

- Place an empty cup on the scale
 - Tare the scale to read 0 with the cup in place
 - Drip between 5 and 10 grams 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 showed a reading on the scale of 5.6 grams, add water until it reads 56, or if the syrup in the cup showed a reading on the scale of 7.7 grams, add water until the scale reads 77 grams.
 - 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.

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 glucose in maple syrup, but meters that give numerical readings throughout their range (rather than Hi/Lo at the extremes) are best. These can range in price from nearly \$100 to less than \$10. 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 in determining which to buy. The more expensive meters offer recording and storage of information options that will be of no use to maple producers.



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. The chemicals in the test strips deteriorate with time. Don't 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 di-

rections with your meter. Store your meter and test strips in a place protected from dust, fluids, and extremes of temperature and humidity.

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. Insertion of the test strip will turn the meter on automatically, give a notice of calibration, and then 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 up, otherwise the meter will not give a reading.
- When the meter indicates it is ready for a sample, dip the extended end of the test strip about ½ inch into the syrup dilution and hold for about 5 seconds or until the meter indicates 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. Here you will need to read the manual that came with the meter to know at what number the meter begins reading Hi or Low to understand what range they represent. The reading on the screen should be given as mg/dL or milligrams per deciliter. Most meters read glucose concentration in whole blood. Some meters convert these reading 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 percent of invert sugar. The chart at the end of this section uses this conversion. Bulletins on specific confections will recommend percent invert sugar ranges for best results.

Accuracy and Repeatability

Repeatability means 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, 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% and your meter read 50mg/dl it would be perfectly correct but you should expect readings to vary between 45 and 55mg/dl if you took a number of reading from this same sample. At these low sugar levels this amount of variation is completely acceptable and gives you a close enough knowledge of where the invert sugar levels are in your syrup to make good blends and confections. You should understand though that as the invert sugar levels increase the 20% variation also becomes a bigger number. A 10% invert sugar solution (500 mg/dL) could give a reading between 450 and 550mg/dl.

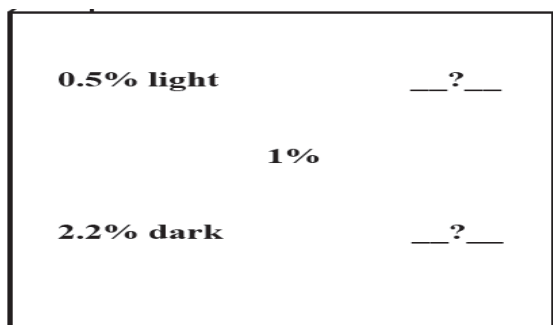
You should check your meter periodically with repeat measurements on the same sample (with different test strips) to get an idea as to what to expect. Be sure that the sample is well mixed. Test Quality Control Solutions can be obtained from some pharmacies or the meter manufacturers if you need to check a suspect meter. Despite their limitations, these meters are a big 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. An invert sugar test can be run on barrels or other storage units as they are stored or a small sample can be held out from each barrel and all samples tested soon after the season so that the syrups can later be selected for use making confections or blending without further testing being necessary. The reading should be recorded on the container or in an inventory log. Also testing can be performed on each batch of syrup being selected for making confections.

Blending for Optimal Invert Sugar

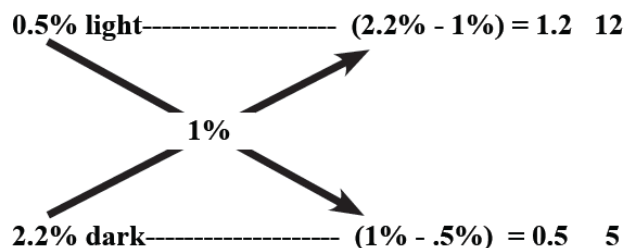
Determining the proportions of two syrups of known invert levels to obtain a blend with the desired invert sugar level can be done very simply, quickly, and directly using alligation. The method is best explained by example, so let's use two syrups with invert sugar of 0.5% and 2.2% to obtain a blend with an invert sugar level of 1%. For simplicity we will call the 0.5 syrup "light" and the 2.2% syrup "dark". Alligation determines the proportion by weight of each that should be blended.



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 of the desired blend.

Subtracting across the two diagonals provides the proportion (by weight) of each syrup required to produce the desired invert sugar percentage. Always subtract the smaller number from the larger,

irrespective of its location. The proportion (by weight) of each syrup to be blended is the number located directly across from it in the diagram. In our example:



The resulting ratio is 1.2 units of the light syrup with .5% invert sugar to each .5 units of the dark syrup with 2.2% invert sugar. To further simplify this, change the ratio to the simplest whole numbers. In this case it would be 12 to 5.

If both of the syrups have similar density, the unit of the ratio can be what ever is the most convenient for you. You could blend it as 12 pounds of light with 5 pounds of dark or 12 cups of light with 5 cups of dark, or 12 barrels of light with 5 barrels of dark. If blending syrups of different densities, like syrup and water, weight only, not volume, should be used. Once you have tested the syrups with the glucose meter blending using alligation is simple and very helpful in making the most consistent confections.

Be especially careful of strong flavors in dark syrup if blending is necessary as these flavors will become more pronounced in the final product.

Doctor Solutions

Some confections need higher than normal invert sugar levels to make the desired product such as the shelf stable maple cream or maple suckers or hard candy made completely from maple syrup (no corn syrup or glucose sugar added). If syrup with high invert sugar level is not available it can be created using a “processing aid” that converts sucrose to glucose and fructose. Usually all or most of the sucrose is converted to create a “doctor” or additive solutions.

To 1 gallon (4.4 liters) of standard-density maple syrup add 2 ½ liquid ounces (80 ml) of *Invertase* (an enzyme that causes the conversion of sucrose to invert sugars). Invertase may be purchased from many confection manufacturers and stored according to directions. Stir the mixture thoroughly and allow it to stand at room temperature (65°F or 18°C) or above for several days. This will convert the treated syrup to between 60% and 67% invert sugar. It would be nice to be able to test the syrup to get an exact invert level, but at these high amounts you are out of the testing range of the 1 in 10 dilution. Also, the 20% accuracy of the meter is not good enough at these high levels. You can get a general sense of whether the invertase converted the sucrose, but you will need a 1 to 400 dilution to get within meter range.

Heating syrup treated with invertase above 140°F will inactivate the enzyme and the sugar conversion will stop. Heat-treat the doctor solution above 140-160°F before adding to untreated syrup because it will convert sucrose in the untreated syrup.

The alligation method can be used to create a desired invert sugar level by blending the doctor solution with the lower invert syrup.

Another convenient type of processing aid is an acid salt such as cream of tartar (potassium acid tartrate). Adding ½ teaspoon (2.5 ml) of cream of tartar to 1 gallon (4.4 liters) of low-invert syrup just before it is boiled for candy making will cause sufficient acid hydrolysis or inversion of the sucrose to form the desired amount of invert sugar. Cream of tartar is available in the spice section of most grocery stores. The difficulty here is that testing can only be done after the fact and the results may not have produced the exact level of invert sugars you were expecting.

(US)	1 - 10 invert
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

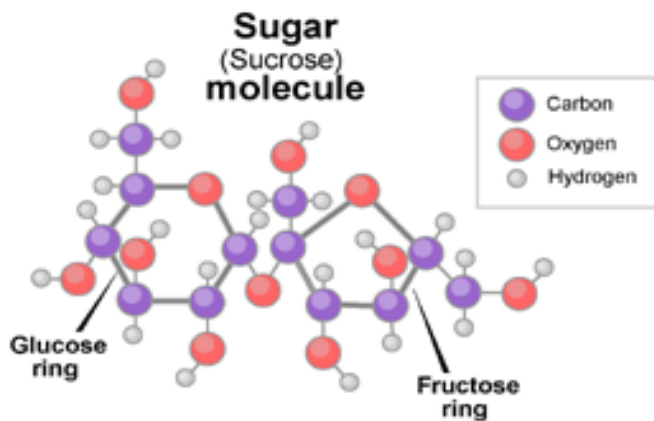
In summary, when making maple confections we recommend that you:

Measure and record the invert sugar levels of your stored syrups

Pick the best syrup for a confection based on the invert sugar levels

Or, blend syrups to get the invert sugar level you want

Where a high level of invert sugar is needed, use a processing aid, measure the results, and blend in the right amount to get the invert levels you want.



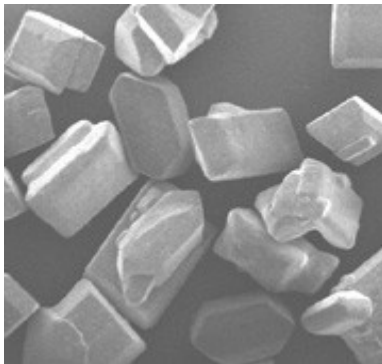
2.2 What is sugar?

The white stuff we know as sugar is sucrose, a molecule composed of 12 atoms of carbon, 22 atoms of hydrogen, and 11 atoms of oxygen ($C_{12}H_{22}O_{11}$). Like all compounds made from these three elements, sugar is a carbohydrate. It's found naturally in most plants, but especially in sugarcane and sugar beets—hence their

names.

Sucrose is actually two simpler sugars stuck together: fructose and glucose. In recipes, a little bit of acid (for example, some lemon juice or cream of tartar) will cause sucrose to break down into these two components.

If you look closely at dry sugar, you'll notice it comes in little cubelike shapes. These are sugar crystals, orderly arrangements of sucrose molecules.



Under a microscope, you can see that sugar crystals aren't cubes, exactly, but oblong and slanted at both ends.

(Image courtesy of Nutrition and Food Management Dept., Oregon State University)

What happens when you heat a sugar solution?

When you add sugar to water, the sugar crystals dissolve and the sugar goes into solution. But you can't dissolve an infinite amount of sugar into a fixed volume of water. When as much sugar has been dissolved into a solution as possible, the solution is said to be saturated.

The saturation point is different at different temperatures. The higher the temperature, the more sugar that can be held in solution.

When you cook up a batch of candy, you cook sugar, water, and various other ingredients to extremely high temperatures. At these high temperatures, the sugar remains in solution, even though much of the water has boiled away. But when the candy is through cooking and

begins to cool, there is more sugar in solution than is normally possible. The solution is said to be supersaturated with sugar.

Supersaturation is an unstable state. The sugar molecules will begin to crystallize back into a solid at the least provocation. Stirring or jostling of any kind can cause the sugar to begin crystallizing.

Why are crystals undesirable in some candy recipes—and how do you stop them from forming?

The fact that sugar solidifies into crystals is extremely important in candy making. There are basically two categories of candies - *crystalline* (candies which contain crystals in their finished form, such as fudge and fondant), and *noncrystalline*, or *amorphous* (candies which do not contain crystals, such as lollipops, taffy, and caramels). Recipe ingredients and procedures for noncrystalline candies are specifically designed to prevent the formation of sugar crystals, because they give the resulting candy a grainy texture.

One way to prevent the crystallization of sucrose in candy is to make sure that there are other types of sugar—usually, fructose and glucose—to get in the way. Large crystals of sucrose have a harder time forming when molecules of fructose and glucose are around. Crystals form something like Legos locking together, except that instead of Lego pieces, there are molecules. If some of the molecules are a different size and shape, they won't fit together, and a crystal doesn't form.

A simple way to get other types of sugar into the mix is to "invert" the sucrose (the basic white sugar you know well) by adding an acid to the recipe. Acids such as lemon juice or cream of tartar cause sucrose to break up (or invert) into its two simpler components, fructose and glucose. Another way is to add a nonsucrose sugar, such as corn syrup, which is mainly glucose. Some lollipop recipes use as much as 50% corn syrup; this is to prevent sugar crystals from ruining the texture.

Fats in candy serve a similar purpose. Fatty ingredients such as butter help interfere with crystallization—again, by getting in the way of the sucrose molecules that are trying to lock together into crystals. Toffee owes its smooth texture and easy breakability to an absence of sugar crystals, thanks to a large amount of butter in the mix

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2.3 Water Activity: Another Critical Factor for Safety of Food Products

Randy Worobo and Olga Padilla-Zakour

If you read the federal or state regulations regarding microbial food safety, two values are always 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) with 4.6 being the limit to define acid and low acid foods. Therefore, any food with a pH below or equal to 4.6 is acid and any food with a pH above 4.6 is classified as low acid. We discussed in detail how to measure the pH of a food in a previous issue of *Venture* (Vol. 1 No. 1).

The second value is water activity, a term most people are not familiar with, which refers to the water in a food that is available for microbial growth. Water activity also affects chemical and enzymatic reactions but these effects will not be covered in this article. Based on regulations, if a food has a value of 0.85 or below, is classified as non-hazardous, because there is not enough free water to allow the growth of pathogens. We 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, that is, the amount of bound plus free water 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, and then the container is 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 called ERH if it is expressed on percentages (0 to 100) or Water Activity if it is expressed as values between 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.

Examples of foods with typical water activity readings are shown in Table 1.

Table 1. Common water activity ranges for selected foods

Water Activity	Foods
1.00 to 0.95	Fresh meat, fruit, vegetables, canned fruit in syrup, canned vegetables in brine, frankfurters, liver sausage, margarine, butter, low-salt bacon, eggs
0.95 to 0.90	Processed cheese, bakery goods, high moisture prunes, raw ham, dry sausage, high-salt bacon, orange juice concentrate
0.90 to 0.80	Aged cheddar cheese, sweetened condensed milk, Hungarian salami, jams, candied peel, margarine, soft pet food
0.80 to 0.70	Molasses, soft dried figs, heavily salted fish
0.70 to 0.60	Parmesan cheese, dried fruit, corn syrup, licorice
0.60 to 0.50	Chocolate, confectionery, honey, noodles
0.40	Dried egg, cocoa
0.30	Dried potato flakes, potato crisps, crackers, cake mixes, pecan halves, peanut butter
0.20 or lower	Dried milk, dried vegetables, chopped walnuts

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. The lack of water prevents the microorganisms from growing but it does not necessarily accelerate the death of microorganisms. An excellent example of this is bakers yeast. The yeast is purchased in a dried form and once water and a small amount of growth substrate (sugar) are supplied, the yeast begin 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. A good example of this technique is heavily salted fish. 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 is by not binding up the available water but by removing it through drying. 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, the distribution and storage temperature, the packaging conditions and expected shelf-life, but in general, most dried products will have a final water activity below 0.85. The level of water activity reduction to render your food safe from spoilage and potential pathogens depends, therefore, on your food and 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 to lower water activities and require a a_w of 0.60 or below to ensure food preservation. This is why bread spoils due to mold growth and not bacterial growth.

Traditional dried foods, or low moisture foods, contain less than 25 moisture and have a final a_w , between 0.0 and 0.60. Examples of these products are dried eggs, crackers and

Another category of water activity controlled foods are those that contain between 15 and 50 moisture and have a a^w between 0.60 and 0.85. These are the intermediate-moisture foods which normally require additional protection from secondary factors such as pasteurization, pH control, refrigeration or preservatives, to produce a stable product. Examples of intermediate-moisture foods are dried fruits, cake and pastry, fruit cake, jams, syrups and some fermented sausages. For meat products, the USDA regulations require a minimum holding temperature during dehydration to be 145°F. The elevated dehydration temperature not only assists in the drying process but also prevents the growth of pathogens and most spoilage organisms. 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.

The dried and dehydrated products must be kept in an environment with a relative humidity lower than the equilibrium relative humidity of the product ($a_w \times 100$). If the dried foods are exposed to higher relative humidity environments, the products will take on the water and their a_w , will increase. This increased a_w may now be 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 not punctured or open. Specialty plastic materials are available to fit different products for specific needs such as grease resistance, UV light protection, low oxygen permeability, vacuum packaging and others. Careful selection will provide an extended shelf-life by minimizing quality changes over time.

The pH is another critical factor for microbial growth. If the minimum pH and a_w for specific microorganisms are known, it is possible to design or adjust food products to control pathogens and extend the shelf-life. Table 2 summarizes critical values of a^w and pH to support microbial growth of important food microorganisms.

Table 2. Approximate minimum values of water activity and pH to support microbial growth

Minimum a_w	Minimum pH	Microorganism
1.00	-	<i>Caulobacter</i>
0.985	5.3	<i>Campylobacter jejuni</i>
0.96	5.0	<i>Clostridium botulinum</i> (non-proteolytic)
0.95	5.0	<i>Pseudomonas species</i>
0.95	4.6	<i>Yersinia enterocolitica</i>
0.95	4.4	<i>Eschericia coli</i>
0.95	4.0	<i>Salmonella species</i>
0.95	3 to 3.5	<i>Lactobacillus species</i>
0.93	5.0	<i>Clostridium perfringens</i>
0.93	4.6	<i>Clostridium botulinum</i> (proteolytic)
0.91	4.9	<i>Bacillus cereus</i>
0.86	4.0	<i>Staphylococcus aureus</i>
0.8 to 0.6	<2.0	Many yeasts and molds

If the pH and the water activity of a food product are known or measured, then it is possible to study processing and packaging alternatives, and formulation changes to render a safe, quality product.

If the pH and the water activity of a food product are known or measured, then it is possible to study processing and packaging alternatives, and formulation changes to render a safe, quality product.

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2.4 Substituting inverted maple syrup for corn syrup in maple value added products.

Stephen Childs, New York State Maple Specialist

When maple syrup is treated with invertase and allowed to stand until completely inverted the sucrose in the maple syrup becomes the invert sugars glucose and fructose. Inverted maple syrup can be substituted for corn syrup in the production of many maple value added products. Making this substitution allows the products to be marketed as being made of 100% maple or all maple sugar. This can be true with maple suckers, hard maple candy, maple marshmallow, maple taffy, frostings, maple coatings and other bakery and candy products where you don't want the sugar to crystallize. When substituting inverted maple syrup in a recipe that calls for corn syrup there are several things to take into account.

First is the moisture content of inverted syrup vs. corn syrup. The percentage of water in inverted maple syrup is typically in the 32% to 34% range while corn syrup is generally between 28% and 30% water. In recipes where the mixture of ingredients is to be boiled to a specific temperature this difference in moisture content is not important as the boiling evens these differences up. However in a recipe where the mixture of ingredients is heated but not boiled to a finishing temperature adjusting for the moisture content could become important. For each cup of inverted maple syrup that replaces a cup of corn syrup you could reduce adding water from other sources by two teaspoons in the recipe.

The second consideration is difference in the amount of invert sugar between the inverted maple syrup and the corn syrup. It is the level of invert sugar in the ingredient mixture that allows the final product to have the correct level of sugar crystallization or a complete blocking of crystallization. In most cases the goal of adding the invert sugar is to have enough to completely block the formation of crystals and allow the product to be soft and moist rather than rock hard or crystalline. Fully inverted maple syrup would have an invert sugar level of between 66% and 69% while corn syrup would usually be in the 15% to 40% range but can be as high as 70% invert sugar. The source and the processes used to make the corn syrup allows for this large variation. In my limited experience a one for one substitution of inverted maple syrup for corn syrup has worked well but there may be recipes or products where less inverted maple syrup could be used to accomplish the goals. Some experimentation may be in order here.

Replacing corn syrup with inverted maple syrup will increase the ingredient costs as maple syrup is more expensive than corn syrup. The fact that the final products do not contain corn syrup or are 100% from maple syrup should be advertised and made known to the consumer and higher prices may also be in order.

The procedure for inverting maple syrup is fairly simple. Inverted maple syrup is made by adding 0.1% to 0.25% by volume of the enzyme invertase to pure maple syrup. For a gallon (4.4 liters) of syrup to be converted to invert syrup add 1.5 teaspoons (8 ml) of invertase or follow your manufacturer's directions. Invertase performs optimally at a temperature 120°F, and is rapidly deactivated at temperatures greater than 170°F. The syrup plus invertase is heated to 120°F for 24 to 48 hours and then stored under refrigeration, or held at lower temperatures for a longer

period of time. Over-heating the treated syrup will stop the conversion process. The use of an oven or crock-pot is ideal for this purpose. Invertase is available from confectionary and baking supply sources 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. For further information on measuring and adjusting invert sugar in maple syrup see Cornell Fact Sheet CMB 206 Measuring and Adjusting Invert Sugar in Maple Syrup. When selecting syrup for inverting to be used to substitute for corn syrup 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 less can be used to make a variety of crystalline maple value added products and should be saved for those purposes. A syrup with a reading over 100 can be used to make these other value added products and significantly increase the value. However if the high invert syrups have too strong a flavor for the end product to be good you may need to use a lighter syrup.

Glucose Meter Reading	1 in 10 dilution of syrup
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

Gray area is the suggested invert sugar levels in maple syrup to be inverted for use in value added products in place of corn syrup

As in making all maple value added products the flavor of the syrup is most important. Only maple syrup with excellent flavor should be used, even when the syrup will be inverted. Making products that use inverted maple syrup does allow good flavored maple syrup that has a naturally high invert sugar level that could not be used directly in making value added crystalline products like molded maple sugar, granulated sugar or traditional maple cream to still be made into very high value products. Be sure to select your good flavored syrups with higher invert sugar levels for making these value added products.

2.5 ADJUSTING OFF-DENSITY SYRUP BY BLENDING WITH SYRUP, SAP, OR WATER How Much Do I Mix?

Dr. Randy Heiligmann
School of Natural Resources, The Ohio State University

No matter how good we are at finishing syrup, most of us occasionally produce syrup with an unacceptable density. Maple syrup with too low a density is not legal, will spoil more quickly, and is thin and runny. Syrup that is too thick will produce sugar crystals and cost us money in syrup not made.

If the syrup's density is too low, it can be reprocessed to a higher density or blended with another syrup. If the density is too high, it can be blended with another syrup, water, or sap. The challenge when blending is to determine how much syrup, water, or sap to blend with the off-density syrup to produce the desired density.

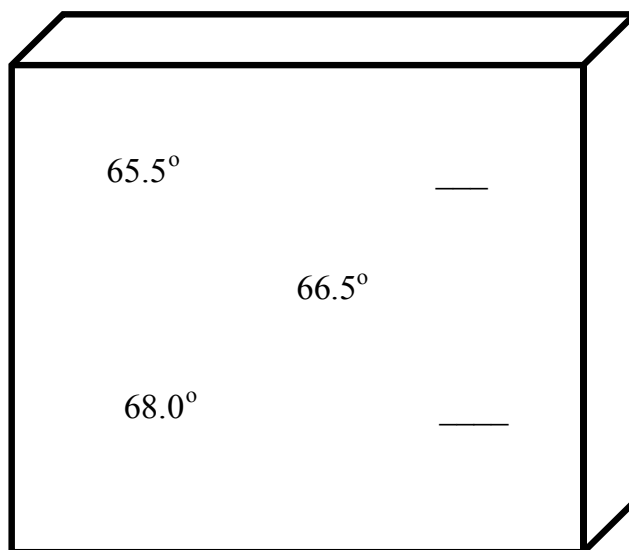
Except for the most experienced among us, guessing the proportion of syrup, water, or sap to blend with off-density syrup can be a frustrating experience. The alternative is to calculate the proportions of syrups to blend to achieve the desired density. Certainly, those of us who are mathematically inclined can and some probably have used algebra to determine the proportions of two syrups to blend to achieve a desired density.

There is, however, a much easier way. Obviously, you can't completely get away from math and accurately determine blending proportions, but the method of alligation discussed and demonstrated in this article requires very simple calculations. Those of you familiar with older editions of the Maple Syrup Manual may remember a discussion on blending syrup using the method of alligation (Pearson square). It is a quick and easy method for determining the proportion of syrup, sap, or water that should be blended with an off-density syrup to achieve the desired density. Alligation can be used directly to determine the weights or volumes to mix when blending syrup with syrup or to determine the weights to mix when blending syrup with sap or water. As shown in this article, it can also be used with slight modification to determine the volumes to mix when blending syrup with sap or water.

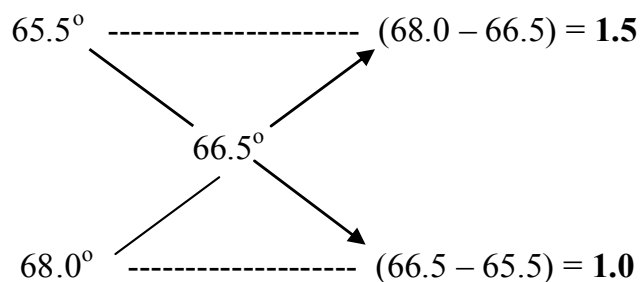
BLENDING SYRUP WITH SYRUP

Determining the proportions of two syrups of known densities to mix to obtain a blend with the desired density can be done very simply, quickly, and directly using the method of alligation. The method is best explained by example, so let's blend two syrups with densities of 65.5° Brix and 68.0° Brix to obtain a blend with a density of 66.5° Brix. The method of alligation determines the proportion by weight of each that should be blended.

Visualize the method utilizing a diagram similar to the five side of 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 density of the desired blend. In our example:



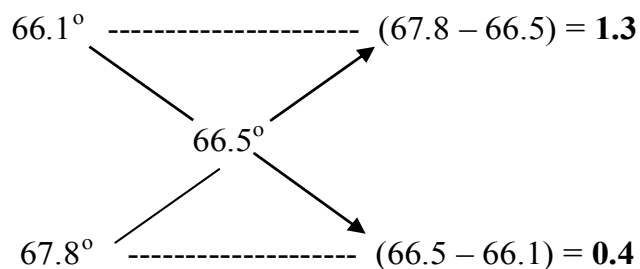
Subtracting across the two diagonals provides the proportion (by weight) of each syrup required to produce the desired density. Always subtract the smaller number from the larger, irrespective of its location. The proportion (by weight) of each syrup to be blended is the number located directly across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



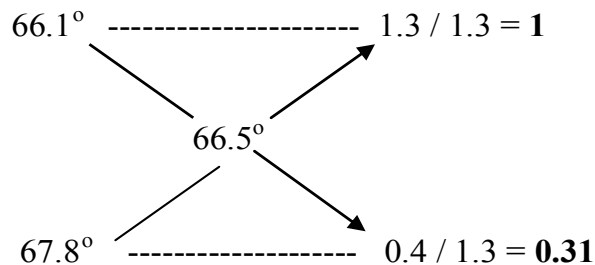
Blending 1.5 parts 65.5° Brix syrup with 1.0 part 68.0° Brix syrup results in a blend with a density of 66.5° Brix . If we had 150 pounds of 65.5° Brix syrup and wished to raise its density to 66.5° Brix by blending it with 68.0° Brix syrup, we would need to mix the 150 pounds of 65.5° Brix syrup with 100 pounds of the 68.0° Brix syrup, producing 250 pounds of 66.5° Brix syrup.

Above we noted that the method of alligation calculates the mixing proportions on a weight basis. However, since the difference in weight between syrups of different densities is relatively small, the proportions calculated using the method of alligation can be applied to volumes with relatively small error. In our example, applying the proportions to volume and mixing one and one-half gallons of 65.5° Brix syrup with one gallon of 68.0° Brix syrup would produce 2.5 gallons of 66.52° Brix syrup – two hundredths of a Brix too high. This accuracy is well beyond that which most of us will ever measure.

Let's look at one more example of blending syrups with slightly messier results. Suppose we have some 66.1° Brix syrup we would like to blend up to 66.5° Brix using 67.8° Brix syrup. Using the method of alligation to determine the proportions to blend:



The mixing proportions are 1.3 parts 66.1° Brix syrup with 0.4 parts 67.8° Brix syrup. We can work with these proportions but it is easier to calculate the amount of syrup to combine with a given amount of off-density syrup if we convert one of the numbers in the ratio to a “one” so it can be interpreted as one pound or one gallon. In this example, since we want to know how much 67.8° Brix syrup to add to a known amount of 66.1° Brix syrup, we can set the proportion of 66.1° Brix syrup to “one” by dividing both numbers by 1.3, resulting in a mixing ratio of 1 part 66.1° Brix syrup to 0.31 parts 67.8° syrup.



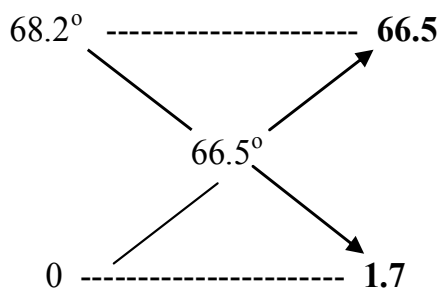
If we had 120 pounds of 66.1° Brix syrup we could combine it with 37.2 pounds of 67.8° Brix syrup (120 times 0.31) to produce 157.2 pounds of 66.5° Brix syrup. Similarly, 3 gallons of 66.1° Brix syrup could be combined with 0.93 gallons (or 119 fluid ounces) of 67.8° Brix syrup to produce 3.93 gallons of 66.5° Brix syrup.

BLENDING SYRUP WITH WATER OR SAP

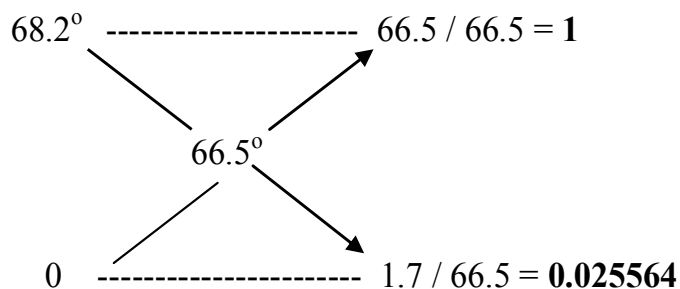
When blending syrup with water or sap on a weight basis, the proportions to mix can be determined using the method of alligation in the same way it was used when blending syrup with syrup. When blending on a volume basis, the proportions must be adjusted because of the difference in the weight of syrup and water or sap.

Weight Basis

Let's first look at blending on a weight basis, and determine how much water to blend with 68.2° Brix syrup to reduce its density to 66.5° Brix.



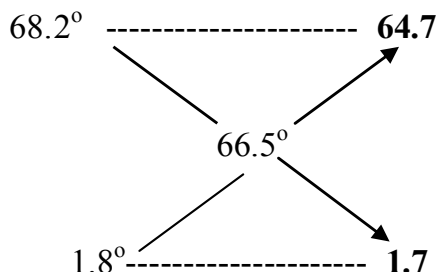
Again, since we are asking the question: “How much water should I blend with the syrup?” let's set the proportion of syrup equal to “one” in the ratio by dividing both numbers by 66.5 resulting in:



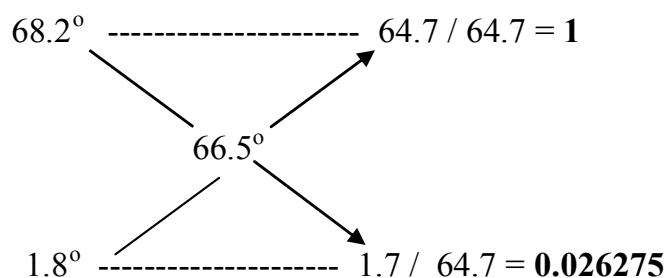
If we wished to lower the density of 350 pounds of 68.2° Brix syrup to 66.5° Brix by adding water, we would add:

$$(350 \text{ pounds syrup}) (0.025564 \text{ pounds water/pound syrup}) = 8.95 \text{ pounds water}$$

The process for determining how much 1.8° Brix sap to mix with the 350 pounds of 67.9° Brix syrup to lower its density to 66.5° Brix is exactly the same:



Converting the ratio to a more useable form by dividing both numbers by 64.7:



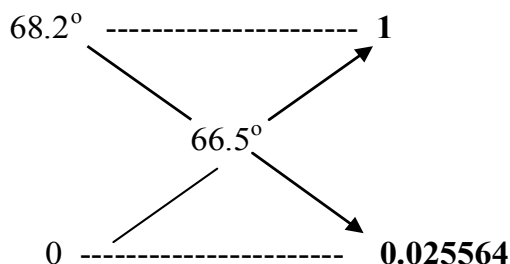
If we wished to use 1.8° Brix sap to lower the density of 350 pounds of 68.2° Brix syrup to 66.5° Brix , we should add:

$$(350 \text{ pounds syrup})(0.026275 \text{ pounds water/pound syrup}) = 9.2 \text{ pounds sap}$$

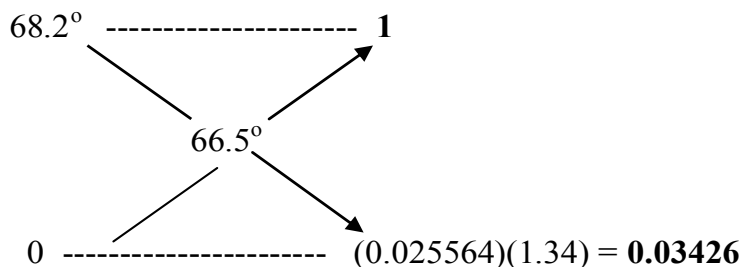
Volume Basis

When blending syrup with syrup we observed that although the proportions determined by the method of alligation were, strictly speaking, weight proportions, they could be interpreted as volume proportions with relatively little error because the difference in weight between syrups of different densities was very small. This is not true when blending syrup with water or sap. Depending on its density, a gallon of syrup generally weighs between 11 and 11¼ pounds, a gallon of water or sap between 8 ⅓ and 8½ pounds. When combining syrup with water or sap, the weight proportions determined by the method of alligation must be adjusted for these differences in weight.

Again, this is best understood by example. Let's look again at the example above blending water with 68.2° Brix syrup to reduce its density to 66.5° Brix. The weight proportions determined were:



A gallon of 68.2° Brix syrup weighs approximately 11.15 pounds; a gallon of water weighs approximately 8.33 pounds. By multiplying the proportion of water (0.025564) by the weight of a gallon of the syrup divided by the weight of a gallon of water (11.15 divided by 8.33 = 1.34) we convert the weight ratio to a volume ratio as follows:



0.03426 gallons (4.4 fluid ounces) of water should be blended with one gallon of 68.2° Brix syrup to reduce the density of the blend to 66.5° Brix.

In our example above (combining on a weight basis) we determined that 8.95 pounds of water should be added to 350 pounds of 68.2° Brix syrup to reduce its density to 66.5° Brix. We have now determined that 0.03426 gallons of water should be added to 1 gallon of 68.2° Brix syrup to reduce its density to 66.5° Brix. Since 350 pounds of 68.2° Brix syrup has a volume of 31.4 gallons (350 divided by 11.15), 1.076 gallons of water (31.4 times 0.03426) must be added to reduce the density to 66.5° Brix. That much water weighs 8.96 pounds (1.076 times 8.33). Using the method of alligation to determine the weight proportions and using it with the correction factor of 1.34 to determine the volume proportions produced equivalent answers (except for rounding error).

Fortunately, the determination of the correction factor can be greatly simplified. If the density of the syrup to be diluted is between 66.5° and 70.0° Brix and water or sap with a density of 4° Brix or less is used, **1.33** can always be used as the correction factor. If this

is done, the maximum error in the desired density will be around 0.02° Brix. Again, this is far more accurately than most of us will ever measure.

SUMMARY

What You Really Need To Know

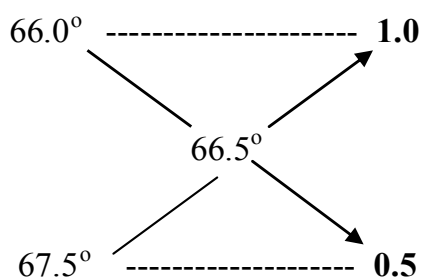
The method of alligation provides a quick and easy way to determine the proportion of syrup, sap, or water that should be combined with an off-density syrup to obtain a blend of the desired density.

Blending Syrup With Syrup

When blending syrup with syrup the proportions determined by alligation may be applied to either weight or volume measurements. To determine the proportions:

- Utilize a diagram resembling the five side of a die.
- Place the density of the two syrups to be blended in the upper and lower left-hand corners of the diagram and the desired density of the blend in the center.
- Subtract across the diagonals to obtain the proportions of syrup to mix. Always subtract the larger number from the smaller. The proportion of each syrup to blend is directly across from it in the diagram.

As an example, how much 67.5° Brix syrup should be mixed with 10 gallons or 110.4 pounds of 66.0° Brix syrup raise its density to 66.5° Brix.

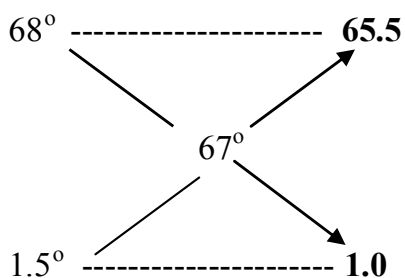


Five gallons of 67.5° Brix syrup should be mixed with 10 gallons of 66.0° Brix syrup to produce 15 gallons of 66.5° Brix syrup, or 55.2 pounds of 67.5° Brix syrup should be mixed with 110.4 pounds of 66.0° Brix syrup to produce 165.6 pounds of 66.5° Brix syrup.

Blending Syrup With Water or Sap

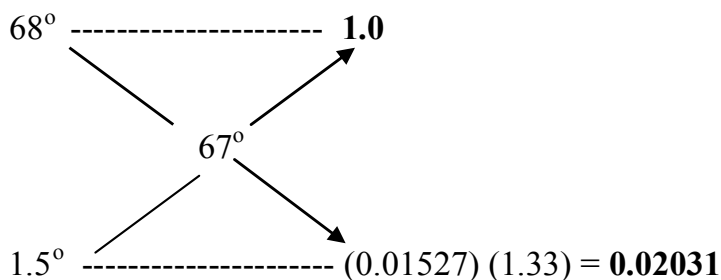
When blending syrup with water or sap the proportions determined by alligation may be applied to weight measurements but must be adjusted when applied to volume measurements because of the relatively large difference between the weights of syrup and water or sap.

When using weight measurements, determine the proportion of syrup and water or sap as summarized above for blending syrup with syrup. As an example, how much 1.5° Brix sap should be blended with 55.7 pounds of 68° Brix syrup to reduce its density to 67° Brix.



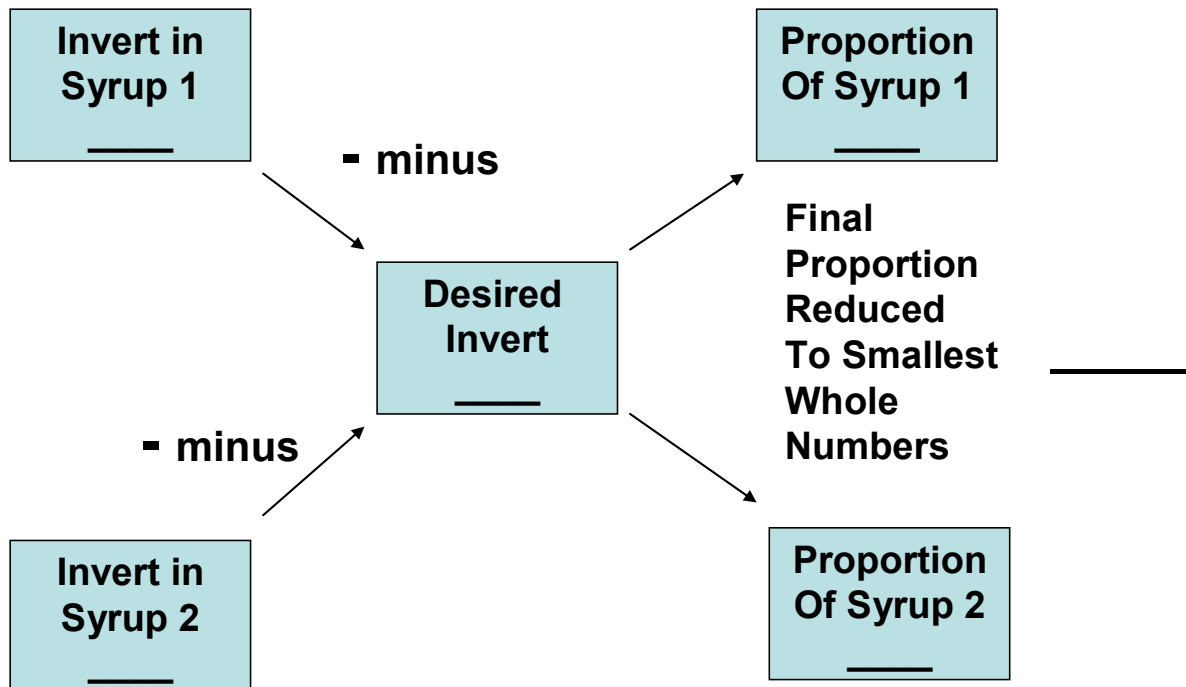
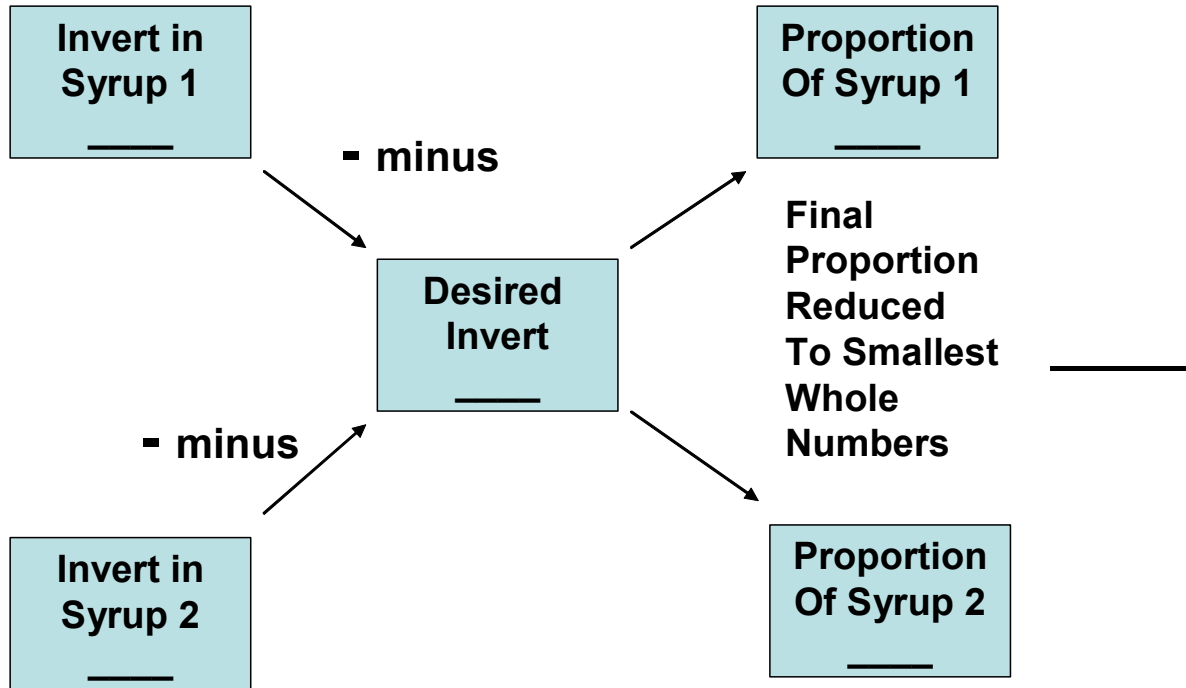
Dividing both numbers by 65.5 indicates that 0.01527 pounds of 1.5° Brix sap should be combined with each pound of 68° Brix syrup to produce a blend with a density of 67° Brix. In our problem, 0.85 pounds of 1.5° Brix sap (0.01527 times 55.7) are required to reduce the density of 55.7 pounds of 68° Brix syrup to 67° Brix.

