New York State Maple Grading Notebook

Assembled by the Cornell Maple Program

New York State Maple Grading Notebook
Table of Contents 2nd edition

Introduction	p. 3
Density	p. 10
Filtering and Clarity	p. 30
Color	p. 46
Flavor	p. 64
Appendix	p. 72
Maple Syrup Producers Manual - Chaper 8	p. 73
Flavor Wheel for Maple Producers	p. 76
In the Judge's Eye	p. 79
US Standards for Grades of Maple Sirup	p. 80
NYS Ag and Markets Circular 947	p. 88
Food Labeling	p. 90
Maple Syrup Quality Control Manual	p. 94
Judging Maple Products	p. 115
Example Judging Sheets	p. 119

Introduction

Maple Syrup Grading

Maple syrup is produced by concentrating the natural sugars found in maple sap through an evaporation process. This process produces characteristic colors and flavors associated with pure maple syrup. Grading maple syrup is an important part of preparing syrup for sale or using it in various maple products. Each different grade of syrup has a characteristic color and flavor, from a golden-colored, mild flavored syrup to a very dark syrup with a strong maple flavor. Different uses of syrup call for using different grades, depending on the intensity of the flavor required. Different value added maple products also may require different syrups for the best products. Syrup is graded by four basic characteristics: clarity, density, color, and flavor. Understanding the characteristics of the different grades of syrup allows producers to give customers the type of maple syrup and maple syrup products they desire. As of the printing of this notebook not all states and provinces have yet adopted the new standard. As a result some of the old grade information is still provided for comparison.

Grade Nomenclature and Colour Class Comparison for Maple Syrup[1]

	CANADA[2]	UNITED STATES[3]			
Light Transmission[10] *o*	**Quebec Ontario New Brunswick Nova Scotia Classification**	**Vermont/ Ohio[4] Classification**	**New York/ New Hampshire/ Connecticut[5] Classification**	**Maine[6] Classification**	**Michigan[4] Classification**
>75.0%	Canada No. 1 **Extra Light**	Vermont Fancy[9] **Fancy**	U.S. Grade A **Light Amber**	U.S. Grade A **Light Amber**	U.S. Grade A **Light Amber**
60.5-75.0%	Canada No. 1 **Light**	U.S. Grade A **Medium Amber**	U.S. Grade A **Medium Amber**	U.S. Grade A **Medium Amber**	U.S. Grade A **Medium Amber**
44.0-60.5%	Canada No. 1 **Medium**	U.S. Grade A **Dark Amber**	U.S. Grade A **Dark Amber**	U.S. Grade A **Dark Amber**	U.S. Grade A **Dark Amber**
44.0-27.0%	Canada No. 2 **Amber**[7]	Vermont Grade B[9] Grade B	U.S. Grade B **Extra Dark Amber**	U.S. Grade A **Extra Dark Amber**	U.S. Grade B
< 27.0%	Canada No. 3[8] **Dark**	**Commercial Grade**		**Commercial Grade**	**Commercial Grade**
Fails to meet requirements of any other grade		**Substandard**	**Commercial or Substandard**	**Substandard**	**Substandard**

[1] This table is prepared for study purposes only. Refer to actual regulations to verify accuracy.
[2] Canadian readings are based on a spectrophotometer or a visual glass comparator.
[3] United States grading is based on USDA permanent glass colour standard.
[4] Grading maple syrup is voluntary in Ohio and Michigan.
[5] Draft Regulation - 2003
[6] Information for Maine was posted on the web.
[7] In Ontario syrup labeled Ontario Amber can only be sold at farm gate.
[8] Canada No. 3 may also be used for the other colour classes.
[9] Syrup produced in Vermont.
[10] Light transmission classes vary slightly in some jurisdictions.

This page represents a comparison between states and Canada prior to January 2015

Main Benefits of Standardized International Grades

1. World standard definition and uniform grading system
2. Consumers will benefit from producers and packers placing greater emphasis on taste and keeping off-flavoured and otherwise defective syrups out of the retail marketplace
3. Removal of U.S. Grade B, Commercial designations and Canada No. 2 & 3 designations which imply lower quality syrup (many consumers and ingredient users prefer these syrups)
4. Both colour and taste descriptors on the label to assist consumers and ingredient users in purchasing syrup in accordance with their preferences

Definition and Grading Standards:

- Produced exclusively by the concentration of maple sap or by the solution or dilution of a pure maple product other than maple sap in potable water
- Minimum soluble solids of 66%
- Maximum soluble solids of 68.9%
- Comply with federal and state/provincial standards for contaminants
- Comply with other federal and state/provincial regulations and policy directives (e.g. labelling, standard containers, establishment registration)
- Proper determination of grade and colour class
- Traceable to batch (daily production)

Quality Descriptors for Grade A

- Uniform in colour
- Intensity of flavour (taste) normally associated with the colour class
- Free from objectionable odours and off-flavours
- Free from turbidity and sediment

Grade A Maple Syrup—4 Classes

Golden Colour and Delicate Taste Light transmittance not less than 75.0% Tc	**Amber Colour and Rich Taste** Light transmittance 50.0-74.9% Tc
Dark Colour and Robust Taste Light transmittance 25.0-49.9% Tc	**Very Dark Colour and Strong Taste** Light transmittance less than 25.0% Tc

Golden Color and Delicate Taste
Pure maple syrup in this class has a light to more pronounced golden color and a delicate or mild taste. It is the product of choice for consumers preferring a lighter colored maple syrup with a delicate or mild taste. Light transmittance not less than 75% Tc.

Amber Color and Rich Taste
Pure maple syrup in this class has a light amber color and a rich or full-bodied taste. It is the product of choice for consumers preferring a full-body tasting syrup of medium taste intensity. Light transmittance 50.0-74.9% Tc.

Dark Color and Robust Taste
Pure maple syrup in this class has a dark color and a more robust or stronger taste than syrup in lighter color classes. It is the product of choice for consumers preferring a dark colored syrup with substantial or robust taste. Light transmittance 25.0-49.9% Tc.

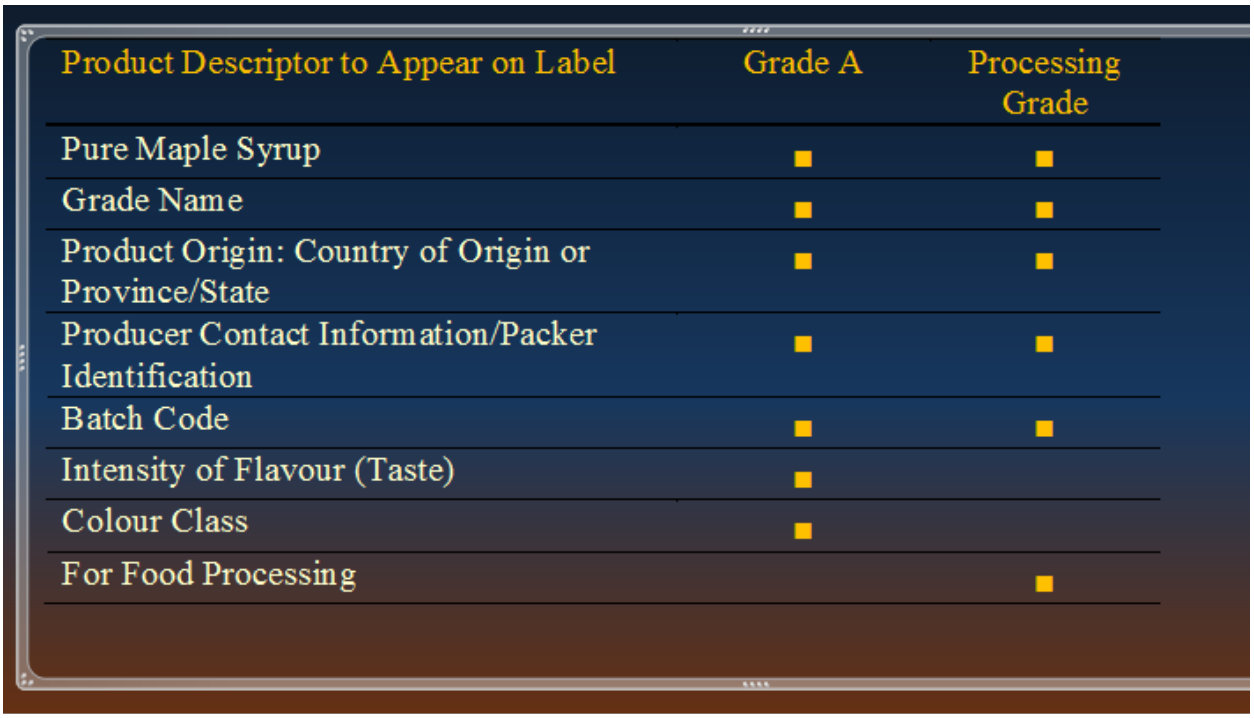
Very Dark Color and Strong Taste
Pure maple syrup in this class has a very strong taste. It is generally recommended for cooking purposes but some consumers may prefer it for table use. Light transmittance less than 25% Tc.

Label Concept – Grade A

Processing Grade Not for Retail Sale

- Any light transmittance
- May be any color class
- May contain off-flavors' (i.e. caramel, woody, buddy, burnt, etc.)
- May be very strong tasting syrup
- Packed in containers of 20 liters (5 gallons) or larger
- Cannot be sold at retail
- May be used in food processing and non-food uses

Product Descriptors to Appear on the Product Label



Product Descriptor to Appear on Label	Grade A	Processing Grade
Pure Maple Syrup	■	■
Grade Name	■	■
Product Origin: Country of Origin or Province/State	■	■
Producer Contact Information/Packer Identification	■	■
Batch Code	■	■
Intensity of Flavour (Taste)	■	
Colour Class	■	
For Food Processing		■

Grade Nomenclature and Color Class Comparison For Maple Syrup

Canada New Brunswick, Nova Scotia	Ontario	Quebec	United States, Michigan[2]	Vermont, Ohio[2]	New York New Hampshire, Connecticut[5]	Maine[3]
Canada No. 1 Extra Light Light transmission not less than 75.0% Tc (all Canada readings based on a spectrophotometer or a visual glass comparator)	Canada No. 1 Extra Light Light transmission not less than 75.0% Tc (all Canada readings based on a spectrophotometer or a visual glass comparator)	Canada No. 1 Extra Light, Transmission not less than 75.0%Tc (Canada prefix if Registered based on spectro readings same as AAFC	U.S. Grade A Light amber Based on a USDA permanent glass colour standard Syrup is as light, or lighter in colour than the USDA light amber glass colour standard	Fancy Grade Light transmission of not less than 75.0% Tc or USDA visual colour standard light amber	U.S. Grade A Light amber Based on a USDA permanent glass colour standard Syrup is as light, or lighter in colour than the USDA light amber glass colour standard	U.S. Grade A Light amber Based on a USDA permanent glass colour standard Syrup is as light, or lighter in colour than the USDA light amber glass colour standard
Canada No. 1 Light, syrup having a % light transmission less than 75.0 but not less than 60.5% Tc	Canada No. 1 Light, syrup having a % light transmission less than 75.0 but not less than 60.5% Tc	Canada No. 1 Light, Less than 75.0 but not less than 60.5% Tc	U.S. Grade A Medium Amber Darker than light amber but no darker than USDA Medium Amber glass colour standard	Grade A Medium Amber 60.5% Tc to 74.9% Tc or the USDA visual standard of medium amber	U.S. Grade A Medium Amber Darker than light amber but no darker than USDA Medium Amber glass colour standard	U.S. Grade A Medium Amber Darker than light amber but no darker than USDA Medium Amber glass colour standard
Canada No. 1 Medium Syrup having a % light transmission less than 60.5 but not less than 44.0 % Tc	Canada No. 1 Medium Syrup having a % light transmission less than 60.5 but not less than 44.0 % Tc	Canada No. 1 Medium Less than 60.5 but not less than 44.0% Tc	U.S. Grade A Dark Amber, darker than medium amber but no darker than USDA dark amber glass colour standard	Grade A Dark Amber 60.4% Tc to 44.0% Tc or no darker than the USDA visual standard for dark amber	U.S. Grade A Dark Amber, darker than medium amber but no darker than USDA dark amber glass colour standard	U.S. Grade A Dark Amber, darker than medium amber but no darker than USDA dark amber glass colour standard
Canada No. 2 Amber Syrup having a % light transmission less than 44.0 but not less than 27.0% Tc	Canada No. 2 Amber or Ontario Amber[4] Syrup having a % light transmission less than 44.0 but not less than 27.0% Tc	Canada No. 1 Amber Less than 44.0 but not less than 27.0% Tc	Grade B Classification Darker than USDA Dark Amber colour standard, but is not off colour for any reason	Grade B 43.9% light transmission to 27.0% Tc, reference to the Canada #2 Amber glass visual comparator equal to 27.0% Tc	Grade B or Extra Dark for Cooking Darker in color than the USDA dark amber. Glass color standard, but is not off - color for any reason	Grade A Extra Dark Amber Classification Darker than USDA Dark Amber colour standard, but is not off colour for any reason
Canada No. 3 Dark (Canada No. 3 may also be used for the other colour classes) syrup having a % light transmission less than 27.0% Tc	Canada No. 3 Dark (Canada No. 3 may also be used for the other colour classes) syrup having a % light transmission less than 27.0% Tc	Canada No. 3 Dark (Canada No. 3 may also be used for the other colour classes) syrup having a % light transmission less than 27.0% Tc	Substandard Fails to meet the A and B Grade Standards	Commercial Grade Light transmission less than 27.0% Tc, _____ Sub-standard fails to meet the requirements of any other grade	Sub-standard or commercial Fails to meet the Requirements of Grade A or Grade B	Commercial Grade Light transmission less than 27.0% Tc, _____ Sub-Standard Fails to meet the Requirements of any other grade

[1]This table is prepared for study purposes only. Refer to actual regulations to verify accuracy.
[2]Grading maple syrup is voluntary in Ohio and Michigan.
[3]Information for Maine was posted on the web.
[4]Syrup labeled Ontario Amber can only be sold at the farm gate.
[5] Draft Regulation - 2003

Revised June 2003

Density

Density

The density of maple syrup refers to the concentration of the sugar in the finished product. All grades of syrup must meet density standards in order to be marketed as pure maple syrup. The international grading system has a minimum allowable density is 66°Brix or 66 by weight of the soluble solids and an upper limit of XX °Brix . These requirements help reduce the likelihood that syrup will ferment and spoil or crystallize in the container. The density of maple syrup is generally determined using one of two scales. The Brix scale is the one most commonly used to determine syrup density. For all practical purposes, the percentage Brix equals the percentage sugar in the syrup. A few states allow the use of the Baume scale for maple syrup density. The Baume scale relates the density of a liquid to a salt solution. Conversion tables can be used for Brix and Baume. See Appendix.

Measuring Density

Instruments for measuring maple syrup density are the thermometer, hydrometer, refractometer, and the hydrotherm. The thermometer can only be used to determine when syrup is finished when it is boiling and when compared to the current boiling point of water. 66 Brix at 68º F would require a finish temperature of 7.1º F over the boiling point of water. To produce syrup at 66.9% sugar or 66.9º Brix at 68º F would require a minimum finish temperature of 7.46º F over the boiling point of water. Automatic take-offs are usually based on the use of an accurate well placed thermometer. The hydrometer is the most common instrument used by maple producers. A hydrometer is a glass instrument with a weighted bottom and a scale inside its glass stem and is floated in the syrup to determine density. It is very important to know the temperature of the syrup before using the hydrometer. Most hydrometers are marked with two red lines, one at 59° Brix or 32° Baume, and the other at 66.9° Brix or 36° Baume. These red lines relate to different and critical temperatures of the syrup. The upper red line relates to syrup directly from the evaporator at approximately 212°+ Fahrenheit, and the lower red line corresponds with 60° or 68° Fahrenheit depending on the maker. The maple producer can take syrup directly from the evaporator into a hydrometer cup, a narrow tall metal cylinder, float the hydrometer and read the scale directly. Also, when the syrup temperature is 60° or 68° Fahrenheit, the reading is direct using the lower red line. Any deviation from these temperatures requires a temperature reading to be taken and a temperature compensation chart to be used. See Density Handouts. Maple producers use a variety of thermometers for this test.

Hydrometers should be kept clean and free of deposits. During use, they should be kept warm, usually done by soaking in hot sap in a hydrometer cup. The hydrometer should be checked annually for accuracy using a testing solution or by comparing with other hydrometers.

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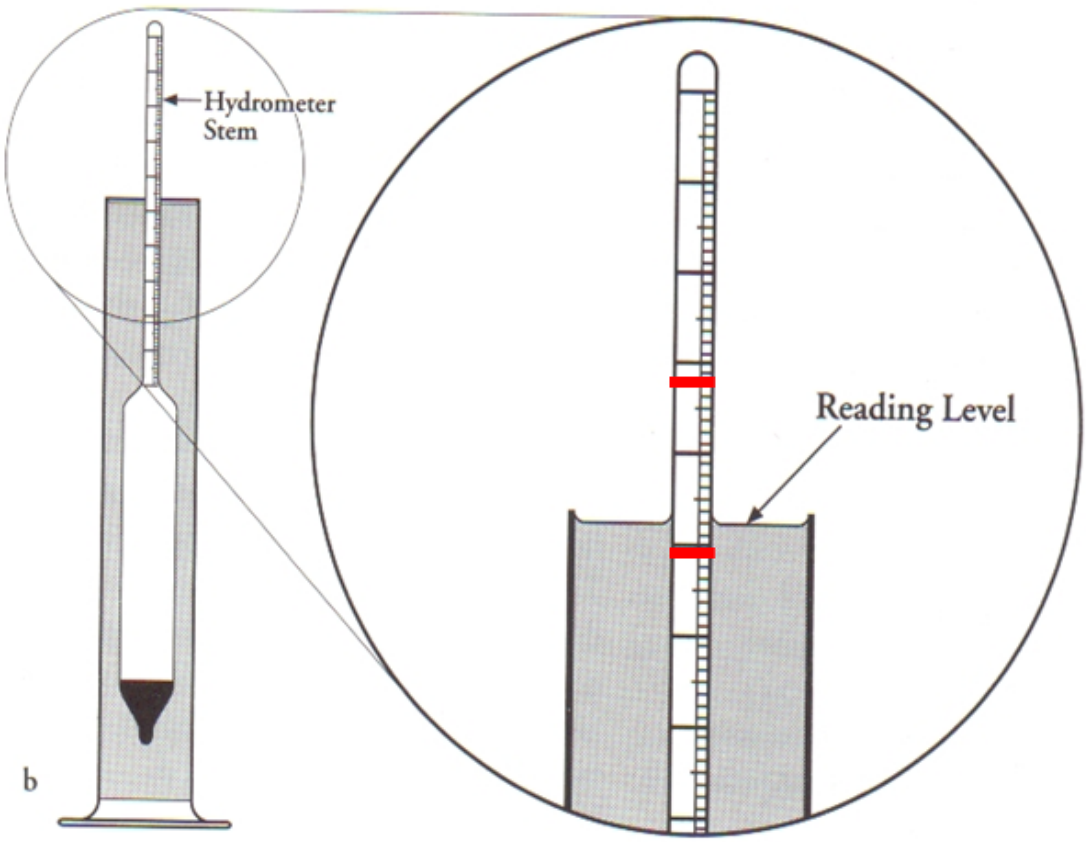
Refractometers measure the density of syrup by measuring its refractive index related to the amount of dissolved solids (sugar). A drop of syrup is applied to a glass window in the refractometer and the density is determined by looking through the opposite end of the instrument at a scale. A dark line will cut across the scale, determining the density reading. 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 60º F to 100º F. On the manually adjusted refractometer you can throw off the adjustment thermometer by where it is held with 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. However most refractometers are automatically temperature compensated, so the reading is direct. These instruments work well for syrup that is near room temperature and are commonly used in retail inspections and maple syrup competitions. When used for hot syrup (180°+ Fahrenheit), the reading may not accurate enough for precise density measurement. Digital refractometers can also be used for maple syrup. Be sure the well is full of syrup when taking a reading on a digital refractometer.

Hydrotherms are special liquid-filled hydrometers that automatically adjust for temperature. The density reading is taken by aligning the top of the liquid column with the level of the syrup being tested. Drawbacks to the use of hydrotherms include the fact that they are not calibrated to determine how much too light or too dense the product is. Also, it is very important to keep them warm during use and allowing them time to acclimate to the temperature of the syrup being tested. As with standard hydrometers, care must be taken to keep the instrument clean and free of deposits. See Appendix for more information on hydrometers.

The higher the density of syrup the less syrup is made from a given amount of sap. For example a producer making 66 gallons of syrup at 67 Brix could have made 67 gallons if it had been finished at 66 Brix.


Hydrometer
Stem
Reading Level
b

For hydrometers which are not temperature compensated, it is necessary to apply a correction factor to the observed reading to obtain the correct density. Hydrometers in current use are calibrated to either 60°F or 68°F which means that no corrections are required when the hydrometer and the syrup are both the calibration temperature (60°F or 68°F). However, many syrup hydrometers also contain a "hot test" scale. A compensation factor is incorporated into the scale which permits the correct determination to be made under hot conditions as well. However, when a non-temperature corrected hydrometer is used and temperatures are either above or below this value, an appropriate correction factor must be applied **(Table 8.1)**. In the past, different density scales were used to evaluate syrup. These included Vermont Baumé, New York Baumé and the Brix scale. Currently, Brix is the scale most commonly used to evaluated syrup density.

Table 8.1. Corrections to be applied to observed Brix readings of maple syrup to compensate for effects of temperature[1].

Temperature of syrup in hydrometer cup, °F	**Correction to subtract from (-) or added to (+) observed Brix reading of:**	
(1)	**60.0-69.9 ° (2)**	**69.9 ° and higher (3)**
	°Brix	*°Brix*
32	-1.4	-1.5
35	-1.3	-1.4
40	-1.2	-1.2
45	-1.0	-1.0
50	-.8	-.8
55	-.5	-.6
60	-.3	-.4
65	-.1	-.1
68[2]	**.0**	**.0**
70	+.1	+.1
75	+.3	+.3
80	+.5	+.5
85	+.8	+.8
90	+1.0	+1.0
95	+1.2	+1.2
100	+1.5	+1.5
105	+1.7	+1.7
110	+1.9	+1.9
115	+2.2	+2.2
120	+2.4	+2.4
125	+2.7	+2.7
130	+3.0	+2.9
135	+3.2	+3.2

140	+3.5	+3.4
145	+3.8	+3.7
150	+4.1	+4.0
155	+4.4	+4.2
160	+4.7	+4.5
165	+5.0	+4.9
170	+5.5	+5.2
176	+5.9	+5.7
[1] If observed reading is in ° Baume, first convert to °Brix, then apply the temperature correction.[2] Most hydrometers are calibrated at exactly this temperature.		