When using volume measurements, determine the proportion of syrup and water or sap as if using weight and then adjust the proportion of sap or water using the **Rule of 1.33**. Using the above example of blending 1.5° Brix with of 68° Brix syrup to produce a blend with a density of 67° Brix, the volume mixing proportions would be



0.02031 gallons of 1.5° Brix sap should be mixed with each gallon of 68° Brix syrup to produce a blend with a density of 67° Brix. In our problem, 0.102 gallons or 13 fluid ounces of 1.5° Brix sap should be mixed with 5 gallons of 68° Brix syrup to produce a blend with a density of 67° Brix

2.6 Practice Alligation Tables for Blending Maple



Section 3

Crystallization

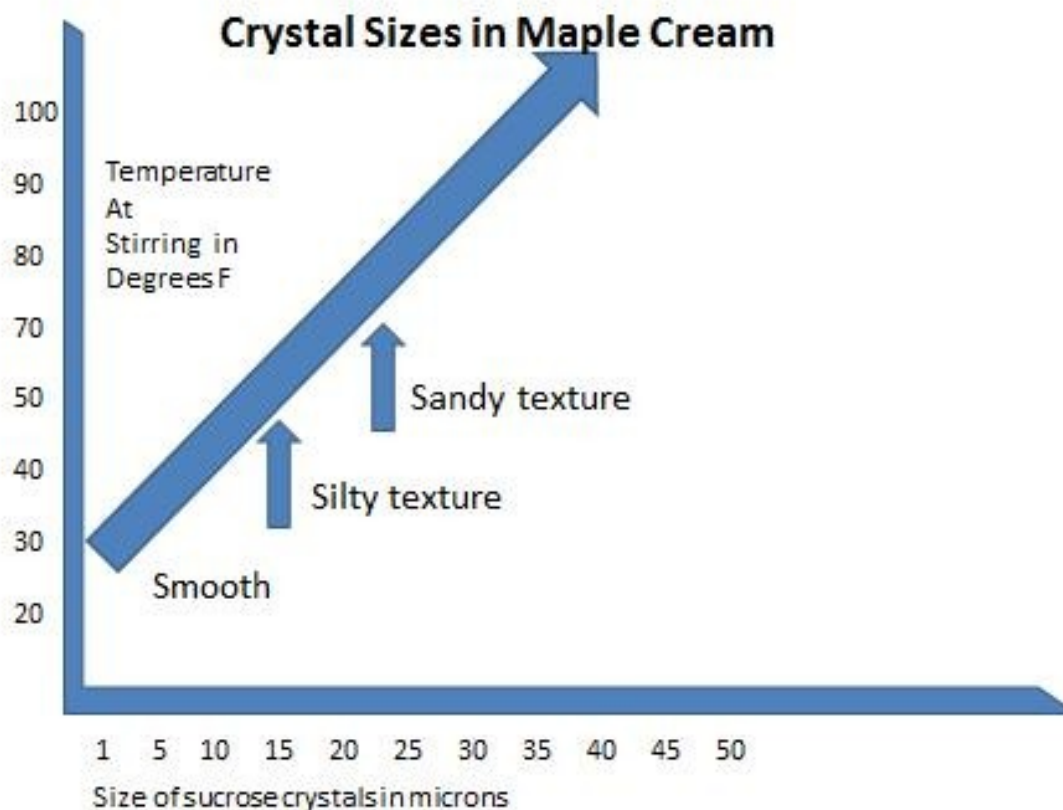
- 3.1 Factors that influence the size of crystals in maple products**
- 3.2 General Candy Making Training**
- 3.3 Forming Crystals in Candy**

3.1 Factors that influence the size of crystals in maple products

3.1 Factors that influence the size of crystals in maple products

By Stephen Childs, New York State Maple Specialist.

A very important factor in making quality maple value added products is to size sugar crystals so the product feels great to the customers' mouth. For some products such as maple candy and maple cream a very smooth mouth feel is preferred by most customers. If making maple granulated maple sugar a grainier texture is preferred. Unfortunately it is much easier to make grainy textured creams and candies than smooth textured due to the extra attention required to make sure a smooth texture is accomplished. There are several basic factors that will influence final crystal size. The first factor is the temperature at the time of stirring. The graph below gives a very general idea of how stirring temperature may influence the texture of the cream.



If temperature was the only factor it would be simple to just say follow the graph and you can get what you want. But there are several other factors that may completely change the angle of the graph. The second factor is the invert sugar level of the syrup. The higher the invert the higher the temperature can be and still keep the finer texture. This has a limit, when the invert sugar level gets too high the product may not harden properly leaving a soupy maple cream or sticky maple candy. Syrups with very low levels of invert sugar can be grainy even when stirred at cool temperatures. The equipment used to stir the cream is another important factor.

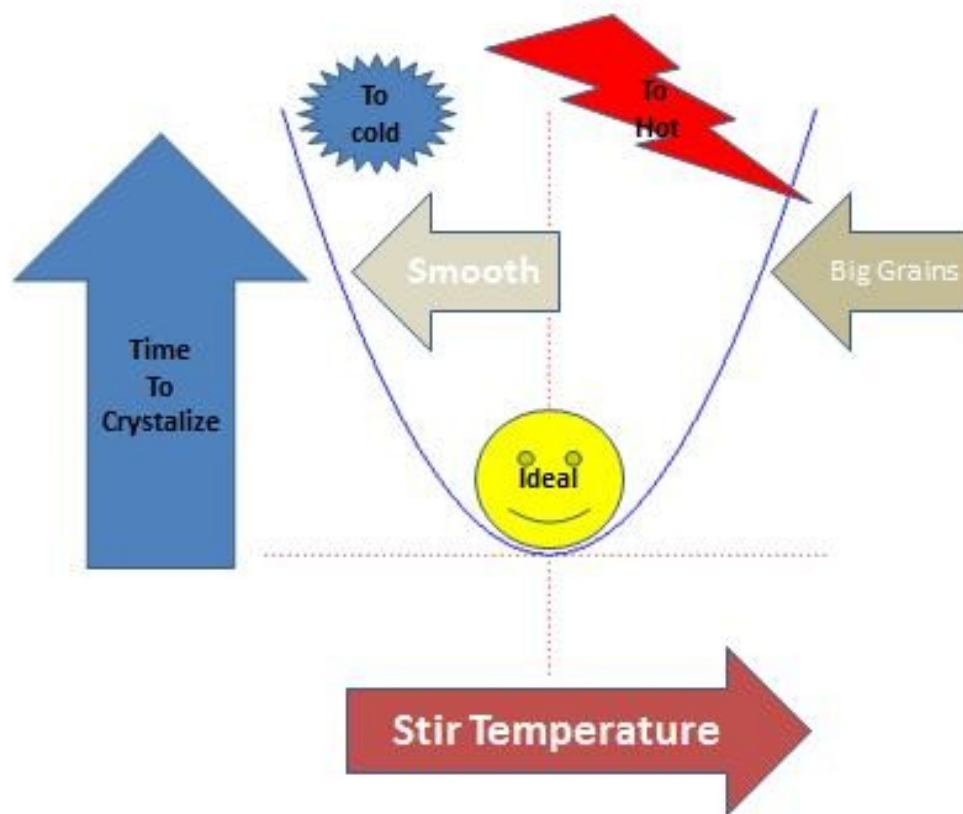
The faster, more powerful or shocking the stir is the smaller the crystal will be. A gear pump machine, depending on speed, will usually make a smoother cream than a turn table or the candy machine. Seeding can also have an important influence on the texture of the cream or candy. If crystals form on the top or sides of the pan while the cooked syrup is cooling those crystals can “seed” the batch. When cooling syrup is exposed to existing crystals the future crystals tend to copy the size of those early crystals. Purposely seeding (adding finished cream) with a smooth textured cream to the batch just as you start to stir can help create a smooth textured finished product. Seeding a candy batch with some cream can result in smoother textured candy. Another procedure that used to be used much more than it is currently is the making of a fondant to add to a new batch of cream or candy. In this system a batch of stiff and very fine textured cream would be made at least one day prior to candy or cream making day. The fondant would be added to the new batch of cream or candy in a volume of between 20% and 50%. Then the mixed batch of fondant and fresh cooked confection would be stirred together to hopefully create a new smooth batch of fine textured product.

With maple molded sugar or candy the temperature difference at stirring is broader than with maple cream as reflected in the sample graph below. Over cooling either cream or candy can make things very difficult for some stirring equipment. Cold syrup has been known to stall most any equipment available so it may be good to gradually work your way down to cooler stirring temperatures to try to predict the limits of the equipment you are using.



With granulated maple sugar stirring hot tends to make the larger crystals that make the best

textures. At the same time stirring right off the stove may lengthen the time it takes to crystallize. If stirring by hand, this length of stirring time can be of great importance as your stirring arm may surpass its' endurance. With most other machinery it is not so important. The simple graph below illustrates that the time it takes from when you start stirring to when it is finished will change with the temperature of the cooked syrup. This is true for all confections but probably is more noticeable with granulated sugar as often we are attempting to stir hotter than the idea crystallization temperature. If it is too hot it takes more stirring time to fully crystalize, if it's too cold it takes more time to fully crystalize, somewhere in the middle is an ideal temperature as far as how long the stirring will take but that is not necessarily the ideal temperature to get the desired texture. The graph shows also that stirring hot gives a more grainy texture and stirring cold gives a smooth texture but there are limitations to both ends of the graph.



Making quality maple confections means that the maple producer gains a clear understanding of these factors influencing product texture, keeps close control of finish temperature, stirring temperature, invert sugar levels, and seeding and operates as consistently as possible all the time to make consistent high quality maple confections.

3.2 General Candy Making Training

CRYSTALLIZATION

The objectives of this unit are:

The student will:

1. Learn to calibrate candy thermometers.
2. Learn the principles of making amorphous candies.
3. Learn the principles of making crystalline candy.
4. Compare amorphous vs. crystalline candies.
5. Learn the principles of sugar crystals vs. water crystals
6. Learn the function of ingredients in candy and ice cream.
7. Learn the principles of making ice cream products.

In this unit you will find:

- **Candy Crystallization**
 - **Crystalline Candy**
 - **Amorphous or Non-Crystalline Candy**
-

PRINCIPLES OF CRYSTALLIZATION

1. Optimum candy quality begins with adherence to standardized measuring techniques.
2. Crystalline candies are viscous until agitated by beating, kneading, or pulling.
3. The end temperature affects the consistency or type of candy. Syrups for amorphous candies are generally cooked to a higher end temperature than syrups for crystalline candies.
4. Amorphous candies are without form and contain no crystals.
5. The ingredients, speed of cranking, proportion of ice to salt, and length of storage control the size of ice crystals in ice cream and sherbet.
6. Ice, salt, and brine are all essential for freezing the mix.

CANDY CRYSTALLIZATION

- Both candy and ice cream will be explored in this unit together since they both exhibit crystallization.
 - Successful candy making depends on controlling crystals made of **sugar**.
 - An optimum ice cream or sherbet depends on minimizing the size of crystals made of **water**.
- Most candies are made by heating and boiling sucrose, also, known as table sugar; until enough water evaporates to produce a sugar concentration that yields a candy of the desired consistency.
 - Other ingredients added to candy, like chocolate and acids, affect the consistency of that candy as well as the flavor and color.
- The end cooking temperature, which determines the sugar concentration, is the most important factor in successful candy making.
 - There are two accepted methods of measuring the sugar concentration, by reading a candy thermometer and by observing the consistency of the cooked syrup by the cold-water test.
- To read the candy thermometer, first calibrate the thermometer by immersing the thermometer in a saucepan of water so that the bulb of the thermometer is completely covered by water.
 - The bulb should not touch the sides or the bottom of the saucepan.
- Bring the water to a boil.
- Read the temperature of the boiling water by making certain that your eye is at the same level as the mercury in the thermometer.
- The ideal temperature will be 212°F (100°C).



- If the water temperature reads above 212°F (100°C), add the difference to the temperature specified in the candy recipe.
- If the water temperature is below the ideal temperature, subtract the difference from the temperature in the candy recipe.



- After calibrating the candy thermometer, proceed with making the candy.
- To accurately read the sugar syrup temperature, during the cooking process, make sure the bulb is completely covered with the hot syrup and does not touch the sides or the bottom of the pan and read at eye level.
- To make the cold-water test, drop a few drops of hot syrup into a small amount of cold water in a custard cup and work your fingers to form a ball or threads.
 - This test is not specific and takes practice to judge the end consistency accurately.

Cold Water Test Cooking Stages and Temperatures of Sugar Syrups:

Cooking Stage	Temperature Range		Appearance
	°F	°C	
Thread	230-236	110-113	Forms a 2-inch thread when poured slowly from a spoon.
Soft Ball	234-240	112-116	Forms a ball that will not hold its shape and flattens when dropped into cold water.
Firm Ball	244-250	118-121	Forms a soft ball that will hold its shape until pressed when dropped into cold water.
Hard Ball	250-266	121-130	Forms a hard ball that is pliable when dropped into cold water.
Soft crack	270-290	132-143	Forms hard, but not brittle, threads when dropped into cold water.
Hard crack	300-310	149-154	Forms brittle and breakable threads when dropped into cold water.
Molten sugar	320	160	Clear, viscous liquid
Caramel	320-348	160-177	Brown, viscous liquid



- There are two types of candies.
 - The first, crystalline candy contains very small sucrose crystals, which should feel smooth on the tongue.
 - These candies include fondant, fudge, divinity, and centers of butter creams, pralines, and nougats.
- The second type of candy is Amorphous or Non-crystalline.
 - These candies do not have sugar crystals since they have so many crystal inhibitors in them or since they are cooked to such a high-end temperature that all the water has evaporated and the syrup is too viscous for the crystals to orient themselves into a crystalline structure.
 - Examples include caramels, taffies, and brittles like peanut brittle, hard candies, marshmallows, and gumdrops.

CRYSTALLINE CANDY

Our example for this unit will be chocolate fudge.

1. Measure the ingredients accurately to obtain an optimum product.

- Any ingredient added to the sugar will affect consistency, color and flavor.
 - The addition of acids, like cream of tartar, fruit juices or vinegar, inhibits crystal size.
 - Fats, like margarine, butter, cream, whole milk, or chocolate, also inhibit crystal size, as does protein in the form of milk, egg white, and gelatin.
 - Fat and protein inhibit crystallization by providing physical barriers, coating the crystal face and preventing one crystal growing on another, thus keeping the crystals small.
 - Chocolate adds brown color and inhibits crystal formation.
 - Corn syrup or honey is often used in candy making since they promote supersaturation by inhibiting the formation of crystals.





2.

- Shave or grate the chocolate for easier and quicker dissolving and blending.
- Grease the pan for the finished candy and set aside so it is ready when needed.
 - Once the candy has been beaten, there will be no time for preparing the pan!

3. Place the sugar, milk, and corn syrup in a heavy saucepan, which holds about triple the amount of ingredients.

- A large saucepan will allow enough head room so the candy does not boil over.
- The pan should be heavy to allow for slow, even heat flow so the candy does not overcook or burn.

Stir while bringing to a boil making sure that all the sugar crystals are dissolved, scraping the sides of the pan to remove all sugar crystals.

- If all the sugar crystals are not dissolved, they will "seed" the mixture.
 - To seed the candy is to introduce a substance, like a sugar crystal or dust particle, which will promote early crystallization of sugar.
 - The object in candy making is to minimize the crystals, not encourage early formation.





4. Bring the mixture to a boil and add the chocolate.

- Stir to evenly blend the ingredients and prevent them from sticking to the bottom of the pan.

5. Boil the mixture until the thermometer registers 234°F (112°C).

- The hot candy mixture will take a long time to raise in temperature from the boiling temperature to the desired end temperature.
- Watch carefully, once the temperature begins to rise, it will climb quickly.
- Overcooking will result in a hard, undesirable fudge.



6. Remove from heat.

- Stir in vanilla and margarine.
- Allow the mixture to cool to lukewarm without stirring or agitating.
 - Stirring will cause premature crystallization giving a gritty consistency to the candy.
 - The pan of hot fudge can be set in ice water to speed up the cooling process

7. Beat with a spoon until the fudge loses its gloss and begins to thicken and lighten in color.

- Quickly pour into the prepared pan before the fudge completely solidifies.
- Crystalline candy will hold a shape after agitation and does not necessarily need to be put in a pan to cool.

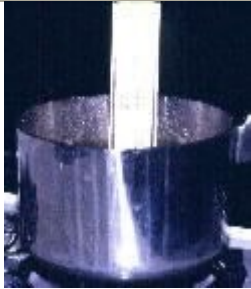





Crystalline candies exhibit the following quality standard:

- **Appearance:**
 - The candy holds the desired shape and appears smooth, not lumpy.
 - The candy will be opaque with no areas of off-color.
 - **Texture:**
 - The candy will have very small crystals and will therefore, feel smooth on the tongue.
 - **Tenderness:**
 - While the candy is firm enough to hold its shape, it should be extremely easy to cut, bite, and chew.
 - If the candy is tough or does not dissolve readily in the mouth, the sugar crystals are too big.
 - **Mouth feel:**
 - The candy will feel smooth.
 - **Flavor:**
 - Mild, sweet and well blended flavor accented by any added flavors like chocolate.
-

AMORPHOUS OR NON-CRYSTALLINE CANDY

Our example of amorphous candy is peanut brittle.

1.	
<ul style="list-style-type: none">• Accurately measure the ingredients for an optimum product.• Grease a baking sheet so the candy will not stick.	
	2. <ul style="list-style-type: none">• Place the water, corn syrup, and sugar in a heavy saucepan, which is about three times larger than the quantity of ingredients.• Stir until blended, scraping sides so no sugar crystals remain.
3. <ul style="list-style-type: none">• Boil the sugar mixture until the thermometer reaches 240°F or the softball stage.• Add the peanuts and butter and continue to cook until 290°F (143°C) or the hard crack stage.<ul style="list-style-type: none">○ Be careful not to have the heat on high or to overcook.○ The sugar will have caramelized by 290°F (143°C) and will produce an acid.	

	<p>4.</p> <ul style="list-style-type: none"> Remove the mixture from the heat and stir in the vanilla and baking soda. <ul style="list-style-type: none"> The baking soda, sodium bicarbonate, will combine with the acid from caramelization of the sugar and will produce carbon dioxide, which aerates the candy, giving it a porous structure. Candies without baking soda cooked to high temperatures, such as lemon drops, will be glassy and hard.
<p>5.</p> <ul style="list-style-type: none"> Pour onto the prepared pan until cool. <ul style="list-style-type: none"> Amorphous candy means "candy without form," so the candy will take the shape of the pan it is poured into. Work quickly so the candy will spread in a thin layer. 	

The quality standard for amorphous candy includes the following:

- Appearance:**
 - Hard candies hard and not sticky and clear, not cloudy.
 - Other candies (peanut brittle, toffee, caramels, marshmallows, etc.) will be opaque with no areas of off-color.
 - The candy will hold its shape upon cooling and after cutting.
- Texture:**
 - The candy will be smooth with no crystals or graininess apparent.
 - Hard candies will be very hard and brittle.
- Tenderness:**
 - Hard candies will be difficult to cut or bite, but will dissolve in the mouth.
 - Soft candies, like caramels, will be soft, yet quite chewy.
- Mouth Feel:**
 - The candy will feel smooth with no lumps or crystals.
- Flavor:**
 - The candy will be mild, sweet, and well blended with added ingredients often predominant.

ICE CREAM PRODUCTS



- Ice creams have ice crystals, not sugar crystals, and the size and quantity of those ice crystals must be minimized for an optimum product.
- Special refrigeration systems are used to freeze ice cream commercially.
- At home, however, the freezing is done in an ice cream freezer using an ice and salt mixture.
- Since ice cream has a lower freezing temperature than water, ice alone will not freeze the mixture, so salt is added.
- The temperature of the ice is lowered when a **brine**, or salt-water mixture, is formed.
- The ice added to the freezer begins to melt and then the salt will dissolve in the water, forming the brine.
- As more salt dissolves and more ice melts, the brine becomes more concentrated and the temperature will continue to drop.
- One part of salt should be added to 12 parts of ice or 1/3-cup salt to 4 cups ice.



- Ice cream can be made from a milk product like cream or whole milk and sugar.
 - Extra ingredients, like chocolate and eggs, are added not only to add flavor interest to ice cream, but to affect the consistency and to minimize ice crystal formation.
 - Of course, ingredients like chocolate and peppermint extract affect the flavor.
- Ice cream flavor should be delicate and well blended.
 - As the ice cream warms at room temperature, the flavor will increase in intensity since very **cold temperatures numb** the taste buds and therefore decrease flavor perception.

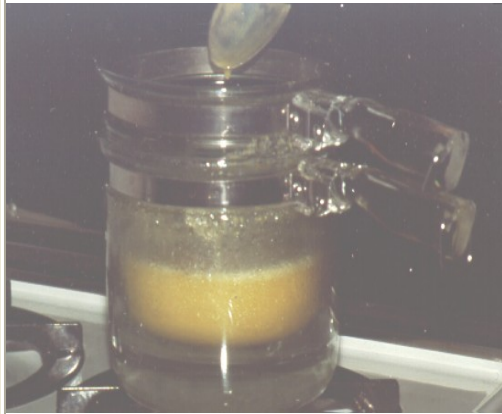
- Ice cream should have good "body" which is a smooth and rich consistency, which does not melt readily.
 - Often nonfat dry milk solids are added to improve the body of ice cream.
 - However, if the dry milk solids exceed 12% of the mix, the ice cream will have a grainy or sandy texture from lactose crystals.
 - This sandiness can be noticed in some soft serve ice creams.
- Fat will influence the consistency of ice cream also, higher fat making the ice cream seem smoother with better body since the fat coats the tongue so it cannot feel the crystals.
 - If two ice cream products, one high in fat and one low in fat with the same size ice crystals, are tasted side by side, the one higher in fat will appear smoother and finer.
 - Sugar helps to keep the ice crystals small by increasing the amount of liquid, which remains unfrozen, and decreases the freezing temperature.
 - Evaporated milk will also help to increase the smoothness due to the high concentration of homogenized milk, but also affects the flavor, adversely to some people's taste.
- Ice cream, especially homemade ice cream, will develop large ice crystals with freezer storage even with short storage periods.
- Stabilizers, such as gelatin, help to keep the ice crystals small over a period of time.



Our example of ice cream for this module is a frozen Custard or New York ice cream. The preparation steps include:

1. Accurately measure all ingredients for an optimum product.





2. Prepare the soft or stirred custard by cooking the milk, sugar, and egg in a double boiler over simmering water until the custard coats a metal spoon.

- The custard will have the consistency of thick cream and will not be solid.
- Take care not to curdle the custard, since curdled custard produces curdled ice cream!
- The egg cooked in the milk will help to stabilize the frozen mixture and to emulsify the milk fat, plus add color and flavor.

3. Chill the soft custard in the refrigerator until cold.

- If hot custard is used in the ice cream mix, it will take too long to freeze.

When cool, add vanilla for flavoring and the cream.



4. Place the ice cream mix in the inner metal, ice cream maker container.

- The mix is placed in a metal container, since metal transfers the cold quicker and better than other materials, such as plastic.

Adjust the top to fit and add ice and salt.

Begin to crank the ice cream maker, either by hand or electrically, depending on the type used.

5. After the electric motor has stopped or after the ice cream is difficult to crank by hand, unplug the freezer if needed, and remove the lid and take out the dasher.

- The ice cream mixture should have increased in volume due to water expansion and air beaten into the mixture.
- This increase is called "overrun."
 - Commercially ice creams are allowed 100% overrun or double the volume, while homemade ice cream normally has less overrun of about 50%.
 - The less the overrun, the richer and more full bodied the ice cream.
 - Thus some brands of commercial ice cream now have less than 100% overrun and a premium price is paid for them.



6. Repack the ice cream in fresh ice and salt or store in the freezer for about an hour or two to allow the ice cream to season, becoming more firm.

The quality standard for ice cream includes:

- **Appearance:**
 - The ice cream will appear smooth, not grainy or sandy.
 - No ice or sugar crystals will be visible.
 - The color will be subtle and is determined by the ingredients.
 - The ice cream will hold its shape **while** still frozen.
- **Consistency:**
 - The ice cream will be smooth and firm with good body.
- **Mouth Feel:**
 - The ice cream will feel quite cold and smooth, not grainy or gritty.
- **Flavor:**
 - The ice cream will have a mild well

3.3 Forming Crystals in Candy

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

- nature of crystallizing substance
- concentration
- rate of cooling
- temperature
- degree of agitation
- impurities and/or interfering agents
- nature of containers
- size and previous history of samples

Candies are made of sugar (sucrose), water or other liquid and usually some interfering agent (s). Butter, milk, cocoa and corn syrup are commonly used as both crystal interfering agents and flavoring. Candy begins when the water or other liquid is supersaturated with the solute, usually sucrose. Supersaturation occurs when more sugar is present than can be dissolved at that temperature. By heating the solution above the boiling point of water the solute concentration becomes greater. A supersaturated solution is formed when this solution, after heating to a high temperature, is allowed to cool undisturbed. Upon cooling the sugar recrystallizes into several small crystals or forms one large amorphous mass. For crystallization to occur, nuclei must form and solute must be added from the solution to these nuclei. Usually these nuclei form spontaneously but sometimes are "seeded" to the cooked mixture to initiate crystallization. The size of the resulting crystals depends on the number of nuclei, rate and temperature of crystallization, agitation and impurities in the solution.

Crystallization is a complex process with many interrelated factors. The nature of the crystallizing substance is important for crystallization, although not as obvious in candy making as sucrose is almost always the substance under discussion. The rate of crystallization is the speed at which nuclei grow into crystals. This rate is dependent upon the concentration of the solute in the solution as a more concentrated (more supersaturated) syrup will crystallize more rapidly than a less concentrated syrup. At a higher temperature the rate of crystallization is slow and becomes more rapid at a lower temperature. Agitation distributes the crystal forming nuclei and hastens crystallization.

Impurities in the solution usually delay crystallization and in some cases such as caramels may prevent crystal formation. Fat and protein decrease the number and size of crystals through the interference of their masses with the orientation of the sucrose molecules. Corn syrup also has this interfering role; however, additionally it serves to enhance the solubility of sucrose and thus decreases its tendency to crystallize. Cream of tartar as an added ingredient in a candy formula serves indirectly to decrease the rate of crystallization as well as crystal size. It does this through its ability to hydrolyze sucrose into its invert sugar. This not only forms two sugars of greater solubility than sucrose, but it gives agents which enhance the solubility of sucrose.

Section 4

Maple Cream

- 4.1 Making Maple Cream
- 4.2 Shelf Life Extension of Maple
- 4.3 Making Maple Cream 1965

4.1 Making Maple Cream

by STEPHEN CHILDS

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

Maple Cream Production

Maple cream is a value-added product that is made from pure maple syrup. The name maple cream, also referred to as maple butter or maple spread, would imply that dairy products are involved, but they are not. Maple cream is made by additional concentration by evaporation, quick cooling, stirring and then packaging at room temperature. Maple spread is an alternative name that does not confuse customers about the inclusion of dairy products. But maple cream is the traditional name and will be used here.

The finished maple cream should be light colored with a smooth, creamy texture that is used on toast, bagels, muffins, pancakes, doughnuts and combined with other bakery or confection products. From a 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 some vitamins. It also has excellent levels of anti-oxidants.

In recent years the procedure for making maple cream has been changing with research on shelf-stable maple cream and the introduction of the gear pump maple cream machine. Now a maple producer needs to choose between making traditional maple cream or the higher invert sugar shelf-stable maple cream. A producer can also choose to use the common turn table and paddle cream machine, the spiral drive candy machine, the new gear pump maple cream machine, or the no machine manual stirring method to perform the required agitation to crystallize the maple cream. Each method offers its own advantages and disadvantages. The introduction of flavored maple creams where such flavors as raspberry, cinnamon, strawberry, peanut butter and extra dark maple syrup creams have been popular with customers.

Traditional Maple Cream

Generally maple cream is made from light or medium colored maple syrup, however guessing which syrups to use can result in poor quality maple cream or batch failures. For details on measuring and adjusting invert sugars in maple syrup see the Cornell Maple Bulletin titled "Measuring and Adjusting Invert Sugar in Maple Syrup." The levels of invert sugar recommended in syrup for making traditional maple cream is between 0.5 and 3% with 1.5% a suggested ideal. When the invert sugar level is between 3 and 4%, use the higher boiling temperatures to finish. See the chart on the following pages for the ideal reading on a glucose meter when using a 1 in 10 syrup dilution.

To prepare traditional maple cream, heat syrup to a temperature of 22° to 24° F (12° to 13° C) above the boiling point of water. Boil to the higher temperature on rainy or humid days or when your invert sugar level is between 3 and 4 %. Remember to establish the exact temperature at which water boils at the time the maple spread is prepared since the exact temperature at which water boils depends on weather (barometric pressure) conditions. Watch the boiling syrup carefully as the temperature climbs. It can get too hot very quickly near the end. A good digital thermometer, especially one that shows temperatures to one tenth of a degree can be very helpful in more precisely determining the temperature to finish. Many modern digital thermometers also have alarm functions that can help alert you when the finishing temperature is getting close. See the bulletin on

thermometers and temperature measurement. As soon as the syrup reaches the desired temperature it should be removed from the heat and rapidly cooled. The longer it takes to cool the finished syrup the more likely large crystals will form on the surface or bottom of the pan. Using an in-fared thermometer to follow the temperature drop can reduce the likely hood of crystal forming on a thermometer stem.

» Glucose Meter Reading

(US)	1 - 10 invert
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

*The light gray indicates values **usable** in syrup for traditional maple cream*

*The darker gray indicates values in **ideal** syrup for traditional maple cream*

If you are using a paddle and turn table machine for stirring and you are only making a single batch, cool the syrup in the pan that will be used for stirring. If you plan to stir the cream by hand,

the syrup can be chilled and stirred in the boiling pan. Rapid cooling reduces premature crystallization. Cooling the cooked syrup in large shallow pans will facilitate quick cooling. Place the pans in a refrigerator or in troughs with circulating cold water and elevate the pans off the bottom so cool water surrounds all sides. Small batches can be efficiently cooled in a sink of cold water. Ice can be added to the water to speed the process. Heat is removed faster by cool water than by cool air. *Be sure that the cooling syrup solution is kept absolutely still.* Do not move or stir it, because crystals will begin to form and result in a grainy maple spread. The cooler the syrup becomes before stirring, the more smaller sugar crystals will form and the longer the crystals will stay small while the maple cream is stored. Cooling to between 45°F and 55°F will tend to make the finest cream that will maintain that finer quality longer in terms of weeks and months. The problem with these cooler temperatures is that the syrup can be difficult to remove from the pan used for chilling into the equipment used for stirring. This can be overcome by dipping the bottom of the pan into hot water for a few seconds. This breaks the chilled syrup from the pan allowing it to slide out into the stirring pan. Cold syrup can be so thick that stirring by hand is very difficult. This thicker, cooler syrup has also been known to stall the various machines used to stir it. For good results, the syrup should be cooled to at least 75°F (24° C) or below before stirring with any method. Stirring the chilled syrup at warmer temperatures tends to make a cream that will separate sooner and have a grainy texture. In the case where the cream will be consumed immediately, this temperature is not as critical. If crystals begin to form on the surface of the cooling solution, mist the surface lightly with clean water. This creates a very thin layer of low-density syrup on the surface and tends to dissolve the surface crystals and disperse any bubbles or foam.

When you begin 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. Crystallization, similar to ice formation, involves sugar molecules moving from a higher energy state to a lower energy structure releasing energy as heat in the process.

Turn Table Cream Machine

If using a paddle and turn table type 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. When using a mechanical cream machine and the syrup solution starts to get 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 recognize that this type of reheating can cause the finished product to be grainy and to separate more quickly.

Hand Stirring

Stirring by hand must be done slowly - don't beat or whip the syrup. The objective is to slowly stir the solution until crystals start to form. This will require some time and strength, especially if the syrup is cooled below room temperature. This is usually a two-person operation - one to hold the bowl and one to stir. While being stirred, the cooled syrup first tends to become more fluid (less stiff). Later it will gradually become thicker, lighter in color, and most importantly will lose its glossy appearance and become opaque. Eventually it will become a smooth paste-like consistency. When this occurs, the crystallization process is 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. If the cream separates, stirring will bring it back together. Stirring the mixture too long may cause it to start to harden in the pan. If this occurs, add a small amount of hot water as a mist and stir it in to soften it a bit. If the syrup solution does harden in the pan, it can be immersed into a pan of hot water, heat from a heat gun applied or placed into a warm oven until it can be easily stirred again.

Candy Machine Method

An advantage of making cream with a candy machine is that you can conveniently fill the finished jars directly from the machine; hand scooping will not be necessary. This machine also will allow you to run multiple batches without stopping by simply continuing to add syrup to the trough. Further, you can produce two products with one machine.

When making maple cream with the candy machine you would start the worm drive and then slowly fill the trough about half full with the chilled syrup and allow it to stir until the syrup in the trough forms crystals and loses that glossy appearance. This may take anywhere from just a few minutes to 20 to 40 minutes depending on many factors. 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 overflow the sides near the far end. When the cream loses that glossy appearance and looks finished, begin gradually adding more syrup to the trough from the pan or pig and gradually fill jars or containers with finished cream by opening the end of the trough.

Gear Pump Cream Machine

This is the fastest and easiest way to make large amounts of cream. Machines from equipment manufacturers are expensive, but it is the way to go for larger producers of maple cream.

When making maple cream with the gear pump maple cream machine, start the pump before you fill the top cone with syrup. Also, lightly mist the cone and pump with warm water and gradually add the chilled syrup to the cone until the syrup begins to circulate. Too much chilled syrup at once has been known to stall the pump or increase current draw causing circuit breakers to open. This method of stirring causes the syrup to crystallize rapidly so that the loss of the glossy appearance takes just a few minutes and canning can begin soon after starting the process. So have your containers ready before you begin. Continually scrape the interior of the cone while you are filling containers so it will completely empty. The gear pump cream machine allows for continuous operation with multiple batches. When switching to an additional batch, be sure that all the syrup gets into circulation as it is possible for some to stick in the cone and get pumped directly into a jar without proper stirring. Also do not try to rinse the cone between batches as water will be trapped and upset the density of the next batch.

With this machine containers can be quickly and easily filled without any scooping or extra handling. Be sure that all of the syrup has moved through the pump and crystallized before you begin filling jars. It is easy for pockets of syrup to be in the cone that have not yet been stirred. The ability to control the speed of the gear pump can give better control to the stirring and filling processes and significantly reduce introducing air into the cream in the last few containers filled. Controlling gear pump speed can be accomplished by using three phase electric, single phase electronic controls or a transmission between the motor and gear pump.

Seeding Crystals

With any of the methods of stirring, to hasten crystallization, add a small amount of “seed” crystal (previously made maple cream) to the chilled syrup just before or as it is stirring. The addition of one teaspoonful of “seed” for each gallon of cooked syrup provides small particles to serve as nuclei so crystals will form more rapidly. For best results use “seed” from the best and smoothest maple cream available

Packaging

Maple cream can be packaged in food grade glass or plastic. Containers with wide mouths are best for easy filling. Care must be taken to prevent air bubbles from forming during stirring or filling, especially when the maple spread is packaged in glass. Air bubbles are not only unpleasing in appearance but also create the impression that the package is short in weight. Furthermore, separated syrup can collect in air pockets, further adding to a poor appearance.

During cream production, the maple syrup is heated to high temperatures, which eliminates all pathogenic microorganisms, but the subsequent steps of rapid cooling and filling at room temperature occur in an open environment where the maple cream is re-contaminated. At the high levels of sugar concentration of the cream, pathogens cannot grow, but the spoilage microorganisms, reportedly molds and yeast, can slowly grow and spoil the product. That is why the traditional cream is sold under refrigeration. If the spread is packaged in glass or other moisture-proof containers, it can be stored in the refrigerator for a month or two with little likelihood of the saturated syrup in the spread separating. Because traditional maple cream, like maple syrup, contains no preservatives, it is susceptible to mold forming on the surface. For long-term storage (up to a year) it should be stored in a freezer where it will not mold and will show little or no separation.

Pure traditional maple cream has a shelf life of less than one month if stored at room temperature. The maple cream may mold and physically separate into its maple syrup component during this period. This product requires refrigeration to achieve an acceptable shelf life of 6 months. It can be stored frozen indefinitely.

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. It is best to make cream in a clean environment with easily sanitized surfaces.

Shelf-Stable Maple Cream

Over time at room temperature separation in traditional maple cream is likely to occur and mold growth on the surface is as possibility. Research at the Cornell Food Venture Center found a way to make maple cream stable for a longer time when stored at room temperature. The Food Venture Center staff discovered that having a higher amount of invert sugar in the syrup used to make the cream could prevent separation during storage. For a complete review of the research conducted see the section titled “Shelf Life Extension of Maple Cream”.

Making shelf-stable maple cream requires using a mix of regular maple syrup and syrup that has been treated with the enzyme invertase to break all of its sucrose into invert sugars. We will call this enzyme-treated syrup “invert syrup”. The invert syrup will have an invert sugar level of 50 to 67% depending on the extent to which invertase has completed converting the sucrose. The level of

invert sugar in the final combined syrup mix should be between 7 and 9%. Be careful not to confuse the level of invert sugar in the final mix with the percent of invert syrup we are adding to the regular syrup. Totally converted invert syrup will contain about 67% invert sugar and the invert syrup is added to the regular syrup at a rate of about 10% by weight or volume. This means that totally converted invert syrup will add about 6.7% invert sugar to the final mix and the regular maple syrup will usually add between .5% to 2% invert sugar to the final mix. Measuring the invert sugar in the invert syrup with your glucose meter is not possible unless the invert syrup is diluted enough to be within the measurement range of the meter. The high sugar level in the invert syrup and the normal variation of meter readings being about 20%, combine to make readings at the higher sugar level undependable. The final mix or a sample of the mix can be read on the glucose meter with reasonable accuracy and provide helpful information for making up batches with consistent invert sugar levels. The chart for suggested invert sugar levels for making shelf stable maple cream, featured on the left, shows the ideal range of 7 to 8% and usable range from 6 to 9%.

>> Invert Sugar Reading

(US)	1 - 10 dilute
mg/dL	invert %
250	5
260	5.2
270	5.4
280	5.6
290	5.8
300	6
310	6.2
320	6.4
330	6.6
340	6.8
350	7
360	7.2
370	7.4
380	7.6
390	7.8
400	8
410	8.2
420	8.4
430	8.6
440	8.8
460	9.2
480	9.6
500	10

*The light gray indicates values **usable** in syrup mix for shelf stable maple cream*

*The darker gray indicates values in **ideal** syrup mix for shelf stable maple cream*

The “invert syrup” is made by adding 0.1% to 0.25% by volume of the enzyme invertase to pure maple syrup. For a gallon (4.4 liters) of syrup to be converted to invert syrup add 1.5 teaspoons (8 ml) of Invertase. Invertase performs optimally at a temperature 120°F, and is rapidly deactivated at

temperatures greater than 170°F. The syrup plus invertase is heated to 120° F for 24 to 48 hours and then stored under refrigeration, or held at lower temperatures for a longer period of time. Overheating the treated syrup will stop the conversion process. The use of an oven or crock-pot is ideal for this purpose. When you are ready to make shelf stable maple cream begin by boiling to near finish temperature the regular maple syrup and then adding the 10% of the invert syrup when the cooking is nearly finished. The invert syrup should represent 10% of the final quantity of syrup to be boiled to 25°F to 27°F above the current boiling point of water. 10% is just less than one pint of invert syrup for each gallon of regular syrup.

Invertase is available from confectionary and baking supply sources. In New York invertase is considered a processing aid and does not need to be declared on the maple cream label. This is not the case in Vermont. Adjusting the invert sugar levels allows the maple cream to stay on the shelf much longer at room temperature without separating. Producers can choose to make maple cream this way to solve separation problems without making the next step of mold prevention, but you need to realize that mold can become a problem when cream is at room temperature for significant time.

Any of the stirring methods and equipment listed under the traditional maple cream section above can be used to manufacture shelf-stable maple cream.

Inhibiting Mold Growth

To prevent mold growth on the surface of traditional or shelf-stable maple cream, powdered potassium sorbate can be added after the boiling stage. Potassium sorbate is a commonly used food preservative available at most stores that supply materials for wine making. Add potassium sorbate at the rate of 500 parts per million based on volume to the concentrated cooled product prior to stirring. If the cooled product is a result of one gallon of syrup prior to cooking add 0.3 teaspoons of potassium sorbate to the surface of the concentrated syrup. For a four-liter quantity (prior to cooking), add 1.4 ml of potassium sorbate. A producer in New York will need to have 20-C food processor certification with the Department of Agriculture and Markets to legally add potassium sorbate to maple cream, or the products will need to be made in a certified facility.

Shelf Life

Shelf-stable maple cream with higher sugar levels and potassium sorbate will not mold or separate for six months when held at room temperature. However, for the benefit of consumers it is recommended that containers in which maple spread is placed be labeled “Best if used by _____” (dated six months after production) and “Refrigerate after opening”.

» Shelf Stable Maple Cream

~ 1 pint of maple syrup + .4 teaspoon invertase and 48 hours at 120°F
+
One gallon of maple syrup with .5 to 2% invert sugar
+
Boil to 25°F to 27°F above boiling point of water
add 0.3 teaspoons of potassium sorbate
+
Chill to 45°F to 75°F, (the lower the better) then stir

4.2 SHELF LIFE EXTENSION OF MAPLE CREAM

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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, that is used 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 steps involved rapid cooling to produce the fine crystals and filling at room temperature, all in an open environment where the maple cream is re-contaminated. At the high levels of sugar concentration of the cream, the pathogens can not grow but the spoilage microorganisms, reportedly molds and yeast, can slowly grow and spoil the product. That is why the 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 physically separate into its maple syrup component 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 6 months 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 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 & closure 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 and;
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 and to more accurately assess the effectiveness of the various treatments, mold from spoiled maple cream samples was collected, cultured and used as an inoculum to 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, 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 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 better shelf-life as the mold will not grow or 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.

Physical separation problem: To address the physical separation the amount of invert sugar present in the maple syrup was studied. The concept was based on the honey cream, 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 to 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 hrs. in a regular oven. The degree of inversion was monitored using the simple and inexpensive urine sugar test (Clinitest tablets by Bayer).

Small percentages of the inverted syrup solution were added to the maple syrup to be used for boiling to determine the optimum level. The inverted syrup was then boiled to concentrate to approximately 85°Brix (235 to 240°F). The syrup was then rapidly cooled to temperatures below 50°F. For creaming purpose, 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 oz. 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 to 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

MOLD PROBLEM

Initial studies with all the treatments 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 prod-

ucts were used (250, 500 and 1000 ppm) with freshly prepared maple cream and subsequently inoculated with the same maple cream mold spoilage organism. The samples were then incubated at 86T (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. In case of samples with potassium sorbate added, no spoilage was observed at the levels used (Table 1) The maple cream samples containing the various levels of potassium sorbate were evaluated for their organoleptic qualities. No differences were noted in 250 or 500 ppm but an off-flavor was detected with the 1000 ppm potassium sorbate maple cream samples.