Maintaining and Adjusting Density

The Brix Scale

The Brix scale relates the density of syrup to sugar solutions of the same density and known percentages of sugar. The Brix value does not express the true percentage of sugar in a solution containing sugar plus other dissolved solids; rather, it indicates what the percentage of sugar would be if the density of the solution were due only to dissolved sugar. The Brix scale is particularly well suited for measuring the density of maple syrup because 98 percent of the dissolved solids are sugar. For practical purposes, the Brix value equals the percentage of sugar in the syrup.

A good approximation of the weight of sugar in any lot of maple syrup, whether or not it is standard-density syrup, can be found by multiplying the weight of the syrup by its density (° Brix) and dividing by 100. This information is important to the producer who sells their syrup wholesale, since the price is based on its solids (sugar) content or weight. Thus, 100 pounds of syrup at 65° Brix contains 65 pounds of sugar, whereas 100 pounds of standard-density syrup (66.0° Brix) contains 66.0 pounds of sugar. Therefore, 100 pounds of the low-density syrup has a lesser value than 100 pounds of standard-density syrup. Likewise, 100 pounds of syrup with a density of 66.8° Brix contain 66.8 pounds of sugar, which is more than that contained in 100 pounds of standard-density syrup, and it has a greater value.

Brix Corrections for Hydrometers Calibrated at 60°F and 68°F

Temperature of Syrup (°F)	Correction value to be added to observed Brix to give true Brix for Hydrometer Calibration: 60°F	68°F	Temperature of Syrup (°F)	Correction value to be added to observed Brix to give true Brix for Hydrometer Calibration: 60°F	68°F
215	7.3	6.9	**120**	2.8	2.4
210	7.1	6.7	**115**	2.6	2.2
205	6.8	6.4	**110**	2.4	2.0
200	6.6	6.2	**105**	2.1	1.7
195	6.3	6.0	**100**	1.9	1.5
190	6.1	5.7	**95**	1.6	1.3
185	5.9	5.5	**90**	1.4	1.0
180	5.6	5.3	**85**	1.2	0.8
175	5.4	5.0	**80**	0.9	0.6
170	5.2	4.8	**75**	0.7	0.3
165	4.9	4.6	**70**	0.5	0.1
160	4.7	4.3	**65**	0.2	-0.1
155	4.5	4.1	**60**	0.0	-0.4
150	4.2	3.9	**55**	-0.2	-0.6
145	4.0	3.6	**50**	-0.5	-0.8
140	3.8	3.4	**45**	-0.7	-1.1
135	3.5	3.1	**40**	-0.9	-1.3
130	3.3	2.9	**35**	-1.2	-1.6
125	3.1	2.7	**30**	-1.4	-1.8

These figures are calculated from the formula on page 74 of the Maple Syrup Producers Manual, Agricultural Handbook No. 134, July 1976. True Density (° Brix) = Observed Brix + (0.047 x Temperature of Syrup - Temperature for which the hydrometer is calibrated).

Edmund E. Grote, Uihlein Sugar Maple Research Extension Field Station, Lake Placid, NY. March 1996.

CORRECTION TABLES FOR HYDROMETERS

(For temperatures other than that for which Hydrometer was calibrated)

Scale for 68 Degrees F. Hydrometer*

Subtract 0.4 Degrees Brix from 32-49 Degrees F.
Subtract 0.3 Degrees Brix from 50-56 Degrees F.
Subtract 0.2 Degrees Brix from 57-61 Degrees F.
Subtract 0.1 Degrees Brix from 62-66 Degrees F.
Subtract 0.0 Degrees Brix from 67-69 Degrees F.
Add 0.1 Degrees Brix from 70-73 Degrees F.

Adjusting Syrup Density

Heavy syrup decreases the potential number of gallons of syrup that can be made from a quantity of sap. Syrup should, therefore, be adjusted to the proper density. Further, syrup with a density of more than 67° Brix must be diluted or it will crystallize in storage. The syrup can be diluted either by adding sterilized (boiled) water or sap or low-density syrup.

The calculation for adjusting heavy syrup can be done accurately only after its true density (Brix value) has been determined. If the true density is known the amount of water to add to yield 66° Brix syrup can be obtained directly from the data in **Table 8.3**. The syrup should be thoroughly stirred following addition of the water to ensure uniform mixing. Afterwards, the Brix value should again be determined to make certain the correct density has been obtained.

Table 8.3. Water to add to 100 pounds or 1 pound of heavy syrup (66.1 ° to 70.0 ° Brix) to obtain 66 ° Brix syrup.

True Brix value of undiluted syrup[1]	Amount of water to add to heavy syrup[2]		
	Per 100 pounds		Per pound
	Pints	Ounces	Fluid ounces
66.1 °	0	2	0.02
66.2 °	0	5	.05
66.3 °	0	7	.07
66.4 °	0	10	.10
66.5 °	0	12	.12
66.6 °	0	15	.15
66.7 °	1	1	.17
66.8 °	1	3	.19
66.9 °	1	6	.22
67.0 °	1	8	.24
67.1 °	1	11	.27
67.2 °	1	13	.29
67.3 °	2	0	.32
67.4 °	2	2	.34
67.5 °	2	4	.36
67.6 °	2	7	.39
67.7 °	2	9	.41
67.8 °	2	12	.44
67.9 °	2	14	.46
68.0 °	3	1	.49
68.1 °	3	3	.51

68.2 °	3	5	.53
68.3 °	3	8	.56
68.4 °	3	10	.58
68.5 °	3	13	.61
68.6 °	3	15	.63
68.7 °	4	1	.65
68.8 °	4	4	.68
68.9 °	4	6	.70
69.0 °	4	9	.73
69.1 °	4	11	.75
69.2 °	4	14	.78
69.3 °	5	0	.80
69.4 °	5	2	.82
69.5 °	5	5	.85
69.6 °	5	7	.87
69.7 °	5	10	.90
69.8 °	5	12	.92
69.9 °	5	15	.95
70.0 °	5	1	.97

[1] °Brix of syrup after correction for temperature.
[2] For practical approximations, pints = pounds avoirdupois, and fluid ounces = ounces avoirdupois.

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.

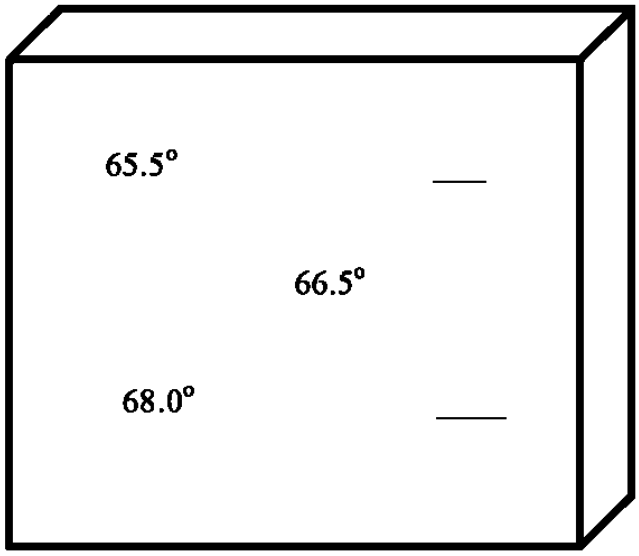
Except for the most experienced among us, guessing the proportion of syrup, water, or sap to blend with off-density syrup can be a frustrating experience. The alternative is to calculate the proportions of syrups to blend to achieve the desired density. Certainly, those of us who are mathematically inclined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

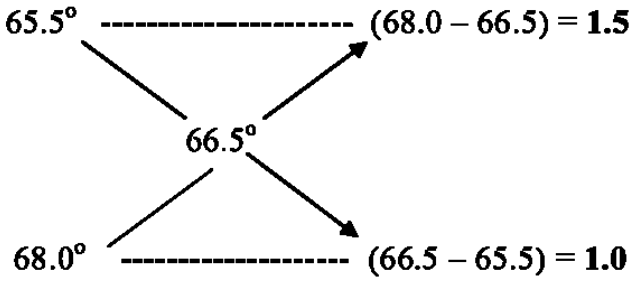
BLENDING SYRUP WITH SYRUP

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:



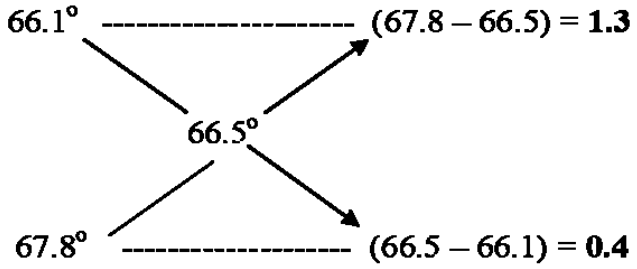
Subtracting across the two diagonals provides the proportion (by weight) of each syrup required to produce the desired density. Always subtract the smaller number from the larger, irrespective of its location. The proportion (by weight) of each syrup to be blended is the number located directly across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



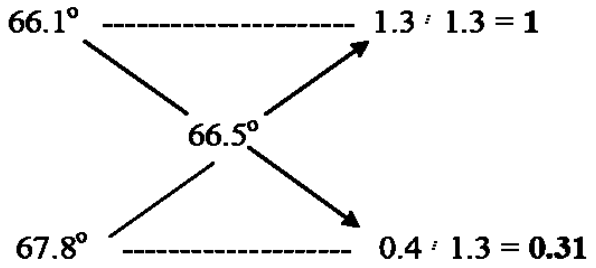
Blending 1.5 parts 65.5° Brix syrup with 1.0 part 68.0° Brix syrup results in a blend with a density of 66.5° Brix . If we had 150 pounds of 65.5° Brix syrup and wished to raise its density to 66.5° Brix by blending it with 68.0° Brix syrup, we would need to mix the 150 pounds of 65.5° Brix syrup with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



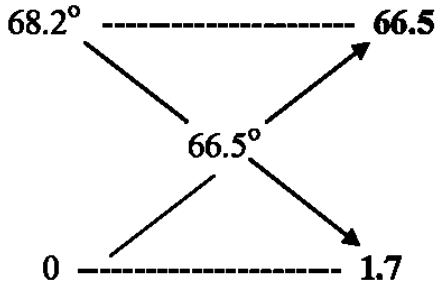
If we had 120 pounds of 66.1° Brix syrup we could combine it with 37.2 pounds of 67.8° Brix syrup (120 times 0.31) to produce 157.2 pounds of 66.5° Brix syrup. Similarly, 3 gallons of 66.1° Brix syrup could be combined with 0.93 gallons (or 119 fluid ounces) of 67.8° Brix syrup to produce 3.93 gallons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

BLENDING SYRUP WITH WATER OR SAP

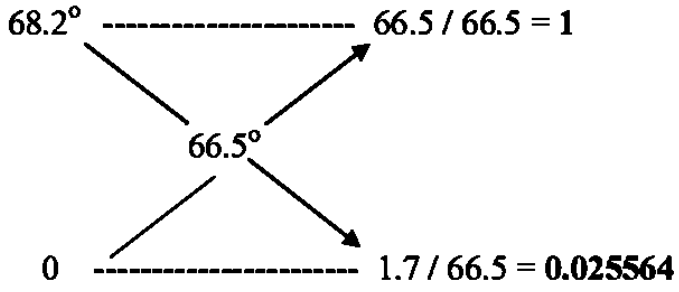
When blending syrup with water or sap on a weight basis, the proportions to mix can be determined using the method of alligation in the same way it was used when blending syrup with syrup. When blending on a volume basis, the proportions must be adjusted because of the difference in the weight of syrup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



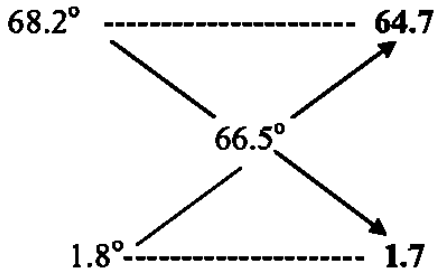
Again, since we are asking the question: "How much water should I blend with the syrup?" let's set the proportion of syrup equal to "one" in the ratio by dividing both numbers by 66.5 resulting in:



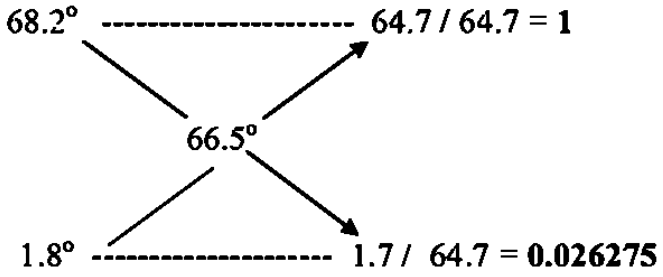
If we wished to lower the density of 350 pounds of 68.2° Brix syrup to 66.5° Brix by adding water, we would add:

(350 pounds syrup) (0.025564 pounds water/pound syrup) = 8.95 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:



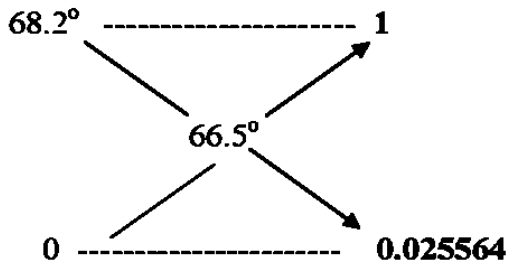
If we wished to use 1.8° Brix sap to lower the density of 350 pounds of 68.2° Brix syrup to 66.5° Brix , we should add:

(350 pounds syrup)(0.026275 pounds water pound syrup) = 9.2 pounds sap

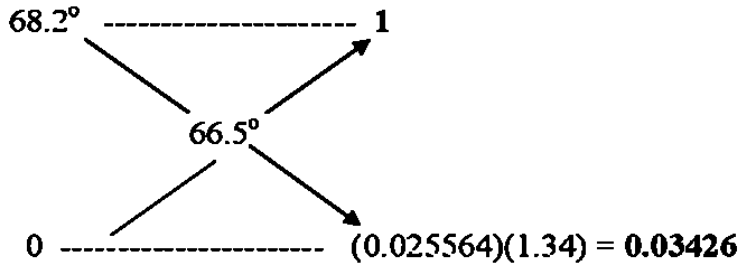
Volume Basis

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 (0.25564) 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

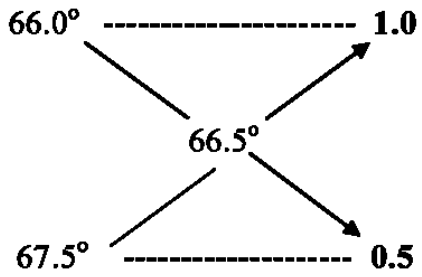
The method of alligation provides a quick and easy way to determine the proportion of syrup, sap, or water that should be combined with an off-density syrup to obtain a blend of the desired density.

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.

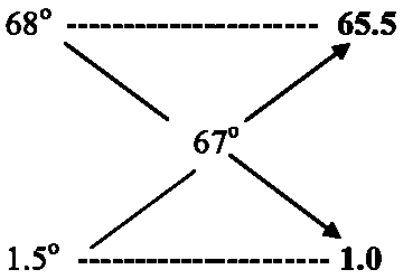


Five gallons of 67.5° Brix syrup should be mixed with 10 gallons of 66.0° Brix syrup to produce 15 gallons of 66.5° Brix syrup, or 55.2 pounds of 67.5° Brix syrup should be mixed with 110.4 pounds of 66.0° Brix syrup to produce 165.6 pounds of 66.5° Brix syrup.

Blending Syrup With Water or Sap

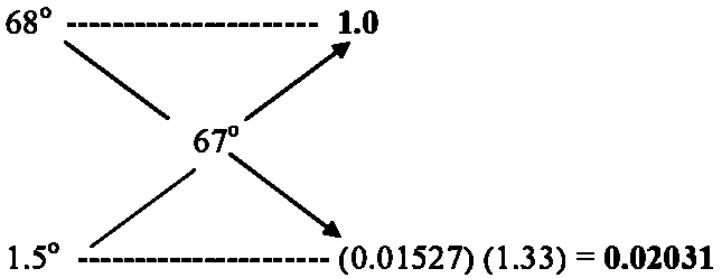
When blending syrup with water or sap the proportions determined by alligation may be applied to weight measurements but must be adjusted when applied to volume measurements because of the relatively large difference between the weights of syrup and water or sap.

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

Hydrotherm

Description:

The hydrotherm is a combination of the hydrometer and the thermometer. It will indicate clearly the density of the maple syrup at any temperature between 35 ^{0} F. and 210 ^{0} F. (r 2 ^{0} C and 99 ^{0} C). The scale of the hydrotherm is graduated in 0.2 ^{0} Brix and will show how far the syrup is from the correct density.

Measuring Method:

For instant reading in hot syrup, keep the hydrotherm in hot water; before use dry it well. Fill the cup with syrup and lower the hydrotherm slowly down into the cup. Avoid knocking the sides and bottom. The maple syrup will be ready to draw-off when the top of the red column floats even with the surface. Pay no attention to the scale. If the red stands too high, the syrup is too thick. If the red does not show, it is too thin and needs to be boiled more.

Note:

To meet federal requirements, maple syrup should be packed at a minimum of 66 percent soluble solids content or 66 ^{0} Brix. Since the density of syrup is about 65.8 ^{0} Brix when the top of the red floats even with the surface, you will have to boil it 0.2^0 Brix over.

Precautions:

The hydrotherm should always be stored in a vertical position when not in use. Do not let it freeze in water or sap. Should the red column separate, get it at the boiling water point, put it in a strong cotton or nylon stocking with a stopper in the bottom and go outside and whirl it around like a slingshot. If limestone coats the hydrotherm, scrape it gently with a razor blade. Never clean it with emery paper.

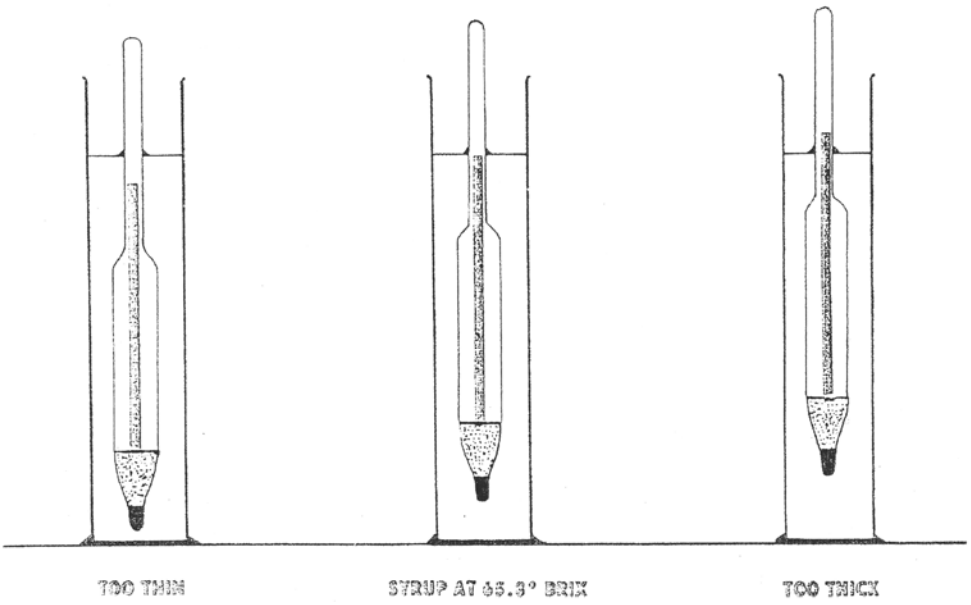


Table 8.2. Comparison of Brix with Baumé scales for values between 30° and 70° Brix at 68°F.

° Brix	° Baumé	° Brix	° Baumé	° Brix	° Baumé	° Brix	° Baumé	° Brix	° Baumé	° Brix	° Baumé
30.0	16.6	43.5	23.8	57.0	30.9	62.0	33.5	64.7	34.9	67.4	36.3
30.5	16.8	44.0	24.1			62.1	33.6	64.8	34.9		
31.0	17.1	44.5	24.4	57.5	31.2	62.2	33.6	64.9	35.0	67.5	36.3
31.5	17.4			58.0	31.5	62.3	33.7			67.6	36.4
32.0	17.7	45.0	24.6	58.5	31.7	62.4	33.7	65.0	35.0	67.7	36.4
		45.5	24.9	59.0	32.0			65.1	35.1	67.8	36.5
32.5	17.9	46.0	25.2	59.5	32.2	62.5	33.8	65.2	35.2	67.9	36.5
33.0	18.2	46.5	25.4			62.6	33.8	65.3	35.2		
33.5	18.5	47.0	25.7	60.0	32.5	62.7	33.9	65.4	35.2	68.0	36.6
34.0	18.7			60.1	32.5	62.8	33.9			68.1	36.6
34.5	19.0	47.5	26.0	60.2	32.6	62.9	34.0	65.5	35.3	68.2	36.7
		48.0	26.2	60.3	32.6			65.6	35.3	68.3	36.7
35.0	19.3	48.5	26.5	60.4	32.7	63.0	34.0	65.7	35.4	68.4	36.8
35.5	19.6	49.0	26.8			63.1	34.1	65.8	35.5		
36.0	19.8	49.5	27.0	60.5	32.7	63.2	34.1	65.9	35.5	68.5	36.8
36.5	20.1			60.6	32.8	63.3	34.2			68.6	36.9
37.0	20.4	50.0	27.3	60.7	32.9	63.4	34.2	66.0	35.6	68.7	36.9
		50.5	27.5	60.8	32.9			66.1	35.6	68.8	37.0
37.5	20.6	51.0	27.8	60.9	33.0	63.5	34.3	66.2	35.7	68.9	37.0
38.0	20.9	51.5	28.1			63.6	34.3	66.3	35.7		
38.5	21.2	52.0	28.3	61.0	33.0	63.7	34.4	66.4	35.8	69.0	37.1
39.0	21.4			61.1	33.1	63.8	34.4			69.1	37.1
35.5	21.7	52.5	28.6	61.2	33.1	63.9	34.5	66.5	35.8	69.2	37.
		53.0	28.9	61.3	33.2			66.6	35.9	69.3	37.2
40.0	22.0	53.5	29.1	61.4	33.2	64.0	34.5	66.7	35.9	69.4	37.3
40.5	22.2	54.0	29.4			64.1	34.6	66.8	36.0		
41.0	22.5	54.5	29.6	61.5	33.3	64.2	34.6	66.9	36.0	69.5	37.3
41.5	22.8			61.6	33.3	64.3	34.7			69.6	37.4
42.0	23.0	55.0	29.9	61.7	33.4	64.4	34.7	67.0	36.1	69.7	37.4
		55.5	30.2	61.8	33.4			67.1	36.1	69.8	37.5
42.5	23.3	56.0	30.4	61.9	33.5	64.5	34.8	67.2	36.2	69.9	37.5
43.0	23.6	56.5	30.7			64.6	34.8	67.3	36.2	70.0	37.6

Filtering and Clarity

Syrup filtration and clarity

Maple syrup is produced by concentrating the sugar in maple sap through evaporation. Concentration results from boiling the sap and reducing the water content. The maple flavor and color are the result of evaporation by boiling. Along with the concentration of sugar during evaporation other compounds present in the sap increase in concentration. While these non-sugar components are present in very small quantities in sap, evaporation can increase their content to significant levels. When maple sap is boiled, the process causes the sugar in the sap to be concentrated, excess water to be evaporated and some of the minerals in the sap to become suspended solids. These solids are known as sugar sand or niter and give the syrup a gritty texture and a cloudy appearance. It is very important to remove the niter from the syrup as leaving it in may cause the syrup to have an off-flavor. This off-flavor can be described as creating a baking soda affect on the tongue. Also, in the international standard, it is a law that syrup must be clear and free of niter.

The amount of niter or sugar sand is not the same in all syrups. It is theorized that the amount of niter can be attributed to soil types, site factors, and weather conditions, though these relationships have not been proven. It certainly appears that the amount and types of niter have a correlation with the amount of sap flow, governed by weather conditions. It will vary from year to year as well as during the season. It will also vary from one sugagrbush to another even with in the same season. Factors responsible for the amount of mineral compounds in maple sap are not completely understood. Apparently soil and site factors upon which the maple trees are growing contribute. Weather conditions affecting the soil moisture level and ground water pH are likely involved.

The composition of sugar sand is outlined in a table further along in the section but it is dominated by calcium and magnesium salts of malic acid. These salts become suspend in the concentrating sap because they are less soluble than the sugars and fall out of solution and become temporarily suspended in the cooking syrup. Some will collect on the bottom and sides of the evaporator, the rest will need to be filtered from the syrup. Sugar sand can occur in various forms ranging from a nondescript oily substance which is dark in color to a fine grained crystalline material which is light in color. The color of the suspended sugar sand can cause syrup to appear cloudy or darker in color than it actually is.

There are two methods of removing suspended materials from maple syrup. These involve sedimentation or settling, and filtration. There are advantages and disadvantages to each method and producers should choose the method that works best for his or her situation. Syrup which is to be marketed commercially must have all suspended precipitates' removed. Clarification by filtering is necessary to meet the international standards. Two methods of removing suspended materials which involve sedimentation and filtration systems.

Sedimentation

In the past, many producers used a sedimentation or settling process to clarify maple syrup. Sedimentation has several disadvantages and is not commonly used by commercial producers. Sedimentation consists of placing finished syrup in a large container and allowing the suspended material to settle out. This process may require a long time ranging from a few days to several weeks. Sedimentation is effective for removing most suspended material , however, some very fine particles may remain suspended. When the syrup in the settling tank indicate the syrup is clear, the syrup is carefully removed. Before packaging, it must be reheated to 180 degrees F to ensure a sterile pack. This reheating may darken the syrup resulting in a reduction of grade and may initiate new sugar sand forming in the syrup, especially if heated much above 180.

Filtration

Filtration involves pouring or forcing finished syrup through a filter or series of filters to remove all suspended particles. Syrup[may be filtered either through a gravity system or a pumped pressure system. When done correctly either process will result n effective clarification.

Gravity filtering—Gravity filtering systems are of two types, cone and flat filters. The cone filters uses a cone shaped wool or Orlon felt bag or cone which is suspended over a container. Hot syrup from the evaporator is poured into the filter and allowed to flow into the collection container. To speed up filtering several cones may be hung over a single collection container. Often the collection container will have the capacity to keep the filtered syrup hot (180 F) and a canning spigot so canning is accomplished with the same equipment.

Flat filters consist of a wool or Orlon felt sheet which is placed over a hardware cloth screen. Hot syrup is poured on the filter and allowed to pass through to the collection tank below. As with the cone filters the collection container is usually equipped to keep the syrup hot and has the spigot for directly canning the filter syrup. As syrup passes through the filter sugar sand collects on the face of the filter reducing the rate that syrup is being filtered. Eventually the filter will become clogged and must be cleaned. To prolong the period of use between washings it is recommended that a pre-filter be used. Paper or nylon pre-filters are available which can be placed on top of the felt filter. When accumulations of sugar san build up, the pre-filter is either replaced or removed, washed and reinstalled. This process will extend the life of the felt filter and will increase the rate at which filtration occurs.

While different techniques are used to wash filters, many producers use a system which attempts to keep the syrup side of the filter from coming in contact with the accumulated sugar sand material. Before washing the sugar sand is carefully scraped off. Then, water is forced through the filter from the syrup side to the sugar sand side. When all sugar and has been removed the filter is washed and allowed to dry. In the washing process it is important not to use chlorine bleach, scented detergents or other washing aids which might impart an off flavor to finished syrup. Between seasons, filters should be stored in a clean, dry place. Filters should not be exposed to moth balls or other aromatic substances, or these odors and flavors may be transferred to the syrup.

Filtering Rules - Gravity

•Pre-filters (both "cone" type or "flat type" filters) save labor. When used, the felt filters may be in service longer between cleanings. Wash and dry pre-filters often in pure, hot water.

•Pre-filter are usually paper.

•Old, threadbare filters cause cloudy syrup. Holding filters up to light will reveal filter problems.

A typical orlon filter has openings in it which are about 40 microns in size. If the syrup is too watery and not boiled enough, the sediment has not had a chance to fully precipitate out and will pass through the filter with the watery syrup. Go the other way and make your syrup too thick and nothing will go through the filter, not even the syrup. The syrup needs to be hot, the hotter the better and as close to 66.5 brix as possible.

•if the syrup cools below 180 degrees F during the filtering process, heat your syrup to the recommended 180 to 200 canning range. Care must be taken so that the syrup is not overheated, however. Syrup heated beyond the 200 degree F. mark is likely to produce more sugar sand and needs to be re-filtered.

•DO NOT store filters in moth balls, cedar closets, airtight containers, or near scented materials.

•CLEAN filters thoroughly, dry thoroughly, and store in a cloth bag in clean, dry, airy, storage.

•CHLORINE BLEACH should NOT be used to clean filters. In spite of repeated washings, rinsings, and airings, filters which have been washed with bleach impart off-flavors to syrup.

•Scented cleansers, fabric softeners, and "dryer sheets" should NOT be used.

•New filters and pre-filters must be thoroughly BOILED in CLEAN water (not in sap pans) and AIR DRIED (in the sun if possible.)

•Use the "SNIFF" test to provide an added check for your filters. Musty old filters, and new chemical-smelling filters should NOT be used.

•Filters can impart off-flavors to syrups, making the product unfit for sale.

•Filter HOT syrup (210 degrees F.) IMMEDIATELY after removal from the pan. Do not stir syrup through the filter. Not this hot when reheating.

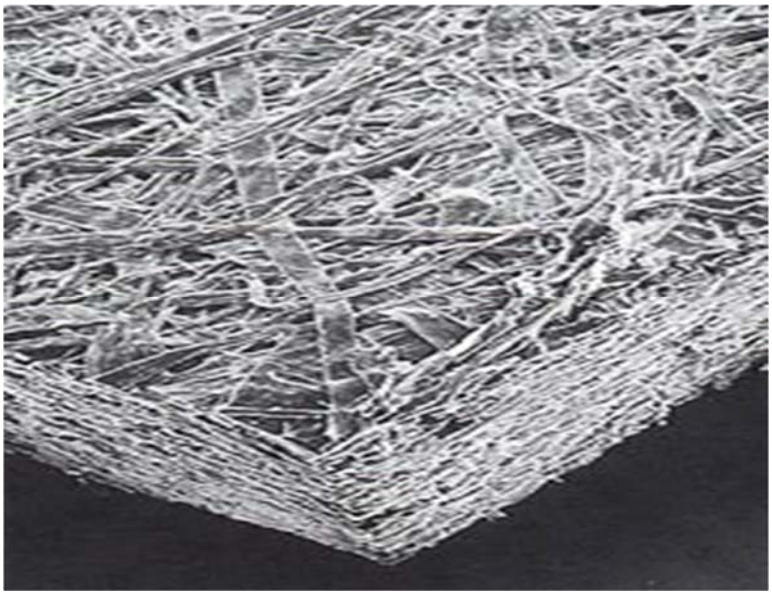
Pressure Filters—For producers who process relatively large volumes of syrup or for those who do not want the bother associated with gravity filters, pressure filtering units are available. Pressure units are capable of filtering finished syrup quite rapidly and at the same time, producing a product of the highest clarity. Pressure filters consist of a mechanical pump, usually gear pumps or diaphragm pumps, which forces the syrup trough a series of filter plates and disposable filter pads. Before pumping finished syrup through the filter a small amount of filter aid, diatomaceous earth (DE) is added to the finished syrup. This product increases the efficiency and speed of the filtering by catching suspended sugar sand . Care must be exercised in assembling filter plates and pads to ensure all syrup is forced through the press. Likewise, pump pressure must be carefully regulated to avoid rupturing the filer pads. Guidelines for use of filter presses are provided by the manufacture of these units.

Filter Press

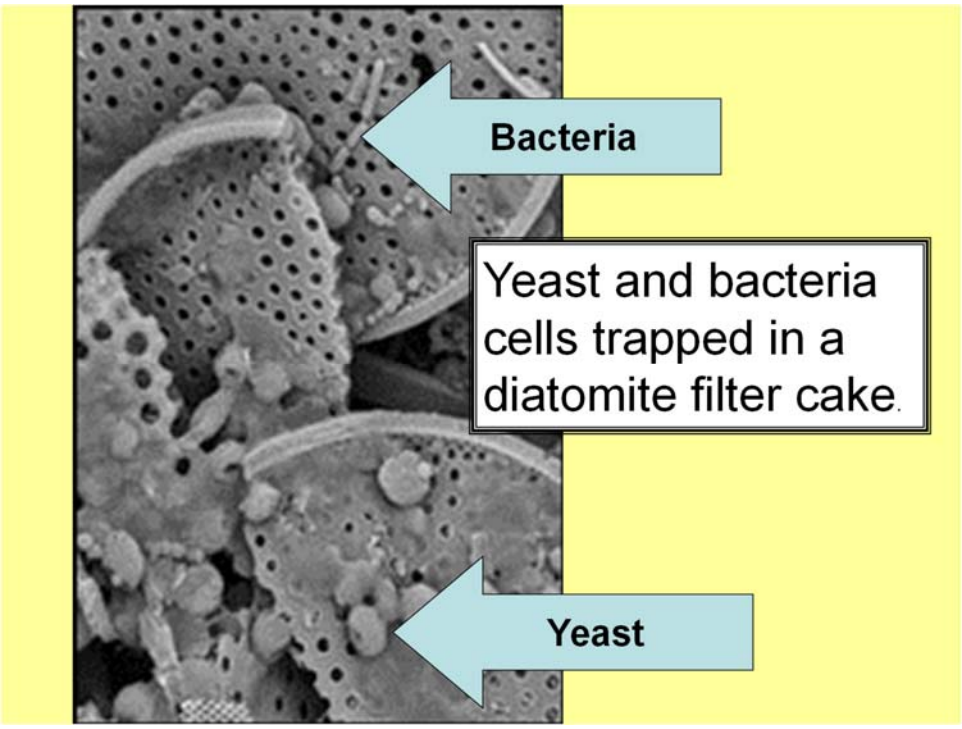
•Syrup is pumped through the filters
•You know you need to change filters when the pressure goes up.
•Filter Aid is used to increase the life of the filter papers
•Surface to built DE cake
•Use correct size
•Match inlet and outlet holes
•Moisten papers to hold place during setup

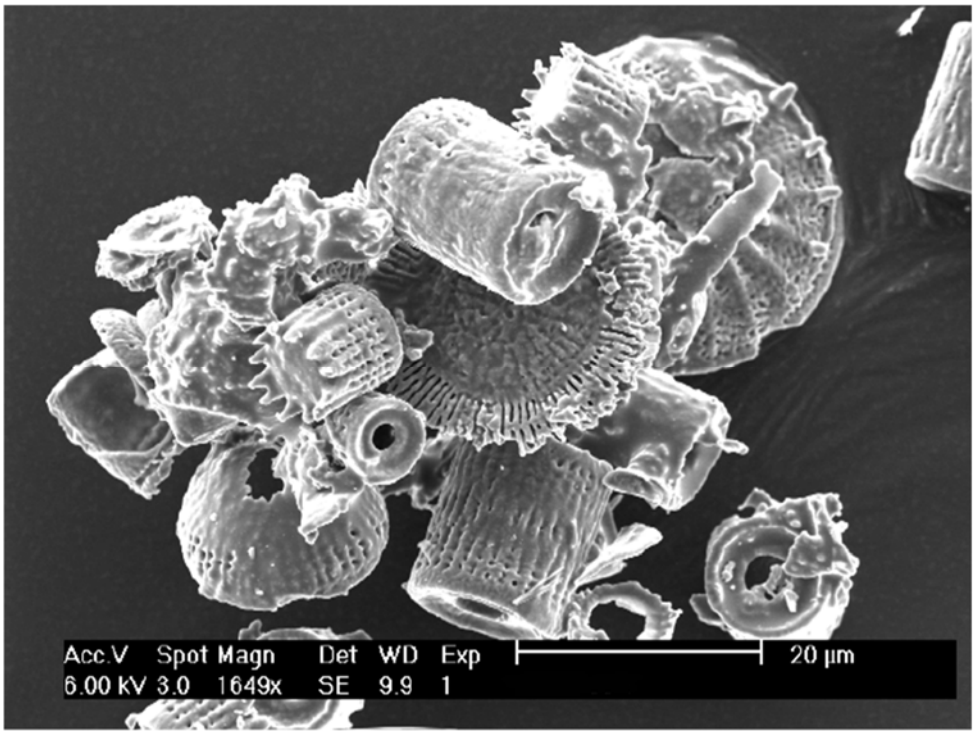
Filter Aid
•Diatomaceous earth is skeletal remains of diatoms, a diverse array of microscopic, single -cell algae. Diatomite products have an inherently intricate and highly porous structure composed primarily of silica.

Filter Paper and Diatomaceous Earth



•A paper filter has paper fibers with a width of about 20 microns . These fibers form a "mesh" through which only objects that are smaller than the openings in the mesh can pass. Diatomaceous earth, made up of diatoms that are 15-30 microns in diameter, cannot pass through this paper fiber mesh. •When you pump syrup and diatomaceous earth through the paper filter, the syrup can go through the filter, but the diatoms are too large.





Chemical Analysis

Arsenic

SiO_2	80 TO 82
Al_2O_3	4.64
Fe_2O_3	4.83
TiO_2	0.31
CaO	0.68
MgO	0.70
Na_2O_3	0.40
K_2O	0.10

Grades of Filter Aid

- Do not use garden grade diatomaceous earth
- Do <u>NOT</u> to use swimming pool grade for syrup even though it is much less expensive.

- Normal operating pressure for a 10” plate press with seven plates is between 0 and 20 psi
- Watch for spikes in the pressure, generally do not exceed 50 to 60 psi
- Opening the bypass value will reduce pressure but will also reduce filtration rate
- A general rule of thumb is to clean your press if the bypass valve is used

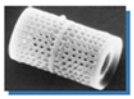
There are grades of diatomaceous earth:
Here is a report from one of the research on DE cooperators:

Maple Producer Comments:

I've been trying different grades of De and doing things different with the filter.

Happy to report things are much better. I'm using the FW 60 the courses of the grades. We are pre coating with 1 1/2 lbs of De. Then adding 1 cup additional when the pressure goes up 5lbs. This has allowed us to filter 3 barrels plus per setup.

By adding the extra De it helps maintain the pressure. It won't lower the pressure but it helps maintain the pressure. When we breakdown the filter the plates are full.



Celatom

Filtration Spectrum Performance Scanner

Eagle-Picher Minerals, Inc.
A Wholly Owned Subsidiary of Eagle-Picher Industries, Inc.
9785 Gateway Drive - Reno, Nevada 89521 / P.O. Box 12130 - Reno, Nevada 89510
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web: http://www.minerals.epcorp.com e-mail: sales@minerals.epcorp.com

Product Category/Nomenclature	Water Permeability Min-Max [1a]	Water Permeability Darcy (Typical)[1b]	Median Particle Diameter[2] - Micron (Typical)	Particle Size Removal - Micron (Approx.)	Color	Bulk Density lbs./ft.³ (Typical) Dry Loose	Bulk Density lbs./ft.³ (Typical) Wet Cake	Bulk Density g/l (Typical) Dry Loose	Bulk Density g/l (Typical) Wet Cake	General Application
Filter Natural (Polish)										
FN-1	21-23	0.04	13	<0.1	Off White	12	24	190	380	Polishing beer, fats, gelatin, lacquers, oils, pections, sugar, wine, filter pads.
FN-2	23-28	0.06	16	0.1	Off White	14	21	220	340	
FN-6	15-20	0.02	12	<0.1	Off White	12	26	190	420	
Filter Calcined (Polish)										
FP-1SL	20-26	0.07	13	0.1	Pink	12	25	190	400	Polishing beer, fats, gelatin, lacquers, oils, pectins, sugar, cider, petro-products, vinegar, alcohol, citric acid, phosphoric acid, lube oil additives, enzymes, liquid sugar.
FP-1W	31-40	0.13	13	0.2	Pink	12	25	190	400	
FP-2	24-31	0.09	13	0.1	Pink	12	25	190	400	
FP-3	40-48	0.20	14	0.3	Pink	12	25	190	400	
FP-4[3]	40-59	0.22	16	0.5	Pink	12	23	190	370	
Filter Flux (Slow)										Acids, antibiotics, beer, caustics, chemicals, cider, enamels, gelatin, glue, fruit juices, kelp, lard, oils, petro-products, pharmaceuticals, plastics, shellac, lube oils, solvents, starch, alcohol, pectin, wine, phosphoric acid, vinegar, tallow, plating solutions, liquid sugar, molasses, titanium sulfate, dry cleaning solvents, waxes.
FW-6	59-79	0.48	18	.5	Lt.Pink/White	12	23	190	370	
FW-12	85-100	0.80	24	0.7	Lt.Pink/White	13	20	210	320	
FW-14	100-125	1.20	28	0.75	White	14	20	210	320	
Filter Flux (Medium)										Liquid sugar, vinegar, water, waxes, whiskey, acids, citrates, tallow, water chemicals, fruit juices, kelp, hemp oil, fuel oil, oils.
FW-18	125-145	1.50	31	0.8	White	14	20	220	320	
FW-20	130-155	2.10	33	0.9	White	14	20	220	320	
FW-40	143-183	3.20	40	1.0	White	15	20	240	320	
Filter Flux (Fast)										Algins, wort beer, antibiotics, casein, pressed juices, lacquers, polymers, syrups, sorghum, tallow, varnish, water, titanium sulfate, corn gluten, citric juices, chemicals, resins, enzymes, enamels, kelp, plastics, shellacs, corn syrup, phosphoric acid.
FW-50	143-183	3.50	42	1.1	White	15	19	240	300	
FW-60	191-258	5.00	48	1.2	White	15	19	240	300	
FW-80	312-400	10.00	77	1.6	White	16	19	260	300	

1a The flow rate ratio in which distilled water is passed through a 4g sample and compared to an EPMI Standard (FW-14 = 100).
1b A unit of permeability, equivalent to the passage of 1cc of fluid with 1 centipoise viscosity, flowing in 1 sec. under a pressure of 1 atmosphere, through a porous medium 1 sq. centimeter in area and 1 centimeter thick.
2 Percent by weight by forward scattered laser light. Particle size does not necessarily reflect filtration performance.
3 FP-4 is produced with a small amount of flux.

•Always use food grade grease and dispense it using a grease gun that is only used for this purpose
Do not run the pump with out fluid. This causes excessive wear and tear.
If you reheat cold syrup for canning, you may want to re-filter that syrup as you may create new mineral sediment, this is especially important when canning into glass .
When reheating syrup for canning you may want to avoid heating to over 200ºF as excessive heat can induce significant sediment and further darken the grade .
•Experiment to find the exact amount of filter aid (Diatomaceous Earth) needed to filter the syrup.
•Filter papers should be changed when pressure builds up.
•Surface to built DE cake
•Use correct size
•Match inlet and outlet holes
•Moisten papers to hold place during setup.

Table 1-1: General recommendations for Diatomaceous Earth needed for various filtering batch sizes in 7" or 10" plate filter presses. (More DE may be needed for dark or late season syrup.)

Gallons=	7" Plate Press	10" Plate Press
40	5 cups	8 cups
45	6	9
50	7	10
55	8	11

BATCH FILTERING

Sugarmakers who collect syrup into a finishing pan or some other holding container before filtering are using the "batch filtering" method.

When charging the press during batch filtering, half the total DE used to filter the batch of syrup is added to the charging bucket of syrup. The remaining DE is mixed with the remaining syrup to be filtered. This insures that DE will be constantly added to the existing cake in the filter press. By adding DE continually to the filter press more surface area is created during filtering. The impurities (niter) being filtered is spread out and filtering capacity is increased.

If more then one batch of syrup is sent through the same set of cakes and papers, care must be taken to prevent excessive cooling of the press.