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

In summary, potassium sorbate even at low levels of 250 ppm was identified

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

as a potential treatment to provide protection for up to 4 months against mold spoilage associated with maple cream product. To assure a 6-month shelf-life at room temperature, a level of 500 ppm is recommended (further testing confirmed the need for 500 ppm).

PHYSICAL SEPARATION

Maple cream samples were produced by adding different concentrations of inverted maple syrup to each batch. The syrup was concentrated to about 85°Brix before the cooling step. Summary of preliminary trials 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.

From the first tests (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

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)

tests was run to narrow down the concentration of invert syrup required.

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 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 invert-

ed syrup and potassium sorbate added to assess the long-term stability of the maple creams.

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

Treatment	Storage Temperature	-Brix	Water Activity (-w)	Observed Surface Mold	Separation vol/vol Syrup/Cream
Control 1	Room temp.	84.6	0.81-0.82	Mold (2 mo.) Mold (6 mo.)	20 (2 mo.) 23 (6 Mo.)
Control 2	Room temp.	84.6	0.79-0.81	No mold (2 mo.) No mold (6 mo.)	21 (2 mo.) 25 (6 mo.)
Control 3	Room temp.	85.9	0.81-0.82	Mold (2 mo.) Mold (6 mo.)	20.5 (2 mo.) 23 (2 mo.)
Control 4	Room temp.	83.8	0.81-0.82	No mold (2 mo.) No mold (6 mo.)	22 (2 mo.) 25.5 (6 mo.)
Invert 1	Room temp.	83.5	0.77-0.79	No mold (2 mo.) No mold (6 mo.)	5 (2 mo.) 12 (6 mo.)
Invert 2	Room temp.	84.3	0.78-0.79	No mold (2 mo.) Mold (6 mo.)	5 (2 mo.) 11(6mo.)
Invert 3	Room temp.	85.0	0.73-0.78	Mold (2 mo.) Mold (6 mo.)	6(2mo.) 12 (6 mo.)
Invert 4	Room temp.	82.4	0.75-0.78	Mold (2 mo.) Mold (6 mo.)	5.5 (2 mo.) 11 (6 mo.)
Control 1	86°F (30-C)	86.4	0.80-0.82	No mold (2 mo.) No mold (6 mo.)	21 (2 mo.) 23 (6 mo.)
Control 2	86°F (30-C)	84.1	0.78-.82	No mold (2 mo.) No mold (6 mo.)	20.5 (2 mo.) 22 (6 mo.)
Invert 1	86°F (30°C)	83.8	0.75-0.78	No mold (2 mo.) No mold (6 mo.)	8 (2 mo.) 12 (6 mo.)
Invert 2	86°F (30°C)	83.1	0.73-0.78	No mold (2 mo.) No mold (6 mo.)	9 (2 mo.) 13 (6 mo.)

The results in Table 5 show that the samples with invert syrup had slightly lower water activities but was not sufficient to impede the growth of mold, even with the addition of potassium sorbate at 250 ppm. Select molds and yeast are capable of growing at very low water activities ($a_w = 0.60-0.70$) 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 signifi-

cantly 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. Results are presented in Table 6. Concentrations above 0.1 were not considered acceptable due to salty taste. The use of salt did not seem to offer advantages but a more complete study was performed to confirm the results. The samples prepared with inverted syrup were very stable as 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

Inverted Syrup	Initial Observations	Separation and Mold after 6 months
5 (3 replicates)	Creamy texture, little separation 84.4°Brix, 0.68 Aw	Minimal separation - no mold
10 (3 replicates)	No separation, creamy texture 81.8°Brix, 0.76Aw	No separation - no mold
10+0.1 salt (3 replicates)	Creamy, no separation, hint of salty taste 83°Brix, 0.72 Aw	No separation • no mold
10 + 0.25 salt (3 replicates)	Loss creamy, no separation, a bit salty 83°Brix, 0.70 Aw	No separation - no mold

Table 7 shows the final shelf-life study conducted using 5 and 10 invert syrup for cream preparation. The study also evaluated the use of salt and potassium sorbate.

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 (2 replicates)	Separation and Mold after 6 months	Texture •Brix.Aa.	Taste/other
5 inverted syrup	No separation No mold	Spreadable 80.4°Brix, 0.76 Aw	Typical
5inv+0.1salt	No separation No mold	Spreadable 80.2°Brix, 0.76 Aw	Hint of Salt Acceptable
5 inv + 250 ppm sorbate	No separation No mold	Spreadable 80.0°Brix, 0.72 Aw	Typical
5 inv+0.1 salt + 250 ppm sorbate	No separation No mold	Spreadable 80.0°Brix, 0.72 Aw	Hint of Salt Acceptable
10 inverted syrup	No separation No mold	Creamy & Spreadable 80.4°Brix, 0.74 Aw	Typical
10 inv+0.1 salt	No separation No mold	Little grainy 85.2°Brix, 0.54 Aw	Hint of Salt Acceptable
10 inv + 250 ppm sorbat	No separation No mold	Little grainy 82.7°Brix, 0.62 Aw	Typical Typical
10 inv+0.1 salt	No separation No mold	Spreadable 82.3-Brix, 0.71 Aw	Hint of Salt Acceptable

From all the shelf-life studies, we concluded that the potassium sorbate at 250 ppm might not be 100 effective as some surface mold was observed sporadically (very small amounts) and the 500 ppm is therefore recommended. The separation problem was minimized by the use of 10 inverted syrup given 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 a room temperature shelf life of six months would benefit the Northeast Maple Syrup Industry by a \$1.6 million yearly increase in revenue. (Note- Total Northeast USA Maple Syrup revenue for the year 2000 is \$28.2; million This represents approximately 20 of North American production.). The estimate was calculated with the following assumptions: Retail value of maple syrup \$28 per gallon, retail value of maple cream \$60 per equivalent gallon (based on syrup), maple syrup producers normally dedicate 5-10 of their syrup to maple cream manufacture. If we assume that currently 5 is dedicat-

ed to maple cream then $\$28.2 \text{ million} \times 0.05 = \1.4 million as maple syrup which is equivalent to \$3 million as maple cream, i.e., a net increase of \$1.6 million. If by developing good manufacturing practices for the production of shelf-stable maple cream we can increase production and market to 10 (conservative value) then an extra \$1.6 million revenue will go to the producers.

ECONOMIC FINDINGS

The addition of potassium sorbate will increase the cost of the product less than \$0.01 per pound of finished product and does not require any specialized equipment. The use of an enzyme to increase the invert sugar content cost is approximately \$0.05 per pound of finished product and utilizes equipment already on a typical maple syrup farm, i.e.: kitchen oven or crock pot. Total cost is expected to be less than \$0.10 per pound of finished product and will not require any equipment not already available on a typical maple syrup farm.

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 is 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 U.S. grade A Medium 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 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 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 "setup". 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.

ACKNOWLEDGEMENTS

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4.3 Making Maple Cream

Extension

Maple Syrup Digest

C. O. Willits, Eastern Utilization Research and Development Division, Agricultural Research Service

Vol. 4, No. 2 (Condensed from Agricultural Handbook #134)

February 1965

REF# 144

The amount of the maple syrup crop that is being converted into maple cream or 'butter has been increasing rapidly. Some producers have built up so large a demand that they convert their entire crop to cream.

Maple cream, a fondant type of confection, has a butterlike consistency. It is made up of millions of microscopic- size sugar crystals interspaced with a thin coating of saturated' syrup. The crystals are not felt by the tongue and give the cream a smooth, non-gritty-texture. To make maple cream, it is necessary first to make a supersaturated sugar solution. This is cooled to room temperature so quickly that crystals have no chance to form . The cool grass like mass is then stirred, which produces the mechanical shock necessary to start crystallization. All of the crystals formed are about the same size and very small.

Syrup for Creaming

For best results, U.S. Grade AA (Fancy) or U.S. Grade A (No. 1) maple syrup should be used; it should contain less than 4 percent of invert sugar.

Syrup that contains from 0.5 to 2 percent of invert sugar should make a fine-textured cream that feels smooth to the tongue. Syrup with from 2 to 4 percent of invert sugar can be made into cream by heating it to 24° or 25° F. above the boiling point of water (instead of the usual 20°).

Syrup with more than 4 percent of invert sugar is not suitable for creaming. if used, it will not crystallize or it will crystallize only if heated to a much higher-than-normal temperature; however, the cream will be too fluid and probably will separate a few days after it is made.

For years, many people throughout the maple producing area have believed that maple cream should be made only from first-run syrup and that all first-run syrup will yield a good cream.

This is not the case. The amount of invert sugar in the syrup determines its suitability for creaming, not the run of sap from which the syrup is made. The amount of invert sugar formed is directly proportional to the amount of microbial fermentation of the sap, and this in turn is related to the temperature. Unseasonably warm weather is not uncommon during the first period of sap flow. Warm weather favors fermentation of the sap, and sufficient invert sugar is produced to make the early run syrup unsuitable for making into cream.

Cooking and Cooling

The syrup is heated to a temperature 20° to 23° F. above the boiling point of water. (The temperature of boiling water must be established at the time the syrup is boiled for creaming.) The boiling temperature determines the amount of syrup Surrounding the crystals, and this in turn governs the stiffness of the final product. As soon as the syrup reaches the proper temperature it should be removed from the heat and cooled quickly. If the cooked syrup is left on the hot stove (even with the heat turned off), enough more water will be evaporated to produce a more concentrated syrup than desired. Rapid cooling prevents crystallization. To facilitate cooling, the

syrup is poured into large, flat-bottom pans (the layer of syrup should be not more than 1 to 3 inches deep), and the pans are set in a trough through which cold water (35° to 45° F.) is flowing.

The thickened syrup is cooled to at least 70° F., and preferable to 50° or below. The syrup is sufficiently cool when the surface is firm to the touch. Appearance of crystals during the cooling process indicate-, either that cooling is too slow or that the invert-sugar content of the syrup was too low for the conditions of cooling used. This situation can be corrected either by more rapid cooling (thinner layers of syrup or more rapid flow of cold water) or by increasing the invert-sugar of the syrup.

Creaming

The chilled, thickened syrup should be creamed (either by hand or mechanically) in a room having a temperature of 70° F. or above. Many producers have developed their own mechanical cream beaters, and there are a number on the market.

Figure 1. Homemade cream beaters in which the stirrers are held stationary and the pan is rotated at approximately 70 r.p.m. The homemade maple-cream beater consists of a pan approximately 13 inches in diameter with a capacity of about 12 quarts. It will stir 1 1/2 gallons of cooked syrup. In this beater, the scrapers are held stationary and the pan revolves. In other beaters, this procedure is reversed. In other beaters this procedure is reversed. Both types work equally well.

A hardwood paddle having a sharp edge 2 or 3 inches wide is used for hand beating. The cooked syrup is poured into a large flat pan, such as a cookie tin. This is held firmly, and the thick syrup is scraped first to one side of the pan and then the other, mixing continuously so that no portion is allowed to stay at rest. If stirring is stopped some of the crystals will grow and cause the product to be gritty.

During the stirring operation the chilled syrup will first tend to become fluid and then begin to stiffen showing a distinct tendency to set. At this time the batch will lose its shiny surface. If creaming is stopped too soon, that is, while the batch is too fluid, large crystals will form.

To hasten the creaming process a small amount of "seed" - previously made cream - can be added to the glasslike chilled syrup just before beating. The addition of 1 teaspoonful of seed for each gallon of cooked syrup will provide crystals to serve as nuclei for the more rapid formation of crystals. Creaming may require from 20 minutes to one hour, depending on the size of the batch, but the use of seed will often shorten the time.

Holding Cream for Delayed Packaging

Often it is not convenient to package the cream at the time it is made. In this case it can be stored or aged for periods of 1 day to several weeks in tightly covered glass or earthen vessels, preferably under refrigeration. Many candy-makers believe that aging of a fondant is desirable because it permits an equalization of the crystals -in the saturated syrup. After aging, the cream is remelted for pouring and packaging by careful heating in a double boiler. The temperature of the cream during this reheating must not go above 120° F. This can be controlled by not permitting the water in the double boiler to go above that temperature. If the temperature of the cream exceeds 120° F, too much sugar will be dissolved and large crystals may form when the remelted cream is cooled.

Packing and Storing Maple Cream

Maple cream can be packaged in tin, glass, or wax paper cups. Containers with wide mouths are best for ease of filling. Care must be taken to keep air bubbles from forming. This precaution is of particular importance when the cream is packaged in glass because the air bubbles are unpleasing in appearance and create the impression the package is short in weight. Further, air pockets provide a place where the separated mother liquor can collect, and also produces an undesirable appearance.

Freshly made cream should be packaged immediately, before it “sets up.” Remelted cream should be packaged while it is still warm and fluid. Since maple cream is a mixture of sugar crystals and saturated maple syrup, storing the cream at temperatures above 70° F. will cause more sugar to go into solution. This increased volume of syrup will tend to separate as a dark liquid layer on the surface of the cream.

For the best storage conditions keep the cream at low temperature and constant humidity. If the cream is packaged in moisture-proof containers, glass, tins, or heavy waxed boxes, it can be stored in refrigerators for long periods of time prior to use, with little danger of the saturated syrup in the cream separating.

Summary

1. Use U.S. Grade AA (Fancy) U.S. Grade A (No. 1) syrup.
2. The syrup must not contain more than 4 per cent of invert sugar.
3. Heat the syrup to a temperature 20° to 23° F. above the boiling point of water.
4. Cool the syrup rapidly to about 50° F.
5. Stir the thickened syrup continuously until creaming is completed.
6. Freshly made cream can be packed immediately or it can be aged before packaging.
7. Aged cream can be softened for pouring by heating to temperatures not exceeding 120° F.
8. Store cream under refrigeration.
9. Causes of failure to cream:
 - a) If the syrup contains too little invert sugar or if it is not chilled sufficiently before stirring, the cream will have a gritty texture.
 - b) If the syrup contains too much invert sugar, it will not cream (crystallize).

Section 5

Molded Maple Sugar Candy

5.1 Molded Sugar Candy

Molded Sugar Candy (Soft Sugar Candy)

by STEPHEN CHILDS



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

Background

Molded sugar candy is a popular maple value-added product. Approximately 7 ½ pounds (3.4 Kg) of molded sugar can be prepared from one gallon (4.4 liters) of maple syrup. Molded maple sugar contains nothing other than maple sugar with little or no free syrup, thus it is stiff and can be molded into a variety of shapes. The crystals in molded sugar are larger than in maple cream and can be sensed on the tongue, but they should not be so large as to have an unpleasant sandy or gritty texture.

The temperature and humidity of the room where you make candy will affect the quality of the candy and repeatability of the process. Best results will occur at normal room temperature (68-72°F) and humidity in the 40-45% range. Dry days are best and rainy or humid days should be avoided.

Syrup Grade and Invert Sugar

Syrup Grade and Invert Sugar

Molded sugar can be made from any of the top three grades of syrup with an invert sugar level between 0.5% and 1.5% with the ideal being about 1%. Lower levels of invert sugar in the syrup tend to produce large crystals that give the sugar a grainy texture. Lower levels also can cause problems because the syrup is more likely to crystallize in the pan as it is cooling before stirring. Higher levels of invert sugar tends to make the candy very slow to harden. This can make pieces difficult to remove from the molds and pieces may become misshapen when handled.

For details on measuring and adjusting the invert sugar levels in syrup see Bulletin 203 covering this topic. A chart on the glucose meter readings preferred when making molded maple sugar is given below.

» Glucose Meter Readings

Reading	1 - 10 invert
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

*The light gray indicates values for **usable** syrup for molded maple sugar*

*The darker gray indicates values for **ideal** syrup for molded maple sugar*



Heating Syrup

Concentrate the Syrup

Heat the syrup to 32° to 34° F (18° to 19° C) above the boiling point of water. Then cool the pan of cooked syrup to the temperature required for the hardness of candy that you want before stirring. The following chart roughly outlines the candy hardness obtained when you begin stirring the syrup at different temperatures.

» Candy Hardness

- >200°F at agitation = a harder candy more suitable for crystal coating
- 190°F to 175°F at agitation = a medium hard candy
- <170°F at agitation = a softer candy but may be too soft to coat

Harder Candy

Where the candy will be crystal coated or handled in bulk packages you may find a harder piece of molded sugar candy works better. The harder molded sugar is made by beginning to stir the cooling syrup at around 200°F. Crystal coating then softens and protects the candy making it more desirable to the consumer. Filling the molds with the hotter syrup usually is easier as the syrup should flow readily.

Medium Hard Candy

A medium hardness molded sugar candy can be made by beginning the stirring when the syrup temperature has cooled to between 190°F to 175°F. This medium hardness makes the molded sugar durable for handling yet suitable for crystal coating and a nice level of hardness for the consumer.

Soft Candy

Allowing the syrup to cool to less than 170°F before stirring makes a fairly soft molded sugar candy. This softer candy is by far the most attractive for eating appeal for the customer. The softer candy is recommended when doing demonstrations where the candy will be consumed soon, such as at fairs or farmers markets. However, the softer candy can be soft enough to be squashed or broken with handling and can be more easily dissolved if you attempt to crystal coat. It may need to have the crystal coating syrup cooler to coat it successfully. Filling the molds to make the softer candy is also 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 table knife or putty knife. Candy stirred cooler may also lack some of the mold detail compared to pieces that were put into the mold at a hotter temperature.

Stirring

Stirring and Crystal Development

Once the syrup has been properly heated then cooled to the temperature to make the desired hardness of candy, it must be stirred, either by hand with a large spoon or with a commercial maple sugar machine. The lower the temperature to which the syrup is cooled before stirring, the finer (smaller) will be the sugar crystals formed in the candy. However, large batches



(how large is large?) of candy are commonly cooled only to approximately 200° F (93° C), or higher, because when cooled to lower temperatures it becomes almost impossible to mold the entire batch before it becomes too stiff. Rapidly filling the molds will result in greater consistency of product.

When stirring, the syrup solution must be watched carefully as it becomes lighter in color, somewhat thicker, and has a creamy opaque appearance. This is the result of the many tiny sugar crystals that form and increase in size in response to the agitation of the syrup. Stirring will take only a few minutes, usually less than five. With experience you will learn the exact moment to pour the syrup into the molds. If the mixture is stirred too long, the thickened syrup will “set up” (harden) in the pan. It’s best to err on the early side. It can be very helpful to have a bottle of warm water with a mist pump to lightly mist sugar that becomes too hard in the trough of the candy machine or mixing pot. This will re-liquefy the hard sugar and allow it to fill the molds. Be careful not to use too much misting as this may risk the quality of the molded sugar.

Molding

While the sugar is still soft and plastic, pour or pack it into rubber or metal molds. Molds with a variety of shapes are available from all equipment dealers and cooking suppliers. If packing the molds by hand is necessary, use a wide-blade putty knife or spatula. When using a maple candy machine, the semi-liquid sugar can be run directly into the molds without packing or leveling. Use a rigid support under rubber molds to prevent them from flexing during handling. Place molds on a rack to cool. It sets up in 10 to 30 minutes. Then the individual pieces can be removed from the mold. Sugars formed by pouring rather than packing have an attractive glazed surface. Fresh maple candies can be stored in cool dry conditions for a few weeks.

Candy Machine

Making Molded Sugar Candy with a Candy Machine

A candy machine is a good investment if large batches of candy are made on a regular basis. Most commercial candy machines can make up to 18 pounds (8.2 kg) of candy at one time. The metal pan that holds the boiled syrup on a candy maker is called a “pig”, because of its shape and the pouring snout at the front. Immediately after the boiling syrup has reached the proper temperature the syrup is poured into the pig. The syrup can also be boiled directly in the pig. Place the pig on the candy machine shelf and tip it up into the locked position, first making certain the nose valve is completely shut. It is not necessary to let the syrup cool much when using a candy machine; experiment to see what works best. Make sure the trough valve is closed before adding any syrup to the trough. Open the pig nose valve slightly and allow a half-inch or less of syrup to flow into the trough. Close the valve, turn on the motor and the stirring coil will slowly rotate. Watch carefully at the front of the trough by the valve. After a few minutes the syrup will become lighter in color, somewhat thicker and have a creamy, paste-like, opaque appearance. At this critical stage the syrup has lost some of its gloss because many tiny sugar crystals have formed to cause this change in appearance. Stirring will only take a few minutes, usually less than three.

Open the trough valve and allow the opaque, partially crystallized syrup to flow out into your mold. Don’t wait too long to complete this step because the sugar may harden in the nose of the trough. It’s 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, slightly



Drying Candies

Crystal Coating

open the nose valve of the pig to allow more syrup to flow into the trough. The goal here is to have a small continuous flow of fresh hot syrup from the pig into the trough, while at the same time the stirring coil is crystallizing the syrup, but is still allowing liquid crystallized syrup to flow out from the trough into the molds. An extra set of hands is helpful at this stage when this equipment is being used for the first time. Try to balance the flow of liquid into the trough with the flow out into the molds keeping the syrup being stirred only a quarter inch to one half inch deep. This will reduce the chances of having the sugar harden into a solid mass in the trough. If the syrup crystallizes in the trough valve and stops the flow, a small knife can be used to reach into the valve and clear out the clog. Be careful of the turning coil. Misting the trough with a fine spray of warm water can also cure a temporary clogging from sugar that has hardened there. Usually very little is needed. After a little experience it will be possible to make perfect candy in a continuous operation.

Remove and Dry Candies

Candies may be removed from the molds after 30 minutes to one hour. Do this over a coarse wire rack that allows sugar that has run beyond the mold to be removed and collected for other uses. The candies should be placed on wire racks that allow for good air circulation. Candies need to completely cool and air dry for 24 hours before packaging or crystal coating.

Crystal Coating Molded Sugar Candy

Over time individual pieces of maple sugar have a tendency to dry out. Coating them with a moisture-impervious shell made from crystalline sucrose can delay this. To make the crystal coating syrup, heat low invert sugar maple syrup to 9.5° to 11° F (5° to 6° C) above the boiling point of water. This syrup should have a Brix value of 70° to 73° at a temperature of 68°F (20° C). One gallon (4.4 liters) of standard-density syrup (66o Brix) will make seven pints (3.8 liters) of crystal coating syrup (70o to 73o Brix). The invert sugar level in syrup used to make the crystal coating syrup should be between 0% and 1% with the lower the level the better.

» Glucose Meter Readings

Reading	1 - 10 invert
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

*The light gray indicates values for **usable** syrup for crystal coating*

*The darker gray indicates value for **ideal** syrup for crystal coating*



Molded Sugar Candy

Avoid Humid Days

Molded sugar should not be crystal coated on humid or rainy days, unless the work can be done in a humidity-controlled room, because pieces will not dry properly. If the crystal coating is not thoroughly dried, the coating will dissolve when it is packaged.

Cool Coating Syrup

Set the hot, heavy syrup aside to cool where it will not be jarred or shaken or transfer it immediately to pans that will be used to treat the maple sugar. To retard surface crystallization (caused by rapid cooling of the surface), the syrup can be covered with a piece of damp cheesecloth or paper (preferably the same kind used as a syrup pre-filter, because it has a high wet strength). The cloth or paper must be in contact with the entire surface of the syrup. If crystals form, they attach to this cover and can be removed along with the covering. The sugar crystals can be recovered by rinsing the cover in hot water, or the cover can be allowed to dry for a few days and the sugar crystals will peel off easily. The concern with the crystals forming on the surface is that they will stick to sugar pieces as they are being added or removed from the syrup soak. This will give them an unacceptable appearance. Some producers have success without covering the coating solution.

Soak Candies

The sugar pieces to be coated should be dry (24 hours old). Place the pieces loosely in a mesh basket or other container that will allow them to be completely submerged in the coating solution. The covering is removed from the cool (70° to 80° F or 21° to 27° C) crystallizing syrup soak solution, and any crystals not removed with the cover are skimmed off. Submerge the sugar pieces completely in the coating solution; place a fresh cover directly on, and in contact with, the entire surface of the coating solution. Leave the candies in the coating soak at a temperature of 65° to 80° F (18° to 27° C) for 6 to 12 hours or overnight. Most of the crystal coating forms on the molded sugar pieces during the first few hours. Therefore, the time the sugar pieces are left in the crystallizing syrup beyond a six-hour period is not critical. If your molded pieces are soft or you are having trouble with the pieces dissolving, use the lower soak temperature.

Brix Values

The most important factor related to crystal coating is the Brix value of the coating solution; if it is too high, coarse crystals will result. Sugar precipitates out of the thick syrup and is deposited and grows on the surface of the maple sugar pieces. The ideal density of the coating syrup is determined by trial and error; Brix value between 70-73 is a place to begin.

Remove Candies

Remove the paper or cloth cover when sufficient sugar coating has been deposited on the candy and lift the wire baskets of coated sugar out of the soak solution and support them above the trays of soak solution until the candy pieces have drained. The outside of the candy should feel like fine sandpaper when it is sufficiently coated. A single batch of sugar coating solution can be used about three times, before it gets too low in density to sufficiently coat the candy pieces. The used solution can be boiled again to make maple cream. It is suggested that different approaches be tried to determine what will work best for each individual situation.

After the syrup has drained off, this usually requires about one half hour, dry the candy pieces by manually removing all remaining drops of syrup. Failure to do this results in areas having a glazed (non-crystalline) surface that is not a water barrier thus permitting the sugar to dry out during storage. The dried areas will appear as unattractive white spots on the candy.



Remove Excess Syrup

Drying

There are two ways of removing excess crystallizing syrup: Either spread the sugar pieces out in a single layer on a clean sheet of paper and turn each piece over at intervals of one to two hours or wipe each piece of sugar with a clean, slightly damp sponge or cloth to remove any moist areas. Some producers have developed ways of turning large batches at a time using top and bottom holders where the pieces are trapped briefly between two layers and the batch turned over and then the new top removed. This kind of system can save substantial labor. Then place the sugar pieces on screen trays to dry. Set the trays in racks to complete the air-drying process at room temperature. This usually requires from four to seven days, but the process can be hastened by using a fan and/or a dehumidifier. After drying, the candies are ready for packaging.

Shelf Life

Shelf Life

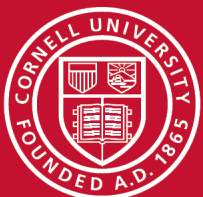
Crystal coated maple candies have a relatively long shelf life of several months, and they tend not to absorb moisture or dry out. Sugar that is not crystal coated may either absorb moisture or dry out, depending on the humidity of the room in which it is stored. In a dry environment it will lose moisture. The dried-out areas will appear as white spots and will become stone-like in hardness. If the humidity is high, the sugar will absorb moisture and moist areas or droplets of water will appear on the surface. The droplets become dilute sugar solutions and are good sites for mold growth. The humidity of the packaging room and the candy storage area should be kept relatively low. Use a dehumidifier or air conditioner when the situation warrants.

Packaging

Packaging

The packages for molded maple sugar candies have two functions: (1) to make the sugar as attractive as possible and (2) to keep them in good condition. Boxes, individual wrappings and paper candy cups can be purchased from a confectioner's supply house or a maple equipment supplier. The net weight of the sugar pieces must be stated on the outside of the package. Consult local health officials or food production authorities for specific regulations about package requirements.

The best type of wrapper for the outside of the sugar package should not be 100% moisture proof but should allow the sugar to breathe slightly and not totally dry out. Consider that the emulsion applied to cellophane to make it heat seal with a hot iron also makes the cellophane moisture proof. Some packers of maple confections obtain longer storage by puncturing the moisture-proof wrapper with some pinholes to permit limited air exchange between the inside and outside of the package. Humidity and temperature will affect length of storage time. A cool storage temperature with 50-60% humidity works the best.



Section 6

Maple Sugar—Granulated

6.1 Granulated Maple Sugar

6.2 Replacing Table Sugar with Maple Sugar

Granulated Maple Sugar



by STEPHEN CHILDS

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

Background

Granulated Maple Sugar is the most versatile product that is made from maple syrup. Because it has no available water, this product is totally shelf stable, it will not separate or mold. It can be stored indefinitely at room temperature and with proper packaging and moisture control will not lose its granular nature. It can be used in recipes as a replacement for brown or white sugar on one for one exchange by volume or by weight. It can be reconstituted into maple syrup of any density and from there converted into any of the other maple confections. It can be an easier product for chefs or restaurants to use because of its storability and versatility. It can also be used as a topping on cereal, placed in sugar straws or used anywhere other sugar would be used to add flavor or sweetness. The flavor of many products is enhanced by using maple sugar in place of white sugar and is especially valued by many consumers for its natural and sustainable origin.

A quart (one liter) of syrup will yield about 2 pounds (one Kg) of granulated sugar.

Temperature and Glucose Level

Temperature and Invert Sugar Level

Granulated maple sugar is prepared by heating maple syrup until the temperature is 45° to 50° F (25° to 28° C) above the boiling point of water. When selecting syrups to be made into granulated sugar, select or blend the syrup to be less than 2% invert sugar. Use the higher finishing temperature for syrups closer to the 2% invert sugar while the lower

temperature can be used with syrups with low invert sugar content. Syrups with invert sugar levels above 2% are likely to make partially granulated batches that will not finish properly. For details on measuring and adjusting the invert sugar levels in syrup see the section titled "Measuring and Adjusting Invert Sugar in Maple Syrup". A chart of the glucose meter readings preferred when making granulated maple sugar is given below.

» Glucose Meter Readings

Reading	1 - 10 invert
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

The gray area indicates acceptable readings or maple syrup to be made into granulated maple sugar



Cooling and Safety

Cooling and Stirring

Following cooking the syrup can then be stirred immediately or allowed to cool to about 200° F (93°C), and stirred either in the cooking vessel or in an appropriately sized container until granulation is achieved. Due to the high temperature of the syrup when it is being handled and stirred several precautions should be observed. The producer should have protective gloves, protective apron, long pants, closed shoes and eye protection. For further suggestions for protecting producers and workers working with hot maple products see the section titled “Exercise Caution when Making Maple Confections”.

Stirring

Stirring can be done by hand or by using a mechanical stirring machine. There are a couple of mechanical stirring machines used by maple producers. The most common is a commercial mixer. The mixer must have a slow speed and a beater with few cross bars will generally work best. Using a home quality mixer is not recommended as the pressure on the engine and drive is high after crystallization begins and often burns out a kitchen quality machine with just a few uses. Some producers make maple sugar on the turntable and paddle machine commonly used to make maple cream. Unlike maple cream where the turntable machine stirs the chilled syrup, with granulated sugar the syrup is removed directly from cooking and poured into the turntable pan and stirring started immediately. Over-filling some turntable machines can cause them to stall when the sugar begins to crystallize and becomes very thick. Some producers have created a mixing impeller that they place into an electric drill and use this to stir the syrup with good success. Granulated sugar will pile up high around the edge the pan as it is stirred. A pause in stirring will cause it to drop back down again; after which stirring can be resumed. Your mixing bowl should have sufficient depth to contain the granulated sugar. The depth of most commercial cream machine pans limit the amount of sugar that can be made at one time.

As the syrup crystallizes, the heat of crystallization given off can be significant, releasing a burst of hot steam that can catch the person stirring the mix by surprise and cause burns if protective equipment is not being used. Stirring continues until all moisture is essentially removed from the cooked syrup and crumbly, granulated sugar remains. Stirring aggressively tends to make a finer more powdery sugar while slow even stirring tends to make a grainier sugar that is very similar to common brown sugar. Granulated maple sugar made with syrup higher in invert sugar tends to make a finer powdery sugar while syrup low in invert sugar tends to make a grainier sugar. Light low invert syrup tends to make a “drier” finished product than if darker higher invert syrup is used.

Screening

Screening

At this point the sugar is sifted through a coarse screen (1/8-inch or 3mm hardware cloth is commonly used though stainless steel is recommended for cleanability and durability) to make a uniformly sized product. Stainless steel sieves with handles are available at restaurant supply stores. Various sizes of commercial sifters are available. Allowing the sugar to stand exposed to air in a humidity controlled room and sifting a second time before packaging can reduce the chances of the sugar clumping after placed in packaging. Some producers save out the pebble sized clumps that do not go through the sieve and sell them as a specialty sugar to be used in hot drinks such as coffee or hot chocolate.



Packaging

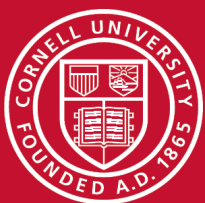
Creep Test

Packaging and Moisture Content

Granular sugar absorbs moisture and should be stored in dry, air-tight containers. Glass or see-through packaging is ideal in that the consumer can see the product being purchased.

The moisture content of the sugar as it is packaged can be important. One way to check for the proper moisture content is to use the creep test. To conduct the creep test you simply make a small pile of granulated sugar on a clean dry surface, and then pour additional sugar on the top with a spoon. Sugar that is still too wet will not creep but will cling together and sugar that is too dry also does not creep but just slides down. Good creeping begins to occur about the time the pile is an inch high you will see the sugar begin to move down the slope. It creeps or moves with a thick fluid motion and the crystals make it appear as though it is crawling. It looks like the movement of a mass of larvae almost like something is alive there.

Packaging maple sugar when the moisture content is still too high is the primary reason for the sugar to harden later. Maple granulated sugar also hardens when water content is too low, usually when water evaporates from the sugar when the packaging is not properly closed or has allowed moisture to escape. Storing maple sugar in a way that allows the product to retain its natural moisture—in its original airtight container—helps maple sugar stay moist. If maple sugar hardens, let it stand overnight in a sealed jar with a damp paper towel. For a quick fix, heat the needed amount in a 250° F oven for a few minutes or in a microwave oven on low for 1-2 minutes per cup. The softened maple sugar should be used immediately. The clumps of sugar can also be broken up in a blender.



Replacing Table Sugar with Maple Sugar

by STEPHEN CHILDS



6.2

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 add 1 $\frac{1}{4}$ cup of syrup to replace one cup of sugar, others say to replace one cup of sugar with $\frac{3}{4}$ 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 one cup of granulated cane sugar with one cup of granulated maple sugar. In this case you gain the extra flavors from maple while the sweetness and the liquid stay in balance. I would especially suggest this where the recipe is depending on the qualities of milk or another liquid that you may be reducing to perform some important function in the recipe beyond what simply using water would accomplish.

Liquid vs. Dry

Liquid vs. Dry

One cup of maple syrup at a fairly common density of 67° Brix provides 7.5 ounces (214 grams) of sugar and 3.7 ounces (105 grams) of water. One cup of cane sugar averages about 7.4 ounces (210 grams) of sugar. This is roughly the same amount sugar in a cup of maple syrup as in a cup of granulated sugar. The space around the grains of granulated sugar about equals the space taken up by the water in the cup of maple syrup. The amount of sugar in maple syrup and granulated sugar of the same volume is essentially the same. Using the cup of maple syrup in place of granulated sugar adds an extra 3.7 ounces (105 grams) of water to the recipe. To balance the liquid in the recipe when replacing the granulated sugar with maple syrup you need to reduce other liquids in the recipe, typically water or milk, by 3.7 ounces (105 grams) or between $\frac{1}{3}$ and $\frac{1}{2}$ cup for each cup of sugar replaced.

Replacing Brown Sugar

Replacing Brown Sugar

If it is brown sugar you are replacing you would need to go through similar calculations depending whether the recipe calls for packed brown sugar or loose brown sugar. When replacing one cup of loose brown sugar that weighs 5 $\frac{1}{4}$ ounces (149 grams) of sugar per cup with maple syrup where just the sugar weighs 7.5 ounces (214 grams) per cup, you would replace one cup of loose brown sugar with $\frac{3}{4}$ cup of maple syrup. This would leave 2.8 ounces (79 grams) or about $\frac{1}{4}$ cup to reduce from other liquids in the recipe to make the liquids balance

When replacing one cup of packed brown sugar which weighs 8 ounces (227 grams) with maple syrup where just the sugar weighs 7.5 ounces (214 grams) per cup you would only need to add one cup and one half ounce (one tablespoon or 21 grams) of maple syrup to balance the sugar in the recipe. Now you have just 3.9 ounces (112 grams) or just less than $\frac{1}{2}$ cup to reduce from other liquids in the recipe to make the liquids balance



Powdered Sugar

Powdered Sugar

Replacing powdered sugar would be very similar to replacing granulated sugar, however powdered sugars often perform some specific function in the recipe or confection that may not be accomplished by the maple syrup or sugar. In this case I would suggest you experiment with the replacement before simply counting on everything going well with replacing powdered sugar with maple syrup.

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 grain and 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. Recipes and these conversions usually are based on ingredients being at room temperature. Also, the volume of measuring cups intended for dry ingredients (cups 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

1 cup of maple syrup = 240 ml = 319 g of syrup (density of 1.33 g/ml)

At 67° Brix, 1 cup of maple syrup provides 7.5 weight ounces (213 grams) of sugar and 3.7 weight ounces (105 grams) of water.

One gallon of maple syrup at 67° Brix 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 **1 cup** = 5 1/4 weight ounces

One pound brown sugar = 2 cups packed **1 cup** = 8 weight ounces

One pound granulated sugar = 2 1/8 cups **1 cup** = 7 1/2 weight ounces

1 cup of water = 8 fluid ounces = 16 tablespoons = 227 grams

One fluid ounce of water = 28.35 grams

Based on these values:

1 cup of granulated sugar = 1 cup of maple syrup, and this will add 3.7 oz (105 grams) of water.

The influence of the maple flavor on the recipe is most closely related to the grade of the syrup used. Grade A light or medium amber syrups will add a mild maple flavor to the recipe. Using Grade A dark amber syrup will add more noticeable maple flavor. Maple syrup labeled Extra Dark for Cooking will add the most robust maple flavor. Granulated



Measuring Methods

maple sugar tends to concentrate maple flavors. Which grade you use should depend on your flavor preference and what other flavors maple would be competing with.

Measuring Methods

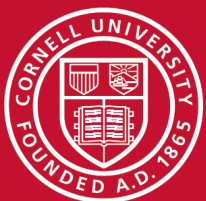
Use dry measures (measuring cups and spoons that hold the exact amount) for dry ingredients and liquid measures (glass, plastic, or metal containers graduated in cups and fluid ounces) for liquids. When measuring liquids, place the cup on a level surface and get at eye-level to determine the liquid amount. With glass containers, some liquid may creep up the side to create a false level. You need to look through this to judge the level of the liquid in the center of the cup.

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 sugar means just that, and the final level amount can be determined with a flat knife blade.

Ounces are measures of both volume and weight, but they are different; a reason to use the metric system. The conversion chart above and recipes need to be read carefully to determine which ounce is being referred to.

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.



Section 7

Other Maple Confections and Value Added Products

- 7.1 Coating nuts with Maple Syrup**
- 7.2 Maple Sugar Coated Nuts**
- 7.3 Making and Marketing Maple Soft Drink**
- 7.4 MAPLE MERINGUES**
- 7.5 MAPLE SLUSHIES**
- 7.6 MAPLE SUCKERS/LOLLIPOPS AND HARD CANDY**
- 7.7 MAPLE JELLY**
- 7.8 MAPLE SYRUP STICKS/STRAWS**
- 7.9 Making and Marketing Maple Suckers**
- 7.10 Making Maple Marshmallows**
- 7.11 Making and Marketing Maple Cotton**
- 7.12 Maple Coated Popcorn**
- 7.13 Maple Ice Cream**
- 7.14 Maple Granola**
- 7.15 Maple Brittle and Taffy**
- 7.16 Maple Sugar on Snow**
- 7.17 Substituting inverted maple syrup for corn syrup in maple value added products.**
- 7.18 Maple Candy and Other Confections**

7.1 Coating nuts with Maple Syrup

Nuts:

You can store nuts in the freezer until you are ready to use them. Make sure the nuts are at room temperature or above before attempting to coat. If they are cold the syrup sets up so fast it does not get time to grow crystal or if the nuts become wet with condensation the sugar may not stick completely. Using high quality nuts makes a big difference in the quality and consistency of the coating. When using fresh roasted nuts, make sure they have had a couple of days for the oils to soak in.

Syrup:

Use 7 ounces of Grade B or dark amber Maple Syrup per pound of nuts. Darker syrups with a robust flavor works best with the intense flavor of most nuts. Use 8 ounces per pound for batches under 2.5 pounds. To crystallize properly the syrup used to make maple coated nuts should have a invert sugar level of 1.5 or less. Maple Syrup with higher invert levels will not sugar on the nuts and will tend to stay sticky.

Glucose Meter Reading	1in 10 dilution of syrup
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

Gray area is the suggested invert sugar levels in maple syrup to be used to make maple coated nuts

Cook the Maple Syrup to 32 to 34°F above the boiling point of water.

Pour the Maple Syrup over the nuts. Fold syrup into the nuts in nut mixer or with a pancake turner on a cookie sheet. Continue stirring until the mixture crystallizes and coats the nuts. Stop stirring when completely crystallized and dry to the touch.

Bake at 110 to 130 degrees for 2 to 3 hours. Optional step, but extends the shelf life by several months.

Store in a sealed container.

7.2 Maple Sugar Coated Nuts

Ingredients:

- 1 egg white
 - 1 tablespoon water
 - 1 pound nuts
- 1 cup maple sugar

Directions:

1. Preheat oven to 250 degrees F (120 degrees C). Grease one baking sheet.
 2. In a mixing bowl or freezer bag, whip together the egg white and water until frothy. In a separate bowl place the granulated maple sugar
 3. Add nuts to the egg white mixture, stir to coat the nuts evenly. Remove the nuts, and stir in the sugar mixture until coated. Spread the nuts out on the prepared baking sheet.
 4. Bake at 250 degrees F (120 degrees C) for 1 hour. Stir every 15 minutes.
 5. Remove and cool.
- Break into individual pieces and store in re-sealable plastic bag, jar or tin.

Additional Information:

Nuts:

You can store nuts in the freezer until you are ready to use them. Make sure the nuts are at room temperature or above. If they are cold the nuts may become wet with condensation the sugar may not stick completely. Using high quality nuts makes a big difference in the final quality and consistency of the coating. When using fresh roasted nuts, make sure they have had a couple of days for the oils to soak in.

Maple coated nuts are subject to sale tax in New York State. Making maple coated nuts for sale also requires one of the following certifications: a 20C food processing license from the New York State Department of Agriculture, a home kitchen exemption from Ag and Markets or a food service permit from the county department of health. Products made in the same facility where peanuts are processed need to carry a notice on the label to that effect.

7.3 Making and Marketing Maple Soft Drink

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

Soft drinks, pop or sodas, which ever name you are used to, are a very common product in to-day's market place. Producing a maple soft drink at the site of consumption can be fairly easily accomplished and can be a profitable use for dark and extra-dark good flavored maple syrup. It can be as simple as adding maple syrup to purchased carbonated water, which is available from most grocery stores. Table top carbonators can also be used or a commercial fresh soft drink dispenser. Getting the mix right to meet the preference of the consumer is the part that seems a mystery to many potential maple soda marketers. There is a fairly wide range in sweetness in the commonly available soft drinks. By checking the labels of some common products we see that moderately sweet soft drink have a sugar level of about 25 grams in eight ounces or about 11% sugar while sweeter ones have a little over 30 grams of sugar in eight ounces or about 14% sugar. Since maple syrup is usually about 66% sugar and 34% water this needs to be considered in our calculation. See the following tables for various sugar and maple syrup mix rates as suggestions for upper and lower limits for sweetness.