CONTINUOUS FILTERING

An alternative to batch filtering is "continuous filtering", which involves the same steps for charging the press as batch filtering. With continuous filtering each draw off is sent directly through the press.

sugarmakers that will only produce a gallon of syrup an hour may encounter problems with clogging or noticeable drop in temperature within the press. A press that has cooled can in turn cool filtered syrup below 180'F. Gravity will naturally pull downward on the filter cakes over time. If the press is left idle for too long, gaps may be created in the DE cake allowing unfiltered syrup to pass through.

Grades of Diatomaceous Earth

Do not use garden grade or swimming pool grade diatomaceous earth to filter syrup. Even though these may be less expensive and work well for filtering, they may contain minerals and contaminants not acceptable for use with filtering food. Always use food grade filter aid.

RECOMMENDATIONS FOR PROPER PLATE FILTER PRESS OPERATION

M. Isselhardt, S. Williams,
B. Stowe and T. Perkins

Proctor Maple Research Center

The UNIVERSITY of VERMONT EXTENSION

AES Vermont

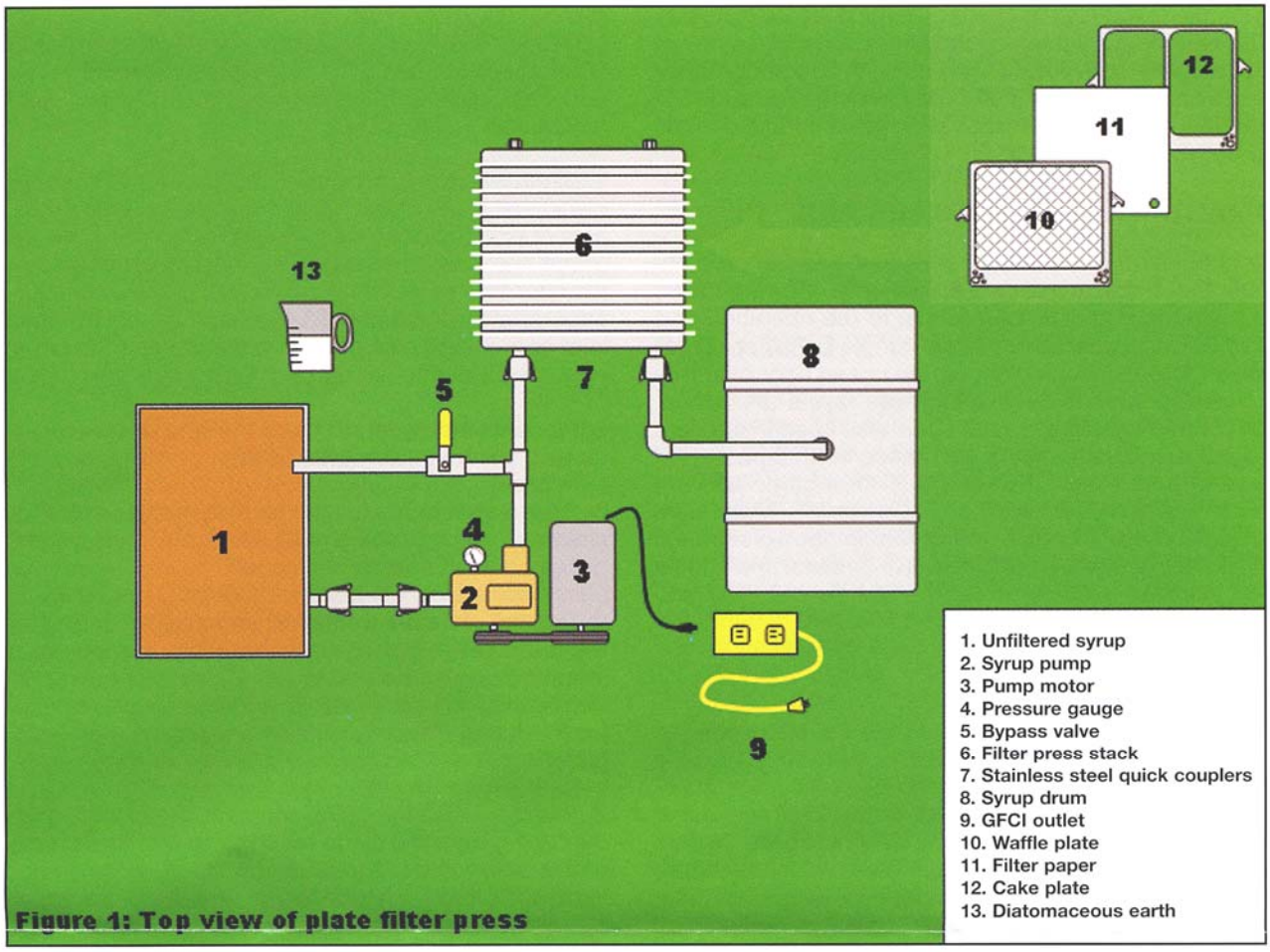

Figure 1: Top view of plate filter press

INTRODUCTION

Consumers of pure maple syrup demand a high quality product. Like most food items, appearance can affect the value of maple syrup and the customer's perception of quality. Proper filtration is essential to remove sugar sand (niter) in order to ensure a quality finished product. The two main categories of filtration are gravity filters and pressure filters (filter presses). Both methods can produce excellent results; the major difference is the rate of processing. Filter presses are designed to filter large volumes of syrup in a relatively short amount of time.

New filter presses do not always include a complete set of instructions and the proper procedures in using a filter press are not always apparent. This publication is meant to provide guidelines for the proper use of plate filter presses.

THE PLATE FILTER PRESS

There are two main types of filter presses on the market: the canister and plate press. This guide deals specifically with plate presses.

The plate press works by pumping unfiltered syrup through a series of filters coated with filter aid under pressure. The result is an attractive "polished" product. This value added product generally commands a higher price in the marketplace.

THE PARTS OF A FILTER PRESS

Figure 1 shows the major components of a plate filter press: Syrup pump and motor with safety guard, filter press frame and filter plates, pressure gauge, bypass valve, filter papers and filter-aid (commonly Diatomaceous Earth or DE). A GFCI (ground fault circuit interrupt) is used in conjunction with a filter press.

SYRUP PUMP AND PUMP MOTOR: 2 & 3

A variety of pumps are available for filter presses, including bronze gear pumps, plastic diaphragm pumps which require an air compressor, stainless steel gear pumps and hand operated pumps for small presses. Most filter presses come equipped with a gear type pump powered by an electric motor. The motor commonly has a rubber belt that drives the pump. This assembly should always be covered by a safety guard. WARNING: excessive recirculation of syrup through older bronze gear pumps may lead to elevated lead levels in syrup.

FILTER PRESS STACK AND FILTER PLATES: (6, 10 & 12)

The filter press frame acts as a support for the filter plates. The filter press is made up of a "stack" of waffle and cake plates. Waffle plates act to distribute the syrup evenly while providing a firm backing for the DE cake and filter paper. Cake plates have a cavity that allows the cake of DE to form.

Filtering capacity increases with size and number of plates used. The method for tightening the plates is usually a pair of threaded bars with heavy-duty wing-nuts. A pan or container is needed to catch the syrup that weeps from the press. Many sugarmakers add a set of stainless steel quick couplers to the inlet and outlet of the press.

DIATOMACEOUS EARTH (FILTER AID): 13

Diatomaceous earth works in a filter press by forming a complex matrix that traps suspended solids while allowing maple syrup to pass through. DE is essential to the operation of a filter press. DE, the skeletal remains of single-celled sea creatures called Diatoms accumulate on the ocean floor over millions of years forming thick layers. These layers are mined, sifted, and sorted by particle size. DE is also used in the beer and wine industry, it is the gritty substance in toothpaste and DE is used in pool filters. Not all DE is food grade and not all grit sizes will work for filtering maple syrup. Make sure that DE is purchased from a maple equipment distributor. CAUTION: DE is a finely ground abrasive material and should always be handled with care. Do not inhale the dust and avoid eye and skin contact.

FILTER PAPER: 11

The purpose of filter paper is to catch the DE suspended in syrup and provide a surface for the DE cake to form. During filter press set-up filter paper is placed between each plate. Filter papers have two holes that match the inlet and outlet hole in the plates. It is important that the correct size papers are used and that the alignment of the holes matches that of the plates. Lightly moistening the papers will help keep them in place during setup. Although filter paper has two distinct sides or textures, there is no detectable difference in filtering performance.

PRESSURE GAUGE AND BYPASS VALVE (4&5):

The pressure gauge is used to monitor back-pressure in the filter press which can lead to filter paper failure. The gauge is plumbed into the pipes that carry the syrup to the press and should be able to read a range of at least 0-50 Pounds Per square Inch (PSI).

A simple stainless steel ball valve can be used as a bypass valve. The valve is placed before the stack. A food grade hose or stainless steel pipe long enough to reach your syrup reservoir should be connected to your bypass valve.

GFCI GROUND FAULT OUTLET (9):

These range from simple plug in type outlets to permanent hard wired outlets in the sugarhouse. These outlets prevent electrocution injuries caused by electrical service grounding through fluids (syrup or water). These outlets represent inexpensive insurance against injury to the operator or the equipment.

SETUP OF A PLATE FILTER PRESS

Make sure all parts of the press are clean, dry and that there are no obstructions in any pipes or plates that carry syrup. This is especially important for new filter presses right out of the box. Take extra time to make sure no debris or oils from the manufacture of the press remains.

Without the proper plate orientation the press will not function correctly. None of the plates should appear misaligned or sticking out of the stack. The plates should always alternate between hollow and waffle plates. The first and last plates in a press are waffle plates.

1. Begin with the first plate in the stack attached to the frame; place one sheet of filter paper against the waffle then slide on a cake plate, sandwiching the paper between the two plates. Some filter press frames do not have a set of guides to keep the filter papers in alignment. If this is the case, use a pair of appropriately sized dowels (1/2 inch for most presses) in the inlet and outlet holes of each plate to keep the papers at the right height during set up.

2. Place a filter paper on the other side of the cake plate and cover it with another waffle plate.

3. Repeat this process until all plates are used. Plates must alternate. At no time should two cake plates or two waffle plates be used next to each other.

4. The end plate is a waffle plate made from thicker metal then the rest of the stack. Attach this plate and secure using the manufacturer's hardware. Tighten down the stack. Remember, a filter press is under pressure; if the stack is loose during filtering, syrup may squirt out between the plates.

5. Make sure all the quick connects are closed; this includes the tubing from the syrup reservoir to the filter press, and out of the filter press to the drum.

CHARGING THE PRESS

The filter press works by completely coating the filter papers with a cake of DE. This process is called charging the press. Without completely coated papers, unfiltered syrup can mix with filtered syrup.

The syrup to be filtered must be heated to 200° Fahrenheit. Draw off three to five gallons of hot syrup into a stainless steel bucket or clean food grade pail used ONLY in maple production. This will be your precharge syrup. Begin by stirring half the DE into the pail of hot syrup (see Table 1-1). For example, a 45 gallon batch of syrup would require 4 1/2 cups of DE to charge a 10 inch press. Combine the DE and hot syrup until completely mixed. Add the remaining 4 1/2 cups of DE to the batch of syrup waiting to be filtered. Pump the bucket with syrup/DE mixture through the press. Catch the syrup exiting the press in another clean bucket at the outlet of the press. Pump the entire 3-5 gallons of syrup through the press before checking the clarity of the syrup leaving the press. The syrup should appear polished and free of any suspended solids. If any cloudiness is present; first shut off the pump, then return the cloudy syrup to the first pail and repeat filtering until syrup comes out clear. Very small air bubbles created by the pump can make the syrup look cloudy. When the syrup is clear, add it back into the batch of syrup waiting to be filtered. This will prevent low temperature syrup from entering a storage container.

Connect the press to the unfiltered syrup (finishing pan). Due to loss of heat while filtering syrup; heat your syrup to 200°F to maintain the minimum temperature of 180°F needed to sterilize syrup storage containers.

Table 1-1: General recommendations for Diatomaceous Earth needed for various filtering batch sizes in 7" or 10" plate filter presses (More DE may be needed for dark or late season syrup)

Gallons =	7" Plate Press	10" Plate Press
40	5 cups	8 cups
45	6	9
50	7	10
55	8	11

FILTER PRESS OPERATION

The press is now ready to operate. Connect the press to the unfiltered syrup (finishing pan). Make sure the drum or container to be filled is clean, dry and ready for use. Make sure the bypass valve is closed and the return line to the unfiltered syrup (finishing pan) is in place. Turn on the pump.

Look over the entire press as it runs and make sure everything is operating smoothly. Monitor the pressure gauge for increases in pressure. If the pressure rises dramatically upon start-up then the press may have been set up incorrectly. Normal operating pressure for a 10-inch plate press with seven cake plates is between 0-20 PSI. This range is meant as a guideline. Presses may occasionally run into problems at lower pressures especially if papers or plates are not seated correctly.

Once back-pressure is observed the plates have begun to clog. This results in a slower rate of filtering and the imminent possibility of a ruptured paper. The bypass-valve can be used to relieve some of the back-pressure but it will decrease the filtering rate. When the valve is opened some of the syrup entering the stack is diverted back to the reservoir thus reducing the load on the filter press. The valve can help finish filtering a batch of syrup but will not allow filtering to continue indefinitely. A general rule of thumb is to clean your press if the bypass valve is used.

BATCH FILTERING

Sugarmakers who collect syrup into a finishing pan or some other holding container before filtering are using the "batch filtering" method.

When charging the press during batch filtering, half the total DE used to filter the batch of syrup is added to the charging bucket of syrup. The remaining DE is mixed with the remaining syrup to be filtered. This insures that DE will be constantly added to the existing cake in the filter press. By adding DE continually to the filter press more surface area is created during filtering. The impurities (niter) being filtered is spread out and filtering capacity is increased.

If more then one batch of syrup is sent through the same set of cakes and papers, care must be taken to prevent excessive cooling of the press.

CONTINUOUS FILTERING

An alternative to batch filtering is "continuous filtering", which involves the same steps for charging the press as batch filtering. With continuous filtering each draw off is sent directly through the press.

CHOOSING A FILTERING METHOD

Before deciding on continuous filtering, be aware of how much syrup will be filtered and at what rate. For example, sugarmakers that will only produce a gallon of syrup an hour may encounter problems with clogging or noticeable drop in temperature within the press. A press that has cooled can in turn cool filtered syrup below 180°F. Gravity will naturally pull downward on the filter cakes over time. If the press is left idle for too long, gaps may be created in the DE cake allowing unfiltered syrup to pass thru.

CLEANING THE PRESS

When filtering is complete, a small amount of syrup will remain in the press. This syrup can be recovered by pumping a few gallons of hot water through the press. Catch the discharge in one of the buckets used for charging the press. The mix can be held in a bucket until the next boil, added to the evaporator syrup pan or returned to the clean finishing pan to be incorporated with the next batch. If you add this concentrate to your evaporator from the filter press, be careful not to add too much at one time and scorch your pan. Only clean water should be used to clean the filter press.

Water should be run through the pump and the plates should be thoroughly scrubbed and then rinsed with hot water. It is important to make sure that all surfaces are clean and all of the small holes in the filter plates are clear of obstructions.

Dealer recommendations about when to grease the syrup pump vary and range from once a year to each day of use. Too much grease can be harmful, both to the pump and any syrup that it might come in contact with. The amount of grease needed will vary with the volume of material filtered, its viscosity and the amount of time the pump is in operation. Always use food grade grease and dispense it using a grease gun that is only used for this purpose.

TIPS AND TROUBLE SHOOTING

- Watch for the appearance of back-pressure; this indicates clogging in the press. Sudden spikes of pressure indicate imminent paper failure.
- Occasionally niter is too small to filter. If this is the case, let the barrel stand for a month and then carefully pump out syrup without distributing niter that settled out. Filter the syrup a second time. This usually occurs at the beginning of the season.
- Look for seeps and weeps of syrup beyond normal. Check pressure, check stack tightening hardware.
- Do not run pump without fluid. This causes excessive wear and tear.
- Make sure papers are aligned correctly. If the filter press stand does not include a set of rails for keeping papers aligned then a set of two dowels run through the inlet and outlet holes of each plate will help keep the papers from falling out of place when setting up the press.
- Check for proper plate alignment
- Use DE; add more for darker or late season syrup.
- Avoid wearing loose fitting clothes around pulleys.
- Operate the press hot.
- Keep syrup temperature leaving the press above 180°F.

Pure Maple syrup is a carefully crafted product. Its value is judged not only on taste but appearance. Proper filtering of raw syrup is essential to making a high quality and appealing product. A filter press is a useful tool for modest to large sized sugaring operations. This pamphlet is intended to guide operators in the use of plate filter presses.

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Color

Color Grading

Using color to grade maple syrup is recognized in the United States and Canada by Federal regulations and standards. Most states follow the international color grading system for light transmittance. Grading can be done with spectrometer based equipment or with a visual grading kit.

Grading Kits

There are two types of visual color comparators used for grading maple syrup. A permanent color grading kit is made of a set of colored glass windows that correspond to specific light transmittance. A temporary color grading kit is made by using colored glycerin in bottles to compare to samples of maple syrup. Each kit has drawbacks. The permanent kits are very accurate, but costs several hundred dollars. The temporary kit is inexpensive but the color of the standards may fade over time. With this type of kit, it is very important to remember that it is an inexpensive guide and not an approved standard. Also, to prolong the accuracy of this kit, it must be kept cool and in a dark location when not in use.

When using either visual comparator, it is important to remember that the color standards are the minimums of the color grade. That means the color of the syrup sample must be equal to or lighter than the standard to be that grade. Many maple producers mistakenly decide the grade is the color to which their sample is closest. That is not the proper way to use any of these kits. Another very important thing to remember is to use good light when using these kits. A clear sky or a fluorescent light is the best lighting to use. Trying to color grade indoors or using a standard light bulb may result in an inaccurate color grade.

Another method of determining color grade is using an instrument called a spectrophotometer. A spectrophotometer determines the light transmittance of a sample of syrup in an optical cell inserted in the unit. Careful calibration must be done before use to assure an accurate reading. Spectrophotometers have been successfully used in laboratory settings for many years. One concern of its use in sugarhouse situations is that the sample must be completely clear of any bubbles or turbidity. Any variation will result in a reading darker than the actual grade of the syrup. Cold syrup may also test darker than syrup that is hot. 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.

Guidelines for visual color grading of maple syrups

Brian Chabot and Steve Childs

Why color grade?

In the US, maple syrup is usually sold by color classification. The primary distinction between Grade A and Grade B, or Extra Dark for Cooking, syrups is color. Producers are not required to color classify within Grade A, though it is almost always done. The main reason that color is used is that it has some general relation to the intensity of maple and other flavors in the syrups and is more easily measured than is flavor. This allows the consumer to choose syrup that matches their flavor preference.

The color grade of most syrup samples will be easily determined. When the syrup is very close in color to the visual color reference, determining grade can be difficult. These situations require an understanding of how visual grading works and what conditions improve your chance of a correct grade determination.

What visual grading kits are available?

The most common method for color grading is to compare the syrup sample with a set of visual color references. The USDA developed a set of glass color references that do not change with time. This is standard reference for USDA and several state regulations. The USDA glass kits are no longer manufactured in the US. Three options are currently available: a new USDA kit using plastic color references, the Lovibond kit, and the Vermont Temporary Kit. There are a number of older kits (Berliner, Grimm, etc) that are still in use. Lovibond uses glass filters in replaceable color wheels for USDA, Vermont, and Canadian color grades. The Vermont Temporary Kit uses caramel in glycerine solutions that are matched to the USDA glass standards.

Different types of grading kits can give somewhat different results. This is in the nature of how the kits are constructed and how our visual system functions.

Advantages/disadvantages of the several kits.

USDA glass- As noted above, this is the current standard. If you have one, take good care of it! These kits use a relatively inexpensive and reusable 1 oz glass bottle as the sample container. The space between samples, although small, can make close comparisons more difficult than the Lovibond.

USDA plastic- This replaces the older glass kit. It has two design flaws. The plastic color references are easily scratched and the samples and references are placed quite far apart making it difficult to compare. The 2 oz sample bottles that come with the kit are poorly made.

Lovibond 2000 Comparator- Although more expensive than other kits, it is the only currently manufactured kit with permanent glass and it places the samples next to each other visually making color comparison quite easy. The glass cuvette is expensive and unique to the kit. It seems to grade a little darker than the USDA glass kit, but is approved by the USDA.

Vermont Temporary- This is the least expensive in initial purchase, but needs to be replaced every year. It uses a caramel/glycerine solution matched to the USDA glass standard. The sam-

ple bottles are relatively inexpensive and are reusable. It gives results very close to the USDA kit with white light, but the two kits react differently to colored light.

Use the container intended for the kit
Each kit is calibrated with a particular container. The path-length of light through the sample determines the amount of light that you see in comparison with the standard.

Temperature is important
The density of color will change with temperature as the syrup density changes. It will be lighter at high temperatures and darker at low temperatures. All kits are calibrated at "room temperature," which is considered to be around 68^{o}F. Five degrees on either side may not matter, but you shouldn't determine final grade at canning temperature or at very low temperatures.

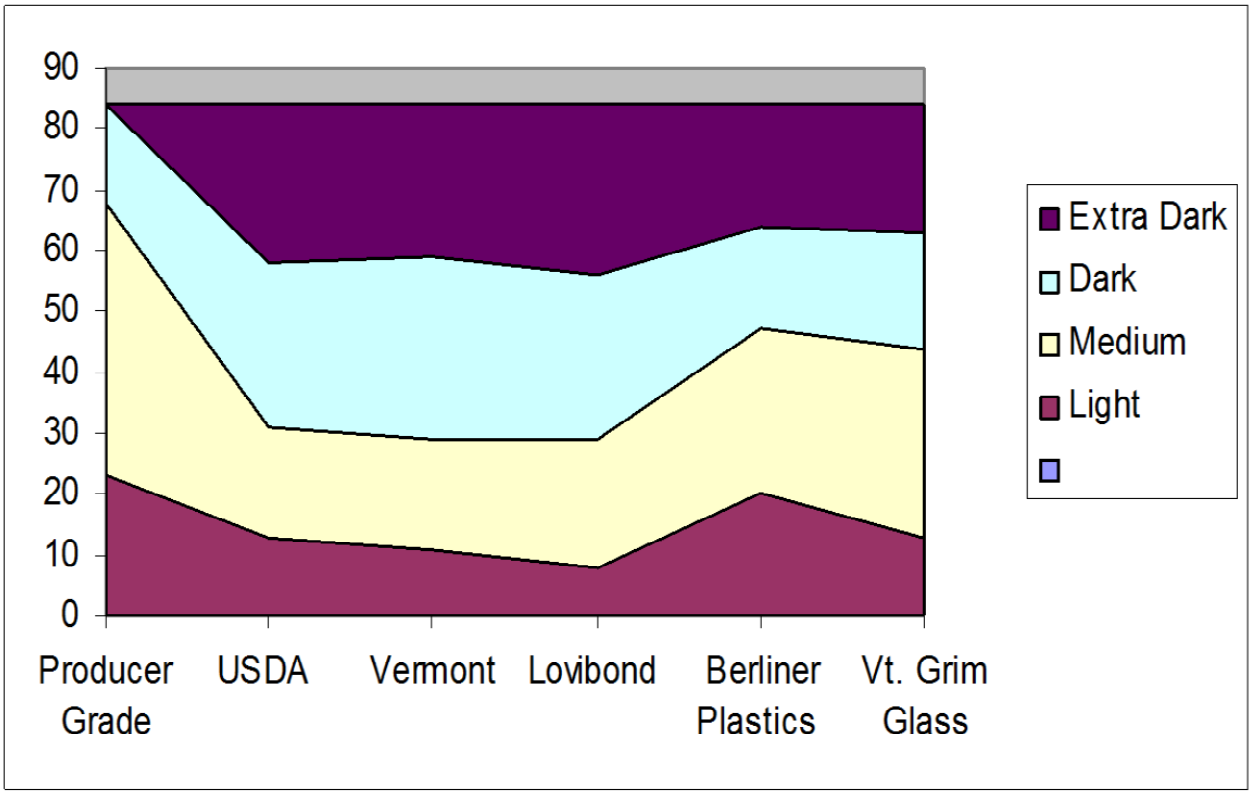
Light quality is important too
The USDA and Lovibond kits are intended for use against a true white light (these are expensive) or a clear northern sky. The color quality of the background light will affect the color appearance of the syrup, sometimes substantially affecting the grade decision. Grading against green (forest) and brown (sugarhouse walls) should be avoided. If you must use electric light, consider using a 100watt incandescent bulb.

The Vermont Temporary Kit
This kit is designed for use for one year and we recommend that all the instructions be followed about storage and replacement.

Close calls
When a syrup sample is very close to one of the standards, it may be best to put it in the darker grade. There are several reasons for this. If the syrup is hot, it will become darker as it cools. Syrup will darken over time in storage. Two observers may make different grading decisions because our eyes and color acuity are different. And different types of visual graders will produce slightly different decisions, as noted above.

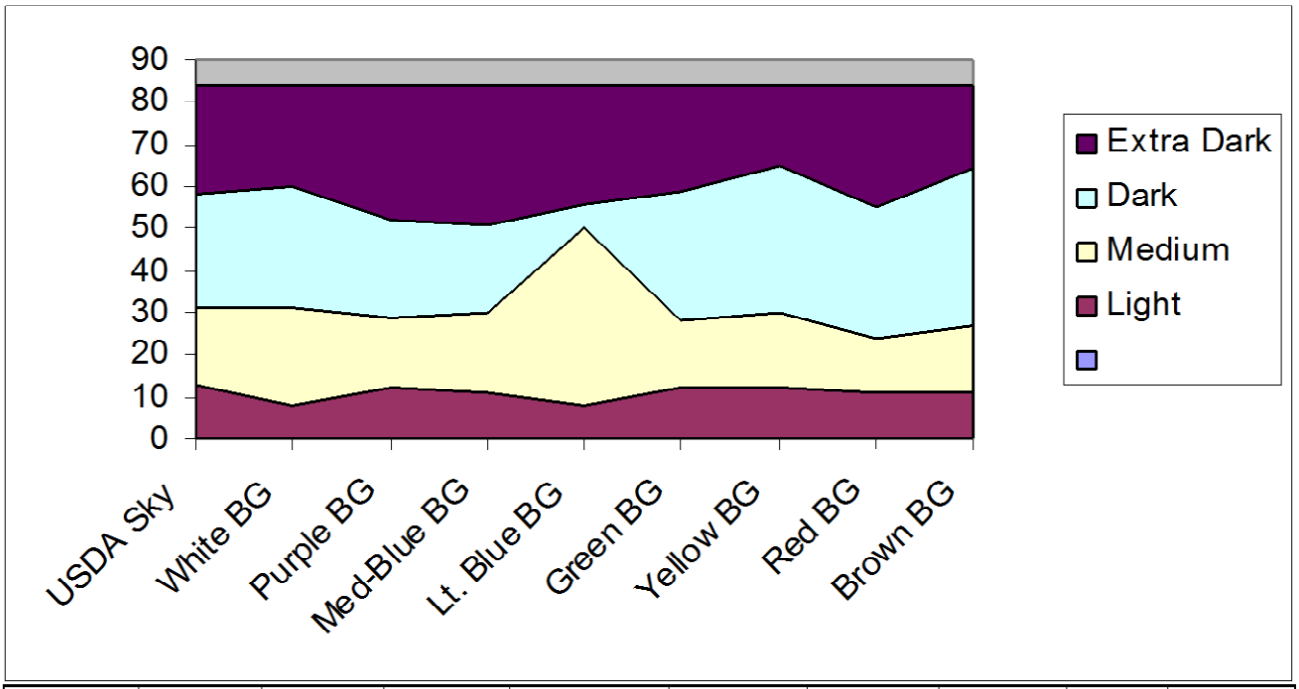
Keeping a reference sample
It is good practice to retain a sample of each batch you can and store it in the freezer. This will help if any questions arise about the color, density, or flavor of syrups that are distributed.

Visual Grader Comparison – Natural Light



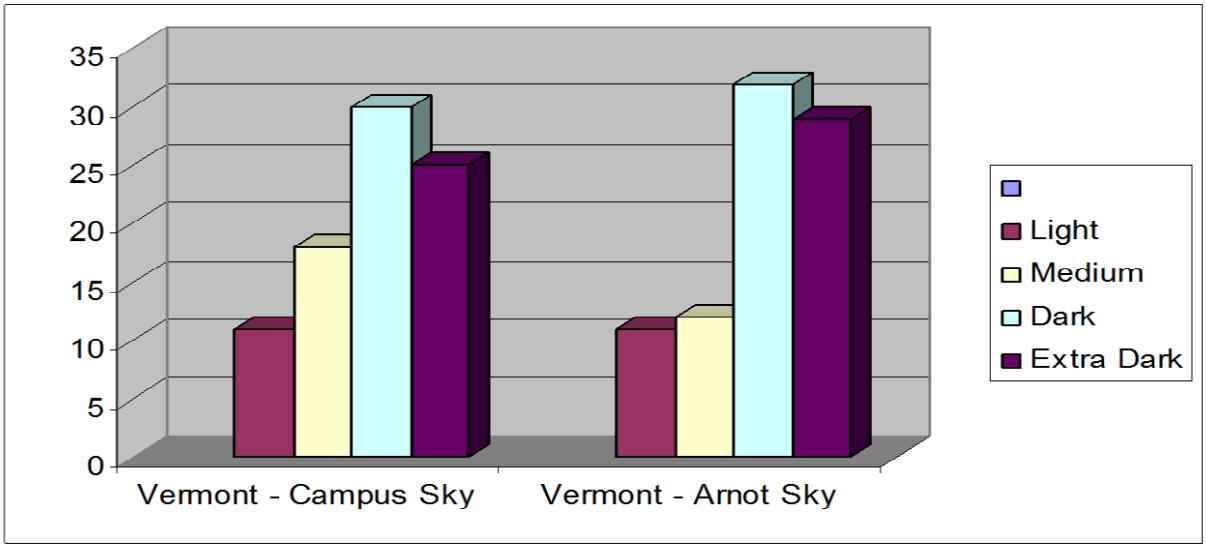
Grade	Producer Grade	USDA	Vermont	Lovibond	Berliner Plasti	Vt. Grim Glass
Light	23	13	11	8	20	13
Medium	45	18	18	21	27	31
Dark	16	27	30	27	17	19
Extra Dark	0	26	25	28	20	21

Variation in Color Backgrounds
USDA Grading Kit



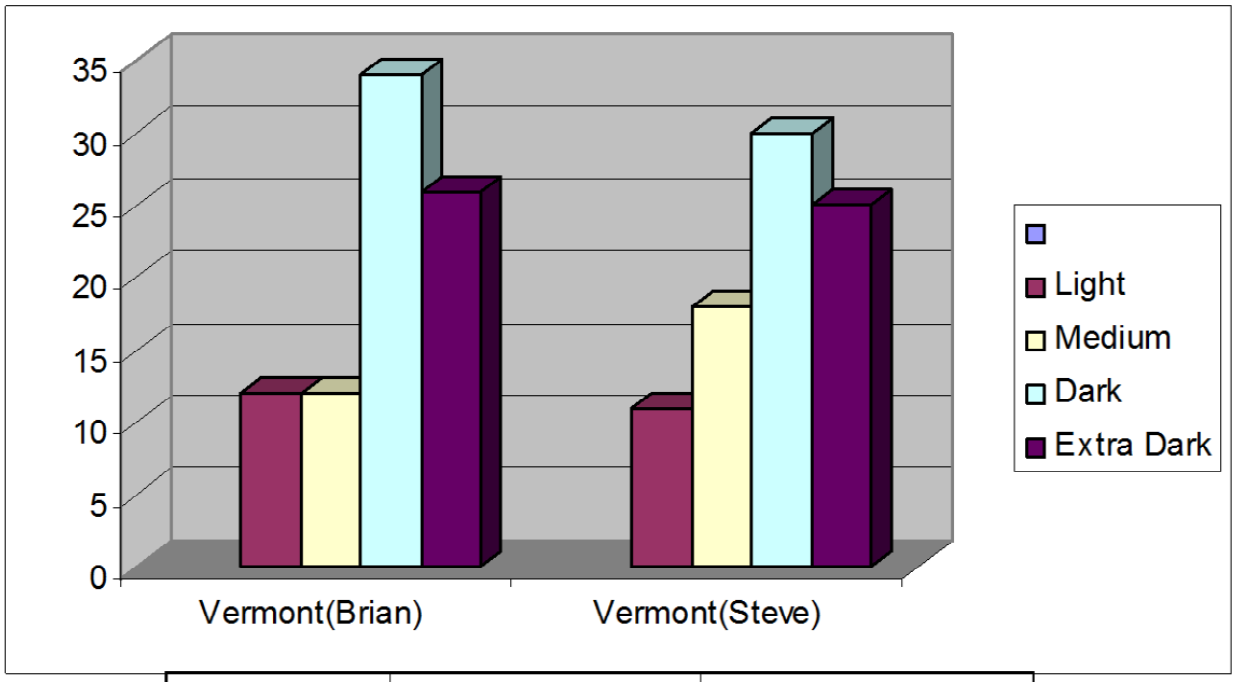
Grade	USDA Sky	White BG	Purple BG	Med-Blue BG	Lt. Blue BG	Green BG	Yellow BG	Red BG	Brown BG
Light	13	8	12	11	8	12	12	11	11
Medium	18	23	17	19	42	16	18	13	16
Dark	27	29	23	21	6	31	35	31	37
Extra Dark	26	24	32	33	28	25	19	29	20

Variation with the same kit in different settings



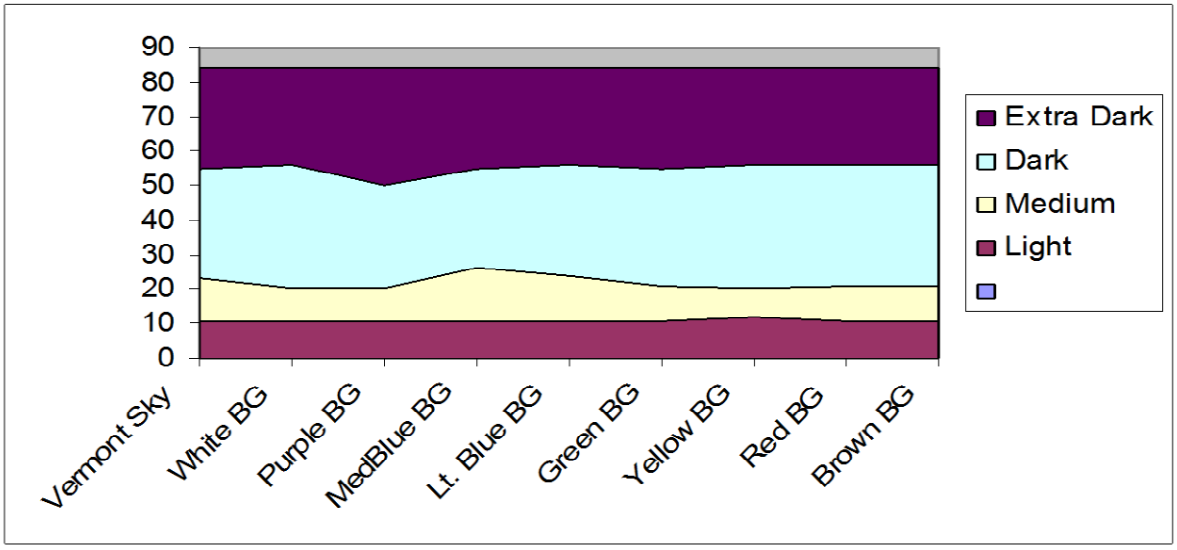
Grade	Vermont - Campus Sky	Vermont - Arnot Sky
Light	11	11
Medium	18	12
Dark	30	32
Extra Dark	25	29

Different person grading with the same kit in the same location against sky light



Grade	Vermont(Brian)	Vermont(Steve)
Light	12	11
Medium	12	18
Dark	34	30
Extra Dark	26	25

Variation in Color Backgrounds
Vermont Grading Kit



Grade	Vermont Sky	White BG	Purple BG	MedBlue BG	Lt. Blue BG	Green BG	Yellow BG	Red BG	Brown BG
Light	11	11	11	11	11	11	12	11	11
Medium	12	9	9	15	13	10	8	10	10
Dark	32	36	30	29	32	34	36	35	35
Extra Dark	29	28	34	29	28	29	28	28	28

Effects of Background Colors

- Results were different with different grading kits
- Green was the most difficult background color to differentiate the grades
- Medium blue and purple were the easiest background colors to differentiate grades
- All background colors distorted the grading to some degree compared to white

The ideal visual kit

- Kit is sturdy and not expensive
- Sample placed next to standard
- Sample container is sturdy, inexpensive and available.
- The color standards are stable and difficult to scratch or damage

Bottom line

- Each grading kit produces somewhat different results
- Knowing how your kit differs from the USDA glass kit helps you make decisions about grading your syrup for market.

Guidelines for maple syrup grading with a Hanna meter

Brian Chabot and Steve Childs
Cornell Maple Program
Cornell University

Maple color classification can be done with visual grading or spectrophotometricly using the Hanna meter. Both methods must be used properly to achieve the correct results and both methods are subject to errors that you need to be aware of.

A spectrophotometer has a source of light that passes through the maple sample and is measured by a detector. It is necessary to use a limited part of the light spectrum that is absorbed by maple syrup. In the Hanna meter cut-off filters narrow the light color used.

The Hanna meter is a sensitive piece of equipment that should only be used at "room temperatures," approximately 50-80 F. It is not designed to be used at near-freezing or freezing temperatures. Also, the syrup color density varies with temperature (is lighter at high temperatures), so the syrup also should be at room temperature when measurements are taken. This is necessary for visual grading also.

The meter should be protected from dust and dirt when it is being used and when it is stored. Accumulated dust will reduce its accuracy.

Syrup samples are placed in plastic cuvettes. Care must be taken not to scratch or get fingerprints or dirt on the optical surfaces of the cuvette. As noted above, the syrup should be at room temperature when measurements are made. The small syrup volume in the cuvette will equilibrate to room temperature in 15-30 minutes, depending on the initial temperature difference.

The Hanna meter needs to be zeroed using a cuvette filled with glycerin. Glycerin is used because it bends (refracts) light in about the same way as does a sugar solution. The cuvette does not need to be filled to the top because the light path is through the lower half of the cuvette. Keeping glycerin or syrup below the top will help prevent fluids from spilling into the sample compartment.

The cuvette should be placed in the sample holder and the cover placed over the holder to exclude light. The reading is then taken by pressing the read button. The values shown are transmittance (T), the percent of light passing through the sample compared with clear glycerine. We recommend taking a second reading after turning the cuvette 90^{o} in the sample holder. This will be a check on imperfections in the plastic cuvette. The two readings should be within 1-2 units of each other. If they are not, look to see if the cuvette is dirty or scratched or if there is a problem with the syrup sample. Don't expect the two readings to be exactly the same (see more on this below). If the two readings are too different from each other, then you should try a new syrup sample in a new cuvette.

Variation in the readings

An electronic meter with digital readout may suggest that the readings are more precise and accurate than visual grading. This can be misleading because all methods, including visual methods, are subject to errors. Here are some sources of variation in the values you get for a syrup sample.

- Electrical noise in the circuits and variation in light output of the light source. This means that even successive readings on the same sample in the same orientation will be different by small amounts.
- Different meters will give different readings. In our tests these differences are small (1-3 units) for well-maintained instruments.
- Imperfections in the cuvette, scratches, dirt and debris in the syrup. These can produce different readings when the cuvette is re-oriented in the sample holder.

Syrup that is too hot or too cold. The transmittance change between hot and room temperature syrups are quite large and you can watch the %T values change and stabilize as the syrup reaches room temperature.

Because variation in readings is normal, do not use the Hanna meter or visual kits to make close calls. If the syrup is within 2 units of the transmittance values that divide grades, it could easily be on either side of the line with another meter or another grading technique. Also syrups get darker with age. For these reasons, our recommendation for syrups close to the line is to put them in the next darker grade.

Transmittance values and grades

Canadian syrup grading adopted spectrophotometric transmittance as the method to differentiate syrup grades. The Hanna meter uses these Canadian transmittance values and it is the best way to grade syrup intended for sale in Canada. However, in the United States, the USDA permanent glass visual reference is still the standard method to establish syrup grades. The USDA kit is no longer manufactured. The most critical problem relative to use of the Hanna meter in the US is that the Canadian transmittance values do not correspond with the USDA grading kit. This difference was first discovered in 1983 and we have confirmed this in more recent tests.

To make the Hanna meter transmittance values correspond with the USDA kit, we recommend adopting the following guidelines:

Syrup Grade Classification	%Light transmittance
Light Amber	Not less than 62
Medium Amber	Not less than 50
Dark Amber	Not less than 36

Hanna Analyzer Grades

Grade Classification	Canadian %T	Cornell %T
Light Amber	75	62
Medium Amber	60.5	50
Dark Amber	44	36
Extra Dark	less than 44	less than 36

Bottom line

- The Hanna meter does grade darker, but the problem is with the Canadian standards. They don't match the USDA visual reference.
- The USDA visual reference is the standard in the US

Potential Discrepancies in Applying U.S. and Canadian Syrup Color Standards Extension

Maple Syrup Digest
L. D. Garrett Forest, M. F. Morselli, W. L. Jenkins
Vol. 23, No. 4
December 1983

This research was undertaken in cooperation with the University of Vermont while the senior author was forest economist and W. L. Jenkins was a chemist at the George D. Aiken Sugar Maple Laboratory, Northeastern Forest Experiment Station, Burlington, Vermont.

Abstract

With both the U.S. visual method and the Canadian spectrophoto metric method, we color-graded 120 maple syrups produced and graded in Vermont and 53 syrups produced and graded in Canada. Results indicated that the spectrophotometric measure of variation corresponding to each of the U.S. visual grades is lower than that specified in the Canadian standards.

Introduction

Standards for maple syrup products are established to ensure their proper manufacture and to provide consumer information. Today, all maple syrup grading systems in the U.S. use visual comparison with either glass-chip or caramel-glycerol solution color comparators as standards (Table 1). The judgment is not made using a spectrophotometer. However, the visual standards were developed using a spectrophotometer. Percent light transmittance (% T) values of not less than 75.0, 74.9 to 60.5, and 60.4 to 44.0 correspond to U.S. Grade A--light, medium, and dark amber, respectively (USDA 1979).

Table 1.--Current U.S. and Canadian Federal standards for table grade maple syrups

US. Federal		Canadian Federal	
Grade	**Standard (visual)**	**Grade**	**Standard (Spectrophoto metric. % T)**
Grade A. Light amber	Not darker than Light amber Standard	No. 1. Extra light	Not less than 75.0
Grade A, medium amber	Not darker than medium amber standard	No. 1, light	74.9 to 60.5
Grade A, dark amber	Not darker than dark amber standard	No. 1, medium	60.4 to 44.0

In Canada, two grading systems exist, a federal system and one for the Province of Quebec. All other provinces use the federal system. Both the Quebec Provincial and Canadian Federal regulations specify that the spectrophotometer is the official standard. But, producers use permanent

glass and caramelglycerol visual kits for unofficial field grading. Both Canadian and Quebec standards specify not less than 75.0, 74.9 to 60.5, and 60.4 to 44.0 % T for the three table grades of syrup (Agric. Canada 1977, Quebec MinisterAgric. 1980) (Table 1).

Evaluation of Visual and Spectrophotometer Standard

Examination of pure maple syrup visual and spectrophotometric standards has revealed a discrepancy in application. Morselli and others (1982) found that a glass chip or corresponding caramel-glycerol solution and pure maple syrup, which visually look the same, give different readings in a spectrophotometer.

To investigate the phenomenon, 173 standard density (66°Brix) samples of filtered pure maple syrups, representing the three table grades, were packed in glass bottles directly from producers: 120 from Vermont and 53 from Canada. Percent transmittance values were determined on all syrups at a wavelength of 560-nm in a dual beam spectrophotometer with a pair of optically matched quartz cuvettes with a 10-mm light path. Chemically pure glycerol was used as the 100% T reference.

Visual grading was accomplished with an official USDA permanent glass color comparator using daylight illumination (Willits and Underwood 1961). Measurements were made at room temperature on clear syrup samples with no air bubbles.
Visual grades were determined by the consensus of three people experienced in the color grading of maple syrup. Independent instrument light transmittance values were obtained by persons not involved in visual grading.