Table 1 Mix Rate for Carbonated Water and Maple Syrup by Weight in Grams

Sweet-ness	Sugar grams	Syrup grams	Finish Soft Drink Weight
11%	25	38	8 oz./227 grams
11%	38	57	12 oz./340grams
11%	63	95	20 oz./567grams
11%	110	167	35.3 oz./ 1000grams
14%	31	47	8 oz./227 grams
14%	47	71	12 oz./340grams
14%	78	130	20 oz./567grams
14%	137	208	35.3 oz./ 1000grams

Table 2 Mix Rate for Carbonated Water and Maple Syrup by Weight in Ounces

Sweet-ness	Sugar Ounces	Syrup Ounc-es	Finish Soft Drink Weight
11%	0.9	1.3	8 oz./227 grams
11%	1.3	2.0	12 oz./340grams
11%	2.2	3.4	20 oz./567grams
11%	3.9	5.9	35.3 oz./ 1000 grams
14%	1.1	1.7	8 oz./227 grams
14%	1.7	2.5	12 oz./340grams
14%	2.8	4.6	20 oz./567grams
14%	4.8	7.3	35.3 oz./ 1000 grams

Note that all figures are by weight, volume measures will differ slightly.

These tables will allow you to experiment with sweetness as well as calculate potential costs and pricing. Both tables are given so you can choose to measure in grams or in ounces.

Where you are starting with a given volume of carbonated water such as a liter or two liter bottle the rates below are for adding maple syrup to check out the suggested lower and upper limits

of sweetness:

180 grams or about 1/2 cup of syrup (or maple sugar) should be added to 1 liter of carbonated water to reach the 11% sugar level

230 grams or about 3/4 cup of syrup (or maple sugar) should be added to 1 liter of carbonated water to reach the 14% sugar

To get some estimates of just how much it might cost to make a maple soft drink check out the two sets of calculations below, one at the 11% sugar level the other at 14%.

Maple soft drink estimated cost evaluation at 11 % sugar:

\$40 per gallon of syrup =	\$.008 per gram
38 grams x \$.008 =	\$ 0.30 per cup
Carbonated water at	\$ 0.05 per cup
Cup, straw and cover at	\$ 0.10 per cup

Material cost per 8 oz. cup of maple soda	\$ 0.45 per cup
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Material cost per 12 oz. cup of maple soda	\$ 0.70 per 12oz.
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Material cost per 20 oz cup of maple soda	\$0.99 per 20 oz
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Maple soft drink cost evaluation at 14 % sugar:

\$40 per gallon of syrup =	\$.008 per gram
47 grams x \$.008 =	\$ 0.38 per cup
Carbonated water at	\$ 0.05 per cup
Cup, straw and cover at	\$ 0.10 per cup

Material cost per 8 oz. cup of maple soda	\$ 0.53 per cup
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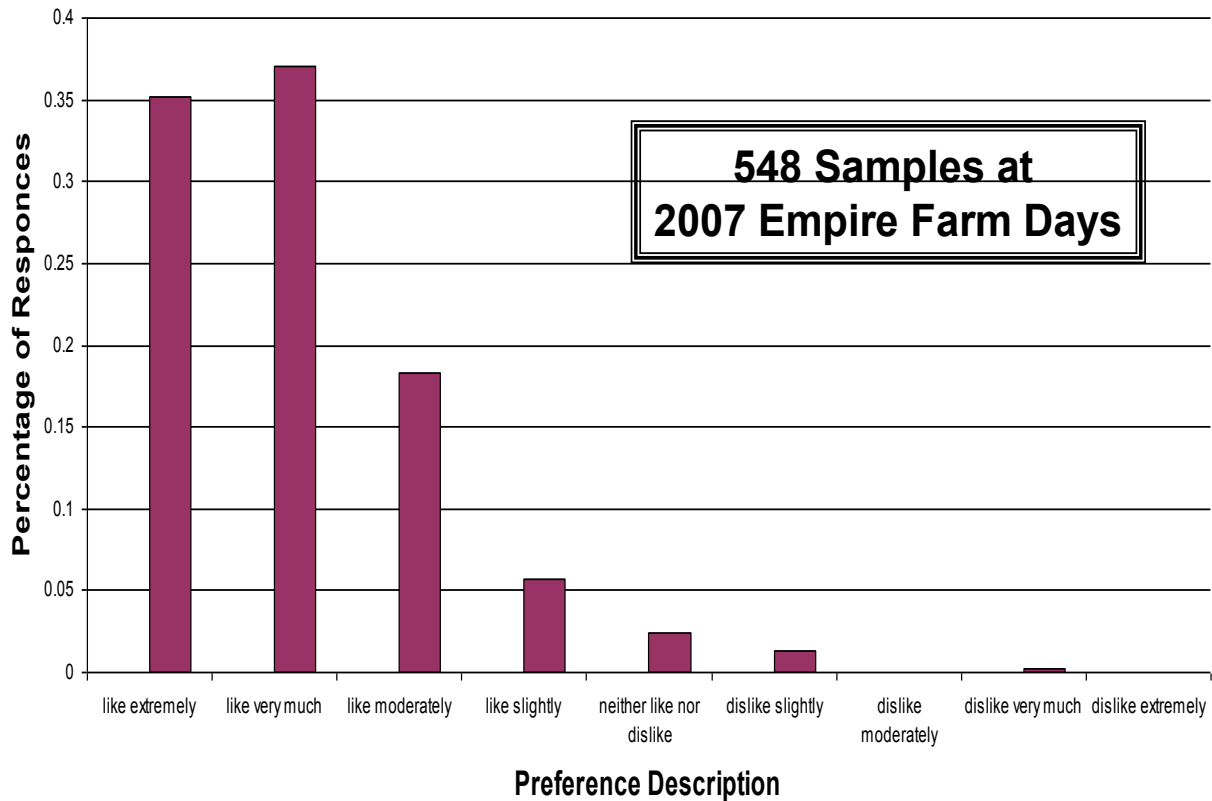
Material cost per 12 oz. cup of maple soda	\$ 0.81 per 12oz.
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Material cost per 20 oz. cup of maple soda	\$1.26 per 20 oz.
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In the writers opinion good flavored dark and extra dark syrups make the best flavored maple soft drink. This could be an excellent way to get value added price for syrup that may be too high in invert sugar to make crystallized maple confections.

Will people like maple soft drinks enough to pay the price? To get some idea of how much people would like this product a couple of test market trials were held. The first to a group of 31 friends tested at the 11% sugar level. In this case 30 rated the drink as very good with one saying it was too sweet. The second trial was held at the 2007 Empire Farms Days with 548 participants tasting one half ounce samples of the 14% sugar. The chart below shows that 70% rated it as "like extremely" or "like very much". Another 24% stated that they liked it moderately or slightly. A few were either neutral or disliked it slightly. Ten indicated that even though they liked the product, they thought it was too sweet, many compared the flavor to cream soda and root beer and a few though it had too much carbonation, one said it was not sweet enough.

Maple Carbonated Soft Drink



How you obtain carbonated water to make the maple soft drink can make a difference in your cost and labor. Simply purchasing carbonated water at the grocery store and adding maple syrup is very reasonable for small quantities especially if it can be located and purchased wholesale. Using a tube to gently place the syrup at the bottom of the container then closing the lid and mixing seems to work with less problems than trying to pour syrup into the top as adding the sugar generates some bubbling. Carbonating at your site with a table top carbonator can be practical and cost effective but can demand extra labor when you are already too busy selling. These units are available from several sources and are easily accessed on the internet. A commercial, on the spot mixer-carbonator has a high initial cost but has a low labor demand. These can also be more difficult to move to remote sites due to size and weight. Commercial units are also available from many sources such as restaurant supply and on the internet.

One of the selling points of maple soft drink is that it has only maple sugar and all natural flavors. No high fructose corn syrup, no artificial colors or preservatives. It has the same minerals as maple syrup. This should be a favorite with health food conscious parents. The fact that it is a product of the local forest and is a factor in preserving those forests in sustainable systems should be a favorite with the environmentally concerned public. Those who could also put the

organic label on it should have a real winner. Who else offers a truly organic soft drink?

Fresh soft drinks of this nature should not be held over for future sale. They can spoil rapidly and are intended only for immediate use. Keeping this product cold is essential. Processing a maple soft drink for bottling is much more complex and will be the subject of a future fact sheet. Making maple soft drinks for private use is not regulated. When maple soft drink is made for sale the producer must have either a processing license with the Department of Ag and Markets or a health permit with the local health department.

If you plan to mix maple syrup and carbonated water there are a few rules to consider to avoid making a mess. First, do not pour maple syrup into a container of carbonated water with a narrow top or neck. It is likely to cause an eruption of liquid and foam pushing out the top, sometimes with enough force to shoot into the air several feet. First pour the carbonated water into a wide top container that can be closed, add the maple syrup, close the container and then mix the water and syrup by gently rotating the container. Second, do not put the syrup into the wide topped container first then add carbonated water. This will cause excessive bubbling that can again cause a mess. Always add syrup to carbonated water not the other way around.

7.4 MAPLE MERINGUES

OLGA PADILLA-ZAKOUR, CHERYL LEACH, HERB COOLEY, BELEN BAVIERA, NYS FOOD VENTURE CENTER, CORNELL UNIVERSITY

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 is funded by the New York Farm Viability Institute.

This is the traditional egg white and sugar cookie that people recognize and enjoy. We worked with different formulations and baking procedures to develop a simple method to obtain consistent results.

Equipment needed: scale to weight ingredients, mixer and oven.

Supplies needed: maple syrup, powdered egg whites, parchment paper, baking sheet, water proof packaging such as heat sealable bags.

Formulation by weight and preparation procedure – 500 g batch

98% maple syrup	490 g maple syrup
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2% powdered egg whites	10 g powdered egg whites
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Weigh the ingredients.

Dissolve powdered egg white in maple syrup by hand first and then whip in mixer at highest speed for 7 minutes.

Drop the whipped syrup in small portions (depending on size desired, 1 teaspoon to 1 tablespoon) on parchment paper over a baking sheet.

Bake in pre-heated oven at 200°F for 1.5 to 2 hr (depending on cookie size and type of oven.

Turn off the heat and leave the cookies in oven overnight. This is necessary to “dry” the cookies and to obtain the crunchy texture.

Package the meringues in air-tight bags. The cookies need to be protected from moisture as they will absorb the moisture from the environment and become sticky. They are dried with a very low moisture content (water activity of 0.2); therefore they can last for many months if packaged properly.

Serving size of finished meringues is 30 g.

Suggested packing is 8-10 cookies/bag or 1 serving of 30 g.

Ingredient declaration: maple syrup, dried egg white.

7.5 MAPLE SLUSHIES

OLGA PADILLA-ZAKOUR, CHERYL LEACH, HERB COOLEY, BELEN BAVIERA, NYS FOOD VENTURE CENTER, CORNELL UNIVERSITY

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 is funded by the New York Farm Viability Institute.

This product will be prepared on site for immediate consumption in festivals and stores. It has a nice maple flavor and a refreshing taste that will delight kids and adults of all ages.

We tested different formulations with Medium Amber and Dark Syrup, from 15 to 30% syrup content in the slushies, and also the addition of milk in the form of non-fat dry milk from 2 to 4%. The best results were obtained with Medium Amber Syrup, which is recommended for these type of products. Maple syrup content of 20 to 30%, which corresponds to 17 to 27°Brix in the slushies, were considered the best formulations. For the slushies with milk, 2 to 3% non-fat dry milk with 25% maple syrup resulted in the preferred samples.

Equipment needed: Blender or similar equipment to crush ice or to make slushies.

Supplies needed: maple syrup, ice, serving cups/glasses.

Formulation by weight and preparation procedure – 500 g batch

20 to 30% maple syrup	100 to 150 g maple syrup
80 to 70 % ice	400 to 350 g ice

For slushies with non-fat dry milk – for a creamier taste and added nutritional value:

25 % maple syrup	125 g maple syrup
2-3% non-fat dry milk	10 to 15 g non-fat dry milk
73 to 72% ice	365 to 360 g ice

Weigh the ingredients.

Prepare the slushies by crushing ice and syrup in the blender until smooth consistency.

Serving size of slushies is 8 ounces.

In addition, these formulations can be used to prepare popsicles – just substitute ice for water, mix well and pour into molds and freeze.

7.6 MAPLE SUCKERS/LOLLIPOPS AND HARD CANDY

OLGA PADILLA-ZAKOUR, CHERYL LEACH, HERB COOLEY, BELEN BAVIERA, NYS FOOD VENTURE CENTER, CORNELL UNIVERSITY

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 is funded by the New York Farm Viability Institute.

Our goal was to develop hard candy with 100% maple or with as much maple syrup as possible. Typically lollipops formulation include the use of corn syrup or invert sugar in order to obtain the right combination of sugars to produce hard candy.

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

For candy making though, careful preparation and experience is necessary, as environmental conditions (temperature and humidity) can make a difference.

Equipment needed: Stove top, pots, scale, candy thermometer or other appropriate food thermometer.

Supplies needed: maple syrup, corn syrup, candy or lollipop molds, sticks.

Formulation and preparation with Corn Syrup – 500 g batch

75% Medium Amber Maple syrup	375 g maple syrup
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25% Corn Syrup (from supermarket)	125 g corn syrup
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Weight the syrups and blend in saucepan.

Heat over low flame, stirring until mixture boils. Add a drop or two of anti-foam to prevent foaming.

Monitor the boiling temperature with the thermometer and let the syrup boil undisturbed until the temperature reaches 280°F, lower heat for the final stage.

When the temperature reaches 300°F, remove from heat and allow to stand until all the bubbles have disappeared.

Pour into molds, insert sticks after initial cooling (for proper placing)

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

Formulation and preparation of 100% Maple with Inverted Maple Syrup – 500 g batch

90% Medium Amber Maple syrup	450 g maple syrup
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10% inverted maple syrup	50 g inverted maple syrup
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To prepare inverted maple syrup add 0.2% of Invertase enzyme to the syrup (available from baking suppliers), mix well and keep at 122°F for 24 hours.

Weight the syrups and blend in saucepan.

Heat over low flame, stirring until mixture boils. Add a drop or two of anti-foam to prevent foaming.

Monitor the boiling temperature with the thermometer and let the syrup boil undisturbed until the temperature reaches 305°F, lower heat for the final stage.

When the temperature reaches 305 to 315°F (depending on syrup type and local conditions), remove from heat and allow to stand until all the bubbles have disappeared.

Pour into molds, insert sticks after initial cooling (for proper placing)

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

Final candy should be clear and brittle, not sticky – If the color is too dark, try boiling rapidly to the final temperature and add the inverted syrup at the end of the boil instead of at the beginning.

Serving size is one lollipop of approximately 15 g or several hard candies to match 15 g.

7.7 MAPLE JELLY

OLGA PADILLA-ZAKOUR, CHERYL LEACH, HERB COOLEY, BELEN BAVIERA, NYS FOOD VENTURE CENTER, CORNELL UNIVERSITY

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 is funded by the New York Farm Viability Institute.

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, measured in Brix, was below 65°Brix, which is the standard of identity to call a product jelly. We rework the recipe to comply with the standard of identity and therefore to have the product under the non-hazardous food category.

Equipment needed: stove top, scale, thermometer, refractometer for jelly range (optional).

Supplies needed: maple syrup, genugel, glass jars and lids appropriate for hot-packing.

Formulation by weight and preparation procedure – 1 kg batch

83.3 % maple syrup	833 g maple syrup
16.5% water	165 g water
0.2% Genugel	2 g of Genugel

Weigh the ingredients.

Dissolve the Genugel in the water, this might take a few minutes with brisk agitation.

Place the syrup into a large pot (mixture will foam), add the solution of Genugel.

Add a few drops of anti foam to minimize foaming.

Boil quickly until the boiling temperature reaches 219-220°F and the Brix is 65-66°.

Hot pack into clean preheated glass jars.

Fill temperature in the jar must be at least 185°F.

Immediately cap with appropriate lids.

Invert or lay on the side for 3 minutes to pasteurize the lids.

Return jars to upright position for proper gelling.

Let cool at room temperature.

If the hot-fill temperature drops below 185°F (a problem with very small jars) then the capped jars should be processed in a boiling water bath for 5 minutes.

If the consistency is still too soft, increase the amount of Genugel to 0.25%. We have observed some surface darkening over time in the jellies, so cool temperature is recommended for prolonged storage.

Serving size is 1 tablespoon.

7.8 MAPLE SYRUP STICKS/STRAWS

OLGA PADILLA-ZAKOUR, CHERYL LEACH, HERB COOLEY, BELEN BAVIERA, NYS FOOD VENTURE CENTER, CORNELL UNIVERSITY

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 is funded by the New York Farm Viability Institute.

One product that is used as a snack is the honey stick/straw. As maple syrup sticks can be also prepared, we evaluated how to stabilize the product to make it shelf-stable, because if the maple syrup is filled cold into the sticks or straws it will mold over time.

The maple syrup was filled at room temperature into the plastic sticks and heat sealed. We placed them into boiling water to establish the time needed to pasteurize the sealed sticks. Five minutes in the boiling water bath is sufficient to stabilize the syrup.

7.9 Making and Marketing Maple Suckers

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

Suckers or Lollipops made with maple syrup can be a popular item at special events, fairs, farmers markets and roadside stands. Maple suckers can be made using a number of different recipes but I will describe just a couple of them here. A maple sucker is a non-crystalline confection often referred to as a glass. Crystallization is prevented by using high levels of invert sugar in the form of corn syrup, glucose, honey or inverted maple syrup, and cooking to a high temperature where the hot syrup is not stirred or agitated. Because suckers are made by cooking to a high temperature be sure you take proper precautions and wear appropriate protective clothing when handling the hot syrup (see the article Exercise Caution When Making Maple Confections in the Confections Notebook). The recipe provided at the 2006 North American Maple Syrup Council Meetings is as follows:

Ingredients:

- 12 oz med or light maple syrup
- 4 oz white corn syrup
- Butter the size of a pea

Procedure:

- Heat to 270°F then pour into the molds
- Spray molds with Pam every 4 batches
- Suggest light weight pan to avoid over cooking from heat residual
- Makes about 50 suckers that they sell for \$.50 each. Farmers market sales of about 200 per day
- Keep suckers in the refrigerator up to one month in air tight container
- Use a glass measuring cup to pour hot syrup into the molds so that if the syrup becomes too cool and thick, put the cup and syrup in a microwave and reheat and continue filling the molds.

The Maple Syrup Producers Manual makes the following suggestions:

- Mix 1/3 light corn syrup,
- 1/3 maple syrup (dark amber or lighter,
- 1/3 white sugar.
- Add the white sugar only after the other two ingredients are boiling. Bring to 295°F degrees, pour in glass measuring cup and then into molds. Pour into the molds when the temperature cools to 250°F.

A third method makes the sucker from 100% maple syrup. In this procedure you use the recipe above but substitute maple sugar for white sugar and inverted maple syrup for corn syrup:

- 1/3 inverted maple syrup
- 1/3 maple sugar
- 1/3 maple syrup

Mix the sugar and untreated maple syrup and cook until about 250°F then add the inverted syrup. Adding the inverted syrup at the beginning can make the suckers darker and stronger fla-

vored. The maple sugar can be replaced one for one with maple syrup; it simply takes longer to cook. So the recipe could read 1/3 inverted maple syrup and 2/3 maple syrup as one cup of syrup has the same amount of sugar as one cup of granulated maple sugar. Using light or medium syrup tends to make a sucker that seems to be preferred by most customers over a darker colored, stronger flavored sucker. You can experiment with your customers on this. With 100% maple syrup you finish at 305°F degrees, if suckers are sticky at this temperature then you may need to increase an additional 5 to 10 degrees with reduced burner heat. Then cool the mix to 250 and pour into the molds. In the recipe you can substitute maple syrup for maple sugar, it will give the same result only more boiling time will be required.

So why do most of the sucker recipes suggest using corn syrup or glucose sugar? The invert sugars in corn syrup act as an "interfering agent" in this and many other candy recipes. It contains glucose molecules that tend to keep the sucrose molecules in the lollipop syrup from crystallizing. Without this interference the sucrose crystals would result in grainy, opaque candy instead of the clear, glassy lollipops you're trying to create. Inverted maple syrup or maple syrup treated with the enzyme invertase can effectively take the place of corn syrup in the recipe allowing the products to be made of 100% maple syrup. This will add to the cost of the suckers as the maple syrup is more expensive than corn syrup. When setting your market price for 100% maple suckers you will have to consider the higher costs of your ingredients and the fact that they are 100% maple should be included in your promotion and signage. For further information on replacing corn syrup with inverted maple syrup and how to invert maple syrup check out the article "Substituting inverted maple syrup for corn syrup in maple value added products" in the Maple Confections Notebook. Including too little invert sugar in a maple sucker recipe can make the sucker hard and harsh, and possibly even sharp. Too much invert sugar in the maple sucker can make it too soft and sticky.

Not all candy molds can be used to make maple suckers as it is placed in the molds at high temperatures which can cause some molds to melt. Be sure to use molds made to tolerate the heat.

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 or suckers are subject to New York State sales tax. Suckers made with all maple do not require a processing license or health permit. Suckers made for sale and made with corn syrup, glucose or sugar other than maple sugar do require a processing license from the Department of Agriculture and Markets or a food service permit from the Health Department.

7.10 Making Maple Marshmallows

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

Ingredients:

4 gelatin envelopes
 $\frac{3}{4}$ cup water

Fit a commercial mixer with the whisk attachment. In the mixer bowl combine the $\frac{3}{4}$ cup of water with the gelatin and allow to bloom (soften). Be sure all of the gelatin is exposed to the water, it is easy for dry pockets of gelatin to remain if just dumped in a lump.

Ingredients:

3 cups maple syrup
 $\frac{1}{2}$ cup water
1 $\frac{1}{2}$ cups inverted maple syrup (or corn syrup)

Add the maple syrup, inverted maple syrup, and remaining $\frac{1}{2}$ cup water to a pan. Bring to a boil while being sure the liquids and sugar are well mixed. When this mixture is at a boil, continue to cook without stirring until it reaches about 34°F above the boiling point of water. With the mixer at medium speed, gradually pour all of the hot syrup down the side of the bowl into the awaiting gelatin mixture. Be careful as the hot syrup is very liquid and hot at this point. When all of the syrup is added, bring the mixer up to full speed. Whip until the mixture is very fluffy and stiff, about 8-10 minutes. You can substitute maple syrup for the maple sugar, the result will be the same only more boiling time will be required. Dark and extra-dark syrups are better at covering the flavor of the gelatin.

At this point you can pour the marshmallow into a pan that has been greased and covered with powdered maple sugar. Powdered maple sugar is made by beating granulated maple sugar to powder it in a blender. Smooth and spread the marshmallow with a spatula if necessary. As an alternative you can spoon the slightly cooled mixture into individual servings onto a well sugared surface. Or spoon slightly cooled mixture between ice cream sandwich wafer cookies, sugar wafer cookies, in to ice cream cones or on gram crackers. Allowing the mix to cool too long will make it impossible to spoon individual servings. Transferring the mix too soon may allow it to spread too thin and off of the intended target. When in the pan or placed into individual servings, allow the mixture to sit, uncovered at room temperature for 10 to 12 hours or chilled for 3 to 4 hours. Sugar all surfaces with powdered maple sugar. A sifter can make this job fairly easy. Marshmallows will keep several weeks in the refrigerator in an air-tight container.

To make maple marshmallows for sale the producer will need either a processing permit from New York State Department of Ag and Markets or a food service permit from the Health Department. All marshmallows are sales tax exempt in New York.

7.11 Making and Marketing Maple Cotton

Stephen Childs, New York State Maple Specialist

Maple cotton has become a very popular value-added product where consumers have had a chance to become familiar with it. At the New York State Fair state association booth maple cotton was first introduced in 1998 and grew in ten years to account for 25% of all sales resulting in revenue of over \$20,000 during the fair in 2008. Yet many customers when given samples say they have never heard of maple cotton before. Maple cotton sells very well at fairs, craft shows, festivals or other high population settings. Many producers also have found it to work well at farmers markets and open houses, such as Maple Weekend. Because of the large space taken up by bags of maple cotton and the fact that maple cotton can be easily crushed, it works best to make it fresh at the market location as opposed to transporting it. However, some producers have been successful in moving finished bags to the market. Providing free samples to prospective customers can dramatically increase sales as you build a regular clientele over time.

Maple Cotton Mix Economics

The maple cotton mix is made by combining maple sugar with cane sugar. Blends of one part maple sugar to three parts cane sugar or one part maple sugar to four parts cane sugar are the most common. The mix rate does influence the economics of the product. Also, the weight of maple cotton sold in a bag, on a stick or in a sealed container will determine the price it should be sold for. Here are some cost comparisons of several mix and weight combinations:

If a one in three mix in a 4 oz bag is the target:

1 part maple – 3 parts cane sugar

\$12 per pound maple sugar = 75¢ per ounce

Cane sugar at \$2.50 for 5 pounds or 50¢ per pound or 3¢ per ounce

Per bag ingredient costs = 75¢ + 9¢ = 84¢

If a one in four mix in a 4 oz bag is the target:

1 part maple – 4 parts cane sugar

\$12 per pound for maple sugar = 75¢ per ounce x .8 ounce = 60¢

Cane sugar at \$2.50 for 5 pounds or 50¢ per pound or 3¢ per ounce x 3.2 ounces

Per bag ingredient cost = 60¢ + 10¢ = 70¢

If a one in four mix in a 5 oz bag is the target:

1 part maple – 4 parts cane sugar

\$12 per pound for maple sugar = 75¢ per ounce

Cane sugar at \$2.50 for 5 pounds or 50¢ per pound or 3¢ per ounce

Per bag ingredient cost = 75¢ + 12¢ = 87¢

Many times maple producers fail to weigh any bags and don't have an idea of just how much product is being sold per bag. If we estimate the other costs involved in producing and selling maple cotton, we can see just what the profitability is likely to be or where the price should be set. In this example, we will use a 1 in 4 mix to produce a 5 ounce bag of cotton.

Sugar costs per bag	\$.87
Bags	\$.05
Equipment	\$.25
Labor – 20 bags per hr.	\$1.00
Marketing (rent, ads, travel)	\$.50
Total	\$2.67

In this example you can see that there are several important pricing considerations beyond the value of the maple sugar. The cost of the bags, cones or plastic containers needs to be added. The investment in the cotton machine needs to be recovered as well as labor and marketing cost paid. Labor costs for making the cotton can vary significantly depending on the speed and capacity of the cotton machine you use and the skill of the operator. Note that our example does not include a margin or mark up for profit, This needs to be added at a level acceptable to your business and market limitations.

Marketing

Maple cotton can be marketed in several ways. The most common is selling in a bag sealed with a twist tie or an adhesive strip. Bags that are not compressed or left in excessive heat can hold up for several days. This is the best approach for customers to transport or for on-site consumption. Selling on a paper cone is also fairly common When you expect customers to consume cotton right away. Finally, some maple producers market maple cotton in plastic containers with a tight fitting lid. These can be held cool for an extended time for low volume retail markets or sold on the internet and shipped out to customers in this kind of container. In each case, understanding the weight and associated costs are an important part of setting price and selling the product.

Weather Issues

Weather, in particular humidity, can be a problem when making maple cotton. A maple producer may want to consider having more than just one mix of cotton candy available. The invert sugars in the maple sugar part of the mix will have a tendency to absorb water on humid days making the cotton sticky and difficult to handle. On humid days the mix with less maple such as the one in four mix will absorb less water making it less sticky. Also on humid days using a mix where the maple sugar is made with syrup low in invert sugar will make it absorb less water resulting in it being less sticky. In an open or outdoor setting wind can be a serious factor, blowing your product to distant places if you don't have a good cotton machine bubble or some other type of tight containment around the machine.

Cotton Machines

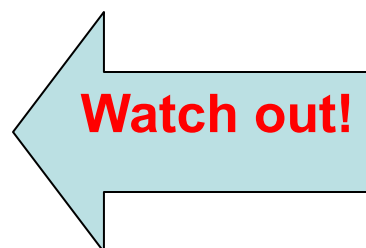
There are a few things to consider when purchasing a cotton candy machine. Some idea of where you plan to sell can make a difference in the size of machine you choose to buy. If your selling site is high volume, a large capacity machine will be required. The capacity of a machine is typically reflected in the voltage and amperage rating of the machine. If you always will be in the same location and have access to 220 voltage and 20 to 30 amp breakers, there are very high capacity machines available. If you anticipate moving the machine to a variety of

locations, it would be more practical to size the machine based on the likely power available. When moving to various sites finding 220 voltage and an outlet that matches your plug is sure to be a problem. In this case purchasing a cotton machine that operates on 110 voltage and 15 amps or less is suggested as it will work most places electric power is available. Purchasing a machine with higher amperage demands will likely mean lots of popped breakers and plenty of frustration. At the same time having customers waiting can also be frustrating. An undersized machine with slow output will demand a lot more of your time and attention. One fulltime person can usually keep up with two machines if only making and bagging the product. Trying to operate two machines as well as handle sales is usually too much for one person to keep up with.

Each machine should come with a full set of instructions. When cleaning the machine always follow the manufactures instructions.

Regulations

There are several regulations that apply to maple cotton in New York State. First, maple cotton is subject to **sales tax**. A vendor of maple cotton should have a sales tax number and a certificate of sales tax collection authority at the sales site each time the product is sold. Because maple cotton is a mixture of maple sugar and cane sugar the maker should also have one of these three **authorizations**: a home kitchen exemption from the New York State Department of Agriculture and Markets, a 20-C food processing license from Ag and Markets or a food service permit with the county department of health. The first two would be the correct permit when making and selling at home or the sugarhouse. The heath department permit would be when selling in a public place away from home or your 20-C kitchen or for specific events only. Any time maple cotton is made it should only be handled with **sanitary food service** gloves. For the protection of the operator and other observers the machine must be covered in a bubble or a display stand that protects bystanders from sugar that can be thrown from the spinner when over filled with sugar. The spinner in a cotton machine also has flow control leather straps that can deliver a painful slap if the operator allows his hands to get too close to the spinner (see the illustration below).



Sugar Issues

When selecting or making granulated sugar for making maple cotton, choose sugar that has larger crystals. With granulated maple sugar, larger crystals are made by stirring when the syrup is the hottest and stirring slowly and continuously. Stirring when the concentrated syrup has partially cooled, stirring too aggressively or having a high level of invert sugar in the syrup prepared for granulated sugar all make for smaller crystals. Smaller crystal can more easily slip through the heaters and grill of the spinner without melting making grainy cotton and allowing the sugar to build up around the edges of the cotton machine pan.

Maple cotton has been a valuable addition to the list of value-added products available to maple producers in New York. For information on making maple granulated sugar please see the Cornell Maple Bulletin 207, Granulated Maple Sugar or your New York State Maple Confection Notebook.

7.12 Maple Popcorn

Maple Kettle Corn

The mix for maple kettle corn as it is made and marketed at the Association Fair Booth at the New York State Fair is listed below. One of the important issues with maple coated kettle corn made right in the popper is to use a low temperature setting on the popper if one is available and second is to pour out the popper before all of the corn has popped. Holding out until the very last kernels pop is likely to add a scorched flavor to the kettle corn. Some maple producers use maple syrup in the popper rather than the maple sugar mix. This will delay the popping time somewhat but seems to make an acceptable kettle corn product. The reason some white sugar is used in the granulated mix at the fair is that it seems to reduce the scorch flavor in the kettle corn. The compound S is a product of Gold Medal, the maker of popcorn machines used at the NYS Fair.

For a 6oz machine

1 cup popcorn

2oz popcorn oil

1 tsp compound S

¼ heaped cup of granulated mix

Granulated mix is:

20 lb granulated maple sugar

4 lb cane sugar

mixed with 2½ cup dark syrup

or for moderate volume

5 pounds of granulated maple sugar

1 pound of white cane sugar

5/8 cup of dark syrup

Or for small volume

1 pound of granulated maple sugar

.2 pounds or 3½ ounces of cane sugar

1/8 cup of dark syrup or 1 ounce

Maple Carmel Corn

Maple Carmel Corn differs from maple kettle corn in that kettle corn has a just part of the surface covered with maple. Carmel corn has the entire surface of the popcorn coated with a maple glass. This coating of hard syrup locks up the movement of moisture in and out of the popcorn greatly extending its shelf life. To make the maple coating from 100% maple use the mixture suggested for 100% maple suckers and hard candy. Mix 2/3 maple syrup with 1/3 maple syrup treated with invertase so that it is all invert sugar. Set the temperature control on the popcorn caramelizer to 285° F and add the untreated maple syrup. Allow it to cook until almost finished then add the inverted maple syrup and then let it cook to the 285° F. When that temperature is reached pour in the already popped corn and have the caramelizer go through the mixing stage. When thoroughly mixed and all the popcorn is completely coated it is poured onto the drying table and stirred until the coated popcorn is free flowing. This can also be done

by using corn syrup instead of the inverted maple syrup. Since specific details for just how much maple syrup is needed to get a perfect coating it is suggested that the dry weight of the syrup equal the weight of the company packages used for caramel coating and adjust as needed. Dry weight of syrup is about 67% of its wet weight.

There are many other ways to coat popcorn with maple by cooking the syrup and stirring it into the popcorn either directly or by baking it on in the oven while stirring every few minutes. Maple popcorn balls can also be a very desirable snack. Below are a few sets of directions for various maple popcorn combinations.

BAKED CARAMEL CORN

Ingredients:

½ cup pure maple syrup

1 cup butter

2 cups maple sugar

1 tsp salt

½ tsp baking soda

1 tsp vanilla

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

Directions:

Heat oven to 250°. Put popped corn into lightly buttered bowl. Melt butter; add maple syrup, maple sugar, and salt. Boil without stirring for 5 minutes. Remove from heat. Stir in baking soda and vanilla. Pour gradually over popped corn and mix well. Turn into large roasting pan; bake for 1 hour, stirring every 15 minutes. Remove from oven and cool.

POPCORN BALLS

Ingredients:

2 cups maple syrup

Popped popcorn

Directions:

Maple syrup can be used to make delicious and easy popcorn balls. Boil maple syrup in a 2-quart saucepan to 260°. Then pour the syrup over a batch of popped corn. Butter hands and shape into balls. This will make 12 to 15 popcorn balls.

7.13 Maple Ice Cream

Soft serve maple ice cream.

Soft serve maple ice cream has become a favorite of many customers at the New York State Maple Producers Association Fair Booth at the New York State Fair. At the Association booth a high quality vanilla mix is purchased from a dairy products supply company and 3 cups of a highly flavored extra dark maple syrup is added to each gallon of the mix as it is placed into the soft ice cream machine.

Frozen Desserts

A supersaturated or supercooled solution forms nuclei. This process involves the uniting of atoms. Solution or liquids at the freezing point form nuclei spontaneously or by a process called seeding. Allowing a solution to stand causes the formation of nuclei in various places spontaneously. These crystals grow from these nuclei and because the number of nuclei formed are small, they grow to large sizes. Seeding is done by adding crystals of the same material to a solution to start the crystallization process. These added crystals serve as nuclei. Agitation of the solution increases the number and the rate of nuclei formation. In water crystallization the nuclei and crystallizing substance is the solvent of the system. The larger portion of reported data have dealt with the crystallization of solute from dispersions.

The rate of crystallization is the rate the crystallizing substance becomes a solid crystal. It is determined by the time required for a drop from one temperature to another. Other components contribute to decreasing or increasing crystallizing rate. Rapid crystallization and agitation during the freezing are a must for the formation of small crystals.

Solutes decrease the freezing point or the point of crystallization of water. Thus, the greater the solute concentration, the slower the rate of crystallization. Rate of crystallization is also decreased during the solidification of water by colloids and suspensions in a mixture. Fats, milk or egg proteins or stabilizers and emulsifiers would be in this category. These stabilizers and emulsifiers help keep the ice crystals small by absorbing some of the free water to form a gel. The gel prevents the growth of large ice crystals due to its stiffness and internal structure. Their physical presence interferes with crystal growth.

In frozen dessert mixes, air is incorporated during agitation in the freezing process. The incorporation of the air causes an increase in volume of the mix. This increase in volume is called "overrun". The whipping ability of the mix is increased by the presence of nonfat dry milk solids, egg yolks and emulsifying agents. Whipped evaporated milk, beaten egg whites and whipped cream help incorporate the air in still frozen desserts. Fat decreases the percent overrun in ice creams especially when present as large fat globules or clumps. Homogenization of the fat reduces the particle size and therefore may change overrun.

The quality of frozen desserts is evaluated by the texture (mouth feel), consistency (hardness or softness) and body. A smooth, creamy texture, a consistency that is neither too hard or too soft and a body that is not too watery and compact nor too viscous and spongy when the frozen dessert starts to melt are the qualities that determine a desirable frozen dessert.

ICE CREAM PRODUCTS



- Ice creams have ice crystals, not sugar crystals, and the size and quantity of those ice crystals must be minimized for an optimum product.
- Special refrigeration systems are used to freeze ice cream commercially.
- At home, however, the freezing is done in an ice cream freezer using an ice and salt mixture.
- Since ice cream has a lower freezing temperature than water, ice alone will not freeze the mixture, so salt is added.
- The temperature of the ice is lowered when a **brine**, or salt-water mixture, is formed.
- The ice added to the freezer begins to melt and then the salt will dissolve in the water, forming the brine.
- As more salt dissolves and more ice melts, the brine becomes more concentrated and the temperature will continue to drop.
- One part of salt should be added to 12 parts of ice or 1/3-cup salt to 4 cups ice.



- Ice cream can be made from a milk product like cream or whole milk and sugar.
 - Extra ingredients, like chocolate and eggs, are added not only to add flavor interest to ice cream, but to affect the consistency and to minimize ice crystal formation.
 - Of course, ingredients like chocolate and peppermint extract affect the flavor.
- Ice cream flavor should be delicate and well blended.
 - As the ice cream warms at room temperature, the flavor will increase in intensity since very **cold temperatures numb** the taste buds and therefore decrease flavor perception.

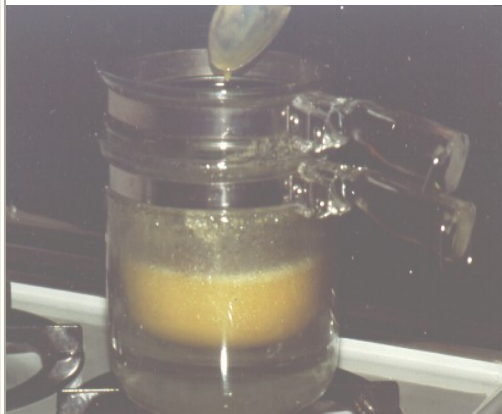
- Ice cream should have good "body" which is a smooth and rich consistency, which does not melt readily.
 - Often nonfat dry milk solids are added to improve the body of ice cream.
 - However, if the dry milk solids exceed 12% of the mix, the ice cream will have a grainy or sandy texture from lactose crystals.
 - This sandiness can be noticed in some soft serve ice creams.
- Fat will influence the consistency of ice cream also, higher fat making the ice cream seem smoother with better body since the fat coats the tongue so it cannot feel the crystals.
 - If two ice cream products, one high in fat and one low in fat with the same size ice crystals, are tasted side by side, the one higher in fat will appear smoother and finer.
 - Sugar helps to keep the ice crystals small by increasing the amount of liquid, which remains unfrozen, and decreases the freezing temperature.
 - Evaporated milk will also help to increase the smoothness due to the high concentration of homogenized milk, but also affects the flavor, adversely to some people's taste.
- Ice cream, especially homemade ice cream, will develop large ice crystals with freezer storage even with short storage periods.
- Stabilizers, such as gelatin, help to keep the ice crystals small over a period of time.



Our example of ice cream for this module is a frozen Custard or New York ice cream. The preparation steps include:

1. Accurately measure all ingredients for an optimum product.





2. Prepare the soft or stirred custard by cooking the milk, sugar, and egg in a double boiler over simmering water until the custard coats a metal spoon.

- The custard will have the consistency of thick cream and will not be solid.
- Take care not to curdle the custard, since curdled custard produces curdled ice cream!
- The egg cooked in the milk will help to stabilize the frozen mixture and to emulsify the milk fat, plus add color and flavor.

3. Chill the soft custard in the refrigerator until cold.

- If hot custard is used in the ice cream mix, it will take too long to freeze.

When cool, add vanilla for flavoring and the cream.



4. Place the ice cream mix in the inner metal, ice cream maker container.

- The mix is placed in a metal container, since metal transfers the cold quicker and better than other materials, such as plastic.

Adjust the top to fit and add ice and salt.

Begin to crank the ice cream maker, either by hand or electrically, depending on the type used.

7.14 Maple Granola

Maple Granola snack

Servings: 32

- 1 large box (42 oz) old fashioned oatmeal
- ½ cup wheat germ
- ½ cup oat bran
- ½ cup wheat bran
- 1 Tbsp cinnamon
- 1 cup each: walnuts, pecans, almonds, coconut
- 1 cup each: chopped dates, cranberries, raisins
- 1 cup canola oil
- 1 cup honey
- 1 cup maple syrup
- 1 cup molasses
- 3 Tbsp vanilla

Directions:

Preheat oven to 350°. In large roasting pan combine oatmeal, wheat germ, oat bran, wheat bran, cinnamon and salt. Mix in chopped nuts. Stir in oil, honey, maple syrup, molasses, and vanilla until everything is well coated. Bake for 30 min, stirring every ten minutes so everything cooks evenly. Add dried fruits of your choice after removing from the oven. You can add more or less oil and sweeteners, depending on your tastes. This granola can be frozen in freezer bags.

7.15 Maple Brittle and Taffy

7.16 Maple Sugar on Snow

7.17 Substituting inverted maple syrup for corn syrup in maple value added products.

Stephen Childs, New York State Maple Specialist

When maple syrup is treated with invertase and allowed to stand until completely inverted the sucrose in the maple syrup becomes the invert sugars glucose and fructose. Inverted maple syrup can be substituted for corn syrup in the production of many maple value added products. Making this substitution allows the products to be marketed as being made of 100% maple or all maple sugar. This can be true with maple suckers, hard maple candy, maple marshmallow, maple taffy, frostings, maple coatings and other bakery and candy products where you don't want the sugar to crystallize. When substituting inverted maple syrup in a recipe that calls for corn syrup there are several things to take into account.

First is the moisture content of inverted syrup vs. corn syrup. The percentage of water in inverted maple syrup is typically in the 32% to 34% range while corn syrup is generally between 28% and 30% water. In recipes where the mixture of ingredients is to be boiled to a specific temperature this difference in moisture content is not important as the boiling evens these differences up. However in a recipe where the mixture of ingredients is heated but not boiled to a finishing temperature adjusting for the moisture content could become important. For each cup of inverted maple syrup that replaces a cup of corn syrup you could reduce adding water from other sources by two teaspoons in the recipe.