The original grade of all syrups used in the analysis was verified. The 53 Canadian syrups were verified with a permanent glass color comparator. These were also the methods used in grading the syrups originally. No color grade changes had occurred in any syrup after packing.

The 173 syrup samples were graded again using a permanent glass-chip color comparator. Each of the colorgraded syrup samples was tested in a spectrophotometer for its % T.

The % T of all syrup samples in each of the three table grades was then statistically analyzed. The results revealed a discrepancy between visual and spectrophotometric grading.

Results

Figure 1 presents a summary of the statistical analysis of the % T of all syrups graded visually as Grade A--light, medium, and dark amber. For each visual grade category, we determined the mean and standard deviation of % T.

Figure l. Means and standard deviations of the spectrophotometric values of 173 maple syrups visually graded into the three table grades.

The three dark lines in Fig. 1 represent the % T "mean" (midpoint cross), and "one standard deviation" from the mean for all syrups visually graded into each of the three table grades. The

"standard deviation" measures the spread of the values around the mean. For a normal distribution of values, 68% are within one standard deviation of the mean. For example, the mean % T for all syrups which visually graded light amber was 78.1 (Fig. 1, cross line on the highest dark vertical line). The mean is above 75.0% T, which is the lowest % T to qualify a syrup as light amber. However, many syrups which visually graded light amber actually graded lower using the spectrophotometer.

The darker the syrup is, the greater the discrepancy. For example, the mean for syrups visually graded medium amber is 57.5% T. This is below the minimum standard spectrophotometer reading for medium amber (60.5% T).

Almost all syrups graded dark amber visually would be Grade B using the spectrophotometer. That is, the mean (33.9% T) plus one standard deviation of all visually graded dark amber syrups actually fell below the minimum spectophotometer value for dark amber (44.0% T).

Conclusions and Recommendations

Our analysis has revealed a discrepancy in applying color standards to maple syrup grades. The source of the problem is that a syrup and a caramel-glycerol solution and/or glasscolor comparator of the same color (determined visually) will not necessarily have the same % T at a given wavelength as measured by a spectrophotometer. The discrepancy results because the syrup and caramel 'have slightly different spectrums. Syrup will look darker to the spectrophotometer than it will to the eye in comparison with either of the currently used color comparators.

Two approaches could be taken to resolve the problem:
1 . Establish the glass-chip color comparator as the universal standard for color grading. The use of caramel- glycerol standards should be discontinued because of their tendency to fade.
2. Change the % T standard to accommodate the different spectrums for caramel and syrup, and continue to use both the glass-chip color comparator and the spectrophotometer.

The most practical approach would seem to be establishment of the glass-chip visual-color comparator as the universal standard. It is the most widely used and understood system, is easiest to apply, and is less expensive than the spectrophotometer. It is the U.S. Federal standard and is included in the latest Federal Canadian maple products regulations as an unofficial alternative to the spectrophotometer.

The second alternative would require a change in spectrophotometric values to accommodate spectrum differences between caramel and syrup. To accomplish this, new % T values must be used for a 10-mm rectangular cell at 560-nm wavelength. The % T values derived in this study are presented in Table 2.

Table 2.--Suggested revised light transmittance for maple syrup grades to accommodate spectrum differences between caramel-glycerol solutions and pure maple syrup

Syrup grade	Light transmittance
Grade A	
Light amber	Not less than 64.5%
Medium amber	Not less than 51.5%
Dark amber	Not less than 29.0%

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Agriculture Canada. 1977. Canadian Agricultural Products Standards Act: Maple products regulation. Can. Gaz. Part 11. 3(9) :1908-1917.

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Flavor

Flavor Grading

Flavor is one of the most unique characteristics of maple syrup. Syrup flavor can be affected by soil type, weather conditions, tree health, method of evaporation, and many other factors that determine how the sap is transformed into maple syrup. Each grade of syrup has unique flavor characteristics that consumers look for when purchasing their choice of syrup. It is personal preference that determines which grade of syrup is, in each consumer's eye, the best.

When flavoring maple syrup, start with a clean palate by rinsing your mouth with water. Smell the sample first - sometimes your nose can help in flavor grading maple syrup. Take a sip of maple syrup and let it thoroughly coat your tongue before swallowing. This method helps in determining if the syrup is of good quality or contains any off-flavors.

Another aspect of flavor grading is preparing samples of maple syrup and products for contests at fairs, field days, etc. Maple producers are proud of their product and enjoy competing with other producers. See the Appendix for a list of helpful hints in preparing products for entry in these contests and for more information on off-flavors.

Maple Syrup Off-Flavors

By Henry J. Marckres

Maple syrup has a unique flavor that sets it apart from other specialty foods. It's characteristic for exhibiting different subtle flavors depending on when it was produced, where it was produced, and, at times, how it was produced make it a product that everyone, regardless of their taste preferences, can enjoy. However, this characteristic also makes syrup flavor susceptible to flavors that are not considered typical. These off- flavors can occur anywhere from the tree to the containers. Not only do production methods affect the flavor, but Mother Nature has a hand in it too. Following are some common off-flavors that have been encountered, their likely causes, and ways to avoid these problems.

Chlorine (Sodium) - Historically, a solution of chlorine and water was used to clean sap tubing systems. Often, these systems were not rinsed afterward, leaving a sodium residue inside the tubing. Sap running the next season would "scrub" the tubing, putting varying amounts of sodium into the finished syrup. It is recommended that only water be used in cleaning tubing to avoid the problem. A chlorine off-flavor often destroys the maple flavor of the product. A significant watering of the tongue will be noted. Depending on the amount of sodium present, the product may have a salty flavor.

Detergents - The only detergents that should be used in syrup production are ones that are approved for food use and approved specifically for maple. Producers have often used products that are designed for home use, damaging the flavor of the finished product. People also submit samples of syrup for contests in used glass jars that have retained a soapy flavor.

A detergent flavor in syrup may taste soapy, or have a perfume odor or flavor, depending on the type of detergent used and if any rinsing was done. Rust Preventative

Paints - In the past, many producers painted the inside of galvanized sap buckets and holding tanks to prolong their useable life. Usually a rust preventative paint was used, often containing a fish oil base. This type of paint should never be used on any surface that is in direct contact with sap or syrup. There are very few products acceptable for food contact surfaces and most require a specific application process and an extensive drying time. The flavor derived from this material may have an oily taste and feel on the tongue, similar to cod liver oil. 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. A metallic off-flavor affects the sides of the tongue, a sharp feeling that almost feels like your tongue is going to water, but it doesn't. It may affect your teeth like biting a piece of tin foil. 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 plas-

tic 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 hat or 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 that tingles in the mouth and on the tongue.

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 defoamer and have an oily or waxy feel on the roof of the mouth and on the tongue.

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. A chemical off-flavor will affect the entire mouth and may get more objectionable with breathing in and out. 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 just like the contaminant smells. Often a strong odor in the product will be a sign of an off-flavor present.

Musty - This off-flavor can become present in the syrup in two ways – from putting hot syrup through filters that contain mold spores or from poorly sealed containers. The musty off-flavor tastes yeasty or moldy and usually has a moldy odor. It is most noticeable on the back of the tongue and in the throat.

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 bacte-

ria 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 and leaves a slimy coating on the roof of the mouth and tongue.

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 with a very strong bite on the tongue and in the throat. 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.

Mother Nature Of/Flavors - The resource itself, the maple tree, and the environment contribute to the next two off flavors. Even though they are naturally occurring, they damage the normal maple flavor and are considered unacceptable in maple syrup. 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. Usually a change to colder temperatures reverses its effect on the finished syrup. This is mostly speculation from working with syrup for many years and research is being done to determine the exact cause of this problem. 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. Usually the production of this type of syrup signals the end of sugaring for the season. Buddy syrup usually tastes chocolaty, almost a tootsie roll type flavor. If very strong, it may take on a bitter chocolate characteristic. An odor of chocolate may be present, but not always. Breathing in and out normally intensifies the flavor.

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.

Appendix

Chapter 8 · Syrup Filtration, Grading, Packing and Handling

Syrup Packing and Handling

Once maple sap has been processed into maple syrup and the correct density obtained, it is ready for packing. It does not require further treatment beyond the normal filtering process.

Hot Packing

To prevent contamination of finished syrup by yeast or mold growth, finished syrup should be hot packed. If the temperature of the syrup following filtering is 180°F or higher it can be packaged immediately. However, if the temperature has fallen below 180°F it should be reheated to this temperature or slightly higher. It is not recommended to heat the syrup to temperatures greater than 200°F since some darkening and accompanying loss of grade may occur. By maintaining temperatures above 180°F when packing, most mold spores are killed, thereby eliminating possible contamination sources. It is important that the entire inside of the container be exposed to 180°F. This is commonly accomplished by inverting the containers immediately after filling and sealing.

Syrup can be packed directly into containers intended for retail sale, or it can be placed in larger cans or drums (ranging from 5 to 55 gallons or more). These larger size containers may either be sold at wholesale or can be used as sources of syrup for filling retail containers later in year. Most maple producers will find it advantageous to pack some syrup in retail containers during the producing season; however, it is recommended that at least part of the crop be packed in bulk containers for filling later orders. This allows individual orders to be filled on a customized basis while making certain syrup quality at the time of filling is high. When syrup is to be stored for longer periods of time, storage in bulk as opposed to retail containers is preferred. It is very helpful to keep a small container of syrup from each batch in a freezer. This can be used to check the characteristics of the syrup batch without unsealing the drums.

Considerations For Glass, Plastic And Metal Containers

All syrup offered for retail sale is packed either in glass, plastic or metal containers **(Figure 8.8)**. Each has advantages as well as disadvantages associated with its use. While the handling and filling of each is generally similar, there are some guidelines regarding the use of each which can be offered.

Figure 8.8. A variety of glass, metal, and plastic containers are available for packaging maple syrup. Each type of container has advantages and disadvantages which producers should understand

Metal containers represent maple syrup packaged in the most traditional manner. They are well suited for packing in the 1 quart to 1 gallon size. When metal containers are clean and dry they are very satisfactory. Some producers prefer to rinse all cans with hot water before filling. If this is done they should be thoroughly and rapidly dried before use. If cans are not rinsed, check for loose metal fragments or rust before filling. Once filled, securely install the cap insert and screw on the cap.

Glass containers are preferred by some because they permit the natural color of the syrup to be seen. Glass is most common for 1-quart and smaller sizes. Glass, like all containers, should be stored in an inverted position before filling to avoid possible contamination.

In the past few years, containers made of various food-grade plastics have become the containers of choice for many. They are available in a variety of sizes and offer distinct advantages, particularly the absence of rust and increased resistance to breakage. However, color changes may occur in syrup stored in standard plastic containers for a prolonged period. For this reason, to avoid possible grade change, syrup offered for sale in these plastic containers should not be packed for periods longer than 3 months before the anticipated sale date.

The potential grade change associated with standard plastic containers appears to be associated with the fact that they are somewhat porous to air. Coated plastic containers are now being manufactured and marketed which are nonporous to air.

Avoiding Stack Burn

The color of pure maple syrup results from a browning reaction which occurs in the latter stages of evaporation. If syrup is packaged hot, this same browning reaction can continue. This may result in changing the grade of medium amber syrup to dark amber or even darker. This darkening of color is known as stack burn. It is usually not a problem with light amber grade syrup.

To avoid stack burn, it is recommended that filled containers be allowed to cool before they are boxed or packed close together. If adequate space is available, this is commonly achieved by separating the filled containers to allow air to freely circulate around them and hasten cooling. Once the syrup and its container has reached room temperature, all containers can be stacked more closely. Some producers have hastened the cooling process by using a fan or by packing syrup in a cool room.

Storage of Packaged Syrup

Once containers filled with syrup have adequately cooled they are ready for storage if necessary. It is recommended that all packages of syrup from a particular lot be coded to distinguish them from other lots. Coding will permit rapid identification if a problem develops or will quickly allow multiple packages of a specific lot to be located.

Time, temperature and exposure, are important factors to consider when storing maple syrup. It is natural for some syrups to lose flavor when stored for long periods of time. For this reason many producers will package syrup in retail containers on an as-needed basis, usually accumulating no more than a 2 to 3 month supply. Filled packages should be stored in a darkened, relatively cool location where temperature fluctuations are minimized. To maintain constant temperatures and control humidity, some producers air condition their storage rooms in the summer months. This will minimize temperature changes and reduce condensation which can occur on packaged syrup. Syrup in retail containers also can be stored at below freezing temperatures (though it never freezes solid). If this is done, quality will be maintained for an indefinite time period.

Bulk Storage

Those conditions conducive to maintaining syrup quality in retail packages are also applicable to storage of bulk syrup. Control of temperature and minimum exposure to airborne contaminants are especially important. For small- to medium-sized operations, storage in 5-gallon containers which can be hot filled and sealed is preferable to drum storage. Their use will reduce the possibility of syrup spoilage or grade reduction due to microbial contamination since repacking all

of the syrup in these containers at one time is more likely. In contrast, repeated opening of larger drums to add or remove syrup increases the likelihood of bacteria, yeast, and mold contamination.

When syrup is removed from bulk containers for packaging into retail containers it must be reheated. If bacteria, mold, or yeast growth is present, all visible growth should be removed and the syrup tested for off-flavor. Following heating to a minimum of 180°F, the syrup should be filtered and packaged. Following reheating, measurements of syrup density should be completed and adjustments made if necessary to make certain the syrup is at the correct density when packaged. It is common for the density of syrup to increase during the process of reheating and packaging. It is also advisable to taste each batch to verify acceptable flavor.

Flavour wheel for maple products

Do you prefer a maple syrup that is lightly malted, with a hint of marshmallow or butter or with a woody note? The maple flavour wheel officially unveiled on February 5, 2004, at the Food Research and Development Centre in Saint-Hyacinthe will help you find that special syrup.

Maple syrup is currently described by its colour (extra clear, clear, medium, amber and dark) and by the presence or absence of defects. A research team made up of sensory evaluation experts from Agriculture and Agri-Food Canada and of maple product professionals from the Centre for Maple Syrup Research, Development and Technology Transfer (Centre ACER inc.) has developed a more elaborate way to evaluate maple syrup, a luxury product that is a source of pride for Canadians. The maple flavour* wheel, which made headlines in the Wall Street Journal, is a visual representation of a reference vocabulary describing very precisely and scientifically the astonishing variety of flavours to be found in the various maple syrups, such as is already available for chocolate, honey, beer, wine and cheese.

The wheel comprises thirteen flavour families, including floral, spice, milky and empyreumatic (a charred or tarry odour, for example). These families are subdivided into 39 subfamilies, and these are in turn subdivided into 91 attributes, which are designated by specific products, such as brown sugar, sawdust, banana and hay.

Thanks to the wheel, maple syrup industry stakeholders will from now have a common language for describing both the quality and the variety of flavours of maple products. This crucial reference tool could enable maple syrup producers as a whole to better respond to consumers' tastes. Also, being able to evaluate the scope of flavours perceptible in the various syrups will help promote the quality of this product so dear to Canadians.

* The term “flavour,” which is of Old French origin, encompasses all the notes of taste and smell comprised in a gustatory experience, as opposed to the four basic tastes, i.e. sweet, salty, acidic and bitter.

Describing the Flavours of Maple Products

There is a science to tasting. Specially trained practitioners known as sensory evaluators take great pains to characterize the taste and smell sensations that foods produce, and share their discovery with others. One of the most difficult parts of taste evaluation is finding the right words to describe your perceptions. Learning the terminology of tasting is a little like learning a foreign language. To help, specialists in sensory evaluation and of maple products have come up with a flavour wheel that groups terms used to describe maple syrup flavours. The wheel was developed from a list of some 250 reference characteristics provided by several tasting panels. It is like a dictionary, providing a common language so all stakeholders can work to improve the quality of maple products.

Could You Be a Good Taster?

An accomplished taster continually explores a vast repertoire of foods, from artichokes to zucchini. Moreover, the food experiences are filed away in the taster's memory banks, readily recalled to help name each new taste sensation. When tasting foods with a

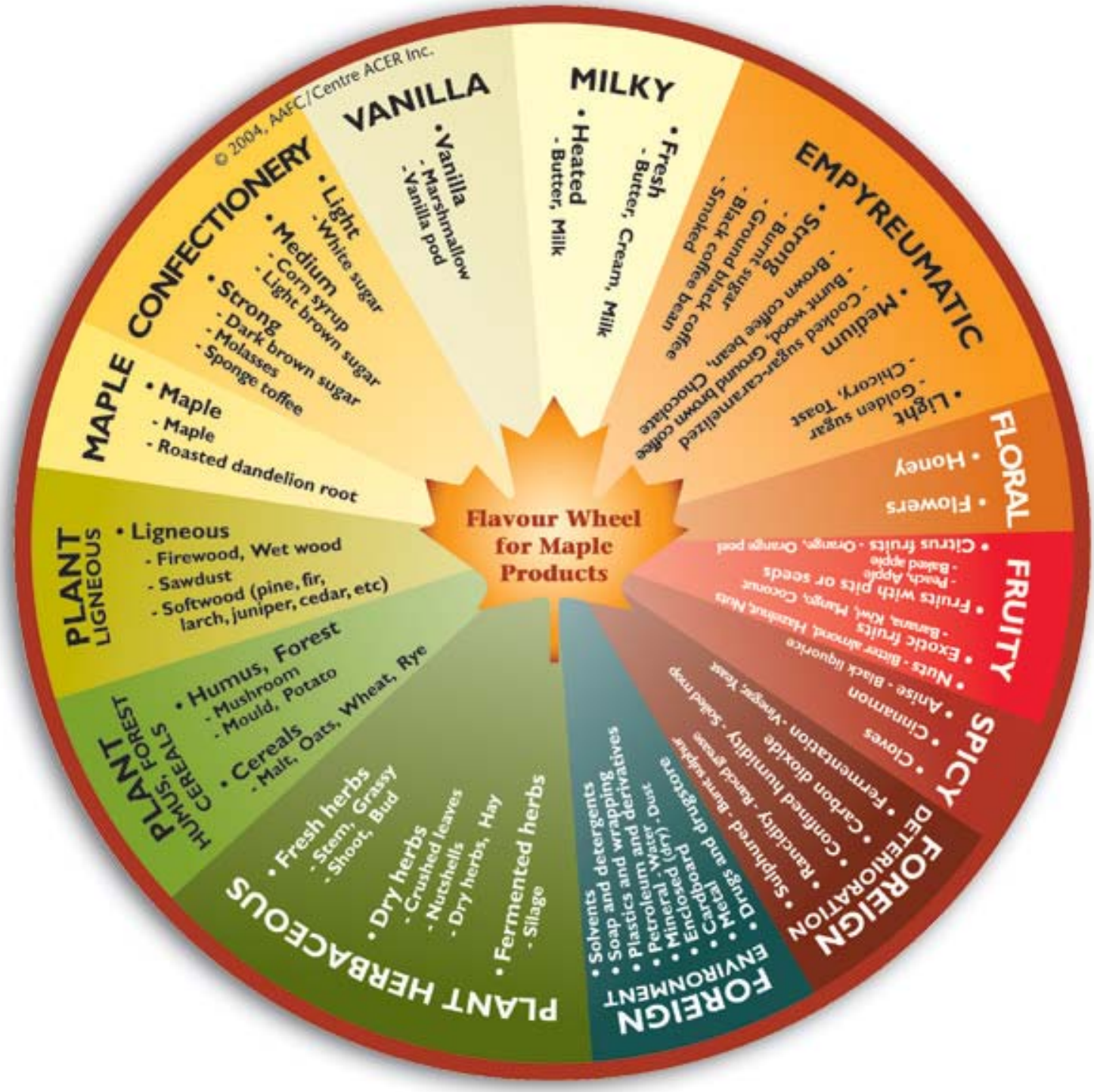
view to describing the sensory experience, the basic rules are: be in good health, avoid smoking, coffee, chocolate and any foods with a strong or persistent taste prior to a tasting, and avoid perfumes, scented lotions and creams. Experts have learned that these conditions will affect the taste perceived. Tasting should be an enjoyable experience for the taster and should be done in a well-ventilated room, where there are no extraneous odours or noises.

Tasting Maple Syrup

Although professional tasters require extensive training, you can sharpen your tasting skills by following these steps:

- First, smell the syrup by taking three quick sniffs. Make a mental note of your impressions. Next, take a small sip of the syrup and swirl it around in your mouth. It is a good idea to spit it out if you can. Take about a minute to concentrate on the full range of flavours.
- Try to associate the flavour with your own experience (for example, the aroma from a bag of marshmallows).
- If possible, share your reaction with others, as this often helps trigger memory associations. Once you have identified what you think characterizes the taste, memorize the sensation and the name for it (for example, vanilla).

Finally, where possible, assess the degree of intensity (for example, mild, medium or strong).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Flavour Wheel for Maple Products
VANILLA
• Vanilla
- Marshmallow
- Vanilla pod
MILKY
• Fresh
- Butter, Cream, Milk
• Heated
- Butter, Milk
EMPYREUMATIC
• Light
- Golden sugar
- Chicory, Toast
• Medium
- Cooked sugar-caramelized
- Burnt wood, Ground brown coffee
- Brown coffee bean, Chocolate
• Strong
- Burnt sugar
- Ground black coffee bean
- Smoked
FLORAL
• Flowers
• Honey
FRUITY
• Citrus fruits - Orange, Orange peel
• Fruits with pits or seeds
- Peach, Apple
- Baked apple
• Exotic fruits
- Banana, Kiwi, Mango, Coconut
• Nuts - Bitter almond, Hazelnut, Nuts
SPICY
• Anise - Black liquorice
• Cinnamon
• Cloves
DETERIORATION
• Fermentation - Vinegar, Yeast
• Carbon dioxide
• Confined humidity - Soaked hay
• Rancidity - Rancid grease
• Sulphured - Burnt sulphur
FOREIGN
• Drugs and drugstore
• Metal
• Cardboard
• Enclosed
• Mineral -Water - Dust
• Petroleum and derivatives
• Plastics and wrapping
• Soap and derivatives
• Solvents
FOREIGN ENVIRONMENT
PLANT HERBACEOUS
• Fermented herbs
- Silage
• Dry herbs
- Crushed leaves
- Nutshells
- Dry herbs, Hay
• Fresh herbs
- Stem, Grassy
- Shoot, Bud
PLANT FOREST PLUS CEREALS
• Cereals
- Malt, Oats, Wheat, Rye
• Humus, Forest
- Mushroom
- Mould, Potato
PLANT LIGNEOUS
• Ligneous
- Firewood, Wet wood
- Sawdust
- Softwood (pine, fir, larch, juniper, cedar, etc)
MAPLE
• Maple
- Maple
- Roasted dandelion root
CONFECTIONERY
• Light
- White sugar
• Medium
- Corn syrup
- Light brown sugar
• Strong
- Dark brown sugar
- Molasses
- Sponge toffee

In the Judge's Eye

By Henry Marckres and George Cook

What does is take to have a, product: that brings home the. blue ribbon at contests? Is there some special inside knowledge that people have that helps them to be consistent winners?

First, the judges don't know whose product they are judging. The judges try to do as fair a job as possible. When some people win consistently, perhaps they know how to care for and prepare their entries to retain the top quality characteristics.

To determine the winners Judges usually check the clarity, density and color, and then taste the entry, setting aside any that have exceptional flavor. They will go back and taste these again to determine the winner. Some contests use a score sheet where each factor (clarity, color, flavor, etc.) is rated; then the totals are added to determine a winner.

Syrup - many people set aside pints of syrup during sugaring season that "stand out". If you do this, keep your entry in glass and in the freezer. Remove the syrup from the freezer two days before the contest. Remember, for best results; use only new, unused containers. Canning jars are okay but do not use mayonnaise jars, or peanut butter jars, or pickle jars. These are very hard to clean properly and may retain enough odor in the jar or cap to affect your syrup. Canning jars washed with detergent either in a. dishwasher or by hand must be well rinsed with hot water,

When getting your entry ready for the contest, open the container and check the four basics: color, clarity, density and the most important TASTE! Have more than one person test the flavor of the syrup. Also, if you are heating syrup to send in, it should be filtered after heating. Always use a kitchen - never a coffee filter. Two other points to remember: 1. Send the required amount of product for the entry. 2. Take your name labels off. The entry tag will identify your product.

Maple Cream - Look for a smooth product with no crystals; spreadable. not too soft and runny but not too hard; and not separated; usually made from a Fancy or Medium Amber syrup. Don't use frosting containers to enter cream in.

Indian Sugar - Use a strong flavored syrup, some dark amber have too light of a flavor for Indian sugar. Watch the moisture content, a sugar should not be like cane sugar, but should have "creep". It needs to have uniform sugar crystals.

Sugar Cakes - Whether you make large batches or small, watch the temperature of the product. Cakes should be well formed, not too hard or soft, and watch out for large crystals. Lighter flavor syrup may be better than strong flavor. Present them in an attractive display.

Maple Fudge - Use light flavored syrup. Fudge should be firm- not too hard or soft; should be able to be cur into squares. Watch for too many nuts, chopped too finely, or rancid flavor. Avoid recipes with too much butter. Remember, maple should be the prominent, flavor.

Maple Specialty - Novel use of maple, any product that isn't covered by other categories. Make sure the maple flavor comes through.

One final reminder to leave you with.. .before you enter syrup, TASTE IT! This is the most important thing to do before entering it or making it into a product. Don't enter questionable syrup or products. Handle the entries as the special products they are.

United States Department of Agriculture

Marketing and Regulatory Programs

Agricultural Marketing Service

Fruit and Vegetable Program

Specialty Crops Inspection Division

United States Standards For Grades of Maple Syrup

Effective DRAFT

This is the Third issue, as amended, of the United States Standards for Grades of Maple Syrup published in the FEDERAL REGISTER of XXX to become effective XXX. This issue supersedes the second issue, which has been in effect since January 14, 1980.

Voluntary U.S. grade standards are issued under the authority of the Agricultural Marketing Act of 1946, which provides for the development of official U.S. grades to designate different levels of quality. These grade standards are available for use by producers, suppliers, buyers, and consumers. As in the case of other standards for grades of fresh and processed fruits 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 U.S. grade standards, grading manuals, handbooks or instructions for inspection of several fresh and processed fruits and vegetables are available on the internet and upon request at the address below. 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:

Director, Specialty Crops Inspection Division
Fruit and Vegetable Program, AMS, U.S. Department of Agriculture
1400 Independence Avenue, SW, STOP 0240
Washington, D.C. 20250
Phone: (202) 720-5870 Fax: (202) 720-0393

Authority: 7 U.S.C. 1621-1627.

Note: Compliance with the provisions of these standards shall not excuse failure to comply with the provisions of the Federal Food, Drug, and Cosmetic Act, or with applicable State laws and regulations.

United States Standards for Grades of Maple Syrup (DRAFT)

Section		Page No.
§52.5961	Product description.	2
§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 the lot.	5

§52.5961 Product description.

Maple syrup is the liquid food derived by concentrating and heat treating sap from the maple tree (Acer) as defined in the U.S. Food and Drug Administration (FDA) Standards of Identity for Maple Sirup (21 CFR 168.140) issued under the Federal Food, Drug, and Cosmetic Act. The solids content of the finished maple syrup shall not be less 66 percent by weight (Brix).

§52.5962 Grades.

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

(1) Not more than 68.9 percent solids content by weight (Brix);

(2) Has good uniform color;

(3) Has good flavor and odor, and intensity of flavor (maple taste) normally associated with the color class;

(4) Is free from off flavors and odors considered as damage;

(5) Is free from cloudiness, turbidity, sediment, and is clean;

(6) No deviants for damage shall be allowed in Grade A.

(b) **Maple syrup for processing (Processing Grade)** means maple syrup that is not permitted to be sold in any retail market. Any maple syrup that does not meet Grade A requirements, but meets the requirement of Processing Grade may be used in the manufacturing of other products, and must be packed in containers of 5-gallons or 20-liters or larger. Processing Grade maple syrup cannot be packaged in consumer-size containers for retail sales.

(1) May be any color class and any light transmittance; and not more than 68.9 percent solids content by weight (Brix);

(2) May contain off flavors; and odors;

(3) May have a very strong taste.

(c) **Substandard** is the quality of maple syrup that fails to meet the requirements of Processing Grade maple syrup.

§52.5963 Recommended Fill of Container.

The amount that a container is filled is not a requirement since the fill of a container is not a quality factor. It is, however, recommended that each container be filled with syrup as full as practicable and that the product occupy at least 90 percent of the volume of the container.

§52.5964 Color.

General. The color class of maple syrup is determined by:

(a) The percent of light transmission through the syrup as measured with a spectrophotometer using matched square optical cells having a 10mm light path at a wavelength of 560 nm. The color value is expressed as percent of light transmission as compared to analytical reagent glycerol fixed at 100 percent. Percent transmission is symbolized by "%Tc."

(b) Any method that provides equivalent results.

When certifying the color of a sample that has been officially drawn and which represents a specific lot of maple syrup, if the number of color deviants exceeds the acceptance number in the appropriate sampling plan, the lot should be designated as mixed color.

§52.5965 Classification Requirements.

(a) **"Grade A" classification.**

(1) Possesses a good maple flavor (taste) characteristic of the color;

(2) Is clean, free from turbidity or cloudiness, and free from off flavors and odors;

(3) Has good uniform color, which means the syrup color is bright and typical of maple syrup.

"Grade A" Maple syrup has four color and flavor classes

Color classes are associated with specific **%Tc** values as follows:

Grade A Color Classes	Taste	Light Transmittance (% Tc)
U.S. Grade A Golden	Delicate	≥ 75.0
U.S. Grade A Amber	Rich	50.0-74.9
U.S. Grade A Dark	Robust	25.0-49.9
U.S. Grade A Very Dark	Strong	< 25.0

(b) **"Processing Grade" classification.** Fails to meet the requirements of Grade A, but possesses a fairly good characteristic maple taste and may contain off-flavors, but is fairly free of damage, fairly free of turbidity or cloudiness, and is fairly clean.

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

§52.5966 Explanation of Terms.

(a) **Brix** is the percentage by weight concentration of total soluble solids (mainly sugar), of maple syrup when tested with a refractometer calibrated at 68 degrees Fahrenheit and to which any applicable temperature correction has been made; **or** by any other method which gives equivalent results.

(b) **Buddy flavor** or buddiness (classified as damage), is a disagreeable flavor characteristic of syrup when sap is collected from maple trees as they come out of dormancy. This flavor can be described as tasting chocolaty to bitter chocolaty.

(c) **Clean** means that the syrup is free from foreign material such as pieces of bark, soot, dust, or dirt.

(d) **Damage** means any defects that materially affect the appearance, edibility, or quality of the syrup. Badly scorched syrup, buddy syrup, fermented syrup, or syrup that has any off flavors or odors shall be considered as damage.

(e) **Fermentation** (classified as damage), means the chemical breakdown of a substance by bacteria, yeasts, molds, or other microorganisms.

(f) **Light Transmittance (Tc)** means the ability of a liquid to transmit light as determined optically by means of a spectrophotometer.

(g) **Off-flavor** or **off-odor** (classified as damage), means any specific and identifiable or unidentifiable flavor or odor defect that is not normally found in Grade A maple syrup. These flavors or odors may be related to natural factors (e.g., woody or buddy), to manufacturing practices (e.g., burnt, chemical, fermented, scorched), or caused by the presence of any disagreeable flavor or odor that may have developed during handling or storage.

(h) **Taste** means the **intensity** of maple **flavor.** The descriptors for the taste of **Grade A** Maple Syrup are as follows:

(1) **Delicate** means mild maple taste.

(2) **Rich** means a full-bodied maple taste of medium intensity.

(3) **Robust** means stronger maple taste than the lighter colors.

(4) **Strong** means a maple taste that is stronger than robust.

(i) **Turbidity** or **cloudiness** means the presence, in the suspension, of fine particles of mineral matter such as malate of lime, niter, sugar sand, calcium malate, or other substance that detract from the clearness of the syrup.

(1) **Malate of lime** means fine particles of mineral matter in maple syrup.

(2) **Sugar sand** or **niter** generally means a harmless gritty substance naturally found in maple syrup, and is often referred to as cloudiness.

(3) **Calcium malate** results from high calcium and malic acid concentrations in the syrup and is one of the least soluble salts in the syrup.

§52.5967 Determining the Grade of a Lot.

The grade of a lot of maple syrup covered by these standards is determined by the procedures in the **Regulations Governing Inspection and Certification of Processed Fruits and Vegetables, Processed Products Thereof, and Certain Processed Food Products** (7 CFR 52.1 through 52.83).

Part 270. Maple Syrup

Section 270.1 Maple Syrup: identities; label statements

(a) Definitions: For the purpose of this section, the following terms shall have the following meanings, unless the context clearly indicates otherwise:

1. Light transmittance means the fraction of incident light at a specified wavelength that passes through a representative sample of a particular sub-grade of Grade A maple syrup.

2. Soluble solids, expressed as a percentage, means the proportion of maple sap solids in the applicable solvent.

3. Tc means the percentage of light transmission through maple syrup, measurable by a spectrophotometer, using matched square optical cells having a 10-millimeter light path at a wavelength of 560 nanometers, the color values being expressed in percent of light transmission as compared to A.R. Glycerol fixed at 100% transmission.

(b) Standards of identity.

1. Maple syrup is the liquid made by the evaporation of pure sap or sweet water obtained by tapping a maple tree. Maple syrup contains minimum soluble solids of 66.0% and maximum soluble solids of 68.9%. Maple syrup includes, and is either, Grade A Maple Syrup or Processing Grade Maple Syrup, as defined in paragraphs (2) and (3) of this subdivision.

2. Grade A maple syrup means maple syrup that is not fermented, is not turbid, and contains or has no objectionable odors, off-flavors or sediment. Grade A maple syrup must fall within one of the color and taste sub-grades of Grade A maple syrup set forth in subparagraphs (a), (b), (c), or (d) of this paragraph.

a. Grade A golden color and delicate taste maple syrup has a uniform light golden color, a delicate to mild taste, and a light transmittance of 75% Tc or more.

b. Grade A amber color and rich taste maple syrup has a uniform amber color, a rich or full-bodied taste, and a light transmittance of 50% - 74.9% Tc.

c. Grade A dark color and robust taste maple syrup has a uniform dark color, a robust or strong taste, and a light transmittance of 25% - 49.9% Tc.

d. Grade A very dark and strong taste maple syrup has a uniform very dark color, a very strong taste, and a light transmittance of less than 25% Tc.

3. Processing Grade Maple Syrup means maple syrup that does not meet the requirements for Grade A maple syrup set forth in paragraph (2) of this subdivision. Processing Grade Maple Syrup may not be sold, offered for sale or distributed in retail food stores or directly to consumers for household use.

(c) Nomenclature label statement.

1. The name of the food defined in paragraph 2 of subdivision (b) of this section is "Grade A Maple Syrup". The name "Grade A Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "golden color and delicate taste", "amber color and rich taste", "dark color and robust taste", or "very dark color and strong taste", as appropriate, must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

2. The name of the food defined in paragraph (3) of subdivision (b) of this section is "Processing Grade Maple Syrup". The name "Processing Grade Maple Syrup" must conspicuously appear on the principal display panel of the food's label, and the words "For Food Processing Only" and "Not for Retail Sale" must also conspicuously appear on the food's principal display panel in close proximity to the food's name and in a size reasonably related to the size of the name of the food.

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/l4 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 (1PT40Z).

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.

The University of Maine Cooperative Extension

Presented by the University of Maine Cooperative Extension in cooperation with the Maine Department of Agriculture, Food and Rural Resources, and the Vermont Department of Agriculture.

Cleanliness and Maple Quality
Sanitizers and Maple Quality
Quality Begins in the Sugarbush
- Spouts
- Buckets and Pail
- Pipelines, Tubing and Conduits
- Tree Tapping
- Sap Collection
- Sap Filtering
- Sap Tanks

Quality Continues in the Sugarhouse
- Processing Sap
- Syrup Density
- Syrup Filtering

Quality Continues in the Sugarhouse
- Syrup Packing
- Packing in Bulk
- Filling Drums
- Filling Retail Containers
- Grading Syrup for Retail Container
- Care and Storage of Canned Syrup

Reducing Lead in Syrup
- Equipment
- Practices

After Sugaring
- Quality Begins for the Next Season

Appendix
- State Regulations and Licensing

OSHA Emergency Action Plan for Maple Producers

Annual Syrup Production & Packaging Record

Maple Resource Links

Putting knowledge to work with the people of Maine

THE UNIVERSITY OF MAINE Cooperative Extension

A Member of the University of Maine System

Send comments, suggestions or inquiries to Kathy Hopkins
Telephone: 207-474-9622

Cleanliness and Maple Quality

The most important contributor to maple quality is cleanliness. Microorganisms, bacteria and yeast are enemies of high quality syrup, affecting both color and flavor. Since these culprits are found on unclean equipment, and may multiply rapidly in sap and syrup, careful sanitary practices are critical in the collection of sap, and the production, packing and storage of syrup.

Sanitizers and Maple Quality

Although cleanliness is a "must," most of the popular cleaning compounds cannot be used in connection with maple production.

WARNING! HOUSEHOLD DETERGENTS and SOAPS which have any fragrance, and IODINE-BASED DAIRY SANITIZERS **SHOULD NOT BE USED** for sanitizing maple production equipment. Both have ruined the flavor of large quantities of syrup, rendering it totally unsaleable.

One part **UNSCENTED** household chlorine bleach (such as unscented Chlorox) to twenty parts of clean water may be used for rinsing, but flushing afterwards with clean, clear water is essential. A stronger solution MUST NOT be used, and the solution should not stand in galvanized equipment, because flavor problems are likely to result.

CAUTION! Household chlorine bleach is generally a 5.25% sodium hypochlorite solution. Commercial bleaches are stronger. The "one part bleach to twenty parts water" mentioned throughout this manual refers to household bleach, not stronger than 5.25% sodium hypochlorite.

REMEMBER! ANYTHING ADDED TO SAP, even in quantities so small as to be undetectable, will become CONCENTRATED as the sap is boiled and the syrup is produced, CAUSING AN OFF-FLAVOR. Plenty of "elbow grease" and lots of clean, HOT water are the best cleaning agents for maple equipment which is to be scrubbed.

Quality Begins in the Sugarbush

WARNING! RUSTY OR CORRODED SPOUTS, BUCKETS, OR OTHER MAPLE UTENSILS SHOULD NOT BE USED. These defects may result in toxic metals and metallic off-flavors in syrup.

Spouts

Prior to use, spouts should be cleaned and dip-rinsed in a chlorine bleach solution (one part of unscented chlorine bleach to twenty parts of water) and then rinsed thoroughly in

hot water. As a substitute for the dip-rinse, metal spouts may be boiled in clean water. A sanitized spout will keep the tap hole open longer, increasing sap yield, and will help to keep tubing lines free of microorganisms.

Buckets and Pails

Hand or machine scrubbing of buckets and pails should be done thoroughly with HOT water. If a chlorine bleach is used (one part unscented household chlorine bleach to twenty parts water), care should be taken to rinse each bucket THOROUGHLY. This should be done promptly at the end of the season in order to make the work easier, and to prevent deterioration of the metal.

Pipelines, Tubing and Conduit

…Installing Pipeline for High Quality Production…

The function of pipeline, tubing and conduits is to help the sugarmaker to get the freshest possible sap to the sugarhouse. "DOWNHILL, STRAIGHT AND TIGHT" is a slogan to keep in mind when installing tubing. Pipeline which sags, or is not adequately pitched may retain sap which can develop microorganisms as it ages, lowering the quality of syrup.

Sugarmakers should be certain to use pipeline of adequate size to move sap efficiently, maintaining high quality sap.

…Choosing Tubing for High Quality Production…

Tubing companies have designed products specifically intended to move large volumes of sap long distances under the most favorable conditions for high quality syrup production. Materials such as black plastic water pipe, which draws heat from the sun, should be used with care. Sap flowing long distances in dark pipeline exposed to the sun may reach temperatures as high as 80 degrees, even though air temperatures are much lower. Warm sap in lines, and later in storage tanks, encourages the growth of microorganisms, reducing the quality and grade of syrup. Dark colored pipe may be painted white with a non-toxic paint. Be certain that lines have NO SAGS; sags trap the sap, and permit bacteria growth. If pipe is used which is not produced specifically for sap collection it must be of high grade, the kind that is designed for drinking water. BE CERTAIN that all TUBING IS MADE OF FOOD-GRADE MATERIALS.

…Clean Tubing and Quality…

Clean tubing is essential if high quality and maximum production are to be achieved. Sanitation of tubing immediately after the last sap run is recommended. Most producers force a chlorine bleach solution through the tubing (one part unscented household chlorine bleach to twenty parts water); it is a common practice to let this solution remain in the lines for a day or two, after making certain that the lines are completely filled.

WARNING! Be sure all solution is THOROUGHLY RINSED FROM THE LINES. In addition to flushing with water after the use of a chlorine solution, many producers allow the first sap to run onto the ground, providing an added rinse at the beginning of the new season; this is done for two reasons: (1) even though most traces of chlorine which are in the sap will evaporate during the boiling process, the sodium or salt remains, and becomes concentrated in the syrup, ruining the flavor. (2) Some sugarmakers and researchers feel that rodents may be attracted by the salt, and the most thorough rinsing procedures at both the beginning and the end of the season will help us to reduce rodent damage.

We recognized the value of rinsing with chlorine, but we cannot emphasize too strongly the danger of producing off-flavored syrup unless extreme caution is used to rinse all chlorine from lines and tanks. Make certain that chlorine solution is NOT PERMITTED TO ENTER THE LINES WHICH MAY END UP IN THE EVAPORATOR.

Alternatively, a hot water air-mixture can be forced through the sap lines. The turbulence of the air mixed with water is an effective cleaner and leaves no chlorine residue.

Tree Tapping

…Only in White Wood…

All tap holes must be drilled into healthy, clean, white wood. It is recommended that the sugarmaker not tap any further than necessary…generally a depth of not more than 1½ inches is recommended. When dark colored wood shows in a hole, that tap should not be used. A bad tap hole will yield little or no sap, and may spoil the flavor of large amounts of syrup.

…Clean the Tap Holes…

Spouts should be inserted immediately after drilling; they should be tapped in gently to avoid any unnecessary damage to the tree. When removing any wood chips, use a twig or other clean tool to brush them out. Blowing into the hole to remove chips is an unsanitary practice which will contaminate the tap hole.

…WARNING! Para-formaldehyde Pellets May NOT Be Used!…

In the past, para-formaldehyde pellets were recommended for use in tap holes; some out-of-date sugaring manuals are still in existence which suggest their use. It has been found that the use of para-formaldehyde pellets can damage the maple tree, and they are now ILLEGAL. Similarly, the use of denatured alcohol as a disinfectant for tapholes is not approved in the state of Maine.

Sap Collection

…Timing is Important…

Sap should be gathered promptly, especially when temperatures are above freezing. Fresh, clean sap which has been kept cool during collection and prior to boiling will produce syrup which is ONE TO TWO GRADES HIGHER than old, contaminated sap. Since higher quality syrup commands a higher price, it makes sense to collect and boil sap as quickly as possible.

…Sap Gathering Pails…

Sap should be gathered from buckets in containers that are used specifically for that purpose. It is important NOT to use pails that have contained non-food products.

…Be Observant…

Maple sap and syrup pick up off-flavors easily. Be sure that particles from exhaust pipes of tractors do not float into gathering pails or tanks. Contact of sap with any petroleum product is especially dangerous.

…Sap Ice…

The ice formed in sap buckets can help to keep the sap cool in storage; however, many sugarmakers throw away the ice because they believe that it contains very little sugar. With today's high fuel costs, the producer may wish to check the sugar content of melted ice before making a decision about whether to keep or discard ice.

Sap Filtering

Filter sap through multiple filters, first through coarse filtering materials to remove bark, small wood shavings and debris, then through a finer filter. Removing foreign materials from the sap before it is evaporated will usually UPGRADE SYRUP BY AT LEAST ONE GRADE…a higher price for a small effort and expenditure. All sap filters should be changed often and kept clean to avoid off-flavors. (Please refer to information regarding care of filters) For filtering sap, many sugarmakers use filtering materials which are available from maple equipment suppliers.