The second consideration is difference in the amount of invert sugar between the inverted maple syrup and the corn syrup. It is the level of invert sugar in the ingredient mixture that allows the final product to have the correct level of sugar crystallization or a complete blocking of crystallization. In most cases the goal of adding the invert sugar is to have enough to completely block the formation of crystals and allow the product to be soft and moist rather than rock hard or crystalline. Fully inverted maple syrup would have an invert sugar level of between 66% and 69% while corn syrup would usually be in the 15% to 40% range but can be as high as 70% invert sugar. The source and the processes used to make the corn syrup allows for this large variation. In my limited experience a one for one substitution of inverted maple syrup for corn syrup has worked well but there may be recipes or products where less inverted maple syrup could be used to accomplish the goals. Some experimentation may be in order here.

Replacing corn syrup with inverted maple syrup will increase the ingredient costs as maple syrup is more expensive than corn syrup. The fact that the final products do not contain corn syrup or are 100% from maple syrup should be advertised and made known to the consumer and higher prices may also be in order.

The procedure for inverting maple syrup is fairly simple. Inverted maple syrup is made by adding 0.1% to 0.25% by volume of the enzyme invertase to pure maple syrup. For a gallon (4.4 liters) of syrup to be converted to invert syrup add 1.5 teaspoons (8 ml) of invertase or follow your manufacturer's directions. Invertase performs optimally at a temperature 120°F, and is rapidly deactivated at temperatures greater than 170°F. The syrup plus invertase is heated to 120°F for 24 to 48 hours and then stored under refrigeration, or held at lower temperatures for a longer

period of time. Over-heating the treated syrup will stop the conversion process. The use of an oven or crock-pot is ideal for this purpose. Invertase is available from confectionary and baking supply sources 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. For further information on measuring and adjusting invert sugar in maple syrup see Cornell Fact Sheet CMB 206 Measuring and Adjusting Invert Sugar in Maple Syrup. When selecting syrup for inverting to be used to substitute for corn syrup 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 less can be used to make a variety of crystalline maple value added products and should be saved for those purposes. A syrup with a reading over 100 can be used to make these other value added products and significantly increase the value. However if the high invert syrups have too strong a flavor for the end product to be good you may need to use a lighter syrup.

Glucose Meter Reading	1 in 10 dilution of syrup
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

Gray area is the suggested invert sugar levels in maple syrup to be inverted for use in value added products in place of corn syrup

As in making all maple value added products the flavor of the syrup is most important. Only

maple syrup with excellent flavor should be used, even when the syrup will be inverted. Making products that use inverted maple syrup does allow good flavored maple syrup that has a naturally high invert sugar level that could not be used directly in making value added crystalline products like molded maple sugar, granulated sugar or traditional maple cream to still be made into very high value products. Be sure to select your good flavored syrups with higher invert sugar levels for making these value added products.



Extension FactSheet

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

7.18 Maple Candy and Other Confections

Randall B. Heiligmann
Extension Specialist, Forestry

Maple season is late winter and early spring. At this time, commercial and hobby maple producers in Ohio and other parts of northeastern North America tap trees, collect sap, and process it to produce maple syrup. Real maple syrup is a pure, natural product with a unique flavor. It is delicious just as it is, served as a topping over pancakes, waffles, ice cream, crushed ice (maple snowcone), or other foods. Or, it can be used as a sugar substitute in cooking a variety of dishes.

Maple syrup can also be processed into a wide variety of confections including granulated or molded maple sugar, molded soft-sugar candy, maple cream, maple fondant, and "Jack Wax" or "Maple on Snow." These confections are easy to make, delicious to eat, and make excellent gifts.

The process of making maple confections is simple—heat maple syrup to the desired temperature and then cool it with or without stirring. The temperature to which it is heated, how rapidly it is cooled, and whether it is stirred as it cools, determines the confection made. In the directions that appear in this fact sheet, a temperature range rather than a specific temperature is recommended for making most confections. Many factors affect confection making, including barometric pressure, humidity, and the character of the syrup used. Often, the recommended finishing temperature must be adjusted upward or downward to produce the desired characteristics.

Making small quantities of maple confections requires little special equipment. A kitchen stove will provide a steady, easily controlled heat source. A variety of spoons, ladles, and pans are necessary, as is a candy or other thermometer with a temperature range of 200 to 300°F. For some confections, a trough or container will be needed; this container must be large enough for stirring or to function as a water/ice bath for rapidly cooling the heated pan of syrup. Rubber candy molds also will be required if candy or molded sugar is made. Common recommendations for new rubber candy

molds are to boil them for 10 to 15 minutes in a mild solution of Sal Soda, Caustic Soda, Arm & Hammer Washing Soda, or Arm & Hammer Baking Soda (1/4 pound to a gallon of water), scrub them well with a semi-stiff brush, and rinse them well with clear, cold water. If the molded confections are sticking, a thin coat of glycerine may be applied with a brush and the excess blotted with a soft cloth. After the molds have been used a couple of times, the glycerine should not be needed. Occasionally the first candy made in new rubber molds has a bitter taste and should be discarded. After use, rubber molds should be placed in warm water until the sugar dissolves, rinsed in clean water, and then placed upside down in a rack to dry.



When heating the maple syrup, experiment to achieve the right combination of pan depth, depth of syrup, and heat to avoid burning the syrup or foaming over. Begin with moderate heat and no more than 1-1/2 inches of syrup in an eight-inch deep pan. If foaming becomes excessive, it can be reduced using a drop of commercial defoamer or vegetable-based oil.

An important step in making any maple confection is determining the boiling temperature of water. The temperature necessary to produce a particular confection is stated in degrees Fahrenheit above the boiling temperature of pure water.

Pure water boils at 212°F only at standard atmospheric pressure. It varies with altitude and weather conditions (low and high pressure). The temperature of boiling water is easily determined by determining its temperature with the candy thermometer.

Maple Sugar (Granulated or Molded)

Much of the maple syrup made in colonial times was processed into maple sugar. In this form, it was easier to store and transport and could easily be reconstituted to syrup by adding water. Today, maple sugar can be used as a partial or complete substitute for cane

sugar, depending on the degree of maple flavor wanted. Try it as a sweetener on cereal or in tea, as a substitute in baking, or when making glazes or sauces for meats.

Make granulated maple sugar by heating maple syrup to a temperature 40 to 45°F above the boiling temperature of pure water, immediately transferring the syrup to a trough or flat pan, stirring until granulation is achieved and all apparent moisture is gone. At this point, the product may be sieved through a coarse screen (e.g., 1/8-inch hardware screen) to produce a uniform product. Making granulated maple sugar can be difficult when the humidity is high.

Make molded hard maple sugar by heating maple syrup to a temperature 40 to 45°F above the boiling temperature of pure water, immediately transferring the syrup to a trough or flat pan, stirring it until crystals form, and then packing it into molds (with a spoon, spatula, or putty knife) to harden. Note that this is not maple candy, but a molded form of sugar that is quite hard.

"Crunchy" Hard Maple Sugar Candy

A relatively hard, crunchy, molded maple sugar candy is made by heating maple syrup to a temperature 28 to 30°F above the boiling temperature of pure water, allowing it to cool to about 150°F, stirring it to develop a plastic consistency containing relatively large crystals, and pouring or packing it into molds.

Molded Soft Sugar Candy

This is the relatively soft maple sugar candy often seen molded in a variety of shapes such as maple leaves. Make soft sugar candy by heating maple syrup to a temperature of approximately 32 to 34°F above the boiling temperature of pure water, pouring the syrup into a flat pan or trough, and allowing it to cool undisturbed to at least 200°F but not less than 160°F, stirring until the syrup is soft and plastic, and then pouring or packing it into molds. Molded candies commonly set up in 10 to 30 minutes. Candies formed by pouring rather than packing will have an attractive glazed surface.

Maple Spread (Cream or Butter)

Maple spread is a smooth, semisolid, creamy-maple spread that is a delicious topping for toast, muffins, plain donuts, or similar products. In many areas, maple spread is referred to as maple cream. Most Ohio producers reserve the term maple cream for the nougat product described in the following section. Maple spread is made by heating the syrup to the prescribed temperature, cooling it rapidly, and then stirring to produce a product with very small, almost undetectable crystals.

Not all syrup is suitable for making maple spread. Almost all the sugar in maple sap is sucrose, but during processing to maple syrup some sucrose is converted to invert sugar. Syrup containing more than four percent invert sugar is unsuited for making maple spread. There are tests to determine the amount of invert sugar in maple syrup, but they are complicated. As a rule, light colored syrup (U.S. Grade A Light Amber) contains small amounts of invert sugar and can be successfully creamed or made into smooth nougat. Darker syrup is more likely to contain higher quantities of invert

sugar, though some contain amounts low enough to be successfully creamed. Without testing for invert sugars, it is best to stick to the light syrups for creaming and nougat making.

Make maple spread by heating maple syrup to a temperature 22 to 24°F above the boiling temperature of pure water, cooling the syrup rapidly in a water or ice bath to room temperature (at least 90 and preferably 70°F or cooler), and then stirring the chilled syrup at room temperature until crystallization is complete. When stirred, the cooled syrup first becomes more fluid (less stiff), and then stiffens and shows a tendency to "set-up." At this point, it loses its shiny appearance and develops a dull or flat look. The crystallization process is then complete, and the spread can be transferred to an appropriate container. Maple spread is best stored at low temperatures, ideally in a refrigerator or freezer.

Maple Fondant or Nougat (Ohio Maple Cream)

Maple fondant or nougat, sometimes called Ohio maple cream, is a "fudge-like" maple product that is often described as the candy form of maple spread. Good maple fondant requires the same low invert sugar content as maple spread. It is made in the same manner as maple cream except that the syrup is heated to a higher temperature.

Make maple fondant by heating maple syrup to a temperature 27°F above the boiling point of pure water, cooling the syrup rapidly in a water or ice bath to room temperature (at least 90 and preferably 70°F or cooler), and then stirring the chilled syrup at room temperature until it sets to a soft solid. Maple fondant can be packed into molds, formed into a small "cake," or dropped in small pieces onto a marble surface, waxed paper, or a metal sheet.

"Jack Wax" or "Maple on Snow"

"Jack Wax" or "Maple on Snow" is a maple product produced by pouring hot maple syrup over snow or crushed or cracked ice. It is most commonly eaten quickly, rather than stored for future use.

Make "Jack Wax" or "Maple on Snow" by heating maple syrup to a temperature 18 to 40°F above the boiling temperature of pure water and immediately pouring the heated syrup over snow or cracked or crushed ice. The nature of the product produced depends on the temperature attained. At the lower end of the temperature range, the "Jack Wax" will be taffy-like, and chewy; at the upper end of the temperature range it will be much harder, and more glass-like.

More Information

Those interested in a more comprehensive discussion of maple confections may wish to obtain a copy of the *North American Maple Syrup Producers Manual*, a 178-page manual dealing with all aspects of maple product production from sugarbush management to marketing. This manual may be purchased through your local county Ohio State University Extension office. Ask for Ohio State University Extension Bulletin 856. Those interested in trying their hand at making maple syrup will also find the *North American Maple Syrup Producers Manual* useful, along with *Hobby Maple Syrup Production*, Extension Fact Sheet F-36.

Visit Ohio State University Extension's WWW site "Ohioline" at:
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Section 8

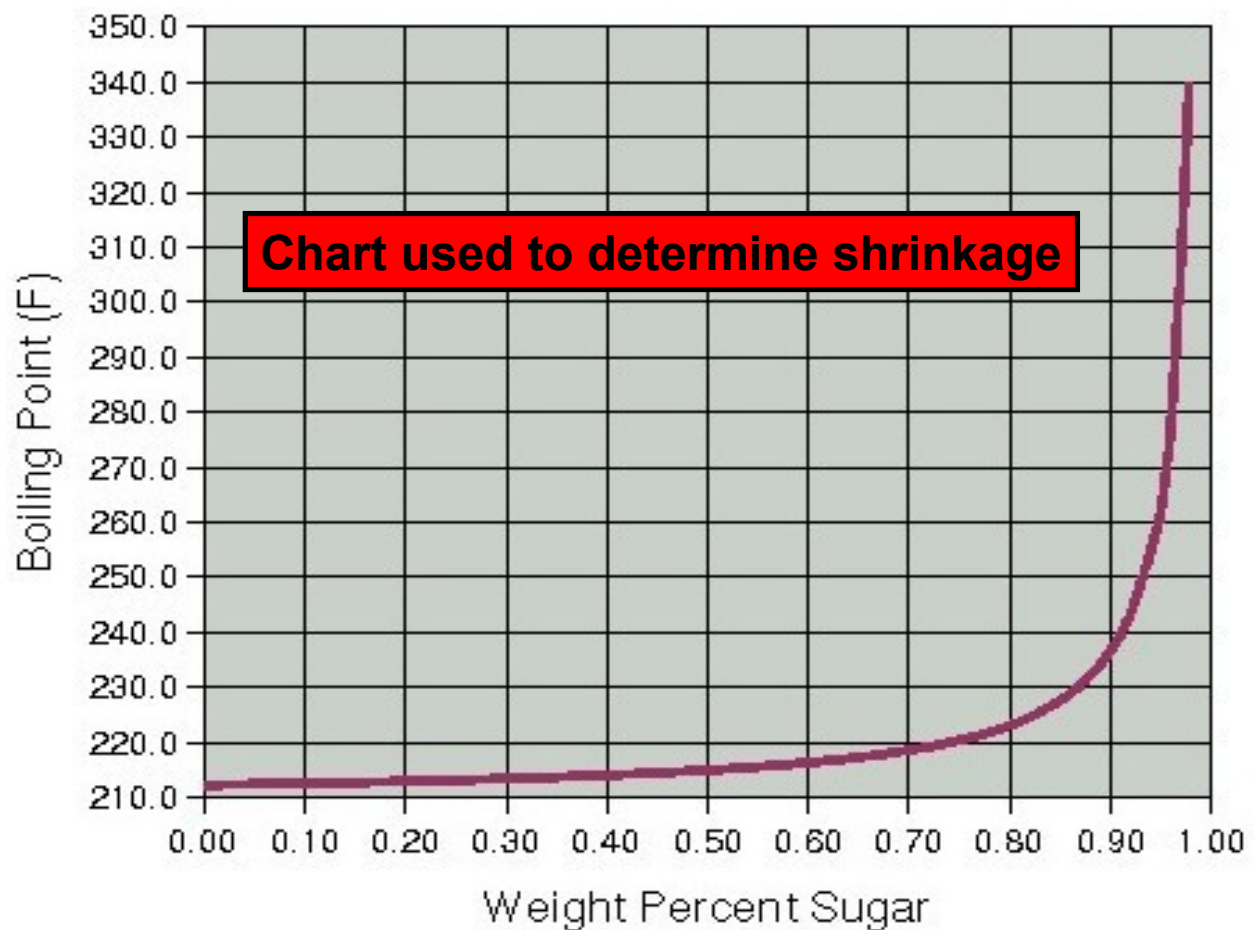
Pricing Maple Value Added Products

8.1 Pricing Value Added Products

8.2 Maple Enterprise Business Summary Chart of Accounts

8.1 Pricing Value Added Products

- Syrup and Shrinkage
- Labor
- Packaging
- Energy
- Capital Investment
- Margin



Shrinkage - Cream

- For maple cream one pound of syrup at 66° Brix becomes .78 of a pound at 88° Brix
- One pound of syrup selling for \$40 per gallon is \$3.64
- It takes 1.28# of syrup to make one pound of cream or \$4.67 worth of syrup.

Shrinkage – Molded Candy

- For maple candy one pound of syrup at 66° Brix becomes .73 of a pound at 93° Brix
- One pound of syrup selling for \$40 per gallon is \$3.64
- It takes 1.37# of syrup to make one pound of candy or \$4.99 worth of syrup.

Shrinkage – Maple Sugar

- For maple sugar one pound of syrup at 66° Brix becomes .7 of a pound at 96° Brix
- One pound of syrup selling for \$40 per gallon is \$3.64
- It takes 1.43# of syrup to make one pound of candy or \$5.20 worth of syrup.

Labor - Cream

Depends on volume being made.

Estimate an hour per gallon of syrup converted at \$10 per hour.

Maple Cream 11#(one gallon) of syrup makes $11 \times .78 = 8.58\#$ cream or 8 marketable 1# units.

Labor costs is \$1.25 per pound of cream

Labor - Candy

Depends on volume being made.

Estimate an hour per gallon of syrup
converted at \$10 per hour.

Maple Candy 11#(one gallon) of syrup
makes $11 \times .73 = 8.03\#$ candy or 8 pounds of
marketable candy.

Labor costs is \$1.25 per pound of candy

Labor - Sugar

Depends on volume being made.

Estimate an hour per gallon of syrup
converted at \$10 per hour.

Maple Sugar 11#(one gallon) of syrup
makes $11 \times .7 = 7.7\#$ Sugar or 7.5 pounds of
marketable sugar.

Labor costs is \$1.33 per pound of sugar

Packaging Energy Capital Investment

- Again depends on volume
- \$1.50 per # container average for cream jars, candy boxes or sugar containers
- 20 cents for energy to convert one gallon of syrup to confections
- 10 cents to over a dollar per pound of confection

Pricing Value Added Products – Cream Per Pound

- | | |
|-----------------------|-----------|
| • Syrup and Shrinkage | • \$4.67 |
| • Labor | • \$1.25 |
| • Packaging | • \$1.50 |
| • Energy | • \$0.05 |
| • Capital Investment | • \$0.50 |
| • Sub Total | • \$7.97 |
| • Margin 33% | • \$2.63 |
| • Total Price | • \$10.60 |

Pricing Value Added Products – Cream Per Pound

• Syrup and Shrinkage	• \$4.67
• Labor	• \$1.25
• Packaging	• \$1.50
• Energy	• \$0.05
• Capital Investment	• \$0.50
• Sub Total	• \$7.97
• Margin 50%	• \$3.99
• Total Price	• \$11.96

Pricing Value Added Products – Cream Per Pound

• Syrup and Shrinkage	• \$4.67
• Labor	• \$1.25
• Packaging	• \$1.50
• Energy	• \$0.05
• Capital Investment	• \$0.50
• Sub Total	• \$7.97
• Margin 100%	• \$7.97
• Total Price	• \$15.94

What is not accounted for?

- Marketing Costs
 - Marketing Labor
 - Delivery
 - Product Loss
 - Samples

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

Thank you for your help and cooperation. If you have any questions, please do not hesitate to contact me by e-mail (slc18@cornell.edu) or phone 607-255-1658. E-mail or send finished worksheets to me. All information is strictly confidential.

You may use either this long hand input sheet or the Excel spreadsheet that was emailed to you.

Stephen Childs
Cornell Cooperative Extension
110 Fernow Hall
Ithaca, NY 14853

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:

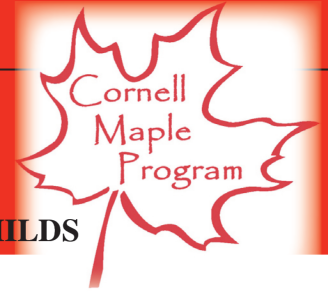
1. Did you participate in a NYS Maple Confections Workshop? _____
2. Following the workshop did your production of confections increase?
3. If yes to #2, by how much? _____
4. Do you expect to make and market more maple confections next year?
If yes estimate how much. _____

Section 9

Equipment Information

- 9.1 Exercise Caution When Making Maple Confections
- 9.2 Choosing and Using Thermometers
- 9.3 Glucose Meter Readings Conversion Chart

Exercise Caution When Making Maple Confections



9.1

by STEVE CHILDS

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 insure 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 injury.

Likely Causes of Burns

- Burns in the food service industry usually occur when:
 - Safety rules 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 compromised by alcohol or drugs and are unable to concentrate.
- Burn injuries to maple producers can result from contact with:
 - Hot syrup or liquids.
 - Steam from cooking or when a steam burst comes off when crystallization occurs while stirring.
 - Hot finished product such as syrup, molded or granulated sugar.
 - Hot surfaces - stoves, grills, ovens, pans, open flame or a hot thermometer or spoon.

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 stout, non-skid, fully enclosed shoes or boots. Open shoes, sandals and similar footwear should not be allowed.
 - Long pants to fully cover the legs should be required. Shorts and skirts should not be allowed.

Setting Up a Safe Environment

In addition to protecting yourself and your employees, it is important to create an environment that is safe as well. There are a few things you can do to ensure that the environment and atmosphere in your work area is of the utmost safety level.

- Suggestions for a Safe Environment:
 - Avoid reaching over or across 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 walk-by areas and keep handles away from heat or flames of burners.
 - Open lids away from you to let steam escape safely.
 - Have a water bath handy to immediately cool any hot products spilled on skin.
 - Have a phone immediately available in the event a call for help is necessary.
 - Be familiar with common 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.

Precautions in Using Electrical Equipment

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.

- When using a mixer, blender or other power equipment in making maple confections please remember to follow these rules:
 - Never put hand or any other inappropriate object other than food into the blender/mixer or power equipment.
 - Unplug and turn off when not in use.
 - No loose or floppy clothing or jewelry should be worn that has the potential to catch in any piece of equipment. Special care needs to be taken with apron strings.
 - Make sure hair is tied back and out of the way.

Burns and Scalds

Whether the burn or scald is large or small, your *first priority* is to *cool the burned area quickly* by any convenient method. Immersion in cool water is ideal. The faster you remove the hot sugar and pull heat out of the affected area the better. This will limit injury and reduce pain.

- Additional treatment for the three specific types of burns is as follows:
 - First-degree burn: In minor burns and scalds the skin goes red. Then apply a moist dressing, and bandage loosely.
 - Second-degree burn: If blisters form, the burn is more serious. Do not break the blisters - this will compound the injury by causing an open wound. Do not apply creams, ointments, or sprays. Seek medical attention.
 - Third-degree burns: In the most severe burns, the skin may be burnt away. Some flesh will be charred. If many nerve endings are damaged, there may be little pain. Do not apply creams, ointments, or sprays. Call 911 for emergency service, call for a family member or friend who may be nearby for assistance. Wrap a clean sheet around the victim and, if the weather is cool, cover them with blankets to reduce the possibility of shock. The victim should be rushed to hospital because their life is at stake.

9.2 Choosing and Using Thermometers

Brian Chabot

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

Types of Thermometers

Mercury-in-glass and liquid-in-glass thermometers have been around forever and most people trust them. However, there are a number of disadvantages. They can break and mercury is toxic. They respond slowly to temperature changes. Your eye needs to be level with the top of the mercury column for accuracy and often close to the thermometer.

Bi-metallic 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.

For both of these thermometers, it is often difficult to see temperature differences of a degree or less because the scale markings are very close together. Long-stem mercury thermometers and large dials can help, but these are large instruments that can be difficult to use in some situations because of their physical size.

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 the older thermometers.

The sensing unit in digital thermometers is either a thermocouple or a thermistor. A thermocouple are two different metals that when in contact generates an electric current that changes with temperature. A thermistor has a resistance to electricity that changes with temperature. 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 can interfere with the measurement and with syrup or confections you really need the internal temperature of the syrup. But they can have value in measuring temperature of a product without opening it or in monitoring temperatures around an evaporator or tree trunk.

Candy thermometers can be any of the above types, except infrared. They are designed to be left in boiling syrup and the best ones have a clip to attach them to the side of a pot or pig. Some digital thermometers have an alarm 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 their resolution, which is the number of digits that show on the dial. You need at least three digits. Four digits may show tenths of a degree. A second factor is the designed accuracy of the unit, which is described as +/- a certain number of degrees. This reflects the quality of the electronics. An accuracy of +/- 2 degrees says that the thermometer has by design a reliable reading of only two degrees around what might be the true temperature. So even if it reads out in degrees or tenths of a degree, readings of less than two degrees cannot be relied upon. Ideally, you want a thermometer where the design accuracy is less than the scale divisions. So 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 5-10 seconds, as opposed to minutes for a large mercury-in-glass thermometer. 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. The secret of fast reading is a small measuring tip.

Immersion Depth

All thermometers are calibrated so that a certain length of the measuring stem is immersed in the liquid being measured. Some thermometers have this depth etched on the stem, for others you will have to work this out by trial and error. Not having the correct immersion depth will produce incorrect readings. There may be situations where the liquid is too shallow to properly immerse the measuring end and still have the thermometer not touching the bottom of the pan. Usually the reading will be lower than the actual temperature and you will need to take this into consideration.

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 pretty accurate to start with and calibration serves as a quality check.

There are a couple of ways to check your thermometer accuracy. One is to compare it with a calibrated thermometer. This is best done at a couple of temperatures to make sure that the accuracy is the same over the range of the thermometer. Calibrated thermometers usually have been checked at 3-5 temperatures. A second 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 from distilled water, but tap water and ice can get you close.

9.3 Glucose Meter Readings Conversion Chart

(Europe)	(US)		1 in 10 dilution	1 in 10 dilution
mmol/L	mg/dL	mg/l	%glucose	invert %
1.1	20	200	0.2	0.4
1.7	30	300	0.3	0.6
2.2	40	400	0.4	0.8
2.8	50	500	0.5	1
3.1	55	550	0.55	1.1
3.3	60	600	0.6	1.2
3.6	65	650	0.65	1.3
3.9	70	700	0.7	1.4
4.2	75	750	0.75	1.5
4.4	80	800	0.8	1.6
4.7	85	850	0.85	1.7
5	90	900	0.9	1.8
5.3	95	950	0.95	1.9
5.6	100	1000	1	2
5.8	105	1050	1.05	2.1
6.1	110	1100	1.1	2.2
6.4	115	1150	1.15	2.3
6.7	120	1200	1.2	2.4
6.9	125	1250	1.25	2.5
7.2	130	1300	1.3	2.6
7.5	135	1350	1.35	2.7
7.8	140	1400	1.4	2.8
8.1	145	1450	1.45	2.9
8.3	150	1500	1.5	3
8.6	155	1550	1.55	3.1
8.9	160	1600	1.6	3.2
9.2	165	1650	1.65	3.3
9.4	170	1700	1.7	3.4
9.7	175	1750	1.75	3.5
10	180	1800	1.8	3.6
10.3	185	1850	1.85	3.7
10.6	190	1900	1.9	3.8
10.8	195	1950	1.95	3.9
11.1	200	2000	2	4
11.4	205	2050	2.05	4.1
11.7	210	2100	2.1	4.2
11.9	215	2150	2.15	4.3
12.2	220	2200	2.2	4.4

(Europe)	(US)		1 in10 dilution	1 in10 dilution
mmol/L	mg/dL	mg/l	%glucose	invert %
12.5	225	2250	2.25	4.5
12.8	230	2300	2.3	4.6
13.1	235	2350	2.35	4.7
13.3	240	2400	2.4	4.8
13.6	245	2450	2.45	4.9
13.9	250	2500	2.5	5
14.2	255	2550	2.55	5.1
14.4	260	2600	2.6	5.2
14.7	265	2650	2.65	5.3
15	270	2700	2.7	5.4
15.3	275	2750	2.75	5.5
15.6	280	2800	2.8	5.6
15.8	285	2850	2.85	5.7
16.1	290	2900	2.9	5.8
16.4	295	2950	2.95	5.9
16.7	300	3000	3	6
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
20	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	8
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	10
28.9	520	5200	5.2	10.4
30	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	12

Section 10

Marketing Maple Products

10.1 Developing Your Brand

10.2 Creating Your Logo

10.3 Brand Awareness

10.4 Making Your Brand Known

10.5 Health Advantages of Grade B Syrup

10.6 Is Maple Sugar Better for People with Diabetes?



10.1

by TARA GUSTAFSON & 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.

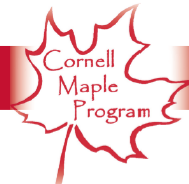
Why Develop a Brand?

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 considerable equity in the public mind: Adirondacks, Catskills, Hudson



Describing Brand Values

Valley, Finger Lakes, etc. When you adopt a well-known place name, some of the work of developing brand equity has already been accomplished.

An accompanying worksheet will have you think through some of the key issues in brand development.

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.

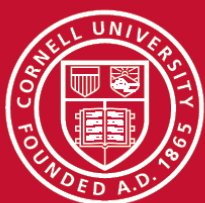
Wegman's is a successful New York-based food retailer. Wegman's is the family name of the founder and current owners. Wegman's has become known for high quality and diverse products and a particular shopping experience from the displays, organization, and services in their stores. This is the customer 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.





10.2

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?

» Logo Examples



Mercedes-Benz

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*.



Goal

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

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 Logo

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.)



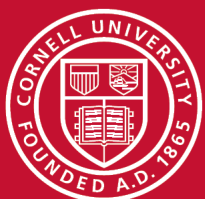
»» Logo Examples

»» 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. (show as a graphic) 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 shows 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.





10.3

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 of 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 known 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 success brand that achieves maximum benefits.

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

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

**Maintaining
Brand
Awareness**

**Purchasing
Decision
Process**



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.

1
Perceived Need

2
Seeking Information

3
**Evaluation of
Alternatives**

4
Value Assessment

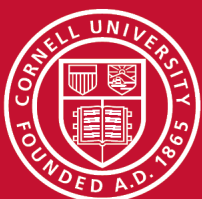
5
**Assessment of
Purchase Decision**



Advertising

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. 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.





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 and they can be used in your public relations 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 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 of the methods best meets your needs and does 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 business 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 ways 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, however, variations in price depends both on the time of the advertisement and the number of expected people watching. Also like the 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 NYSPMA 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 Canandaigua 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.

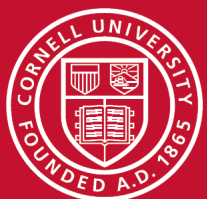
Critz Farms near Cazenovia advertises itself as “the place to come for family fun.” It is a diverse enterprise with a café, playground, and selling maple products, dug and cut trees, and other farm products throughout the year. Educational and family recreation activities are advertised through a well-designed web site, 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 ways to advertise to bring in customers vs. 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 “Its Not Just Breakfast, Its 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 ways for continuous advertising. They use a company to help distribute the brochure around the region and they do some themselves. Newspaper and radio advertising is only used around special events where the costs where the customer flow



Making Your Brand Known

will pay for the 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.



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Health Advantages of Grade B Syrup 10.5

by BRIAN CHABOT



“Master Cleanser” Promotion

The popular press, some entertainment personalities, and some retailers advocate the health advantages of Grade B Pure Maple syrup, usually organic (see Newsweek, May 28, page 43). Grade B syrup also is promoted as one of the components of the “Master Cleanser,”¹ also known as the Lemonade or Maple Syrup diet, which is promoted as a way to “detoxify” your body and to lose weight.

Health Benefits?

We are aware of no research done with suitable controls and sample size that supports unique health advantages of Grade B pure maple syrup. Stanley Burroughs, originator of the Master Cleanser, advocated end-of-season Grade B maple syrup because of its more intense flavor and higher mineral content. No data supported the assertion of higher mineral content. Analyses of the chemical composition of different maple syrups done by the Procter Center suggests that Grade B syrup will have similar health benefits as other syrup grades (see the North American Maple Syrup Producers Manual). Although it is possible that future research could support the marketing claims I have seen, the evidence that is being used to support these marketing claims is not scientifically valid.

There are possible health reasons to choose any pure maple syrup and sugar in comparison with more refined sugars. Pure Maple syrup is higher in mineral content, especially calcium, and contains low concentrations of a variety of anti-oxidants. Calcium and anti-oxidants have proven health advantages for most people based upon research with other food products. The mixture of sugars present in maple syrup is less likely to fuel metabolic pathways leading to fat than high fructose sugar is hypothesized to do. There is research underway in Quebec by Centre Acer examining the health advantages of pure maple syrup, but no results are yet available to support specific health claims.

Maple syrups from different producers, different times of year, and different years vary in chemical composition. No research has demonstrated any differential health benefits related to this variation. Syrups and sugar with higher antioxidant and mineral content may have advantages over those with lower concentrations. Unfortunately, the quantity of Pure Maple products consumed by most people is too small a part of the typical diet, even when used frequently, to argue for an important health advantage from consuming Pure Maple Syrup.

“Master Cleanser” Process

The “Master Cleanser” regimen includes ingredients beyond Grade B Pure Maple syrup. Lemon juice, sea salt, cayenne pepper, laxative tea and mint tea are other parts of the regimen.

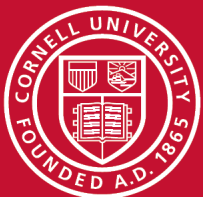
¹Stanley Burroughs. 1976. The Master Cleanser. Self published



Health Advantages of Grade B Syrup

Essentially this is a laxative process in which the role of maple syrup is as a sweetener and energy source to maintain metabolism during the process. Organic Grade B Pure Maple is usually recommended. However, the primary physiological functions in this regimen will be met by any grade of Pure Maple syrup.

I prefer Pure Maple products rather than more refined sugars. There may be health advantages, but the real benefits are flavor, supporting local businesses, and encouraging sustainable forestry.



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Is Maple Sugar Better for People with Diabetes? 10.6

by BRIAN CHABOT



Pure Maple for Diabetics?

Maple producers have asked me whether Pure Maple products are better for diabetics. Though I have seen nothing in writing, the rumor floats around the maple community that Pure Maple can be used with fewer restrictions compared to other sugars. As a consequence of increasing obesity, more people are developing diabetes, though being overweight is not the only cause. What used to be called adult-onset diabetes is now called Type 2 diabetes because it is appearing with alarming frequency in overweight children.

The Claim...

It is occasionally claimed that diabetics can use Pure Maple syrup and sugar without adverse effects. Most diabetics can consume some sugar in conservative amounts. Even those without diabetes should not be consuming large amounts of sugars. No research supports the claim that maple sugars behave differently in the body than other sugars. Moreover, experts on diabetes do not see reasons to think that Pure Maple behaves differently in the body than other sugars.

Pure Maple Not Safer

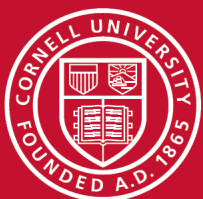
Maple producers or marketers should not be advising individuals with diabetes that maple products are in some way safer or can be used with less caution than other sugar sources. Though there apparently are some testimonials to this effect, it has not been researched or proven to be safer. Such misdirected advice could result in injury to the customer.

The Glycemic Index and Information

The glycemic index is a measure of how rapidly blood glucose concentration increases following consumption of a particular food. Diabetics use the glycemic index, along with regular monitoring of blood glucose, in determining how much of different foods to consume. Pure glucose is used as a standard (=100) because it appears rapidly in the blood when consumed. Sucrose, the main sugar in Pure Maple, has a glycemic index of about 68. Sucrose causes a slower increase in blood glucose concentration because, when consumed, sucrose is broken into two six-carbon sugars: glucose and fructose. The glucose then appears in the blood fairly quickly while fructose follows a different metabolic pathway to appear in the blood much later. By itself, fructose has a glycemic index of 19. The artificial maple syrup made by Fifty50 is based on fructose. Maple Grove's artificial maple syrup uses Splenda as a chemical sweetener. These are two different approaches to creating sweetened products for diabetics.

Conclusion

Another way for diabetics to look at this situation is to use Pure Maple where they need a sweetener and their glucose tolerance allows. The incomparable flavor of Pure Maple along with its minerals and antioxidants create added value and pleasure for the limited sugar intake.



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Section 11

Old Maple Manual, Making Value Added Products

11.1 Old Maple Manual – Making Maple Value Added Products

11.1 Old Maple Manual – Making Maple Value Added Products

Equipment

Making the different maple sugar products is not difficult, nor does it require expensive or unusual equipment. It does require the same type of care and sanitation that is expected of any candy company. Maple confections should be made in a special room, either in the home or in a part of the evaporator house. In some States the law specifies that confections for sale cannot be made in the home kitchen. High-pressure steam is the ideal source of heat for evaporating syrup in making confections. High-pressure steam heat can be easily and instantaneously controlled; and, unlike other types of heat, there is no danger of scorching the sugars. When steam is not available, gas is preferred. Gas heat is also easily controlled. Bottled gas is available almost everywhere. The size of the equipment (kettles, mixers, and pans) depends on the amount of syrup to be processed. A thermometer with a range of 200° to 300° F. in 1° units is a necessity; it can be either a dial thermometer or a candy thermometer. Other equipment includes measuring cups, wooden ladles, wooden paddles, and a house hold scale. Provision should be made for cooling the sugar products. This is especially desirable when making maple cream, fondant, or crystal coating syrup. The cooler for cream can be a trough with circulating cold water into which the pans of cooked syrup are placed. A pan of chipped ice or ice water may also be used. For crystal-coating syrup, an insulated box, such as a used refrigerator from which the cooling unit has been removed, may be used.

Maple Sugar

Chemistry of Maple Sugar

Maple syrup is essentially a solution of sucrose in water. The amount of sugar that can be in true solution in a given volume of water varies with the temperature of the solution. Hot solutions can contain more sugar and cool solutions less sugar. Maple syrup solutions containing 67 percent of sugar (67° Brix) are saturated at room temperature (68° F.). That is, no more sugar can be dissolved in the solution at that temperature. Syrup that has been heated to raise the boiling point of the syrup to 7.5° F. or more above the boiling point of water will be supersaturated when it cools to room temperature; it will contain more than 67 percent of sugar. This supersaturated syrup, with its excessive sugar content, is in an unnatural or abnormal condition, and it tends to return to normal by ridding itself of the excess sugar so that the syrup will again contain only 67 percent of sugar. The excess sugar is forced out of solution (precipitated), and sugar crystals are formed. The slower this occurs, the larger the sugar crystals. To make any of the maple sugar products, it is necessary first to make supersaturated syrup. The degree of super-saturation is increased as the boiling temperature of the syrup is increased and more water is evaporated from the syrup. When the amount of super saturation is small and cooling is slow and is accompanied by little or no agitation, the state of super saturation may persist for a longtime; and little sugar will be precipitated. When the amount of super-saturation is appreciable, as when syrup is boiled to 18° F. or more above the boiling point of water (11°F or more above that of standard density syrup), the syrup will appear to solidify on cooling. This solid cake is mostly sugar, but some liquid syrup (mother liquor) is mixed with the sugar.

Formation of Crystal Sugar

The crystalline or grainy nature of the precipitated sugar is determined by a number of factors, all of which are influential in making the desired type of confection. These factors include the degree of super-saturation, seeding, the rate of cooling, and the amount and time of stirring. Large crystals called rock candy, which represent one extreme, are formed when slightly supersaturated syrup (67° to 70° Brix) is cooled slowly and stored for a long time without agitation. A glasslike noncrystalline syrup represents the other extreme. This is formed when highly supersaturated syrup (the boiling point is elevated 18° F. or more above the boiling point of water) is cooled rapidly to well below room temperature without stirring. The syrup becomes so viscous that it solidifies before crystals can form and grow. If the hot supersaturated sugar solution is stirred while it is cooling, the tendency to form crystals increases. The mechanical shock produced by the stirring cause's microscopic crystal nuclei to form. Continued stirring mixes the crystals throughout the thickened syrup, and they grow in numbers and in size. When the number of crystals is relatively small, stirring causes the largest crystals to grow larger at the expense of the smaller ones. Thus, a grainy sugar tends to become more grainy the longer it is stirred. To produce maple sugar with crystals that are imperceptible to the tongue (impalpable), the crystals must be kept very small, even microscopic in size. This is accomplished by first suddenly cooling a hot, highly supersaturated syrup so that a viscid, noncrystalline, glasslike mass is obtained. Then while it is still in the supersaturated state, fine crystals, called seed, are added to serve as nuclei, and stirring is begun. Since the mass is so highly supersaturated, billions of tiny crystals are formed at the same time, and the result is a very fine grained product.

Invert Sugar

Although sucrose is the only sugar in sap as it comes from the tree, some of the sucrose is changed into invert sugar as a result of microbial fermentation during handling and processing". Both sucrose and invert sugar are made up of two simple sugars, dextrose and levulose. In sucrose, these sugars are united chemically as a single molecule; in invert sugar, they occur as separate molecules. A small amount of invert sugar is desirable in maple syrup that is to be made into maple sugar and maple confections. Invert sugar tends to reduce super saturation, that is, more sugar can be held in solution before crystallization occurs. This helps keep the product moist. Also, it encourages the formation of exceedingly small sugar crystals. But too little invert sugar in the syrup will cause the product to be grainy; too much may prevent formation of crystals (creaming) as required for making maple cream. In general, all grades of maple syrup contain some invert sugar, the amount varying with the different grades. Fancy has the least; and U.S. Grade B or unclassified, the most. Thus, the grade of syrup should be a determining factor in selecting syrup for making a specific confection. A simple chemical test to determine the amount of invert sugar in maple syrup is described on page 113. If the amount of invert sugar in the syrup is so small that a fine crystalline product cannot be made, a "doctor" solution is required.

"Doctor" Solutions

The simplest "doctor" solution and the one most commonly used is U.S. grade B pure maple syrup, which is naturally rich in invert sugar (more than 6 percent in some samples. As a rule, dark syrup made from sap produced during a warm spell contains a high percentage of invert sugar. The addition of 1 pint of this doctor syrup to 6 gallons of maple syrup low in invert sugar (less than 1 percent) usually will correct invert deficiency. When syrup with a high content of invert sugar is not available, the doctor solution can be prepared as follows: To 1 gallon of standard density maple syrup add 2½ liquid ounces of invertase (an enzyme that causes the inversion of sucrose to invert sugar). Stir the mixture thoroughly and allow it to stand at room temperature (65° F. or above) for several days. During this time sufficient invert sugar will form so that 1 pint of this solution can be used to doctor 6 gallons of maple syrup low in invert sugar. Invertase may be purchased from any of the confection manufacturers. Another convenient type of doctor is an acid salt such as cream of tartar (potassium acid tartrate). Addition of ½ teaspoon of cream of tartar to 1 gallon of low-invert syrup just before it is boiled for candy making will cause sufficient acid hydrolysis or inversion of the sucrose to form the desired amount of invert sugar.

Maple Cream or Butter

The amount of the maple syrup crop that is being converted into maple cream or butter has been increasing rapidly. Some producers have built up so large a demand for this confection that they convert their entire syrup crop to cream. Some producers make from 2 to 3 tons of this confection annually.

Maple cream, a fondant-type confection, is a spread of butter like consistency. It is made up of millions of microscopic sugar crystals interspaced with a thin coating of saturated syrup (mother liquor). The crystals are impalpable to the tongue and give the cream a smooth, nongritty texture. The first step in making maple cream is to make a supersaturated sugar solution. This solution is cooled to room temperature so quickly that crystals have no chance to form. The cooled, glasslike mass is then stirred, which produces the mechanical shock necessary to start crystallization.

Syrup for Creaming

For best results, U.S. Grade AA (Fancy) or U.S. Grade A (No. 1) maple syrup should be used. However, any syrup may be used provided it contains less than 4 percent of invert sugar.

Invert Sugar Content

The amount of invert sugar in the syrup selected for creaming should be determined by the simple chemical test described on page 113. Syrup that contains from 0.5 to 2 percent of invert sugar should make a fine-textured cream that feels smooth to the tongue. Syrup with from 2 to 4 percent of invert sugar can be made into cream by heating it to 25° F. above the boiling point of water (instead of the usual 22° to 24°). Syrup with more than 4 percent of invert sugar is not suitable for creaming. It will not crystallize, or it will crystallize only if heated to a much higher-than-normal temperature. However, the cream will be too fluid and probably will separate a few days after it is made. The belief throughout the maple-producing area that maple cream should be made only from first-run syrup and that all first-run syrup will yield a good cream is false. It is the amount of invert sugar in

the syrup that determines its suitability for creaming, not the run of sap from which the syrup is made. The amount of invert sugar formed is directly proportional to the amount of microbial fermentation of the sap. This, in turn, is related to the temperature. Unseasonably warm weather is not uncommon during the first period of sap flow. Warm weather favors fermentation of the sap, and sufficient invert sugar is produced to make the early-run syrup unsuitable for making into cream.

Since most Fancy and Grade A syrup normally contains an adequate amount of invert sugar, the use of a doctor solution is not recommended. The addition or formation of too much invert sugar will ruin the syrup. Syrup for creaming should be selected on the basis of the quick test for invert sugar.

Cooking and Cooling

The syrup is heated to a temperature 22° to 24° F. above the boiling point of water. (The temperature of boiling water must be established at the time the syrup is boiled for creaming.) The boiling temperature indirectly adjusts the amount of syrup (mother liquor) left surrounding the crystals; this, in turn, governs the stiffness of the final product. As soon as the boiling syrup reaches the desired temperature, it should be removed from the heat and cooled quickly. If the cooked syrup is left on the hot stove (even with the heat turned off), enough additional water will be evaporated to produce a more concentrated syrup than desired.

Rapid cooling is necessary to prevent crystallization. To provide a large cooling surface, the syrup is poured into large, flat-bottom pans. The layer of syrup should be not more than 1 to 3 inches deep. The pans are set in a trough through which cold water (35° to 45° F.) is flowing. The syrup is cooled to at least 70° F., and preferably to 50° or below. It is sufficiently cool when the surface is firm to the touch. If crystals appear during the cooling process, cooling is too slow, the pan was agitated, or the invert sugar content of the syrup is too low for the cooling conditions. This situation can be corrected either by more rapid cooling (using thinner layers of syrup or more rapid flow of cold water) or by increasing the invert sugar content of the syrup by use of a doctor.

Creaming

The chilled, thickened syrup should be creamed either by hand or mechanically in a room having a temperature of 70° F. or above. Many producers have developed their own mechanical cream beaters; also, there are a number of inexpensive ones on the market. The homemade maple cream beater consists of a pan approximately 13 inches in diameter that holds about 1.5 gallons of cooked syrup. In this beater, the scrapers are held stationary and the pan revolves at 40 to 50 revolutions per minute. In other beaters, this procedure is reversed. Both types worked equally well. A hardwood paddle having a sharp edge 2 or 3 inches wide is used for hand beating (stirring). The cooked syrup is poured onto a large flat pan such as a cookie tin. The pan is held firmly, and the thick syrup is scraped first to one side and then to the other. Mixing should be continuous. If stirring is stopped, some of the crystals will grow and make the product gritty. While being stirred, the chilled syrup first tends to become fluid and then begins to stiffen and show a distinct tendency to set. At this time the batch loses its shiny surface. If creaming is stopped too soon, that is, while the batch is too fluid, large crystals will form. To hasten the creaming process, a small amount of "seed" (previously made cream) can be added to the glasslike chilled syrup just before beating. The addition of 1 teaspoonful of seed for each gallon of cooked syrup will provide crystals to serve as nuclei for the more rapid formation of crystals. The entire creaming 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. **Holding Cream for Delayed Packaging** Often it is not convenient to package the cream at the time it is made. In this case, it can be stored or aged for periods from 1 day to several weeks in tightly covered glass or earthen vessels, preferably under refrigeration. Many candy makers believe that aging a fondant is desirable because it permits the crystals to equalize in the saturated, syrup. Some producers age the cream 1 day by holding it in an open pan covered with a damp cloth; they package the second day without rewetting. Other producers re-melt the aged cream for ease of pouring and packaging by carefully heating it in a double boiler. The temperature of the cream during this reheating must not go above 150° F. (The temperature can be controlled by not permitting the water in the double boiler to go above 150°.) If the temperature of the cream exceeds 150°, too much sugar will be dissolved, and large crystals may form when the re-melted cream is cooled and stored.

Packaging and Storing

Maple cream can be packaged in tin, glass, plastic, or wax-paper cups. Containers with wide mouths are best for easy filling. Care must be taken to keep air bubbles from forming, especially when the cream is packaged in glass because the air bubbles are unpleasing in appearance and create the impression the package is short in weight. Furthermore, air pockets provide a place where the separated mother liquor can collect, and this also produces an

unpleasant appearance. Freshly made cream should be packaged immediately, before it "sets up", or within a day if it has been covered and set aside to age. Re-melted cream should be packaged while it is still warm and fluid. Since maple cream is a mixture of sugar crystals and saturated maple syrup, storing packaged cream at 70° F. or above will cause more sugar to be dissolved. The syrup tends to separate as an unattractive, dark, liquid layer on the surface of the cream. This syrup layer also forms if the cream is stored at fluctuating temperatures. The cream is best stored at low temperature, preferably under refrigeration and at constant humidity. If the cream is packaged in glass or other moisture proof containers, it can be stored in refrigerators for long periods, with little danger of the saturated syrup in the cream separating.

Fondant

Fondant, a nougat-type candy, is known in Ohio as maple cream because of its very fine crystalline character. Fondant is made in exactly the same manner as maple cream except that the syrup is heated to a higher boiling point (27° F. above the boiling point of water). The thickened syrup is cooled to 50° F and stirred as for creaming. Since there is less syrup left in the fondant, it will set up to a soft solid at room temperatures. Small amounts can be dropped on marble slab, waxed paper, or a metal sheet; or it can be packed into molds.

Soft Sugar Candies

Next to maple cream the making of soft sugar candies is gaining in popularity. Like maple cream, 8 pounds of soft sugar candies can be made from 1 gallon of syrup. Soft sugar candies contain little or no free syrup, so they are stiffer than maple cream. The crystals in soft sugar candies are larger than in maple cream and are palpable to the tongue, but they should not be large enough to produce an unpleasant sandy effect. The candies can be made from any of the top three grades of syrup: U.S. Grade AA (Fancy), U.S. Grade A (No. 1), and U.S. Grade B (No. 2). Unlike maple cream, a small amount of invert sugar is desirable because it reduces the tendency to produce large crystals that give the candies a grainy texture. The invert sugar content can be increased by adding (1) a doctor solution consisting of 1 pint of dark syrup to 6 gallons of table grade maple syrup, or (2) a doctor consisting of Vg teaspoon of cream of tartar to 1 gallon of low invert syrup. Use the quick test for invert sugar to check the syrup to be used for candy making.

Cooking, Cooling, and Stirring

The syrup is cooked to 32° F. above the boiling point of water established for that time and place. The pans of cooked syrup should be cooled slowly on a wooden-top table to 155° F. (as tested with a thermometer). The thick syrup should then be stirred, either by hand with a large spoon or with a mechanical mixer. While the sugar is still soft and plastic, it is poured or packed into rubber molds of different shapes. Packing the molds is best done with a wide-blade putty knife or spatula. Rubber molds for making candies of different sizes and shapes can be purchased from any maple equipment supplier. Before use, the molds should be washed with strong alkali soap, well rinsed, and dried. They should then be coated with glycerin applied with a brush. Excess glycerin is removed by blotting with a soft cloth. If the rubber mold contains too much carbon, it will make a mark on the molded sugar. To test for too much carbon, rub the mold on white paper. The Bob.—Another method of preparing the sugar so that it can be run into the molds is that used by commercial confectioners. After stirring, the soft sugar is set aside for a day to firm and age. The following day it is mixed with an equal amount of "bob," and the mixture is run into the rubber molds while it is still fluid. The bob is syrup that is boiled to exactly the same boiling point as used in making the soft sugar (32° F. above the boiling point of water). As soon as the bob is made and while it is still hot, the sugar made the previous day is added to it, and the mixture is stirred enough to get uniformity but not enough to cause it to set up. The hot bob partly melts the sugar, and the resulting semi liquid sugar can be poured easily. Semi-continuous Process.—Ingenuity can be used in candy making. For example, one producer has developed the following semi continuous process: The syrup is cooked in a special vessel from which the cooled syrup is dispensed to a small mechanical agitator. Here the syrup is partly crystallized, and while it is still fluid it is run into the rubber molds where crystallization is completed. It sets up in 30 minutes to 1 hour. Candies formed by pouring rather than packing have an attractive glazed surface.

Crystal Coating

Candies can be prevented from drying by coating them with a moisture-impervious shell made from crystalline sucrose. The crystallizing syrup is made as follows: Fancy maple syrup low in invert sugar is heated to 9.5° to 11° F. above the boiling point of water. This supersaturated syrup should have a Brix value of 70° to 73° at a temperature of 68° and 63.5° Brix at 210°F (hot). One gallon of standard-density syrup (66° Brix) will make 7 pints of crystallizing syrup (70° to 73° Brix). The hot, heavy syrup can be set aside to cool where it will not be disturbed by jarring or shaking, or it can be transferred immediately to large crystallizing pans. To retard surface crystallization (caused by rapid cooling of the surface), the syrup should be covered with a piece of damp cheesecloth or paper (preferably the same kind used as a syrup pre-filter, since it has a high wet strength). The cloth or paper must be in contact with the entire surface of the syrup. If crystals form, they will attach themselves to this cover and can be removed along with the covering. The sugar crystals can be recovered by rinsing the cover in hot water.

The candies to be coated should be dry (24 hours old). They can be coated by either of two methods. In one method, the candies are loosely packed two or three layers deep in a tin pan, such as a bread tin, which has a piece of 1/2-inch-mesh hardware cloth in the bottom. The covering is removed from the cool (70° to 80° F.) crystallizing syrup, and any crystals not removed with the cover are skimmed off.

In the other method, the candies are loosely placed in wire mesh baskets of such size as to permit submerging both the baskets and the dried candies below the surface of the crystallizing syrup. A fresh cover is placed directly on and in contact with the entire surface of the syrup and left at a temperature of 65° to 80° F. for 6 to 12 hours, or overnight. This is the crystallizing period. The major part of the crystal coat forms on the candies during the first few hours. Therefore, the time the candies are left in the crystallizing syrup beyond a 6-hour period is not too critical. Actually, the most important factor is the Brix value of the crystallizing syrup; if too high, coarse crystals result. Sugar comes out of the thick syrup and is deposited and grows on the millions of tiny crystals on the surface of the candies. The best density of the syrup should be determined by trial runs. When sufficient sugar has been deposited on the candies, the paper or cloth cover is removed, and the wire baskets of coated candies are lifted out of the syrup and supported above the trays of syrup until the candies have drained. After the syrup has drained from the candies (one-half hour), the candies are dried by removing all remaining drops of syrup. Failure to do this, results in areas having a glazed (non-crystalline) surface that is not a water barrier and that permits the candies to desiccate (dry out) during storage. Desiccated spots appear as white areas. The drained candies can be freed of any remaining drops of crystallizing syrup by two methods. In one method the candies are spread out (one layer thick) on a sheet of paper and each piece is turned over at intervals of 1 to 2 hours. In the other method each piece of candy is wiped with a damp sponge to remove any moist areas. The dry candies are placed on trays; the bottoms of the trays are made of 1/4-inch hardware cloth. The trays of candies are set in racks to complete the air drying process at room temperature. This usually requires from 4 to 7 days.

After drying, the candies are ready for packaging. Candies should not be crystal coated on humid or rainy days because they will not dry properly. If candies are not thoroughly dried, their coating will dissolve when they are packaged. The packages have two functions: (1) To make the candies as attractive as possible and (2) to keep them in good condition. Boxes, individual wrappings, and candy cups can be obtained from a confectioner's supply house. The net weight of the candies must be stated on the outside of the package. This requires that the weight of the box (tare) and the net weight of the candies be determined for each box.

Candies that have been crystal coated have relatively good shelf life; they do not tend to take up moisture or to dry out. Candies that are not crystal coated may do either, depending on the humidity of the room in which they are stored. In a room of low humidity, they will lose moisture. The dried-out areas will appear as white spots and will become stone like in hardness. If the humidity is high, the candies will take up moisture, and moist areas or droplets of water will appear on the surface. The droplets become dilute sugar solutions and are good sites for mold growth. The humidity of the packaging room can be controlled by a dehumidifier and air-conditioner. Never package on rainy days.

The best type of wrapper for the outside of the candy package is one that is moisture proof, such as metal foil or wax-coated paper. A moisture proof wrapper helps to prevent changes in the candies during storage. Unfortu-

nately, most wrappers are not completely moisture proof. They reduce the gain or loss of moisture but do not prevent it, especially if the candies are stored under excessively high or low moisture conditions or for long periods. Some packers of maple confections obtain longer storage by puncturing the moisture proof wrapper with many small holes to permit the package to breathe.

Maple Spread

Maple cream, described on page 98, is not stable when stored at room temperature because saturated syrup (mother liquor) tends to separate from the cream and cover it with a syrup layer.

A new semisolid dextrose-maple spread has been developed that prevents this separation of syrup. Also, it requires no heating or stirring.

The process for making the spread consists of three simple steps: (1) The syrup is concentrated by heating it to a density of 70° to 78° Brix; (2) part of the sucrose is converted to invert sugar by enzymatic hydrolysis; and (3) the dextrose (part of the invert sugar) is crystallized to form a semisolid spread.

Standard-density maple syrup (66° Brix) is heated to about 10° F. above the boiling point of water (approximately 76° Brix), and then cooled to 150°F or below (as tested with a thermometer). While the syrup is still fluid, invertase is added at the rate of 1 ½ ounces per gallon of syrup and thoroughly mixed with the syrup by stirring. The enzyme will be inactivated and hence ineffective if it is added while the syrup is too hot (above 160° F.). The enzyme-treated syrup is stored at room temperature for 1 or 2 weeks. At first, crystals (sucrose) appear, but they do not form a solid cake, and as the hydrolyzing action of the enzyme progresses, the crystals dissolve. The result is a crystal-free, stable, high-density syrup (70° to 78° Brix) containing a large amount of invert sugar. This syrup will remain clear at ordinary temperatures. Because of its high density, it makes an excellent topping for ice cream and syrup for waffles or pancakes.

Maple spread is made by seeding this high density syrup with dextrose crystals. A crystalline honey spread, a stock grocery item, is a convenient source of dextrose crystals for seeding the first batch. For additional batches, crystals from previously made lots of the maple spread may be used as seed. The dextrose crystals are added at the rate of 1 teaspoon per gallon of high-density syrup and thoroughly mixed with the syrup. After mixing, the syrup is poured into packages and set aside at a temperature of 55° to 60° F. Within a few days a semisolid spread forms. It is stable at temperatures up to 80° F. If refrigerated, it will keep indefinitely without any syrup separating.

Maple spread eliminates the laborious hand beating or the expensive machine beaters required for making maple cream. Furthermore, the yield of maple spread per gallon of syrup is higher, because it is made from syrup concentrated to between 70° and 78° Brix, whereas syrup for maple cream is concentrated to 80° Brix.

Fluffed Maple Product

In making the maple products described in the preceding pages, only syrup low in invert sugar should be used, except for that used as a doctor. These products, therefore, are primary uses for the top grades of table syrup, U.S. Grade AA, U.S. Grade A, and U.S. Grade B.

A new maple product called fluff has been developed at the Eastern Regional Research Center. It can be made from the lower grades of syrup (syrup high in invert sugar). In addition, it has a number of other advantages. Some of these advantages are: (1) There is a large overrun because the volume of the cooked syrup is increased by incorporating air during the beating process; (2) the new product contains a higher percentage of water than does maple cream so that a larger volume can be made from 1 gallon of standard-density syrup; (3) the monoglyceride used in the formula tends to reduce its apparent sweetness and make it more palatable, but without loss of the maple flavor; and (4) the time required to whip it is only a fraction of that required for making maple cream. The fluffed product has excellent spreading properties and has an impalpable crystal structure. While there is less tendency for the fluff to bleed, it does tend to become somewhat grainy, especially if stirred too long. This tendency to grain is retarded by storing the fluff under refrigeration.

Making the Fluff from Maple Syrup

Heat the syrup until its temperature has been elevated 17° F. above that of boiling water. Allow it to cool, with occasional stirring, to between 175° and 185° F. (as tested with a thermometer). Add highly purified monoglyceride (Myverol 18-00) equal to 1 percent of the weight of the maple syrup used, that is, 0.11 pound (1/3 cup) per gallon or 2 level teaspoonfuls per pint. Dissolve the monoglyceride by adding it slowly and stirring. If the syrup

cools below 145°, the monoglyceride will not dissolve. Cool to between 150°F and 160°F and whip the mixture with a high-speed (household) beater. Fluffing should occur within 2 minutes.

Making the Fluff from Maple Syrup and Maple Sugar

To 1 cup of pure maple syrup (any grade) add 1/2 cup of maple sugar and heat the mixture until the sugar is completely dissolved. Do not boil. Cool to between 175° and 185° F. with occasional stirring. Add slowly and stir until dissolved 1 teaspoonful of Myverol 18-00 for each cup of syrup. Cool to between 150°F and 160°F, and whip the mixture with a high-speed (household) beater. Fluffing should occur within 2 minutes. The sugar must be completely in solution at the time it is whipped to prevent a grainy texture. If sugar crystals do form, they may be re-dissolved by heating the suspension; but loss of water must be avoided, and no more Myverol need be added. Excessive heating of the Myverol tends to cause it to lose its properties.

The texture and consistency of the fluffed products can be varied as follows:

- (1) Whipping Time.—as time of beating lengthens, the stiffness of the product increases. The initial, thin whip can be used as a topping for ice cream or other desserts. The stiffer product is an excellent spread or icing for baked goods. (The beating time will be affected by the temperature of the mixture at the start of the beating. The higher the temperature, the longer it will take to reach a given consistency.)
- (2) Ratio of Sugar to Water.—The higher the sugar content of the mixture in relation to the water content at the time the sugar-water-stabilizer mixture is whipped, the greater the consistency of the fluffed product.

High-Flavored Maple Syrup

As stated earlier, the color and flavor of maple syrup result from a type of browning reaction that occurs between constituents of the maple sap during evaporation. Experiments have shown that all the potential flavor is not developed during the usual evaporation process. To develop maximum flavor, the browning reaction must be carried further; that is, the syrup must be heated to a higher temperature and for a longer time. Unfortunately, high temperatures favor the formation of an acrid "caramel" flavor. The presence of large amounts of water favor caramel formation and the presence of some caramel in the initial syrup accelerates it. Therefore, only the two top grades of syrup—U.S. Grade AA (Fancy) or U.S. Grade A (No. 1)—should be used in making high-flavored maple syrup. It may be made by the atmospheric process, by the constant-volume pressure cooking process or by the new continuous process.

High-flavored maple syrup made from U.S. Grade AA or U.S. Grade A syrup by either process will have a strong full-bodied flavor four to five times that of the syrup from which it was made, and it will be essentially free from caramel.

The high-flavored process does not concentrate the flavor; instead, it develops more maple flavor than present in the original syrup.

Atmospheric Process

In the atmospheric process the syrup is concentrated at atmospheric pressure by heating to a boiling temperature of 250° to 255° F. This reduces the water content of the syrup to approximately 10 percent. The syrup is held at this temperature for 1 1/2 to 2 hours. It is then cooled, and water is added to replace that lost in evaporation so that the syrup is again of standard density.

Because of the low moisture content of the syrup during the cooking period, there is danger of scorching if it is heated in a kettle on a stove or other hot surface. It is recommended, therefore, that the high-flavoring process be conducted with high-pressure steam in a steam-jacketed kettle or in a kettle provided with a steam coil.

The first step of the process—removing the water from the syrup—should be done as rapidly as possible. Steam pressure of from 30 to 100 pounds should be used. As soon as the syrup reaches a temperature of 252° F., the steam pressure is reduced until only enough heat is applied to maintain the syrup between 250° and 255°F. Usually a steam pressure of 20 to 28 pounds is sufficient. A cover is placed over the kettle to prevent further loss of water through evaporation. The cover need not be airtight.

Because of the high viscosity of the syrup, little water will be vaporized. A thermometer calibrated in 1° intervals, with a range that includes 250° to 300° F., is kept in the syrup during the high-flavoring process. If the temperature of the syrup rises above 255° during the holding period, the steam pressure should be decreased. To prevent formation of crystals, the syrup should not be stirred or agitated during the high-flavoring process. The end of the heating (cooking) period is best determined by odor. The cover is lifted, and a handful of steam

is scooped up and brought toward the nose; heating is stopped as soon as an acrid caramel odor is detected in the steam. Care must be taken not to get a steam burn. Always bring the hand to the nose; do not bend over the kettle.

At the end of the cooking period, the thick, supersaturated syrup is cooled to 180° F. Approximately 3 pints of water is added for each gallon of syrup originally used to replace the water lost in evaporation and restore the syrup to standard density. Extreme caution must be exercised in adding the water because the water will be converted to steam with explosive violence if the syrup has not cooled to a temperature below the boiling point of water. After addition of the water, the syrup is again brought to a boil and heating is continued until the temperature reaches that of standard-density syrup (7° F above the boiling point of water).

As flavor and color in syrup develop initially to the same degree, flavor development in the treated syrup may be measured indirectly by measuring the increase in its color. A sample of the high-flavored, standard-density syrup is weighed and then diluted with a colorless cane sugar syrup having a density of 66° Brix as measured with a hydrometer or refractometer. The colorless syrup is added slowly to the high-flavored syrup, with thorough stirring, until the mixture matches the color of the original maple syrup. Then the mixture is weighed. The increase in color and flavor is determined by the ratio,

Weight of mixed syrup

Weight of high-flavored syrup = Increase in flavor

This procedure can be used to follow the progress of the high-flavoring process, since different lots of syrup of the same grade develop flavor at slightly different rates. A sample is removed periodically from the cooking syrup and weighed. Enough water is added to restore the sample to standard density (66° Brix), and its increase in color and flavor is determined. The tests are easy to make; the 2-ounce French square bottle supplied with the U.S. color comparator is used.

Pressure Cooking Process

Many maple producers do not have high-pressure steam equipment. They may make high-flavored syrup by the pressure-cooking process. In this process, standard-density syrup is heated in a closed vessel, such as an autoclave or ordinary pressure cooker, at 15 pounds pressure. Best results are obtained when the syrup is heated to a temperature of 250° to 253° F. as in the atmospheric process.

In the pressure-cooking process, the water content of the syrup is 34 percent during heating rather than 10 percent, as in the atmospheric process. The higher water content favors formation of caramel. However, the rate at which caramel forms depends on the original caramel content of the syrup. The higher the caramel content in the original syrup, the greater the amount formed in the product. Since the amount of caramel in syrup is related to the amount of color, only U.S. Grade AA (Fancy) or U.S. Grade A (No. 1) syrup should be used to make high-flavored syrup by the pressure-cooking process. Darker grades usually result in an unpalatable product. The syrup is heated almost to boiling and immediately is transferred to jars, which are filled to within 1/2 inch of the top. The lids are set loosely in place, and the jars are placed in an autoclave or pressure cooker, which contains the amount of water specified by the manufacturer. The cover of the cooker is assembled, and steam is generated according to the manufacturer's directions. The syrup is heated at 15 pounds' pressure for approximately 1½ hours. Then the pressure is decreased slowly to zero without venting or quenching. The containers must not be jarred or the syrup may boil over.

Uses of High-Flavored Syrup

High-flavored syrup has a number of uses. Because it is richer in maple flavor, it is ideal for making maple products. It is especially desirable for use in making cream and candies. From 1 to 2 percent of invert sugar is formed in the high-flavoring process. This is the optimum amount to make perfect cream or soft sugar candies without the need of a "doctor." High-flavored, high-density maple syrup makes a superior topping for ice cream. Only high-flavored syrup should be blended with other foods such as maple-flavored honey and crystalline honey spreads. Regular maple syrup usually does not have enough flavor to compete with or to break through the flavor of the food to which it is added. An inexpensive table syrup that has the full flavor of pure maple can be made by blending 1 part of high-flavored, standard-density syrup with 3 parts of cane sugar syrup that has a Brix value of 66°. Blended syrup must be properly labeled when offered for sale. The percentage of each ingredient must appear on the label, with the one in greater amount appearing first.

Crystalline Honey – Maple Spread

The development of a maple-flavored crystalline honey spread has produced a new farm outlet for both maple syrup and honey. This spread is made by mixing honey with high flavored maple syrup. The maple flavor must be strong enough to break through the honey flavor and the syrup must contain a large amount of invert sugar. These requirements are met by converting U.S. Grade B (Vermont B or New York No. 2) syrup to high-flavored syrup as described earlier except that the syrup is heated to a temperature 19° or 20° F. above the boiling point of water. It is then cooled to 150°F or lower, and 1½ to 2 ounces of the enzyme is added per gallon of syrup. The mixture is set aside at room temperature until the action has been completed, usually about 2 weeks. The syrup may have the appearance of soft sugar.

The high-flavored, high-density maple syrup is added to mild strained honey at the rate of 33 parts of maple syrup to 67 parts of honey by weight. The mixture is crystallized by the Dyce process as follows: The honey-maple mixture is seeded with crystalline honey (available in most grocery stores) or with some honey-maple spread from a previous batch, at the rate of 1 ounce of seed to 1 quart of honey-maple mixture. After thorough stirring, the seeded mixture is held at 57° to 60° F. until crystallization is complete, usually 3 to 7 days. The resulting product is smooth; it has a barely perceptible grainy character, spreads well, and has a very pleasing flavor. This spread becomes liquid at temperatures above 85°F. Therefore, it should be stored under refrigeration.

Maple syrup blends well with honey in making other honey-maple confections. Recipes for these can be obtained from Pennsylvania State University, University Park, Pa. 16802.

Other Maple Products

Rock Candy

Production of rock candy usually is unintentional. Although it should not be considered a product of maple syrup, this form of "maple sugar" is easy to make, as follows: When maple syrup is evaporated to a density between 67.5° and 70° Brix (heated to 8° F. above the boiling point of water), and the syrup is stored for a considerable length of time at room temperature or lower, a few well-defined crystals of sucrose (rock candy) appear. These continue to grow in size if the syrup is left undisturbed for a long time.

Hard Sugar

Because it is not easy to eat, hard sugar is not classified as a confection. Producers find there is a small demand for hard sugar since it offers a convenient form for the safe and stable storage of maple syrup. The hard sugar cake can be broken up and melted in water, and the solution can be boiled to bring it to syrup density. This syrup is called maple-sugar syrup to distinguish it from syrup made directly from sap.

Hard sugar is made by heating maple syrup to approximately 40° to 45° F. above the boiling point of water. As soon as the syrup reaches the desired temperature, it is removed from the heat and stirred. Stirring is continued until the syrup begins to crystallize and stiffen; then the semisolid syrup is poured into molds. If stirring is continued too long or if transfer of the sugar to the molds is delayed, the sugar will solidify in the cooking vessel.

In the past, hard sugar, often called maple "concrete," was the preferred form for holding commercial maple syrup in storage.

Granulated (Stirred) Sugar

Granulated (stirred) sugar is made by heating maple syrup to between 40° and 45° F. above the boiling point of water, as in making hard sugar. The hot, partly crystallized, thickened syrup is transferred from the kettle to a stirring trough, and it is stirred continuously until granulation is achieved. In the past, this form of maple sugar was made by stirring it in a hollowed log usually made from basswood.

Maple on Snow

Maple on snow is a favorite of guests at a maple-syrup camp. As in making stirred sugar, the syrup is heated to 22° to 40°F. above the boiling temperature of water. The final temperature within this range depends on individual preference. As soon as the syrup reaches the desired temperature, it is poured immediately, without stirring, on snow or ice. Because it cools so quickly, the supersaturated solution does not have a chance to crystallize; it forms a thin, glassy, taffy like sheet.

Recipes for other maple confections can be obtained by writing to your State Department of Agriculture or your Extension Service.

Summary

Maple Sugar

- (1) Converting maple syrup to maple sugar is not difficult. The only special equipment required for small-scale operations is a thermometer having an upper range of 250° to 300° F. calibrated in 1° units.
- (2) Syrup that is saturated with sugar at one temperature will be supersaturated when cooled to another temperature.
- (3) Supersaturated sugar solutions tend to regain their normal or saturated state by throwing the excess sugar out of solution. This precipitated sugar usually is in the form of crystals, and the amount formed depends on the degree of super saturation.
- (4) The size and number of crystals in the precipitated sugar depend on the degree of super saturation, the rate of cooling the syrup, and the amount and time of stirring.
- (5) Invert sugar, a product of sucrose, tends to retard the crystallization. Its presence in maple syrup is usually the result of fermentation of the sap. It influences the crystallization of maple sugar. Too much invert sugar may prevent crystallization of sugar from a supersaturated syrup. Too little will cause the maple sugar to be coarse and gritty.

Maple Cream or Butter

- (1) Use a syrup low in invert sugar (0.5 to 2 percent). U.S. Grade AA (Fancy) or U.S. Grade A (No.1) usually meets these specifications.
- (2) Test all syrup for invert sugar by the quick test. Do not use syrup that contains more than 4 percent of invert sugar.
- (3) Heat the syrup to 22° or 24° F. above the boiling point of water.
- (4) Cool the syrup rapidly to 50° F.
- (5) Stir the thickened syrup continuously until creaming is completed.
- (6) Freshly made cream can be packed immediately or it can be aged before packaging.
- (7) Aged cream can be softened for pouring by heating to a temperature not exceeding 150°F.
- (8) Store the cream under refrigeration.
- (9) Causes of failure to cream:
 - (a) If the syrup contains too little invert sugar or if it is not chilled sufficiently before stirring, the cream will have gritty texture.
 - (b) If the syrup contains too much invert sugar, it will not cream (crystallize).

Fondant

- (1) Prepare as for maple cream, except increase the boiling point of the syrup to 27°F above that for water.
- (2) Stir or beat the syrup as for maple cream.
- (3) Place drops of the semisolid sugar on marble slab, waxed paper, or metal sheet—OR—
- (4) Pour the semisolid sugar into rubber molds.

Soft Sugar Candies

- (1) Use any of the top three grades of syrup.
- (2) Heat the syrup to 32° F. above the boiling point of water.
- (3) Cool the syrup slowly to 155° F.
- (4) Stir the thickened syrup until enough crystals have formed to make a soft, plastic mass.
- (5) Immediately pour or pack the soft sugar into molds—OR—
- (6) Set it aside in a crock at room temperature for 24 to 48 hours.
- (7) Concentrate an equal amount of syrup as before.
- (8) As soon as the same elevation of boiling point (32° F.) is reached, add the hot concentrated syrup (bob) to the aged soft sugar.

- (9) Stir only enough to mix and pour the semi-solid sugar into the molds.

Crystal Coating

- (1) Make crystallizing syrup from top grades of maple syrup. (2) Concentrate the syrup to a density of 70° to 73° Brix by heating it to 9.5° or 11° F. above the boiling point of water (63.5° Brix hot test).
- (3) Cool to room temperature.
- (4) Keep the surface of the syrup covered with heavy paper, except when adding or removing the candies.
- (5) Place the freshly made candies in the heavy syrup and leave them in the syrup 6 to 12 hours.
- (6) Remove the candies and completely drain the syrup from them.
- (7) Place the candies on paper-covered trays and turn each piece every hour until dry, or wipe with a damp sponge.
- (8) Do not attempt to crystal coat candies during humid or rainy weather.
- (9) Air dry at room temperature 4 to 7 days.

Maple Spread

- (1) Use any of the three top grades of syrup.
- (2) Heat the syrup to 10° or 11° F. above the boiling point of water (70° to 78° Brix).
- (3) Cool the thick syrup to 150°F or below and add 1½ ounces of invertase per gallon of syrup.
- (4) Store at room temperature for 2 weeks. The resulting product is high-density syrup. (5) "Seed" the high-density syrup with dextrose crystals from previous batches of spread or from crystallized honey. Use 1 teaspoonful per quart of syrup.
- (6) Mix the seed thoroughly through the syrup and pour the mixture into the final package.
- (7) Store at 55° to 60° F. Within a few days the dextrose crystals will grow to yield a plastic spread.

Fluffed Maple Product

- (1) Can use lower grades of syrup.
- (2) Heat the syrup to 17° F. above the boiling point of water.
- (3) Cool with occasional stirring to 175° to 185° F.
- (4) Add 1 percent (1/3 cup per gallon or 2 level teaspoonfuls per pint) of a purified monoglyceride (Myverol 18-00) slowly with stirring.
- (5) Cool to 150° to 160° F.; whip 2 minutes with a high-speed cake mixer.

High Flavored 'Maple Syrup

Use either of the two top grades of syrup to make high-flavored maple syrup, and make it by either the atmospheric or the pressure-cooking process.

Atmospheric Process

- (1) Concentrate the syrup by heating to 40° F. above the boiling point of water (250° to 255° F.). Process only in a steam kettle, jacketed or with coils.
- (2) Hold the thickened syrup at the final temperature of concentration for 1 1/2 to 2 hours.
- (3) Cover the kettle and reduce the steam pressure to approximately 24 or 26 pounds per square inch—to keep the syrup at 252° to 255° F.
- (4) Turn off the steam at the end of the processing period and cool the thick syrup to 180° F.
- (5) Add water with caution and in small amounts until the syrup is restored to about standard density and re-boil to 7° F. above the boiling point of water.

Pressure-Cooking Process

- (1) Heat the syrup almost- to boiling temperature (210° to 215° F.).
- (2) Transfer to containers to fit the cooker (usually 1- or 2-quart jars).
- (3) Place the lids on the containers loosely, and put them in the cooker.
- (4) Add water to the cooker according to the manufacturer's directions and secure the cooker lid.
- (5) Bring the steam pressure in the cooker to 15 pounds per square inch. Hold at this pressure for 1½ hours.
- (6) Allow the pressure to fall slowly; do not vent or quench.
- (7) When the pressure has fallen to zero, open the cooker and remove the high-flavored syrup.

Crystalline Honey-Maple Spread

- (1) Use U.S. Grade B, Vermont B, or New York No. 2. syrup.
- (2) Heat the syrup to 19° or 20° F. above the boiling point of water (80° Brix).
- (3) Cool the thick syrup to below 150° F. and add 1½ to 2 ounces of invertase per gallon of syrup.
- (4) Store at room temperature for 2 weeks to produce a high density syrup.
- (5) Mix thoroughly one part of the high-density syrup to two parts of mild flavored honey.
- (6) Add seed (dextrose crystals) at the rate of 1 teaspoonful per gallon of mixture. Use a previous batch of honey-maple spread or crystalline honey as seed.
- (7) Hold the seeded mix at 60° F. until the dextrose crystals grow to produce a semi- fluid plastic (from 3 to 7 days).
- (8) Store under refrigeration.

Rock Candy

- (1) Use one of the top grades of maple syrup.
- (2) Heat the syrup to 8° F. above the boiling point of water (67.5° to 70° Brix).
- (3) Store several months at or below room temperature.

Hard Sugar

- (1) Use any grade of syrup.
- (2) Heat the syrup to between 40° and 45° F. above the boiling point of water.
- (3) Remove from the heat and begin stirring the hot, thick syrup immediately.
- (4) Continue stirring until crystals form (syrup begins to stiffen).
- (5) Pour the partly crystallized syrup into molds to harden.

Granulated (Stirred) Sugar

- (1) Use a top grade of syrup.
- (2) Heat the syrup to between 40° to 45° F. above the boiling point of water.
- (3) Pour the hot syrup immediately into a tray or trough for stirring.
- (4) Begin stirring immediately and continue stirring until granulation is completed.

Maple, on Snow

- (1) Use the top grades of syrup.
- (2) Heat the syrup to between 22° and 40° F. above the boiling point of water.
- (3) Without stirring, pour the syrup immediately onto the snow or ice; it will form a glassy, taffy like sheet of candy. The relation between the invert sugar content of maple syrup and its suitability for making maple cream is as follows:

Invert sugar content of syrup (percent)	Suitability for cream
0.5 to 2	The right amount of invert sugar for making a fine-textured cream—one that feels smooth to the tongue.
2 to 4	Can be made into cream if syrup is cooked until it is 2° to 4° F. hotter than temperature called for in standard recipes for cream.
4 or more	Not suitable for cream. If used, sucrose will not crystallize, or it will crystallize only if syrup is heated to a much higher-than-standard temperature. Such cream will be too fluid and probably will separate a few days after it is made.

Two tests are available for determining the invert sugar content of maple syrup. The simple, or short-cut, test merely shows whether the syrup contains less than 2 percent of invert sugar and is therefore suitable for creaming. The other is a quantitative test. It measures invert sugar in amounts up to 7 percent, the upper limit normally found in maple syrup.

Simple Test

The simple test for determining the invert sugar content of maple syrup has been adapted from a standard test for determining the sugar in urine. The test is made by first preparing a syrup-water mixture (1 part of syrup to 20 parts of water) and then color testing the diluted syrup. It can be made in 3 or 4 minutes.

Equipment

The few pieces of equipment required to make the tests can be obtained from the local pharmacy. The following items are required:

- (1) Clinitest tablets¹⁰ obtainable at pharmacy.
- (2) Two medicine droppers.
- (3) A test tube, about 1/2 inch in diameter and 3 or 4 inches long.
- (4) A sample of the syrup to be tested (1 cupful).
- (5) One medicine glass, calibrated in ounces.
- (6) One glass measuring cup, calibrated in ounces.
- (7) Test tube holder.
- (8) Two 8-ounce, clean and dry drinking glasses.
- (9) One 1-quart glass fruit jar and cover.
- (10) One "Clinitest" color scale.
- (11) Water (20 fluid ounces).

Making the Test

- (1) Carefully pour enough of the test syrup into a medicine glass to bring the level of the syrup exactly to the 1-ounce (2 tablespoons) mark. If too much (more than 1 ounce) is added, empty the syrup out of the medicine glass, wash and dry it, and start over.
- (2) Measure 2 1/2 cups of water and transfer it to the quart jar.
- (3) Make the 1-to-20 solution by pouring the fluid ounce of syrup into the jar containing the 2 1/2 cups (20 fluid ounces) of water.
- (4) Pour some of the water-syrup mixture into the medicine glass and return it to the jar. Repeat this three or four times to be sure that all the syrup has been transferred to the water in the jar. Mix the contents of the jar thoroughly by stirring with a spoon or with a portable electric mixer.
- (5) Place the test tube upright in the holder. (The holder can be a 1-inch-thick block of wood, 2 inches square with a 1/2-inch hole 3/4 inch deep.)
- (6) Fill a clean, dry medicine dropper with the diluted (1:20) syrup in the fruit jar. Hold the dropper upright above the test tube and let 5 drops of the diluted syrup fall into the test tube.
- (7) Fill another clean and dry medicine dropper with water and add 10 drops of water to the test tube.
- (8) Place a Clinistest tablet, freshly removed from the bottle or wrapper, in the test tube. As the tablet dissolves, it causes the contents of the tube to boil. Do not remove the tube from the holder while the solution is boiling.
- (9) Fifteen seconds after the boiling stops, add water to the test tube until it is two-thirds filled.
- (10) Observe the color of the solution and compare it with the two colors marked + and - of the color scale furnished with the Clinistest tablets. Disregard everything else on the scale card. The other colors and the labels on the scale card have no relation to this test. Make the color comparison in a room illuminated with an incandescent bulb. The colors are not easily judged by fluorescent or direct sunlight.

Interpreting the Results

Color of Solution in Test Tube.—Blue indicates a negative test; the syrup contains less than 2 percent of invert sugar and can be used to make cream. Yellow or yellow green indicates a positive test; the syrup contains more than 3 percent of invert sugar and is not suitable for making cream.

Quantitative Test

The quantitative test is much longer than the simple test; it requires about 15 minutes.

Preparing the syrup - Water Mixtures

For this step, you will need syrup, 15 quarts of water, measuring cup, quart measure, pail or other large container, long-handled spoon, small spoon, and five 4-ounce drinking glasses. The glasses should be thoroughly dry. You will also need a pencil and labels.

Stir thoroughly the syrup to be tested. Then fill the measuring cup exactly to the 1-cup mark with syrup.

Dilute this syrup with five successive additions of water, as follows:

1-and-12 Dilution (1 cup of syrup and 12 cups of water).—Pour 2 measured quarts (8 cups) of water into the pail. Pour the cupful of syrup into the pail; let the cup drain until most of the syrup is out of the cup.

Measure a third quart (4 cups) of water and use this to rinse the remaining syrup from the cup; fill the cup with water, stir with a small spoon, and pour into the pail until the quart of water is used.

Stir the syrup and water in the pail until it is thoroughly mixed.

Dip one 4-ounce glass into the dilute syrup and withdraw half a glassful.

Label the glass "12" and set it aside.

1-and-20 Dilution.—To the dilute syrup in the pail, add 2 measured quarts (8 cups) of water.

Stir the contents of the pail until well mixed. Remove half a glassful and label it "20."

1-and-32 Dilution.—Add 3 measured quarts (12 cups) of water to the mixing pail. Stir contents until well mixed. Remove half a glassful and label it "32"

1-and-40 Dilution.—Add 2 measured quarts (8 cups) of water to the pail. Stir contents until well mixed. Remove half a glassful and label it "40."

1-and-60 Dilution.—Add 5 measured quarts (20 cups) of water to the pail. Stir contents until well mixed. Remove half a glassful and label it "60."

Color Testing the Dilutions

For this step you will need the labeled samples of the five dilutions, test tube holder for five tubes, five test tubes, six medicine droppers, Clinitest tablets and color scale, a small amount of water, and pencil and paper. Make the color test as follows:

- (1) Place five of the test tubes in the test tube holder.
- (2) Fill a clean, dry medicine dropper with the diluted syrup from the glass labeled "60." Hold this dropper upright above the test tube in the hole marked "60" and let exactly five drops of the diluted syrup fall into the test tube.

Similarly, place exactly five drops of the "40" dilution, five drops of the "32" dilution, five drops of the "20" dilution, and five drops of the "12" dilution in the tubes numbered for these dilutions. Use a separate, clean, dry medicine dropper for each dilution.

- (3) Fill another clean medicine dropper with water and add 10 drops of water to each of the five test tubes, refilling the medicine dropper as necessary.

- (4) Remove five Clinitest tablets from the bottle or wrapper. Place them on a clean piece of paper.

- (5) Place one tablet in each test tube, in order, starting with the tube marked "60." The tablets, as they dissolve, cause the contents of the tubes to boil. Do not move the test tubes while the solutions are boiling. Fifteen seconds after the boiling stops, add water to the test tube marked "60" until the tube is two-thirds full. Add the same amount of water to the other four test tubes, in order, from right to left.

- (7) Compare the colors in the test tubes with the two colors of the color scale marked "trace" and "+". Disregard everything else on the scale; the other colors and the labels on all the colors have no relation to this test.

Make this comparison in a room lighted with an incandescent bulb. You cannot judge the colors of the solutions for this test with fluorescent light or with sunlight only.

Assign to the mixture in each tube one of three values—positive (+) for invert sugar, negative (—) for invert sugar, or doubtful (±) according to the following standard:

Color of solution	Value
Same as or more blue than color on scale labeled "trace"	Negative (-)
Same as or more yellow than color on scale labeled "+"	Positive (+)
Between "trace" and "+" colors on scale	Doubtful (±)

Write down in order the values you have given the five dilutions, starting with the 1-and-12 dilution at the left.

Special Note.—If the first syrup you test proves positive in some dilutions and negative in others, you will quickly see the difference between a positive and a negative color reaction.

It is possible; however, that the syrup you test will give a positive or a negative test in all dilutions. If this happens and you are doubtful about your interpretation of the results, it will be helpful to have a solution that you know will give a positive test.

To prepare such a solution, add three drops of corn syrup to the 4-ounce glass containing the sample of the 1-and-60 dilution. Stir the corn syrup into the dilute syrup.

In a clean test tube place five drops of this solution. Add 10 drops of water, then one Clinitest tablet. After boiling has stopped add water until the test tube is two-thirds full

The color that develops will indicate a positive reaction.

Determining Invert Sugar Content of Syrup

To find the invert sugar content of the syrup you are testing, find the line in table 17 that contains the same combination of values for the five dilutions that you obtained in the color test.

As the table shows, the syrups that are most suitable for making into cream are those that are negative in all dilutions or positive in the first (1-and-12) dilution and negative in all the others.

Summary

- (1) Test the syrup for its invert sugar content before attempting to make maple cream.
- (2) Use the simple or shortcut test, page 113.
- (3) To check the color, positive or negative, use a test solution consisting of the 1- and 60- solution to which is added corn syrup. This will give a positive test.
- (4) Syrup containing more than 3 percent of invert sugar is unsuitable for creaming.

TABLE 17.—Key for interpreting results of color test for invert sugar content of five dilutions of maple sirup

[– indicates negative reaction; + indicates positive reaction; ± indicates doubtful reaction]

Reactions for 5 test dilutions					Invert-sugar content of sirup	Suitability of sirup for making into cream
12	20	32	40	60		
<i>Percent</i>						
—	—	—	—	—	Less than 2 -----	Suitable.
+	—	—	—	—	More than 2, less than 3 -----	Suitable.
+	±	—	—	—	More than 2, less than 4 -----	Suitable if sirup is heated 2 to 4 degrees higher than usual in cream-making.
+	+	—	—	—	More than 3, less than 4 -----	Not suitable.
+	+	±	—	—	More than 3, less than 5 -----	Not suitable.
+	+	+	—	—	More than 4, less than 5 -----	Not suitable.
+	+	+	±	—	More than 4, less than 6 -----	Not suitable.
+	+	+	+	—	More than 5, less than 6 -----	Not suitable.
+	+	+	+	±	More than 5, less than 7 -----	Not suitable.
+	+	+	+	+	Above 6, may be 7 or more -----	Not suitable.

Section 12

Regulations

- 12.1 United States Standards for Grades of Maple Sirup
- 12.2 NYS Circular 947 Syrup Grades
- 12.3 NYS Circular 951 Processing Facilities
- 12.4 Home Processors
- 12.5 Sales Tax and Maple Products What Are the Rules
- 12.6 Taxable and Exempt Foods and Beverages
- 12.7 Application to Register as a Sales Tax Vendor
- 12.8 NYS Food Labeling



United States
Department of
Agriculture

Agricultural
Marketing
Service

Fruit and
Vegetable
Division

Processed
Products
Branch

United States Standards for Grades of Maple Sirup

12.1

Effective date January 14, 1980

This is the second issue of the U.S. Standards for Grades of Maple Sirup. This issue was published in the **FEDERAL REGISTER** of December 14, 1979, to become effective January 14, 1980.

The previous issues of these standards were:

Maple Sirup for Reprocessing

First Issue:	Effective February 15, 1940
Amended:	Effective May 24, 1967

Table Sirup

First Issue:	Effective February 15, 1940
Amended:	Effective May 24, 1967

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 processed fruits and vegetables, 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 standards also serve as a basis for the inspection and grading of commodities by the Federal inspection service, the only activity authorized to approve the designation of U.S. grades as referenced in the standards, as provided under the Agricultural Marketing Act of 1946. This service, available as on-line (in-plant) or lot inspection and grading of all processed fruit and vegetable products, is offered to interested parties, upon application, on a fee-for-service basis. The verification of some specific recommendations, requirements, or tolerances contained in the standards can be accomplished only by the use of on-line inspection procedures. In all instances, a grade can be assigned based on final product factors or characteristics.

In addition to the U.S. grade standards, grading manuals or instructions for inspection of several processed fruits and vegetables are available upon request for a nominal fee. These manuals or instructions contain detailed interpretations of the grade standards and provide step-by-step procedures for grading the product.

Grade standards are issued by the Department after careful consideration of all data and views submitted, and the Department welcomes suggestions which might aid in improving the standards in future revisions. Comments may be submitted to, and copies of standards and grading manuals obtained from:

Chief, Processed Products Branch
Fruit and Vegetable Division, AMS
U.S. Department of Agriculture
P.O. Box 96456, Rm. 0709, So. Bldg.
Washington, D.C. 20090-6456

United States Standards for Grades of Maple Sirup

Section Page No.

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§52.5962 Grades. 2

§52.5963 Recommended Fill of Container. 3

§52.5964 Color. 3

§52.5965 Classification of Requirements. 3

§52.5966 Explanation of Terms. 4

§52.5967 Determining the Grade of a Lot. 5

§52.5968 Reserved. 5

Authority: Agricultural Marketing Act of 1946, Secs. 203, 205, 60 Stat. 1087, as amended, 1090, as amended (7 U.S.C. 1622, 1624).

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.

§52.5961 Product description.

(a) Maple sirup means maple sirup represented as defined in the 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 sirup shall be not less than 66 percent by weight (Brix).

(b) Federal inspection certificates shall limit **U.S. Grade B** maple sirup to a quality suitable for reprocessing only. **U.S. Grade B** maple sirup shall be considered unsuitable for consumer labeling.

§52.5962 Grades.

(a) U.S. Grade A is the quality of maple sirup that:

- (1)** Has good color;
- (2)** Has good flavor and odor;
- (3)** Is practically free from defects; and
- (4)** Is practically clear.
- (5)**

(b) U.S. Grade B for Reprocessing is the quality of maple sirup that:

- (1)** Has fairly good color;
- (2)** Has fairly good flavor and odor;
- (3)** Is fairly free from defects;
- (4)** Is fairly clear; and
- (5)** Is suitably designated or labeled as a reprocessing grade to qualify for Federal grading, inspection, or certification. Reprocessing grade maple sirup shall not be packaged in consumer size containers.

(c) Substandard is the quality of maple sirup that fails to meet the requirements for U.S. Grade B for Reprocessing.

§52.5963 Recommended Fill of Container.

The recommended fill of container is not incorporated in the grades of the product since

fill of container, as such, is not a factor of quality for the purpose of these grades. It is recommended that each container be filled with sirup as full as practicable and that the product occupy not less than 90 percent of the volume of the container.

§52.5964 Color.

(a) General. Color has reference to the color of maple sirup when examined by means of the USDA permanent glass color standards for maple sirup.

(b) Availability of color standards. The color standards referred to in this section are available only from the approved supplier under a license from the U.S. Department of Agriculture. Information regarding these color standards may be obtained by writing to:

Chief, Processed Products Branch
Fruit and Vegetable Division, AMS
U.S. Department of Agriculture
P.O. Box 96456, Rm. 0709, So. Bldg.
Washington, D.C. 20090-6456

§52.5965 Classification of Requirements.

(a) "A" classification.

(1) Good color means that the sirup color is bright and typical of maple sirup prepared from sound, properly gathered sap; and, in addition, meets the following spectral requirements:

(i) U.S. Grade A light amber is as light, or lighter, in color than the USDA Light Amber Glass Color Standard.

(ii) U.S. Grade A medium amber is darker in color than light amber, but is no darker than the USDA Medium Amber Glass Color Standard.

(iii) U.S. Grade A dark amber is darker in color than medium amber, but is no darker than the USDA Dark Amber Glass Color Standard.

(2) The sirup shall have a good maple flavor characteristic of the color; shall be clean; practically clear; practically free from damage; and shall be free from serious damage.

(b) "B" classification.

(1) **Fairly good color** means that the sirup color is darker in color than the USDA Dark Amber Glass Color Standard, but is not off-color for any reason.

(2) The sirup has a fairly good characteristic maple flavor; is fairly free from damage; is fairly clear; and is free from serious damage.

(c) Substandard classification. Maple sirup that fails to meet the requirements of paragraph (b) of this section shall not be graded above Substandard.

§52.5966 Explanation of Terms.

(a) Cloudiness means the presence, in suspension, of fine particles of mineral matter, such as malate of lime, **niter**, **sugar sand**, calcium malate, or other substances that detract from the clearness of the sirup.

(b) Clean means that the sirup shall be practically free from foreign material such as pieces of bark, soot, dust, or dirt.

(c) Damage means any defect that materially affects the appearance, edibility, or shipping quality of the sirup.

(d) Serious damage means any defect that seriously affects the edibility or market value of the sirup. Badly scorched sirup, buddy sirup, fermented sirup, or sirup that has any distasteful foreign flavor or disagreeable odor shall be considered as seriously damaged.

(e) Buddy flavor, buddiness is an unpleasant flavor characteristic of sirup made from sap collected from maple trees as they come out of dormancy.

(f) U.S. Department of Agriculture Color Standard means the official U.S. Department of Agriculture Permanent Glass Color Standards for Maple Sirup.

§52.5967 Determining the Grade of a Lot.

The grade of a lot of maple sirup covered by these standards is determined by the procedures set forth in the **Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Other**

Processed Food Products (7 CFR 52.1 through 52.83); Provided that:

(a) When certifying the color of a sample that has been officially drawn and which represents a specific lot of maple sirup, the lot shall be considered as being of one color if the number of color deviants does not exceed the acceptance number in the appropriate sampling plan. Any lot of maple sirup in which the number of color deviants exceeds the acceptance number shall be designated as a lot of **mixed color**.

(b) No deviants for **serious damage** shall be allowed in grades above Substandard.

§52.5968 Reserved.

Effective date: The United States Standards for Grades of Maple Sirup shall become effective January 14, 1980, and thereupon will supersede United States Standards for Grades of Table Maple Sirup and United States Standards for Grades of Maple Sirup for Reprocessing which have been in effect since May 24, 1967.

NOTE: This final rule has been reviewed under the USDA criteria established to implement Executive Order 12044, **Improving Government Regulations**. A determination has been made that this action shall not be classified **significant** under those criteria. A Final Impact Statement has been prepared and is available from:

Chief, Processed Products Branch
Fruit and Vegetable Division, AMS
U.S. Department of Agriculture
P.O. Box 96456, Rm. 0709, So. Bldg.
Washington, D.C. 20090-6456

Done at Washington, D.C., on: December 14, 1979
/s/

Donald L. Houston
Administrator
Food Safety and Quality Service



NEW YORK STATE
DEPARTMENT OF AGRICULTURE AND MARKETS
DIVISION OF FOOD SAFETY AND INSPECTION
10B AIRLINE DRIVE
ALBANY, NY 12235



12.2

CIRCULAR 947

Pursuant to the

MANUFACTURE, DISTRIBUTION AND SALE OF MAPLE SYRUP AND SUGAR

**Sections 160-u, 203 and 204
Of the Agriculture and Markets Law
Parts 175, 176, 276-1 and 276.4 of Title 1
Of the Official Compilation of Codes, Rules and
Regulations of the State of New York
Revised as of April 1996**

ARTICLE 13-D

NEW YORK STATE
DEPARTMENT OF AGRICULTURE AND MARKETS
DIVISION OF FOOD SAFETY AND INSPECTION
10B AIRLINE DRIVE
ALBANY, NY 12235

MANUFACTURE, DISTRIBUTION and SALE OF MAPLE SYRUP AND SUGAR

Section 160-u. Manufacture, distribution and sale of maple syrup and sugar

- (a) Definitions: (1) "Maple sap" means the sap or sweet water obtained by tapping the maple tree.
(2) "Maple syrup" means syrup made exclusively by the evaporation of pure maple sap.
(3) "Maple sugar" means sugar made exclusively by the evaporation of pure maple syrup.
(4) "Grade" shall mean the standards for maple syrup or maple sugar promulgated by the commissioner of Agriculture and Markets, as the official grades of maple syrup or maple sugar for the state of New York.
- (b) Every consumer package of maple syrup offered or exposed for sale shall be plainly marked as to the grade.
- (c) Advertising. Any person who uses roadside signs within the state or who uses publications printed or distributed within the state, to advertise maple syrup and who quotes a price therein, shall specify the grade of the syrup in a plain and conspicuous manner.
- (d) The commissioner of Agriculture and Markets shall promulgate, after public hearing, rules and regulations to carry out the provisions of this statute.

ARTICLE 17

ADULTERATION, PACKING AND BRANDING OF FOOD AND FOOD PRODUCTS

Section 203. Manufacture and sale of imitation maple sugar and syrup prohibited

1. No person shall manufacture for sale, keep for sale, or offer or expose for sale, any sugar in imitation or semblance of maple sugar which is not pure maple sugar, nor any syrup in imitation or semblance of maple syrup, which is not pure maple syrup, nor shall any person manufacture, offer or expose for sale any sugar as and for maple sugar which is not pure maple sugar, nor any syrup as and for maple syrup which is not pure maple syrup.
2. For the purpose of this article the term "maple sugar" shall be deemed to mean sugar made from pure maple sap or pure maple syrup, and the term "maple syrup" shall be deemed to mean syrup made from pure maple sap.

Section 204. Branding and labeling of maple sugar and syrup mixtures

No person shall manufacture, sell or expose for sale, any compound or mixture as and for sugar which shall be made up of maple sugar mixed with any other sugar or any other substance without branding or labeling the said sugar with a statement giving the ingredients of which it is made up. No person shall manufacture, sell, expose for sale or offer for sale any compound or mixture as syrup which shall be made up of maple syrup mixed with any other syrup or ingredient without branding or labeling said syrup with a statement giving the ingredients of which it is made up. This shall not be construed to apply to a syrup or syrups manufactured and sold for medicinal purposes only.

PART 175

RULES AND REGULATIONS FOR GRADING MAPLE PRODUCTS

Section

- 175.1 Definitions
- 175.2 Grades of maple syrup
- 175.3 Color of maple syrup
- 175.4 Classification of requirements for maple syrup
- 175.5 Determining the grade of a lot of maple syrup
- 175.6 Recommended fill of container
- 175.7 Compliance with other legal requirements

Section 175.1 Definitions.

As used in this Subchapter:

- (a) Maple syrup means syrup made exclusively by the evaporation of pure maple sap. Alternatively, the word syrup may be spelled sirup. The solids content of the finished maple syrup shall be not less than 66 percent by weight (Brix) at 68 degrees fahrenheit.
- (b) Maple sugar means sugar made exclusively by the evaporation of pure maple syrup or pure maple sap.
- (c) Cloudiness means the presence, in suspension, of fine particles of mineral matter, such as malate of lime, "niter", "sugar sand", calcium malate, or other substances that detract from the clearness of the syrup.
- (d) Clean means that the syrup shall be practically free from foreign material such as pieces of bark, soot, dust or dirt.
- (e) Damage means any defect that materially affects the appearance, edibility or shipping quality of the syrup or sugar.

(f) Serious damage means any defect that seriously affects the edibility or market value of the syrup. Badly scorched syrup, buddy syrup, fermented syrup, or syrup that has any distasteful foreign flavor or disagreeable odor shall be considered as seriously damaged.

(g) Buddy flavor or buddiness is an unpleasant flavor characteristic of syrup or sugar made from sap collected from maple trees as they come out of dormancy.

(h) U.S. Department of Agriculture Color Standards means the official U.S. Department of Agriculture (USDA) permanent glass color standards for maple syrup.

Section 175.2 Grades of maple syrup.

(a) Grade A is the quality of maple syrup that is suitable for table use and:

- (1) has good color;
- (2) has good flavor and odor;
- (3) is practically free from defects; and
- (4) is practically clear.

(b) Grade B for reprocessing is the quality of maple syrup that:

- (1) has fairly good color;
- (2) has fairly good flavor and odor;
- (3) is fairly free from defects;
- (4) is fairly clear; and
- (5) is suitably designated or labeled as a reprocessing grade in such manner as to qualify for Federal grading, inspection, or certification. Reprocessing grade maple syrup shall not be packaged in consumer-size containers and shall be considered unsuitable for consumer labeling.

(c) Extra dark for cooking is the quality of maple syrup that:

- (1) has fairly good color;
- (2) has fairly good flavor and odor;
- (3) is fairly free from defects;
- (4) is fairly clear;

(5) is suitably designated or labeled as "extra dark for cooking" in such a manner as to qualify for Federal grading, inspection, or certification. "Extra dark for cooking" maple syrup may be packaged in consumer size containers of one pint or larger. The words "extra dark for cooking" shall appear prominently and conspicuously on the container in letters that shall not be less than one-half the size of the words "maple syrup" and not less than a minimum of three-sixteenths of an inch in height.

(d) Substandard is the quality of maple syrup that fails to meet the requirements for "Grade B for reprocessing" or "Extra Dark for Cooking".

(e) Grade nomenclature may be prefixed with the name of the state of manufacture or the letters U.S. or words United States, where applicable.

Section 175.3 Color of maple syrup.

(a) General. Color has reference to the color of maple syrup when examined by means of the USDA permanent glass color standards for maple syrup.

b) Availability of color standards. The color standards referred to in this section are available only from the approved supplier under a license from the U.S. Department of Agriculture.

Section 175.4 Classification of requirements for maple syrup.

(a) "A" classification (1) Good color means that the syrup color is bright and typical of maple syrup prepared from sound, properly gathered sap; and, in addition, meets the following spectral requirements:

(i) Grade A light amber is as light, or lighter, in color than the USDA light amber glass color standard.

(ii) Grade A medium amber is darker in color than light amber, but is no darker than the USDA medium amber glass color standard.

(iii) Grade A dark amber is darker in color than medium amber, but is no darker than the USDA dark amber glass color standard.

(2) The syrup shall have a good maple flavor characteristic of the color, shall be clean, practically clear, practically free from damage, and shall be free from serious damage.

(b) "B" or "extra dark for cooking" classification. (1) Fairly good color means that the syrup color is darker in color than the USDA dark amber glass color standard, but is not off- color for any reason.

(2) The syrup shall have fairly good characteristic maple flavor, shall be fairly free from damage, fairly clear, and free from serious damage.

(c) Substandard classification. Maple syrup that fails to meet the requirements of subdivision (a) or (b) of this section shall not be graded above substandard.

Section 175.5 Determining the grade of a lot of maple syrup.

(a) The grade of a lot of maple syrup covered by these standards is determined by the procedures set forth in the Federal regulations governing inspection and certification of processed fruits and vegetables, processed products thereof, and certain other processed food products (7 CFR 2852.1 through 2852.83); provided that when certifying the color of a sample that has been officially drawn and which represents a specific lot of maple syrup, the lot shall be considered as being of one color if the number of color deviants does not exceed the acceptance number in the appropriate sampling plan. Any lot of maple syrup in which the number of color deviants exceeds the acceptance number shall be designated as a lot of mixed color.

(b) No deviants for serious damage shall be allowed in grades above substandard.

Section 175.6 Recommended fill of container.

Since both Federal and New York State statutes provide that food shall be deemed to be misbranded if its container is so filled as to be misleading, it is recommended that each container of maple syrup be filled as full as practicable, and that the product occupy not less than 90 percent of the volume of the container.

Section 175.7 Compliance with other legal requirements.

Compliance with the provisions of the rules and regulations in this Subchapter shall not excuse failure to comply with the provisions of the Federal Food, Drug and Cosmetic Act, or with other applicable New York State laws and regulations.

PART 176 STANDARDS OF GRADING MAPLE SUGAR

Section

176.1 Purity requirements

176.2 Labeling

176.3 Grade requirements

Section 176.1 Purity requirements.

If maple sugar is labeled as to grade, it shall possess a characteristic maple flavor, be free of a taste of fermentation, be clean, and free from damage caused by scorching, buddiness, any objectionable foreign flavor or odor or other means.

Section 176.2 Labeling.

If maple sugar is labeled as to grade as set forth in this Part, the grade shall conform to the standards set forth in this Part.

Section 176.3 Grade requirements.

(a) Light amber maple sugar shall consist of maple sugar which shall not be darker in color than light amber, as represented by the color standards of the United States Department of Agriculture.

(b) Medium amber maple sugar shall consist of maple sugar which shall be darker in color than light amber but not darker than medium amber, as represented by the color standards of the United States Department of Agriculture.

(c) Dark amber maple sugar shall consist of maple sugar which shall be darker in color than medium amber but not darker than dark amber, as represented by the color standards of the United States Department of Agriculture.

PART 276

FOOD PROCESSING ESTABLISHMENTS

Subject to Regulation Under Article 20-C of the Agriculture and Markets Law

Section 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 261 of this Title unless exempted by said article 20-C or by this Part.

Section 276.4 Exemption.

(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 substance, shall be exempt from the licensing requirements of this Subchapter, provided that the following conditions are met:

(1) Such establishments are maintained in a sanitary condition and manner, and to this end the following requirements shall be complied with:

(i) 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.

(ii) 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.

(iii) 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.

- (iv) 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 the product shall be maintained in good repair to assure sanitary conditions in the operation.
 - (vi) All finished product containers must be clean, sanitary and properly labeled in compliance with the requirements of Parts 175, 176 and 259 of this Title.
- (d) 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.
- (e) The granting of an exemption pursuant to this section will not except an operation from any inspections the commissioner may deem necessary to assure compliance with this section.



NEW YORK STATE
DEPARTMENT OF AGRICULTURE AND MARKETS
DIVISION OF FOOD SAFETY AND INSPECTION
10B AIRLINE DRIVE
ALBANY, NY 12235

12.3

CIRCULAR 951

Pursuant to the

LICENSING OF FOOD PROCESSING ESTABLISHMENTS

Article 20-C of the Agriculture and Markets Law
Section 251-z-1 to 251-z-12
Revised as of April 1, 2002

ARTICLE 20-C LICENSING OF FOOD PROCESSING ESTABLISHMENTS

Section

- 251-z-1. Declaration of policy and purpose.**
- 251-z-2. Definitions.**
- 251-z-3. Licenses; fees.**
- 251-z-4 Exemptions.**
- 251-a-5. Granting, suspending or revoking licenses.**
- 251-z-6. Review.**
- 251-z-7. Records to be kept by licensee.**
- 251-z-8. Power of commissioner to investigate.**
- 251-z-9. Rules and regulations.**
- 251-z-10. Penalties.**
- 251-z-11. Remedies.**
- 251-z-12. Severability.**

Section 251-z-1. Declaration of policy and purpose

The general purposes of this article are to assure that foods processed in New York state and offered for sale for human consumption are pure and wholesome and that the food processing establishments, in which such foods are manufactured or processed, conform to proper operating and sanitary standards.

Section 251-z-2. Definitions

1. The terms "food" and "food products" shall include all articles of food, drink, confectionery or condiment, whether simple, mixed or compound, used or intended for use by man and shall also include all substances or ingredients to be added to food for any purpose.
2. "Person" shall mean any individual, corporation, partnership, association or other organized group of persons, or any business entity by whatever name designated and whether or not incorporated.
3. The term "food processing establishment" means any place which receives food or food products for the purpose of processing or otherwise adding to the value of the product for commercial sale. It includes, but is not limited to, bakeries, processing plants, beverage plants and food manufactories. However, the term does not include: those establishments that process and manufacture food or food products that are sold exclusively at retail for consumption on the premises; those operations which cut meat and sell such meat at retail on the premises; bottled and bulk water facilities; those food processing establishments which are covered by articles four, four-a, five-a, five-b, five-c, five-d, seventeen-b, nineteen, twenty-b, and twenty-one of this chapter; service food establishments, including vending machine commissaries, under permit and inspection by the state department of health or by a local health agency which maintains a program certified and approved by the state commissioner of health; establishments under federal meat, poultry or egg product inspection; or establishments engaged solely in the harvesting, storage, or distribution of one or more raw agricultural commodities which are ordinarily cleaned, prepared, treated or otherwise processed before being marketed to the consuming public.

4. The term "processing" means processing foods in any manner, such as by manufacturing, canning, preserving, freezing, drying, dehydrating, juicing, pickling, baking, brining, bottling, packing, repacking, pressing, waxing, heating or cooking, or otherwise treating food in such a way as to create a risk that it may become adulterated if improperly handled.

Section 251-z-3. Licenses; fees

No person shall maintain or operate a food processing establishment unless licensed biennially by the commissioner. Application for a license to operate a food processing establishment shall be made, upon a form prescribed by the commissioner, on or before the fifteenth of the month preceding the applicable license period as herein prescribed. The beginning of the license period for an applicant shall be determined by the alphabetical order of an individual applicant's surname or the first word in the name of any other legal entity. The license period shall begin February fifteenth for applicants A through D, May fifteenth for applicants E through K, August fifteenth for applicants L through R, November fifteenth for applicants S through Z. For the license periods beginning September fifteenth, nineteen hundred ninety-eight, the commissioner is authorized to stagger license renewals.

The applicant shall furnish evidence of his or her good character, experience and competency, that the establishment has adequate facilities and equipment for the business to be conducted, that the establishment is such that the cleanliness of the premises can be maintained and that the product produced therein will not become adulterated. The commissioner, if so satisfied, shall issue to the applicant, upon payment of the license fee of seventy dollars, a license to operate the food processing establishment described in the application for two years from the applicable license commencement period set forth hereinabove. The commissioner shall prorate the license fee for any person applying for a new license after the commencement of the license period for such applicant's alphabetical group.

Notwithstanding any other provision of law to the contrary, the commissioner is hereby authorized and directed to deposit all money received pursuant to this section in an account within the miscellaneous special revenue fund.

Section 251-z-4. Exemptions

In addition to the exemptions specified in subdivision three of section two hundred fifty-one-z-two, the commissioner may, if he determines that the protection of the consumers of the state as a whole will not be impaired by such action, provide by regulation for exemption from licensing of small food processing establishments when he finds that such exemptions would avoid unnecessary regulation and assist in the administration of this article without impairing its purposes. Regulations defining such exemptions may classify exempted establishments with respect to the volume and types of food handled, the types of processing involved, or with respect to any other factor or combination thereof which bear a reasonable relation to the purposes of this article. Such exemptions may be conditioned upon requirements relating to sanitation, record keeping and reporting as the commissioner may require.

Section 251-z-5. Granting, suspending or revoking licenses

The commissioner may decline to grant a new license, may decline to renew a license, may suspend or revoke a license already granted after due notice and opportunity for hearing whenever he finds that:

- (1) Any statement contained in an application for license is or was false or misleading;
- (2) The establishment does not have facilities or equipment sufficient to maintain adequate sanitation for the activities conducted;
- (3) The establishment is not maintained in a clean and sanitary condition or is not operated in a sanitary or proper manner;
- (4) The maintenance and operation of the establishment is such that the product produced therein is or may be adulterated;
- (5) The establishment has failed or refused to produce any records or provide any information demanded by the commissioner reasonably related to the administration and enforcement of this article;
- (6) The applicant or licensee, or an officer, director, partner, holder of ten per cent of the voting stock, or any other person exercising any position of management or control has failed to comply with any of the provisions of this chapter or rules and regulations promulgated pursuant thereto; or
- (7) Any person including the applicant or licensee, or an officer, director, partner or any stockholder, exercising any position of management or control has been convicted of a felony in any court of the United States or any state or territory.

Section 251-z-6. Review

The action of the commissioner in refusing to grant or reissue a license, or in suspending or revoking a license, shall be subject to review in the manner provided by article seventy-eight of the civil practice law and rules. The decision of the commissioner shall be final unless within thirty days from the date of service thereof on the applicant or licensee, a proceeding is instituted to review such action.

Section 251-z-7. Records to be kept by licensee

Every operator of a food processing establishment shall keep, in such form as the commissioner shall approve, such records as may be required by the commissioner pursuant to rules and regulations promulgated pursuant to this article.

Section 251-z-8. Power of commissioner to investigate

The commissioner and his duly authorized representatives in the performance of his licensing and inspection duties under this article shall have access to and may enter at all reasonable hours all places where food or food products are being manufactured, packaged, processed or stored, or where food or food products are being bought, sold or handled.

Section 251-z-9. Rules and regulations

The commissioner is hereby authorized, after public hearing, to adopt, amend, promulgate and issue rules and regulations, including, but not limited to regulations prescribing good manufacturing practices and requiring records relating to processing data and food distribution patterns, and such other regulations as he may deem necessary to supplement and give full force and effect to the provisions of this article. A proposal to adopt applicable federal regulations pursuant to the federal food, drug and cosmetic act, relating to commercially processed foods for human consumption may be adopted without public hearing.

Section 251-z-10. Penalties

No operator of a food processing establishment shall fail to conform to any requirement of or violate any provision of this article or of the rules and regulations promulgated thereunder. Each day's operation of a food processing establishment without a license shall constitute a separate violation of this article, punishable by the penalties described in article three of this chapter, in addition to the remedies provided in this article.

Section 251-z-11. Remedies

The commissioner may institute such action at law or in equity as may be necessary to enforce compliance with any provision of this article or of any rule or regulation applicable thereto or promulgated thereunder. In addition to any other remedy prescribed in article three of this chapter, or otherwise, he may apply for relief by injunction without alleging or proving that an adequate remedy at law does not exist. Such application may be made to the supreme court in any district or county, as provided by the civil practice law and rules, or to the supreme court in the third judicial district.

Section 251-z-12. Severability

If any provision of this article or the application thereof to any person or circumstances is held invalid, such invalidity shall not affect other provisions or applications of the article which can be given effect without the invalid provision or application, and to this end the provisions of this article are declared to be severable.

NYS DEPARTMENT OF AGRICULTURE AND MARKETS
DIVISION OF FOOD SAFETY AND INSPECTION
10B AIRLINE DRIVE, ALBANY, NY 12235
FOOD PROCESSING ESTABLISHMENT LICENSE APPLICATION
License Fee \$200.00

Office Use Only

Est. No. _____

Receipt No. _____

Validation No. _____

INSTRUCTIONS

Read and complete both sides of this application.
Prepare a separate application for each location.

Include license fee by check or money order payable to
"Department of Agriculture and Markets".

Section (1) enter and explain any changes in names or
processing facility address.

Sections (2) through (9) must be completed.

Section (9) an original signature of owner or corporate
officer is required.

(1) Individual Owner Name, Partnership (name all partners), or Full Name of Corporation.				County	
Trade Name				Business Telephone Number ()	
Street		City		State	Zip
(2) Federal ID Number		Social Security Number			
Reason for not providing Federal ID No. and/or Social Security No. **					
(3) Mailing address if different from above Attention:		Street	City	State	Zip

(4) IF APPLICANT IS AN INDIVIDUAL, PARTNERSHIP, or LLP THE FOLLOWING MUST BE COMPLETED

Name of Owner Partnership, Name each Partner	Residence - Home Address (Street & No., City, State, Zip)	Date of Birth

(5) IF APPLICANT IS A CORPORATION, or LLC THE FOLLOWING MUST BE COMPLETED

Full Name of Officers	Residence - Home Address (Street & No., City, State, Zip)	Date Took Office	Date of Birth
President			
Vice Pres.			
Secretary			
Treasurer			
Directors (attach list if necessary)			

- (5a.) Principal Office Address ? _____
- (5b.) In what state incorporated? _____ (5c.) Date of Incorporation _____
- (5d.) Foreign or out of state corporation: Date of filing in New York State? _____
- (5e.) Name and address of a New York State resident upon whom service of process may be made? _____

(OVER)

APPLICANTS MUST PROVIDE ALL REQUESTED INFORMATION**

SHOULD YOU FAIL TO DO SO, YOUR APPLICATION MAY NOT BE PROCESSED. IF YOU HAVE QUESTIONS CONCERNING THE INFORMATION REQUESTED, CALL (518) 457-1215 OR WRITE TO THE ADDRESS ON THE FRONT OF THIS FORM.

(6) Has the applicant or any partner, officer, director or stockholder been convicted of, or pleaded guilty to, a felony in any court in the United States? Yes ☐ No ☐ If yes, state the full name of the person _____

Name of Court and its location? _____

Date of Conviction? _____ and attach a "Certificate of Conviction" if not provided on a prior application. If a "Certificate of Conviction" has been provided and a license issued on a prior application, check this box. ☐

(7) 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., repack ready-to-eat foods or ice. Any wholesale food production or packaging.

(8) 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 _____ ☐ Self Insured ☐ Exempt from WCI
Name of Insurance Provider

The undersigned applies for a license to conduct the food processing operations listed above, at this location only, pursuant to Article 20-C of the Agriculture and Markets Law of the State of New York and, in support of this application, makes the above statements and agrees to comply with the requirements of Article 20-C.

The applicant represents that adequate physical facilities, equipment, sanitary controls, records and practices exist to maintain the establishment in a clean and sanitary condition.

The cleaning, maintenance and operation of the establishment is such that products produced and handled therein will not be adulterated.

The issuance of a license is based upon continued compliance with all requirements associated with the processing operations performed at the establishment.

New or additional food processing activities are to be reported to this Department for approval prior to the start of the processing operation.

Applicant consents to free entry and will permit free access to the licensed premises, buildings and offices to the Commissioner, the Commissioner's agents and inspectors in pursuance of the Commissioner's duty to supervise and regulate the production, storage, sale and use of articles subject to the Commissioner's jurisdiction.

I understand the statements made in this application will be accepted, for all purposes, as the equivalent of an Affidavit.

Any false statements made herein, 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.

(9) ORIGINAL SIGNATURE OF OWNER, PARTNER OR CORPORATE OFFICER

TITLE

DATE

AUTHORIZATION AND PURPOSE

* Disclosure of your federal social security and 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.



12.4 Home Processors

Section 276.3 of the New York State Agriculture and Markets regulations states in part that **"Home processed food . . . shall mean any food processed in a private home or residence using only the ordinary kitchen facilities of that home . . . but shall exclude potentially hazardous food..."**

NOTE: Commercial equipment is not considered ordinary kitchen facilities.

Processors of home processed foods who sell or offer for sale such foods may be exempted from the licensing requirements of Article 20-C, provided that the following conditions are met:

1. All finished product containers are clean, sanitary and properly labeled.
2. All home processed foods produced under this exemption are neither adulterated nor misbranded.
3. Glass containers for jams, jellies, marmalades and similar products are provided with suitable rigid metal covers.

In order to protect public health and to minimize the potential of food product adulteration, this exemption is restricted to the following non-potentially hazardous home processed foods.

1. Bakery products, i.e., bread, rolls, cookies, cakes, brownies, fudge, and double-crust fruit pies for wholesale marketing or retail agricultural venues such as farms, farm stands, farmers markets, green markets, craft fairs and flea markets.
2. Traditional fruit jams, jellies, and marmalades
3. Candy (excluding chocolate)
4. Spices or herbs
5. Snack items such as popcorn, caramel corn and peanut brittle

Internet sales are not included in this exemption. Home processors whose residences contain separate segregated facilities for food processing, while not qualifying for a home processor exemption, may apply for licensing under Article 20-C.

NOTE: In any event, all operators must consult with local zoning officials for approval before commencing any food processing operations.

The exemption relates only to Article 20-C licensing. The exempt firm will be subject to inspection by the Department of Agriculture and Markets. For more detailed information, please contact the nearest regional office.

REGIONAL OFFICES

ALBANY	SYRACUSE	ROCHESTER	BUFFALO	NEW YORK CITY
(518) 457-5459	(315) 487-0852	(585) 427-2273	(716) 847-3185	(718) 722-2876

12.5 Sales Tax and Maple Products What Are the Rules

Steve Childs – Cornell Cooperative Extension Maple Specialist

Are all pure maple products sales tax exempt? Does it matter how or where it is sold? When applying to sell at a craft show you are likely to be told you have to have a sales tax number, is that true? What are the rules and where does a maple producer go to find out?

The primary source of sales tax information for maple producers is the New York State Department of Taxation and Finance publication 880, Taxable and Exempt Foods and Beverages Sold at Retail Food Markets and Similar Establishments. The 880 publication states: “The Tax Law exempts from sales taxes, food, food products, dietary foods, health supplements and certain beverages sold for human consumption, when sold in the same form and condition, quantities and packaging as is commonly used by retail food stores or similar establishments such as bakeries or produce stands. This exemption does not apply to the sale of candy and confections; nor does it apply to prepared meals or any food or beverages sold for on-premises consumption, even when sold by a retail food store.” For me that quote created as many questions about the sales taxability of maple products as it answered. Questions like, when does a maple product become a confection or candy, and what defines a product for on site consumption?

Exempt Foods and Beverages

Bakery products
Chocolate (for baking)
Cocoa
Coffee
Condiments
Cookies
Dressings
Flavoring preparations

Frozen desserts

Ice Cream (prepackaged)
Marshmallows (all sizes)
Nuts and nut products!
Oils (cooking, salad)
Peanuts *
Popcorn *
Pretzels *
Sauces
Seasonings

* Provided they are not candy- or sugar-coated or sold heated.

** Sugar-, chocolate- or candy-coated nuts, raisins, malted milk balls and similar products.

Candy and confectionery
Caramels
Carbonated beverages
Chocolate (candy)
Coated candies **

Dietetic candy
French burnt peanuts
Fudges
Maple sugar candy

Lets start with the simple conclusions first. Maple syrup, sugar, cream, mustard, salad dressings, ice cream, cookies, seasonings and maple marshmallows are not taxable unless sold for on site consumption. All these fall into the various products listed under exempt foods. Taxable maple products would include maple coated nuts, maple fudge, maple cotton candy and any maple candy or confection that includes ingredients other than pure sugar, pure maple sugar sold as candy, any maple related breakfasts or meals, any item sold that is not in a sealed consumer package for on site consumption such as maple ice cones or maple cotton.

Maple products open to interpretation would include items that are 100% sugar but not sold, labeled or identified as candy, such as maple cotton, maple suckers and molded sugars. The 880 list specifically records maple sugar candy as taxable, yet products made of 100% sugar, we assume, qualify as sugar which is exempt. My advice here would be to collect the sales tax and use the candy label to enhance your marketing. A well marked candy shelf in your display would likely be less confusing and much more attractive to the public than other names often given these products. This could also eliminate the risk of a confrontation with a sales tax inspector or auditor whose interpretation differed from yours.

If you choose to market only exempt products what are the rules? Tax publication 750 provides this information. A farmer is not required to register as a vendor for sales tax purposes if the only sales the farmer makes are sales of food and food products that are exempt from tax. If, however, a farmer sells taxable tangible personal property such as plants, shrubs, trees, homemade crafts, or items such as candy and other confections, or sells food or drink for consumption on the premises where sold, then the farmer must register as a vendor for sales tax purposes and collect sales tax. When making purchases of maple equipment and supplies the unregistered farm must provide the seller with Form-125 to avoid paying sales tax on these items. This form does not require a tax number.

Since many maple producers have traditionally been farmers who deal strictly with sales tax exempt products most have not needed to obtain a tax number. Many prefer to avoid getting involved with sales tax collection. Yet the vast majority of retail businesses deal with sales tax everyday and though it involves added record keeping it is a common and workable system. Generally it is worth the effort to be able to market taxable value added and maple related items.

What does a marketer need to do to collect sales tax? NYS Tax publication 20 gives these instructions. For your business to be registered as a vendor, it must obtain a Certificate of Authority from the Tax Department. This certificate gives your business the authority to collect the required sales tax, and to issue appropriate sales tax exemption documents, including resale certificates used for purchasing inventory. To obtain a Certificate of Authority, you must complete Form DTF-17, Application for Registration as a Sales Tax Vendor, and send it to the address listed in the instructions, at least 20 days before you begin conducting taxable business. According to NYS tax publication 750, if you engage in sales taxable business without having obtained a valid Certificate of Authority, you will be subject to a penalty. The maximum penalty for engaging in business without obtaining a valid Certificate of Authority is \$10,000, imposed at the rate of up to \$500 for the first day business is conducted without having obtained a valid Certificate of Authority, plus up to \$200 per day for each day thereafter.

Other expectations of a business that collects sales tax include keeping sales records You must keep

records of every sale, the amount paid, and the sales tax that is due, if any. If you give a written receipt or other evidence of the sale to the purchaser, you must retain a copy of the receipt or other evidence. Otherwise, you must keep a daily record of all cash and credit sales in a day-book or similar journal. When you have a sales tax number, if you wholesale product to a business exempt from sales tax, the purchaser must give you a properly completed exemption certificate ST-120. You must keep your records for a minimum of three years. You must make the records available to the Tax Department upon request.

One other point of interest relates to how you may list products for sale. This is outlined in NYS tax publication 34. Where no written receipt is given to the customer at the time of the sale, the unit price method is allowed for sales. The unit price is the total price charged, including the sales tax. The customer must be made aware that the sales tax is included in the selling price of such sales. The vendor must visibly display a placard or sign stating that the selling price of all taxable items includes sales tax. In addition, the vendor must distinguish between taxable and nontaxable items offered for sale. This may be done by such methods such as attaching labels to merchandise. When a vendor gives the customer a sales slip, or receipt, the sales tax must be separately shown. If the tax is not separately stated, the entire amount charged is considered the sales price of the property sold and is subject to tax.

Sales tax issues can be confusing. Make sure you have the best information available. Sales tax publications are available at: http://www.tax.state.ny.us/pubs_and_bulls/publications/sales_pubs.htm

Forms most relevant to maple producers are also available at the Cornell Maple Webpage at: <http://maple.dnr.cornell.edu/pubs/index.htm>

12.7 Taxable and Exempt Foods and Beverages Sold at Retail Food Markets and Similar Establishments

The Tax Law exempts from sales and use taxes, food, food products, dietary foods, health supplements and certain beverages (liquid, frozen or solid) sold for human consumption, when sold in the same form and condition, quantities and packaging as is commonly used by **retail food stores** or similar establishments such as bakeries or produce stands. (See page 2 for information regarding eligible food purchases made with food stamps.)

This exemption does not apply to the sale of candy and confections; alcoholic beverages; soft drinks, fruit drinks**, sodas or beverages such as are ordinarily dispensed at soda fountains; nor does it apply to heated or prepared meals (hot or cold sandwiches, self-service salad bars, etc.); or any food or beverages sold for on-premises consumption, even when sold by a retail food store.

Note: Since restaurants, taverns or similar establishments generally sell only prepared meals and beverages, they do not qualify for the exemption stated previously and must therefore collect sales tax on their sales. However, if the establishments provide both restaurant meals and food or beverages that are ordinarily sold by food markets (e.g., bakeries, delicatessens, etc.) they do not have to collect sales tax on the exempt food or beverages sold for off premises consumption. Vendors in this position must keep accurate records of the sales of food or beverages that qualify for exemption. **See note** under food stamp purchases.

Listed below are some examples of foods and beverages that would be taxable or exempt when sold at retail food markets and similar establishments. Any brand name product shown in *italics* is included as an example and is not to be construed as an endorsement of the product. This list is intended to be used as a guide for cashiers in the collection of sales tax. Questions about items not included should be referred to the store manager or to the Taxpayer Assistance Bureau.

Exempt Foods and Beverages

Artificial sweeteners	Grain products	Poultry and poultry products
Baby food	Granola Bars	Preservatives
Bakery products	Gravies	Pretzels†
Baking products	Health Bars	<i>Quik</i>
Cereals	Health supplements	Relishes
<i>Chicory</i>	Herbs	Sauces
Chocolate (for baking)	Ice Cream (prepackaged)	Seafoods
<i>Clamato Juice Cocktail</i>	Iced Tea (frozen or canned)	Seasonings
Cocoa	Iced tea mix	<i>Slim Fast</i>
Coffee	Instant breakfast mix	Spices
Coffee creamers	Jelling agents	Start (for cooking)
Condiments	Leavening agents	<i>Start</i>
Cookies	Liquid diet food	Sugar
Diet substitutes	Marshmallow fluff	Sugar substitutes
Diet supplements	Marshmallows (all sizes)	Syrups
Dressings	Meats and meat products	<i>Tang</i>
Eggs and egg products	Milk and milk products	Tea
Fats	Nonstick cooking sprays	<i>V-8 Juice</i>
Flavoring preparations	Nuts and nut products†	Vegetable juices
Food colors	Oils (cooking, salad)	Vegetable and vegetable products
Frozen desserts	<i>Ovaltine</i>	Vitamins
Fruit juices*	Peanuts†	
Fruit rollups	Popcorn†	
	Potato chips	

Taxable Foods and Beverages

<i>Awake</i>	Cocktail mixes	<i>Kool Aid</i>
Beer	Collins mixer	Lemonade
Bottled water	Cranberry juice cocktail	Licorice
Candy and confectionery	Dietetic candy	Maple sugar candy
Candied apples	French burnt peanuts	<i>Orange crush</i>
Caramels	Fruit drinks**	Pet food and supplies
Carbonated beverages	Fudges	Soft drinks
Carbonated beverages (dietetic)	<i>Gatorade</i>	Soft drinks (dietetic)
Chewing gum	<i>Hi-C</i>	Vichy water
Chocolate (candy)	Ice cubes	<i>Yoo Hoo</i> (assorted flavored soda)
Coated candies††	<i>Jordan Almonds</i>	

* Containing at least 70% natural fruit juice.

† Provided they are not candy- or sugar-coated or sold heated.

** Containing less than 70% natural fruit juice — drinks, ades, punches, fruit nectars.

†† Sugar-, chocolate- or candy-coated nuts, raisins, malted milk balls and similar products.

12.5 Application for Registration as a Sales Tax Vendor

Please print or type

1 Type of certificate you are applying for
(You must check one box; see instructions): Regular Temporary Show Entertainment

2 Legal name of vendor

3 Trade name or DBA (if different from item 2)

4 Federal employer identification number

5 Address of business location (show/entertainment or temporary vendors use home address)

6 Business telephone number (include area code) ()

7 Date you will begin business in New York State (see instructions)

8 Temporary vendors: Enter the date you will end business in New York

9 Mailing address, if different from business address on line 5

10 Type of organization: Individual (sole proprietor) Partnership Trust Governmental Exempt organization Corporation Limited Liability Partnership Limited Liability Company Other (specify)

11 Reason for applying: Started new business Purchased existing business Adding a new location Change in organization Other (specify)

12 Regular vendors: Will you operate more than one place of business?

Yes (check appropriate box below) No

A Separate sales tax return will be filed for each business location.

B One sales tax return will be filed for all business locations (complete Form DTF-17-ATT and attach it to this application).

13 List all owners/officers. Attach a separate sheet if necessary. All applicants must complete this section.

Name	Title	Social security number	
Home address	City	State	ZIP code Telephone number ()

Name	Title	Social security number	
Home address	City	State	ZIP code Telephone number ()

Name	Title	Social security number	
Home address	City	State	ZIP code Telephone number ()

14 If your business currently files New York State returns for the following taxes, check the box for the appropriate tax type and enter the identification number used on the return:

Corporation tax ID # Other (explain) ID #

Withholding tax ID #

15 If you have ever registered as a sales tax vendor with New York State, enter the information shown on the last sales tax return you filed:

Name Identification number

16 Do you expect to collect any sales or use tax or pay any sales or use tax directly to the Department of Taxation and Finance? Yes No

17 Describe your major business activity and enter your six-digit NAICS code:

Describe your business activity in detail (attach a separate sheet if necessary)	North American Industry Classification System (NAICS)

18 Are you a sidewalk vendor? Yes No

If Yes, do you sell food? Yes No

19 Do you participate solely in flea markets, antique shows, or other "shows"? Yes No

20 Do you intend to make retail sales of cigarettes or other tobacco products? Yes No

21 If you withhold or will withhold New York State tax from employees, do you need withholding tax forms or information? Yes No

22 Do you intend to supply two-way wireless communication services to New York State customers? Yes No

23 Do you intend to sell new tires in New York State? Yes No

24 Have you been notified that you owe any New York State tax? Yes ☐ No ☐

Type of tax	Amount due	Assessment number (if any)	Assessment date	Assessment currently being protested? Yes <input type="checkbox"/> No <input type="checkbox"/>
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25 Do any responsible officers, directors, partners, or employees owe New York State or local sales and use taxes on your behalf, on behalf of another person, or as a vendor of property or services? Yes ☐ No ☐

Individual's name	Street address	City	State	ZIP code
Social security number	Amount due	Assessment number (if any)	Assessment date	Assessment currently being protested? Yes <input type="checkbox"/> No <input type="checkbox"/>

26 Have you been convicted of a crime under the Tax Law during the past year? Yes ☐ No ☐

Date of conviction	Court of conviction	Disposition (<i>fine, imprisonment, probation, etc.</i>)
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27 During the past year, has any responsible officer, director, partner, or employee of the applicant been convicted of a crime under the Tax Law? Yes ☐ No ☐

Individual's name	Street address	City	State	ZIP code
Social security number	Date of conviction	Court of conviction	Disposition (<i>fine, imprisonment, probation, etc.</i>)	

28 If previously registered as a New York State sales tax vendor, was your *Certificate of Authority* revoked or suspended during that past year? No ☐ Yes ☐ If Yes, please indicate why _____

Questions 29, 30, and 31 apply to corporations only.

29 If any shareholder owns more than half of the shares of voting stock of the applicant, has this shareholder ever owned more than half of the shares of voting stock of another corporation? No ☐ Yes ☐ If Yes, complete questions 30 and 31.

30 Did this shareholder own these shares of another corporation when the corporation had a tax liability that remains unpaid? Yes ☐ No ☐

Shareholder's name	Corporation name	Federal identification number
Street address	City	State ZIP code
Type of tax	Amount due	Assessment number (<i>if any</i>)
Assessment date	Assessment currently being protested? Yes <input type="checkbox"/> No <input type="checkbox"/>	

31 Did this shareholder own these shares of another corporation at a time during the past year when the corporation was convicted of a crime under the Tax Law? Yes ☐ No ☐

Corporation name	Federal identification number
Street address	City State ZIP code
Date of conviction	Court of conviction
Disposition (<i>fine, imprisonment, probation, etc.</i>)	

I certify that the information in this application is true and correct. Willfully filing a false application is a misdemeanor punishable under the Tax Law.

Signature	Title	Telephone number	Date
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☐ Check this box if you want your sales tax returns mailed to a tax preparer rather than the address on the front of this application. Enter preparer information in the box below:

Name of preparer	Street Address	City	State	ZIP code

This application will be returned if it is not signed or if any other information is missing.

Mail your application to: NYS Tax Department, Sales Tax Registration Unit, W A Harriman Campus, Albany NY 12227, at least 20 days (but not more than 90 days) before you begin doing business in New York State.



Instructions for Form DTF-17

Line 1 — There are four types of sales tax vendors, as defined below. Select the definition that best describes your business, then check the appropriate box on line 1.

A *regular vendor* is any individual, partnership, company, or organization who makes taxable sales within the state or who accepts or issues exemption certificates. Regular vendors always have permanent business locations. In addition, they may sell at craft fairs, flea markets, or similar enterprises.

A *temporary vendor* is anyone who expects to make sales of tangible personal property or taxable services in New York State for no more than two consecutive quarterly sales tax periods in any 12-month period. A vendor who attends shows or entertainment events on a continual basis, even for only short periods, should register as a show/entertainment vendor, not a temporary vendor.

A *show vendor* is anyone who displays for sale or sells taxable goods or services at a flea market, a craft fair, a coin show, an antique show, or any similar enterprise that occurs on either a regular or temporary basis. A show vendor does not have a permanent business location.

An *entertainment vendor* is anyone who makes taxable sales at a concert, an athletic contest or exhibition (other than amateur sports), or similar form of entertainment, in which performers do not appear on a regular, systematic, or recurring basis, held in a facility or site with capacity to accommodate more than 1,000 persons. An entertainment vendor does not have a permanent business location.

Line 2 — Enter the exact legal name of the business that you are registering. For a corporation, the legal name will be the name that appears on the *Certificate of Incorporation* filed with the New York State Department of State. For a business that is not incorporated, the legal name is the name in which the business owns property or acquires debt. If the business is a partnership, use the names of the individual partners. If the business is a sole proprietor, show or entertainment vendor, the legal name is the name of the individual owner of the business.

Line 3 — Enter the trade name, doing-business-as name, or assumed name if different from the legal name. For a corporation, enter the name that appears on the trade name certificate filed with the New York State Department of State. For a business that is not incorporated, enter the name filed with the county clerk's office under Section 130 of the General Business Law.

Line 4 — Enter your federal employer identification number (EIN). If you are not required by the IRS to have an EIN, or you do not yet have a required EIN, leave line 4 blank.

Line 5 — Regular vendors enter the actual street address of your business. Show/entertainment or temporary vendors use your home address. Do not enter a PO box on this line. This address **will** appear on your *Certificate of Authority*. It

will also be used for mailing unless you list a different mailing address on line 9 or a tax preparer's address on the back page of the form. If you have more than one location, see the instructions for line 12.

Line 7 — Enter the date you will begin making taxable sales or providing taxable services within New York State, or begin issuing or accepting New York State exemption certificates. Do not mail your application more than 90 days before this date.

Line 8 — If you are a temporary vendor, enter the date you will end business in New York State.

Line 10 — Indicate how your business is organized by checking the box that best describes it.

Governmental organizations include the federal government, New York State and any of its agencies, instrumentalities, public corporations, or political subdivisions (counties, towns, cities, villages, school districts, and fire districts).

An *exempt organization* is one that qualifies under Tax Law section 1116 and has been issued an *Exempt Organization Certificate*.

Line 11 — Check the appropriate box to indicate why you are applying.

For a change in organizational structure, (for example, sole proprietor to corporation), you must register as a new business by completing Form DTF-17. You must file a final return and surrender your *Certificate of Authority* for the old business.

If you are going into business as, or changing your organizational structure to, a limited liability company (LLC) or a limited liability partnership (LLP), you must first contact the New York State Department of State. Once you have been granted your LLC or LLP status, you will be sent Form TR-570, *LLC/LLP Request for Information*, which contains instructions on how to register as a vendor for sales tax purposes.

For a change in business name or location, file Form DTF-95, *Business Tax Account Update*. We will send you a revised certificate.

Line 12 — If you will be operating from more than one business location, you must have a separate *Certificate of Authority* for each location. Check the appropriate box to indicate whether you will file one return for all locations or a separate return for each location.

If you check box A and will be filing separate returns for each location, you must file Form DTF-17 for each location.

If you check box B and will be filing one (consolidated) return, list all your business locations on Form DTF-17-ATT and attach it to your application.

Line 13 — Enter the required information for all owners or officers of the business who are responsible for the day-to-day operations of the business. This generally includes anyone who:

- signs checks on the company's bank account
- signs business tax returns
- pays creditors
- hires and fires employees
- determines which bills are to be paid
- attends to the general financial affairs of the business

If a partnership, enter the required information for all general partners and for those limited partners who are active in running the business. Indicate whether the partner is a general partner or limited partner by entering **GP** or **LP** after the partner's name.

Include the social security number of all owners, partners, or officers listed. (The Tax Law requires you to disclose your social security number.) If your application is missing social security numbers, we will return it to you.

Line 16 — If you are a manufacturer or wholesaler whose activities are such that you are not required to collect any sales and use tax or pay any sales and use tax directly to the Department of Taxation and Finance, check *No*. Because you are registering only to accept or issue exemption certificates, you need only file an annual information return. There are other instances when you may file an annual return. Refer to Publication 750 for instructions on filing returns and for what constitutes a taxable sale. You will, of course, still have to collect sales or use tax and to pay sales or use tax on any taxable retail sale or purchase.

Line 17 — Business activity — Describe your business activity in the space provided. If you have more than one business activity, attach additional sheets.

North American Industry Classification System (NAICS) — Enter the six-digit code from Publication 910 that best describes your business. Show vendors and entertainment vendors use code **454390**.

Line 18 — You are a sidewalk vendor if you do **not** have a permanent business location, you operate in places other than or in addition to flea markets or other shows, and you make sales from a portable stand, pushcart, or other device in New York City.

Line 19 — Check *Yes* if you do not have a permanent place of business and you participate exclusively in flea markets or other shows.

Line 20 — If *Yes*, you must file Form DTF-716, *Application for Registration of Retail Dealers and Vending Machines for Sales of Cigarettes or Tobacco Products*. For forms, call us at the numbers listed in the **Need help?** section on this page.

Line 22 — If *Yes*, you must file Form WCS-1, *Wireless Communications Service Surcharge Report*. For more information, please see memo TSB-M-02(5)M, *Wireless Communications Service Surcharge*. For forms, call us at the numbers listed in the **Need help?** below.

Line 23 — If *Yes*, you may be required to file Form MT-170, *Waste Tire Management Fee Quarterly Return*. For more information, please see memos TSB-M-03(3)S, *Initiation of Waste Tire Management Fee on Sales of New Tires* and

TSB-M-03(5)S, *Amendments to the Waste Tire Management and Recycling Fee on Sales of New Tires*. For forms, call us at the numbers listed in the **Need help?** below.

Lines 24 through 31 — Answer *Yes* or *No* to each question. If you answer *Yes* to any question, enter the required information for that line. Attach additional sheets as necessary to fully answer all questions.

Responsible officers, directors, partners, and employees are those who act for the business in complying with the Tax Law.

Questions 29, 30, and 31 apply **only** to corporations.

Signature — This application must be signed by a person whose responsibility it is to act for the business in complying with the tax law. This person may be a member of a partnership, an officer or director of a corporation, the owner of a sole proprietorship, or an authorized employee of the business.

If the application is not signed or is incomplete, we will return it to you.

Mail your application to: NYS Tax Department, Sales Tax Registration Unit, W A Harriman Campus, Albany NY 12227, at least 20 days (but not more than 90 days) before you begin doing business in New York State.

Need help?



Internet access: www.nystax.gov
(for information, forms, and publications)



Fax-on-demand forms: 1 800 748-3676



Telephone assistance is available from 8:00 A.M. to 5:00 P.M.
(eastern time), Monday through Friday.

To order forms and publications: 1 800 462-8100
Business Tax Information Center: 1 800 972-1233
From areas outside the U.S. and outside Canada: (518) 485-6800

Hearing and speech impaired (telecommunications device for the deaf (TDD) callers only): 1 800 634-2110 (8:00 A.M. to 5:00 P.M. eastern time).



Persons with disabilities: In compliance with the Americans with Disabilities Act, we will ensure that our lobbies, offices, meeting rooms, and other facilities are accessible to persons with disabilities.

If you have questions about special accommodations for persons with disabilities, please call 1 800 972-1233.

Privacy notification

The Commissioner of Taxation and Finance may collect and maintain personal information pursuant to the New York State Tax Law, including but not limited to, sections 171, 171-a, 287, 308, 429, 475, 505, 697, 1096, 1142, and 1415 of that Law; and may require disclosure of social security numbers pursuant to 42 USC 405(c)(2)(C)(i).

This information will be used to determine and administer tax liabilities and, when authorized by law, for certain tax offset and exchange of tax information programs as well as for any other lawful purpose.

Information concerning quarterly wages paid to employees is provided to certain state agencies for purposes of fraud prevention, support enforcement, evaluation of the effectiveness of certain employment and training programs and other purposes authorized by law.

Failure to provide the required information may subject you to civil or criminal penalties, or both, under the Tax Law.

This information is maintained by the Director of Records Management and Data Entry, NYS Tax Department, W A Harriman Campus, Albany NY 12227; telephone 1 800 225-5829. From areas outside the United States and outside Canada, call (518) 485-6800.

12.8 FOOD LABELING

This is a brief summary of the labeling regulations governing foods offered for sale in New York State. It is not meant to be all inclusive of all of the labeling requirements. Prior to printing, it is strongly suggested that labels be submitted to this agency for review.

For specific information write to:

State of New York
Department of Agriculture and Markets
Division of Food Safety and Inspection
Attn: Economic Section
10B Airline Drive
Albany, NY 12235

FSI-514 (Revised 5/01)

Five Basic Label Requirements

- > Identity of Food in Package Form
- > Name of Manufacturer, Packer or Distributor
- > Place of Business
- > Ingredient Declaration
- > Net Quantity of Contents

> IDENTITY OF FOOD IN PACKAGE FORM

- a. The principal display panel of a label for a food in package form shall bear as one of its principal features a statement of the identity of the commodity by its common or usual name.
- b. Where a food is marketed in various forms (grated, sliced, diced, etc.) the particular form shall be considered as part of the identity statement.
- c. The statement of identity shall be present in bold type on the principal display panel and shall be in a size reasonably related to the most prominent printed matter.

> Name of Manufacturer, Packer or Distributor

- a. In the case of a corporation, only the actual corporate name, and this may be preceded or followed by the name of the particular division involved.
- b. In the case of an individual, partnership or association, the name under which the business is conducted shall be used.
- c. When the food is not manufactured by the person whose name appears on the label, a qualifying phrase such as "Manufactured for _____", "Distributed by _____", or other expression of facts, shall appear with the name.

> Place of Business

The place of business shall include the street address, city, State and ZIP code. However, the street address may be omitted if it is shown in a current city or telephone directory.

> Ingredient Declaration

- a. The ingredients shall be listed by their common or usual name in descending order of predominance by weight, on a single panel of the label.
- b. The name of the ingredient shall be a specific name and not a collective name.
 1. If the ingredient is a designated spice, flavoring or natural color, it need only be stated as spices, artificial color or artificial flavor. Colorings subject to certification (FD&C) must be listed by their specific name, i.e. FD&C Yellow #5.
 2. If an ingredient used in the product conforms to a standard of identity or is a multi-ingredient product, its ingredients are required to be listed on the label.
 3. When blends of fats and/or oils are used, the common or usual name of each fat or oil used must be listed in parenthesis following the term vegetable shortening, animal fat or marine oil.
 4. If an individual fat and/or oil ingredient is used, not a blend, the common name of that product must be listed in the correct order of predominance.
- c. No abbreviations of an ingredient's common or usual name are permitted, unless explicitly provided for in the statutes.
- d. Water used in fabricated foods shall be declared on the label in its order of predominance.

> Net Quantity of Contents

- a. The principal display panel of a label for a food in packaged form shall bear a

declaration of net quantity of contents.

1. The declaration shall be expressed in terms of avoirdupois pound and ounce, volume, and/or numerical count.
2. The declaration shall appear as a distinct item within the lower 30 percent of the principal display panel. The declaration shall be printed in boldface print or type in letters and numbers in a size in relationship to the total square inches of the principal display panel.

Area of PDP	Minimum Type Size
5 sq. inches or less	1/16 inch (1.6 mm/6 point)
> 5 sq. inches, but < 25 sq. inches	1/8 inch (3.2mm/14 point)
> 25 sq. inches, but < 100 sq. inches	3/16 inch (4.8mm/20 point)

3. The declaration of net quantity of contents shall be expressed in the following terms:
 - a. Weight (one pound, but less than four pounds) expressed in ounces and followed by the largest whole unit in parenthesis, i.e. NET WT. 24 OZ (1 LB 8 OZ).
 - b. Fluid measure (one pint, but less than one gallon) expressed in fluid ounces and followed by the largest whole unit in parenthesis, i.e. 20 FLOZ (1PT4OZ).
4. A separate statement of the net quantity of contents in terms of the metric system is required to appear on the principal display panel as part of the required declaration, i.e. NET WT 9 OZ (255g) or 9 FL OZ (266 ml).

> General Label Information

a. Principal Display Panel:

The term "principal display panel" as it applies to food in packaged form means the part of the label that is mostly to be displayed, presented, shown or examined under customary conditions of display for retail sales. The principal display panel shall be large enough to accommodate all the mandatory label information required to be placed thereon with clarity and conspicuousness and without obscuring design, vignettes, or crowding.

b. Information Panel:

The term "information panel" as it applies to packaged food means that part of the label immediately contiguous and to the right of the principal display panel as observed by an individual facing the principal display panel.

c. Labeling Information Requirements:

All information appearing on the principal display panel or information panel shall appear prominently and conspicuously, but in no case may the letters/numbers be less than one-sixteenth of an inch in height, except for those requirements previously addressed.

d. Language:

1. All required label information shall appear in the English language.
2. If the labeling bears any statutory information in a foreign language, all the required labeling information shall appear in both the foreign and English language.

e. Imitation Foods:

If any food product is an imitation of another, and is nutritionally inferior to that product, it must be labeled "Imitation ____", with the space being filled in with the name of the food imitated, and with the word "imitation" in type of uniform size and prominence as used for the name of the food.

f. Packaging:

A package or commodity in packaged form means any commodity put up or packaged in any manner in advance for retail sale. This should include cellophane wrapped products kept in a closed display case, even if these products need to be weighed and priced at the time of sale.

g. Nutrition Information:

Information as to the requirements for inclusion of nutrition information on a label should be addressed to this agency.

Section 13

Other Materials

13.1 Maple Flavors and Syrup Grading

13.2 Maple Grading in New York

13.3 Judging Maple Products

13.1 Maple Flavors and Syrup Grading

By Stephen Childs, Cornell Extension Maple Specialist

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 with a single producer 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 as they find that another producer's syrup is "just not the same". Sometimes the flavors are less pleasing and this can lead to difficulty keeping customers. Noticeable and even severe flavor problems can often be identified and the cause corrected. The recognition of off flavors and the severity of those flavors is part of the rules and regulations for grading maple products in New York State.

The New York State Agriculture and Markets Circular 947 "Manufacture, Distribution and Sale of Maple Syrup and Sugar" quite broadly describes how off flavors influence the syrup grade. The rules define several flavor related terms. First, "damage" means any defect that materially affects the appearance, edibility or shipping quality of the syrup or sugar. Second, "serious damage" means any defect that seriously affects the edibility or market value of the syrup. Badly scorched syrup, buddy syrup, fermented syrup, or syrup that has any distasteful foreign flavor or disagreeable odor shall be considered seriously damaged. Third, "buddy flavor or buddiness" is an unpleasant flavor characteristic of syrup or sugar made from sap collected from maple trees as they come out of dormancy. For syrup to be labeled as Grade A for table use it must have good flavor and odor, be practically free from damage and practically clear. No serious damage or buddiness is acceptable. The rule also states that the syrup shall have a good maple flavor characteristic of the color. For syrup to be labeled as Grade B for reprocessing or "Extra Dark for Cooking" it must have fairly good characteristic maple flavor, shall be fairly free from damage, fairly clear, and free from serious damage. In other words a syrup that has a clearly identifiable off flavor would not be legally marketable as either Grade A or Grade B and could only be sold in bulk as substandard.

Henry Marckres with the Vermont Agency of Agriculture, Food and Markets has pulled together some excellent information on maple syrup off-flavors, their likely causes, and tips to avoid these problems. The following information has been edited from material he has written.

Chlorine (Sodium) - A solution of chlorine and water has often been used to clean sap tubing systems and storage tanks. When these systems were not fully rinsed afterward it would leave a residue inside the tubing. Sap running the next season would "scrub" the tubing, putting varying amounts of sodium into the finished syrup. A chlorine off-flavor often destroys the maple flavor and may have a salty flavor.

Detergents - The only detergents that should be used in syrup production are ones that are approved for food use. Producers have often used products that are designed for home use, damaging the flavor of the finished 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. Often these paints 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 usually is 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 any with obvious rust or cracked epoxy. The recommendation for metal syrup cans is to only pack what will be sold in 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 nonfood 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 a flavor that tastes the way 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 filters:** These are the type of filters that use the weight of the syrup to filter, usually a cone type or flat filter. During the manufacturing process, these filters pick up and retain a slight chemical odor and flavor. Before use, they should be boiled in clear water and dried thoroughly. If not, they impart a chemical flavor to the syrup. **Previously used filters:** Once used, filters should never be washed with any detergent, as 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 musty off-flavor when hot syrup is filtered through them the next season. Never store filters with mothballs, as this will create a chemical off-flavor.

Defoamers - Many different products are used to reduce 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. Only a small amount is needed to control foaming and using too much will create an off-flavor in the syrup. A defoamer off-flavor may taste like whatever was used for a defoamer or have a rancid taste.

Chemicals - The technology used in producing syrup today often requires the use of powerful cleaners and preservatives. It is very important to follow the manufacturer's recommendations carefully and rinse thoroughly before continued use. The off-flavor usually relates to the smell of the chemical used.

Lubricants and Fuels - Care should be taken to avoid contamination of the sap or syrup from exhaust fumes or improperly operating equipment. Also, only food grade lubricants should be used in any pumps or equipment that comes in contact with sap or

syrup. Off-flavors attributed to this type of contamination will taste and smell just 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 syrup has not been boiled enough to concentrate the correct amount of sugar, then the syrup may work like apple cider. At times, we find correct density syrup fermented and that is usually from syrup stored in barrels that have not been properly cleaned. Even barrels that have been previously steam cleaned may have moisture in them that have revealed yeast, mold, and bacteria in great numbers. Syrup that is fermented will have a sickening sweet flavor, at times a honey like similarity. Depending on the type of ferment, it may have an alcoholic or fruity taste. Severe ferment may have a foamy appearance.

Sour Sap - As the weather warms near the end of the sugaring season, sap left in a tank begins to warm, basically beginning to spoil the sap. Syrup made from this sap has a ropy 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 that manner. 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 low a level of product in the front pan actually bums 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 a warming of temperatures. This can be present at any time during the sugaring season, from the first run on. A metabolism off-flavor robs the product of most of its maple flavor. The resulting flavor has been described as woody, peanut butter, or popcorn. An almost cardboard like flavor may be present. A chocolaty smell may be detected.

Buddy - Buddy syrup is usually produced during the late season, depending on the weather conditions present. The tree begins to produce buds, and the sap takes on a distinctive quality that is transferred into the syrup. Buddy syrup usually tastes chocolaty, almost a tootsie roll type

flavor. If very strong, it may take on a bitter chocolate characteristic.

At the New England Grading School we had the opportunity to sample many of the off flavors known to damage the maple syrup flavor. Learning to identify these off flavors should be helpful to recognize the likely source of a production problem. I would like to conduct similar schools in New York in the future but to be effective I need to have samples of off flavored syrups. I would love to accept donations of a gallon or less from any producer with some off flavor batches available. I'm not suggesting anyone purposely make some off flavor syrups but I would be grateful for any sample you might be willing to donate.

13.2 Maple Grading in New York

I recently attended the New England Maple Grading School in New Hampshire and came away with a better understanding of just how confusing this whole issue of maple grading can be. Since many states and provinces were represented there, our first task was to understand the different regulations. The state and province regulations vary significantly and so do the definitions. Some states have no regulation at all. The USDA standards for grades of maple syrup are voluntary and violations are based only on incorrect grading of products. States generate their own standards that are enforced by their agriculture or markets departments. I can see why selling across state lines can be a major headache. For instance, there is no “fancy” syrup in New York, but if light amber syrup produced in New York is sold in Vermont it must be labeled fancy or it can be pulled off the shelf as improperly labeled. Canadian syrup correctly graded as medium amber by Canadian standards and shipped for sale in New York could be pulled from the shelf here because by New York standards it should be classified as dark amber.

Even the trusted thermometer cannot seem to give a universally accepted syrup product. Not that the thermometer is wrong, the standards for finished syrup density differs from place to place. In New York, syrup is of legal density when at or above 66% sugar or 66° Brix at 68° F. That would require a finish temperature of 7.1° F over the boiling point of water. In Vermont, the lower limit is 66.9% sugar or 66.9° Brix at 68° F, this would require a minimum finish temperature of 7.46° F over the boiling point of water. Several states also place an upper limit on the density of syrup that can be sold. New York does not have an upper limit. In New York, a producer is free to make and market an extra thick syrup that would be pulled off the shelf as off grade if sold in Vermont.

Grading for density

Density testing with the hydrometer though reasonably accurate at measuring density is affected by temperature. Density or thickness decreases as temperature increases. The key issue when using a hydrometer to finish syrup is to make corrections for the temperature of the syrup being tested. For instance, syrup that had a hydrometer reading of 67° Brix at 68° F would have an acceptable finish density. However, if this same syrup were still cooling after boiling and tested at 120° F, it would read 64.6° Brix on the hydrometer. This reading could make one think it was not yet up to legal density if the temperature adjustment was being ignored.

A very simple means of measuring density is with the hand held refractometer. The concern here is that some models automatically adjust for the temperature and some do not. Be sure you know which you have and adjust accordingly. Even the units that automatically adjust for temperature are for a limited range of temperatures, typically 60° F to 100° F. I found on the manually adjusted refractometer I could throw off the adjustment thermometer by where I held it with my warm hands when taking the reading. Also adjusting to the syrup temperature may take a little time, so an immediate reading may not be as accurate as waiting a minute or so. The hand held refractometer is also poor at reading hot syrup. This makes it impractical to test the density of syrup that is being boiled and nearing finish. By the time the sample cools enough for a correct reading, the syrup being boiled has changed. I’m also learning that as I get older seeing some refractometer scales seems more difficult.

The new digital refractometer appears to be very easy to use, simple to read and automatically adjusted for temperature. The first day of using this tool at the grading school was very disappointing. The various instruments did not agree and even a given machine was constantly changing its reading. A discussion with a company representative did wonders. We were used to placing just a drop or two of syrup on the hand held refractometer and continued that practice with the new digital tool. We were advised to fill the sample well as full as possible using more like a teaspoon or two of syrup. This change did wonders. Following this change in the amount of sample used, all the machines were reading consistently.

Grading for color

The color and flavor of maple syrup were also very problematic to the grading school participants. Color of syrup fortunately is consistent between all the states, the USDA and Canada. The color standards of US Grade A and Canada Number 1 are the same; however, the three subdivisions or classifications of this grade are not titled the same. The lightest classification of US Grade A is called light amber in New York and all other states except Vermont where it is called Fancy Grade Light, but Canada calls this classification extra light.

The USDA standard and most states including New York say the flavor must be characteristic of the color. In other words, a light colored syrup that for some reason carried a flavor normally associated dark syrup should be titled dark amber. The interesting issue here is that to sell syrup in New York, the producer or packer is not required to list the classification (light, medium or dark amber). Only the fact that it is Grade A or Grade B “extra dark for cooking” is actually required. If the producer chooses to list the classification (light, medium or dark amber) on the label, then what is in the container must meet that standard or it can be pulled as off standard.

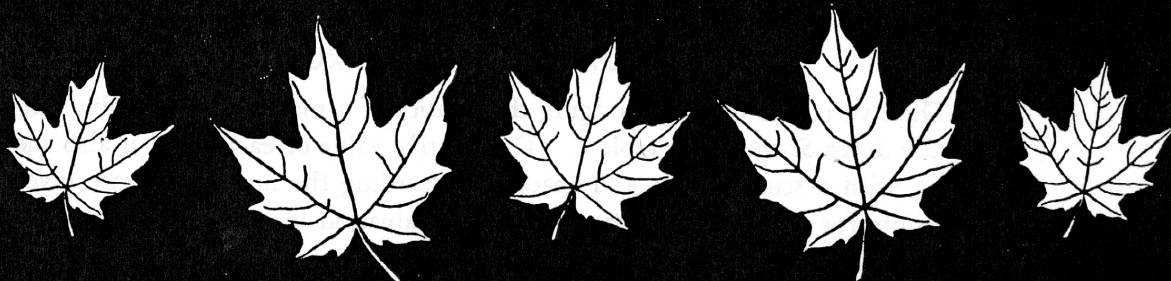
The only legal color standard used in New York is the “USDA glass color standard”. The Vermont temporary kit may be very helpful, allowing the producer to come very close to the proper classification but an inspector from New York Agriculture and Markets will have to test it against the USDA glass color standard according the current New York law. At the grading school with various levels of light and a mix of color grading kits, we found the 33 of us occasionally disagreed as to the color classification of some samples. Many samples clearly belonged in certain color classes, others due to variation in the kits, light levels and individuals eyes were not so consistently assigned the right color. Having lots of light when grading is a must. There is much more to be said on the issues of color grading and flavors which I need to save for a separate article.

We spent some time evaluating the performance of light transmission equipment, such as the Hanna meters. We again were having some trouble getting consistent readings. Some light transmission machines seemed to consistently read the samples slightly darker than machines made by other manufactures. Many times the same machine would give slightly different reading on the same sample. It was obvious that using the proper standard to calibrate these machines is very important. Calibration, cleanliness of sample tubes, consistency of room and

sample temperature and clean storage of the equipment and sample containers all must be meticulously managed. Where the small plastic sample containers are used, they should only be used once or very carefully cleaned. They must not be scratched. Readings should be taken from each of the four sides of the sample and averaged to get results in which you can have good confidence. The sample containers may have small scratches or defects that may change the reading from one or more of the sides, thus the need for an average of the reading from each side. All this was very interesting except that light transmission is not a legal grading measure in New York. New York has no standard for this. In fact, Vermont is the only state that has a transmission standard. Canada has a national standard. That's not to say the standards won't change in New York in time but right now it doesn't exist

Overall the training was very helpful and useful. If you sell only in New York you have just a few key things to remember. Color grading is based on the USDA glass color standard which is closely mimicked by the Vermont temporary and other grading kits. The color Grades in New York are Light Amber, Medium Amber, Dark Amber, and Extra Dark for Cooking. Minimum density is 66° Brix at 68° F obtained by boiling sap to 7.1° F over the boiling temperature of water. Grade A syrup must be of good maple flavor, characteristic of the color, clean, practically clear, practically free of damage and free from serious damage. B grade syrup can be sold in a pint or larger container and must be marked with "Extra dark for cooking" and should be of fairly good color and flavor with no serious damage. For a copy of the New York grading law "Circular 947" and "US standard grades" go to the Cornell Maple Web Page <http://maple.dnr.cornell.edu>. If you sell outside of New York, I would be glad to assist you with understanding the regulations in other areas.

Stephen Childs, Maple Extension Specialist, Cornell University



13.3 Judging Maple Products

F. E. Winch, Jr., J. C. Underwood, C. O. Willits, and W. W. Simonds

Each year in the north central and northeastern United States, numerous fairs and festivals are held to celebrate the production of maple sirup and its products. At each of these affairs there are exhibits and demonstrations to determine the best maple sirup and maple confections made that season. In the past, the standards by which the products have been evaluated were left to the discretion of the judges. It is natural that in local centers the criteria of quality of maple sirup—density, clarity, color, and flavor—have taken on different meanings and relative values. As transportation and communications bring these local centers closer together, leaders in the maple industry of one state are being asked to serve as product judges in neighboring states. Under these circumstances, the job of the visiting judge is not an easy one. For a fair and proper evaluation, a judge now must learn the local ideas of what characterizes a high quality maple product. In national shows of maple products, there is no uniform set of standards which are known to all entrants.

To equalize judging, each festival should have entry blanks that list the factors on which the products will be judged, and the relative value of each factor should be given. For this purpose the authors have brought together in this publication the descriptions, characteristics and standards which they feel represent a cross section of the maple industry. Also included are score sheets for the use of judges in maple competitions.

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- Be familiar with common first aid actions to take in the event of an accident.

SCORING MAPLE SIRUP

The five points used for judging the quality of a maple sirup are given in the *Maple Sirup Score Sheet*, table 1. The relative value of each point is also shown along with a scoring scale and space for recording the numerical score given to a sample for each characteristic. The full evaluation for each sirup can be given a numerical value by totaling the five sub-scores.

Density

Density is the most important tangible quality of maple sirup. Maple sirup must contain at least 65.5 percent sugar to meet minimum state and federal standards, and any sirup below this density is automatically disqualified. The viscosity of maple sirup changes greatly in the range of 65.5 percent sugar solids. Actually, the sirup has a better flavor if it contains more than 65.5 percent sugar because of its greatly increased viscosity. However, sirup with a Brix above 67° (sugar percentage) is supersaturated with sugar and will tend to crystallize in storage, producing an unattractive product and reducing sales. The ideal sirup should have a sugar content of 66.5 to 67.0 percent (Brix), and the highest score for density should be given to sirups in this range.

The sugar content should be carefully determined with a precision Brix hydrometer or hand refractometer. Special attention must be given to making the proper temperature correction, for the graduated scoring scale can be of value only if accurate density measurements are made.

Sirups found to be below standard density (65.5° Brix) should be disqualified from the competition. Because it may reduce the number of samples to be scored in the other categories, density has been placed first on the score sheet.

Clarity

Clarity is another factor of quality that is included in the standards for maple sirup. All sirups should meet the minimum requirements and should be disqualified if they do not.

Sirups having debris, such as small pieces of bark or dirt, (have not been filtered) should be disqualified. Sirups with small amounts of sugar sand in suspension will be cloudy and indicate inadequate filtering; settled sugar crystals indicate that the sirup was too dense to remain in solution. Clear sirups indicate proper filtering procedures.

Flavor

Flavor is the most important characteristic to be evaluated and the least standardized because it can be evaluated only subjectively. Both judges and contestants should have a common understanding of what constitutes good maple flavor and the score can show only differences between the best and poorest flavored

entries. Unacceptable sirups are those having noticeably scorched, buddy, or other off-flavors.

Color

The color of maple sirup can be accurately rated, but there may be local differences in the relationship of color and high quality. This relationship should be determined before the competition and made known to contestants and judges. As various maple states do not have the same color designation for the different grades, the scoring scale in table 1 may not be directly applicable in all areas. However, the total points awarded for this characteristic should be 20, as indicated.

Packaging

Marketing is becoming an important phase of maple sirup production. The successful producer is packaging his product attractively, and, according to law, maple sirup offered for sale must be in a clean, sanitary, properly labeled container. Points are awarded for sirup samples in neat, clean containers. They do not have to be expensive or elaborately decorated.

SCORING MAPLE SUGARS

There are so many different maple confections that it has been difficult to condense them all into a small number of similar classes that could be contained on a single, reasonably-sized score sheet.

Table 2, *Maple Sugar Score Sheet*, contains a class arrangement that includes all the more commonly made maple confections. A scoring scale is also given for each class. The four characteristics, appearance, texture, flavor, and packaging, are used to evaluate the products. The scoring scale indicates the particular attribute of each of the qualities that should be evaluated for a given sample. The sum of the scores for each characteristic gives an accurate appraisal of the entries in a maple products contest.

Packaging

Although packaging is the least important scoring factor, it does contain a disqualifying element: if a wrapping is missing, as in the case of a hard confection, the particular entry should be eliminated from the scoring. The packing

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June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York. PS-5M

of maple confections should be done in the best manner possible to protect the product from dirt and microbial contamination. Many states have food laws that set standards of sanitary practices, and maple producers should be encouraged to follow them.

A maple confection, like sirup, will have more sales appeal if it is offered in an attractive package. An attractive package does not need to be an expensive one. Neatness and originality will be scored higher than cost of package.

Flavor

As with sirup, the most important factor for judging maple confections is flavor. A true, distinctly maple flavor will receive top score. Any product with a foreign, off-flavor (buddy, moldy, or fermented), will be eliminated completely from the competition.

Appearance

Under this factor of quality are a number of characteristics that apply to only one or two of the various confections. The drying out of solid candies as evidenced by white surface areas is a defect that lowers the grade. The form of the individual piece of candy should be definite, smooth in texture, and complete (no broken corners). Opinions about the optimum color of a maple product vary with locality; both contestants and judges should know the local preference and rate the products accordingly. Mold, of course, denotes poor handling and old candy. The factor of separation applies specifically to maple cream, although it may be used to lower the score of hard candies that have crumbled. The *creep test* is a special test used to rate crumb sugar. It is an indication of the amount of moisture in the product, the more the creep the drier the product, an important quality factor. The presence of air bubbles in maple cream lowers its quality.

Texture

The texture of maple confections has been rated by evaluating the three characteristics, hardness, crystallinity, and surface. Hardness refers to the condition of the product (pieces of confection) as a whole. Maple candies are divided into two large classes, hard and soft sugars, according to their firmness. A candy in the soft sugar class should fracture easily, but a hard candy is broken only with difficulty. Crystallinity refers to the condition of the individual sugar crystals in a confection. High scores will be given to products of small crystalline structure. Coarse crystals are easily detected on fracture of the confection and by their sandy taste when eaten. A high quality confection should have a surface free of holes that may result from poor filling of the mold. This does not mean that the best surface should be absolutely smooth, because crystal-coated candies may have a rough, sandpaper finish.

MAPLE SIRUP Score Sheet

Entry No. _____ Class _____ Score _____

DENSITY—Highest Score (25) points

68° — Brix	15
66.5° — 66.9°	20
66.5° — 66.9°	25
66.0° — 66.4°	20
65.5° — 65.9°	15
*Below standard density	0

Score
Partial Total

CLARITY—Highest Score (15) points

Crystal clear	15
Sugar crystals (settled)	10
Cloudy	5
*Cloudy plus debris	0

FLAVOR—Highest Score (30) points

Best	30
2nd best	25
3rd best	20
4th best	15
5th best	10
*Unacceptable	0

COLOR—Highest Score (20) points

US VT N.Y.			
AA — Fancy	Fancy	Fancy	16-20
A	A	1	11-15
B	B	2	6-10
Unclassified	C	3	1-5

PACKAGE—Highest Score (10) points (attractiveness — protection)

Best	10
Poor	5
Very poor	0

GRAND TOTAL (score) _____

*Disqualify entry

MAPLE SUGAR Score Sheet

Entry No. _____ Class _____ Score _____

	Hard Sugar	Soft Sugar Solid	Sugar Semi- solid	Crumb Sugar	Score Partial	Score Total
APPEARANCE—Highest Score						
	(25)	(25)	(25)	(25)		
No white areas (dried)	5	5	—	—	_____	
Form good	5	10	—	—	_____	
Color	5	5	10	—	_____	
No mold	5	5	—	—	_____	
No separation	5	—	10	—	_____	
*Creep test	—	—	—	25	_____	
Air bubbles	—	—	5	—	_____	_____
TEXTURE—Highest Score						
	(30)	(30)	(30)	(30)		
Hardness	10	10	15	—	_____	
Crystallinity	10	10	15	30	_____	
Surface (smooth)	10	10	—	—	_____	_____
FLAVOR—Highest Score						
	(35)	(35)	(35)	(35)		
Best	35	35	35	35	_____	
2nd best	30	30	30	30	_____	
3rd best	20	20	20	20	_____	
4th best	10	10	10	10	_____	
**Unacceptable	0	0	0	0	_____	_____
PACKAGE—Highest Score						
	(10)	(10)	(10)	(10)		
Attractiveness	5	5	5	5	_____	
Sanitation	5	5	5	5	_____	
**No wrapping	0	0	0	0	_____	_____
GRAND TOTAL (score)						_____

*Creep (dryness) test—Movement of sugar when poured in cone-shaped pile.

**Disqualify entry

CLASS

- I. Hard sugar, A. Larger than 1 pound, B. smaller than 1 pound.
- II. Soft Sugar, solid
 - A. Large crystal. 1. Large pieces, 2. small pieces.
 - B. Smooth grain. 1. Large pieces, 2. small pieces, 3. filled, 4. fondant.
- III. Soft Sugar. A. Semi-solid—Tub, B. cream (maple butter).