Sap Tanks

…Keep Tanks Clean Throughout the Season…

Between runs, when practical, sap gathering and storage tanks may be rinsed. Be cautious if using the solution of one part unscented household chlorine bleach to twenty parts of water. Make sure that everything with which sap may come in contact has been THOROUGHLY RINSED so that no chlorine residue remains. The solution should not be permitted to remain in the tanks, since chlorine has corrosive effects on galvanized metal.

…Keep it Cool and Covered…

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

…Storing Sap…
Sap should not be left long in tanks when weather is above freezing; the quality of the sap will begin to deteriorate, producing lower grade syrup.

Quality Continues in the Sugarhouse

Processing Sap

…Prompt Processing: One Key to High Quality…
To obtain the highest quality syrup, sap should be evaporated as quickly as possible. Holding sap in buckets or tanks lowers the quality of the syrup produced from that same sap. Producers should strive to evaporate sap completely before stopping. Generally a shallow sap depth and a hot fire make for rapid syrup production, and high grade syrup.

…Reverse Osmosis…
The use of reverse osmosis units is becoming more common as a means for the sugarmaker to remove large quantities of water before beginning the conventional evaporation process. As with all sugaring equipment, cleanliness is critical to the maintenance of quality. Follow the manufacturer's suggestions for cleaning. If an anti-bacterial storage solution, or any sanitizing solution is used, be sure to FLUSH THOROUGHLY with PURE WATER before processing sap to avoid off-flavor and/or syrup contamination.

…Defoamer…
Use as LITTLE defoamer as possible. Defoamer should be fresh; old defoamer becomes rancid, and causes a rancid off-flavor in syrup. Excess use of some defoamers has also been known to cause "fatty" off-flavors.

If vegetable oil must be used because of special market requirements (religious or dietary) take care to use the SMALLEST POSSIBLE AMOUNT. In recent years some off-flavors due to vegetable oil have occurred; the vegetable oil flavor tends to especially affect Fancy syrup.

…Evaporator Pans…
Keep pans clean. Change draw-off sides often to prevent the accumulation of niter (sugar sand), which can cause scorching and off-flavored syrup. In recent years an increase in off-flavored syrup due to burnt niter has been noticed. When evaporating reverse osmosis concentrate, niter build-up is faster, requiring more frequent change of draw-off sides. Should any scorching occur, shut down and clean up the burned area in order to prevent imparting off-flavor to the next batch of syrup.

…Maple Quality Control Puts the Accent on Flavor…
Maple flavor must be guarded from sap to store shelf.

Flavor can be damaged from contaminated, unfiltered, or old sap, new and used filters, caramelized sugar, fermentation and mold, detergents, chemicals and rust.

Syrup Density

Maine law requires maple syrup to be evaporated to a density greater than 66% Brix at 68 ° F. Various instruments can be used to check the density: hydrometers, hydrotherms, refractometers and light transmittance meters. For best results, know how the instrument works and how to protect its accuracy.

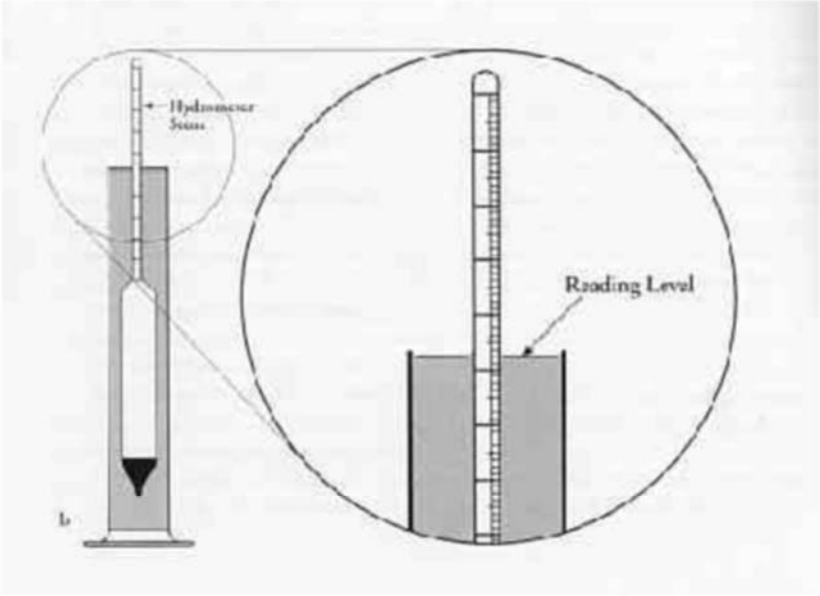
Low Density Syrup…

The principal causes of low density syrup are:

1. Not making an adjustment of syrup temperature when checking density with a hydrometer.
2. Using an inaccurate hydrometer.
3. Inaccurate adjustment of heavy density syrup.
4. Steam condensing on surfaces, and running into the last containers of syrup to be packed. The last syrup in the tank should not be canned unless checked carefully for proper density. REMEMBER! Low density syrup is ILLEGAL.

…Density Check at Draw-Off…

Use a deep container of small diameter (hydrometer cups are convenient) so that the hydrometer may be floated IMMEDIATELY AFTER each drawoff.



Lower the hydrometer gently. Be sure that the hydrometer DOES NOT TOUCH the bottom or sides of the hydrometer cup.

Reading should be made at the point on the hydrometer stem that is LEVEL WITH THE SURFACE OF THE SYRUP (not the top of the meniscus.)

CAUTION! Remember that syrup having a density reading below 66% Brix is in violation of the Maine state law. Such syrup is more likely to ferment. Syrup with a density above 68 % Brix may crystallize, causing consumer complaint.

…Syrup Refractometer…

Syrup refractometers are instruments which may be used in testing the density of maple syrup. They are available through maple equipment dealers. With the use of a

refractomer, the sugarmaker should be certain to follow instructions. Occasionally problems have occurred which are due to incorrect calibration of the instrument, leading to light or heavy syrup. Also, producers and the Department of Agriculture have found that some instruments do not consistently provide accurate readings when testing hot syrup. Refractometers may be checked by comparing with an accurate, tested hydrometer used in conjunction with a thermometer.

...Hydrotherm...

Hydrotherms are special hydrometers with thermometers build in to locate the point on the hydrometer to measure standard density syrup. It is used like a hydrometer but allowed to sit for 30-40 seconds for the thermometer column in the hydrotherm to warm or cool to the syrup temperature. Hydrotherms are not recommended for use by the Department of Agriculture because they are not calibrated to a standardized scale.

..Light Transmittance Meter...

A light transmittance meter is a newer tool that can be used to check the color of syrup. In a light transmittance meter a syrup sample is checked for color by passing light through a sample. The percent of transmission of light is compared to the ranges of light transmission already established for the different grades. Care must be taken with the meter to assure that no fingerprints are on the maple bottle, and that the syrup sample has no bubbles or cloudiness. Any of these conditions may diminish the light that it transmitted through the sample and therefore lower the grade.

…Automatic Draw-off…

Automatic draw-offs are not completely accurate. Change the draw-off side frequently, within hours, not days, or when your scoop shows niter beginning to build up in the pan. Using a hydrometer or refractometer, test the first syrup drawn off at the new side. Adjust the draw-off frequently each day, using a hydrometer or refractometer, to establish the appropriate adjustment.

WARNING! DO NOT SCOOP near the automatic draw-off until after it shuts off. Scooping near the draw-off will change the density reading of the drawn-off syrup. CLEAN the control when changing sides. Nylon scouring pads (unscented and soap-free) are helpful. Never use steel wool! It will scratch the pan and speed the build-up of niter.

Syrup Filtering

…Care of Filters…

DO NOT store filters in moth balls, cedar closets, airtight containers, or near scented materials.

CLEAN filters thoroughly, dry thoroughly, and store in a cloth bag in clean, dry, airy, storage.

CHLORINE BLEACH should NOT be used to clean filters. In spite of repeated washings, rinsings, and airings, filters which have been washed with bleach impart off-flavors to syrup.

Scented cleansers, fabric softeners, and "dryer sheets" should NOT be used.

New filters and pre-filters must be thoroughly BOILED in CLEAN water (not in sap pans) and AIR DRIED (in the sun if possible.)

Use the "SNIFF" test to provide an added check for your filters. Musty old filters, and new chemical-smelling filters should NOT be used. Filters can impart off-flavors to syrups, making the product unfit for sale.

The use of synthetic filters as pre-filters (above "cone" type or "flat type" filters) save much labor. When they are used, more effective filtration results, and the heavy filters may be in service longer between cleanings. Wash and dry pre-filters often in pure, hot water.

Old, threadbare filters will cause cloudy syrup. Holding filters up to bright light will sometimes reveal filter problems. Cloudy syrup must be graded substandard.

Filter HOT syrup (210 degrees F.) IMMEDIATELY after removal from the pan. Do not stir syrup through the filter.

…Pressure filters…

All pressure filter parts should be thoroughly cleaned with hot water prior to each reassembly.

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

Experiment to find the exact amount of filter aid (Diatomaceous Earth) needed to filter the syrup.

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

Syrup Packing

Most sugarmakers will find it advantageous to pack some syrup in consumer-size containers during the producing season; however it is recommended that at least part of the crop be packed in bulk containers for later reheating and packing. It is

recommended that bulk containers be used when storage is to be for longer periods of time because:

- Packing syrup closer to the date of sale reduces the possibility of grade change in the consumer size container; this is especially important when packing in plastic jugs.
- The potential of metallic flavors from cans is reduced.
- Reheating at packing time renews the fresh maple flavor.
- The possibility of rusty containers is lessened.
- The producer has greater versatility in meeting the current market demand for specific container size and style. The producer also maintains the potential for bulk sale.
- The potential of waste due to leftover, unwanted sizes is eliminated.
- The producer can blend different "runs" to achieve greater uniformity of product.

For small producers, five gallon cans offer similar advantages to the 30 gallon barrel.

Packing in Bulk

…Always examine bulk containers before filling…

More bulk syrup is downgraded or ruined by storage in drums which are in poor condition than by any other single storage cause.

Use a FLASHLIGHT to examine the interiors of drums.

Use ONLY bulk storage barrels or five gallon cans which are rust free, clean, and dry. Steam cleaning is the best assurance of completely clean barrels.

"SNIFF" test the barrel and do not use if a foreign odor is present.

If you are buying new barrels, purchase stainless steel barrels.

Filling Drums

Fill containers or drums with HOT syrup (above 180 degrees!)

Fill FULL. Any air space in the drum may cause problems.

Use new gaskets; tighten bungs as soon as possible.

Keep a sample from each drum in your freezer and accurately identify the sample and its drum number so that syrup may be selected for repacking without opening additional drums.

Store drums in a cool, dry place.

Educate your bulk customers in the proper storage and handling of bulk syrup.

Filling Retail Containers

Open the cartons in which syrup cans are packed so that the empty cans are UPSIDE DOWN. Keep the cans in that position until they are filled, in order to eliminate the possibility of foreign material entering them.

Closely EXAMINE all containers; return any which are damaged by excess flux or solder, dents, or other imperfections. Do not fill cans which show any rust.

"SNIFF" test empty containers; this will sometimes alert the packer to a container in which syrup should not be packed due to a foreign odor.

Fill containers **FULL** to assure correct volume for the consumer, and to minimize airspace which contributes to product spoilage.

…Hot Packing…

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

The LOWEST SAFE temperature limit for packing syrup is 180 degree F. WHEN THE CAP GOES ON. Syrup which is left uncapped for a few moments can cool sufficiently and collect enough yeast and mold spores from the air to spoil some cans in an otherwise perfect lot. Research by Dr. Maria Franca Morselli of the University of Vermont Maple Research Center indicates that packing syrup at temperatures higher than 180 degrees F. (but not higher than 200 degrees F.) will result in fewer trouble-causing microorganisms. However, if temperatures are raised too high for too long a time, new niter may precipitate, causing cloudiness. Refiltering reheated syrup eliminates the possibility of cloudiness.

For best results when heating syrup, use a continual flow method rather than heating a large volume of syrup in a vat. Some syrups are more apt to deteriorate in both color and flavor when heated in large vats or pans, and held until canned in retail containers. All of the syrup continually flowing through several divided compartments, while heating, retains most of the original flavor and quality, and makes it easier to maintain correct packing temperature (180 degrees and above.)

REMEMBER! The last container filled from any batch may NOT be of correct density. When a cover is used on filter tanks, condensation may cause the last syrup to be THIN. If no cover is used, the last syrup may be HEAVY.

Continue to CHECK TEMPERATURE with a sterile thermometer immediately prior to filling the container.

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

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

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

…Avoid "Stack Burn"…

"Stack Burn" is grade change caused by hot containers of newly canned syrup "stacked" together, intensifyi ng the heat, and prolonging the cooling time. "Stack burn" can change a low Grade A Medium Amber syrup to Grade A Dark Amber. This is a common cause of grade violations.

Cans must be cooled quickly. Space cans apart, so that air may circulate around them. Do not place cans in cartons or on pallets until cool. A fan may be helpful to speed the cooling process.

…Code All Syrup…

Code each batch of syrup as it is packed. If problems are later found in some syrup, positive identification will allow the producer to recall only the syrup from the lot which is defective.

Grading Syrup for Retail Container

…Grading Kits…

Be sure that your grading kit is accurate.

It is not possible to make an accurate grade determination by placing a round bottle of syrup in a kit intended for square bottles, or by using bottles of different sizes. This has been the cause of some off-grade syrup.

Colored glycerine grading guides fade with age. After one year, most of these temporary guides are off-grade; old kits should be checked, or replaced with a new one.

…Color…
Proper grade can only be determined if the grading set is held up against a correct background. A clear, blue sky is ideal; a fluorescent light is better than a regular incandescent bulb.

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

Care and Storage of Canned Syrup

The three main enemies of all stored syrup are TEMPERATURE, AIR, and TIME.

…Temperature…
Syrup should be stored in a clean, dry place of cool (if not refrigerated) uniform temperature. Some producers have found that a common household air conditioner in the storage room helps to retain syrup quality, protecting grade and price.

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

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

Reducing Lead in Syrup

As a natural product, the content of lead in maple syrup is normally low. Lead does not come from trees but from the environment. The only way to know the actual lead content of syrup is to have it tested. At this point, testing services are available in the state of Maine at the University of Maine. If you are interested in testing your syrup, contact any of the following labs:

Analytical Laboratory Department of Plant, Soil & Environmental Sciences 407 Deering Hall University of Maine Orono, ME 04469-5722 Phone: 207-581-2917 Cost: $23.00	Agricultural and Environmental Testing Lab 220 Hills Building University of Vermont Burlington, VT 05405	New Hampshire Public Health Labs Attn. George Robinson 6 Hazen Drive Concord, NH 03301 Phone: 603-271-4784

To reduce the possibility of having lead accumulate in your syrup, the following practices are recommended.

…Equipment…

Use as much lead free equipment as possible. Sap collected with lead-free plastic tubing accumulates virtually no lead. Equipment that may include lead are: 50/50 solder used in the production of evaporators, tanks, and some buckets manufactured before 1995 (Leader Evaporator changed to lead-free solder in 1991); galvanized equipment made before 1994; most brass and bronze fittings or pump parts; and terneplate, an alloy used in some older equipment. Sugar sand concentrates any lead in the sap and roadside dust and dirt that blows into open buckets can introduce lead into sap and syrup. Old metal spouts frequently contained lead and these may introduce lead into the sap. Old tin buckets and buckets made with a shiny terneplate leach lead into maple sap for as long as the sap sits in the bucket. Older, galvanized storage tanks, lead soldered evaporators and barrels can add significant amounts of lead to the boiling syrup or stored syrup.

…Practices…

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

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

After Sugaring

Quality Begins for the Next Season

It is recommended that all equipment be cleaned as soon as possible at the close of the maple season.

…Evaporators…

Some producers allow sap to ferment in English tin or stainless steel pans. If this method is used, watch the fermenting action carefully. When scale loosens, scrub with a nylon pad . If fermenting sap is left in pans too long, serious damage may result. Rinse with clear water, and dry.

If chemical cleansers are used, be sure to rinse thoroughly to prevent possible damage to the pan, and off-flavors next season.

Materials which collect on the underside of the evaporator during the season are generally corrosive to metal; if corrosive deposits are permitted to remain until the next season, holes may result in the bottom of the front pan, or in the flues. In order to avoid damage, clean the underside of the front pan and use a brush to clean the flues. Special flue brushes may be purchased from maple equipment suppliers.

…Paint…

If sap tanks or other equipment needs to be painted, use a non-toxic epoxy paint; paint meeting these standards is available from a maple equipment dealer. Painting at the close of the season, as opposed to the beginning of a new season, allows time for odors to dissipate, reducing the possibility of off-flavored syrup.

…Storage…

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

…Gathering Equipment…

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

1. To do the best job, laterals should be rolled up and tied in bundles, taken down to the sugarhouse for cleaning and then stored under cover. Before doing this, number the system so it can be rehung the next year. This is best done by painting numbers or letters on trees and putting a tag with a corresponding number or letter on the tubing. You don't have to number each tree - usually every fifth or sixth one is adequate. There are countless variations of identification systems, but the important thing is that the laterals go up in the same place next year. Once the laterals are numbered, roll them up into bundles of about 25 taps. Take each bundle to a tank filled with cleaning solution and fill the bundle with solution. This can be done by pumping solution into the bundle or mounting the bundle on a rack that rotates the bundle through the solution. Let the bundles sit in the sun for one or two days and flush them with clean water. As an added precaution, some sugarmakers let the first sap run through the lines onto the ground. The same procedure works well for cleaning main lines. The rinse step is particularly important in preventing off-flavors.
2. Many sugarmakers are leaving their tubing up in the woods year round and cleaning it in place. They usually do this by hooking up a vacuum pump to the lower end of the line, going to the top with a bucket of cleaning solution, pulling a spout, placing it in the bucket so solution is sucked through the tubing, then capping the spout and moving to the next.
3. Some tubing manufacturers are now making fittings that are tight under positive pressure as well as vacuum. With this type of fitting, the cleaning solution can be pumped from the lower end of the line back up the system.
4. Maple equipment suppliers now have available commercial pipeline cleaning equipment, consisting of a portable compressor pump which injects air with the cleaning solution, thus increasing the turbulence in the tubing, and improving the cleaning action. Some producers have purchased these in conjunction with one or more other sugarmakers to share the expense.

Appendix

State Regulations and Licensing - Chapters 117 and 347
http://www.state.me.us/sos/cec/rcn/apa/01/chaps01.htm

Official Grade Standards
http://janus.state.me.us/legis/statutes/7/title7sec892-A.html

State License Application
http://www.state.me.us/agriculture/forms/qar/Food%20Establishment.pdf

Maple Resource Links

- North American Maple Syrup Producers Manual
  http://ohioline.osu.edu/b856/index.html
- Maine Maple Producers' Association
  http://www.mainemapleproducers.com/
- University of Vermont Extension Maple Pages
  http://www.uvm.edu/~uvmaple/
- Proctor Maple Research Center
  http://www.uvm.edu/~pmrc/
- New England Agricultural Statistics Service - Maple Page
  http://www.nass.usda.gov/nh/0601MapleRelease.pdf
- Cornell Cooperative Extension Maple Syrup Production
  http://www.cce.cornell.edu/clinton/ag/maple.html#organizations
- Cornell Maple Sugar Research and Extension Program
  http://maple.dnr.cornell.edu/
- Ontario Agroforestry
  http://www.gov.on.ca/OMAFRA/english/crops/hort/agrofore.html
- Acer Centre
  http://www.centreacer.qc.ca/

Emergency Action Plan for _____

Background

The primary hazard at _____ is _____(fire). The building is/is not equipped with a fire alarm system and/but does have smoke detectors.

Emergency Procedures

In the event that you:

Discover a fire or chemical spill;
Smell smoke or the odor of burning or abnormally hot material; or
The alarm is sounded.

You shall:

Verbally warn others in the area.
If your workspace is not involved and you can do so safely:
Shut windows and close the door tightly behind you as you leave.
Evacuate the building, conducting a minimal sweep for visitors on the way out.
If you discovered the fire or chemical spill, call 911 from a safe place and inform them of what has happened.
Assemble at the rally point and account for all employees.
Brief the Fire Department of concerns upon their arrival.
Remain outside the building until the all clear has been given by the authorities.

Exit Pathways

(See attached building map)

Rally Points

The Rally Point for _____ is at _____ .

At this Rally Point, an accounting of employees will be taken by _____ or the most senior of the staff available. If people cannot be accounted for, inform the Emergency Responders.

Employees authorized to remain behind to operate or shut down critical operations

_____ **(NONE)**

Use of Emergency Equipment

Although it is policy to evacuate in case of a fire, circumstances may dictate that a fire extinguisher is needed. DO NOT use a fire extinguisher unless:

1. You have been trained in the hands-on use of an extinguisher within the last year.
2. You are able to put out the fire without endangering yourself or others.
3. You have an open path of escape at all times.

Personal Injury Emergency Procedures

In the event that:
1. You are injured.
2. Come upon an injured person.
3. Encounter what you suspect to be blood or other bodily fluids.

You shall:
1. Call 911 and inform them of what has happened.
2. If the victim is other than yourself, administer first aid only if you have been trained and are using the proper personal protective equipment.
3. If the situation involves suspected blood or other bodily fluids and no victim, you should still call 911 and inform the dispatcher. Keep people away from the suspected bodily fluid. (DO NOT attempt a clean up on your own.)

Prevention/Follow-up

Periodic safety audits will be conducted by the employees and safety coordinator reducing the risks of hazards within the workspaces. Once an emergency or safety situation has been mitigated, an incident investigation will be completed, and

corrective measures will be implemented to prevent future recurrence of the problem.

Implementation and Maintenance

This plan will be reviewed and exercised when the plan is first implemented, whenever a new employee is hired, when changes necessitate, or at least once a year. The training will consist of providing a copy of the Emergency Action Plan and evacuation map to the employee, explaining procedures, walking through an evacuation, and answering any questions the employee has.

Annual evacuation drills will also be conducted.

The person responsible for updating and training this Emergency Action Plan is: _____. **Date:** _____

Training Record for Emergency Action Plan

This document is to record that training as outlined in the Emergency Action Plan has taken place. (see Implementation section)

Date of Training: _____

Employee Trained: _____

Employee ID #: _____

Employee Signature: _____

Position: _____

Department:
Building:

ANNUAL SYRUP PRODUCTION & PACKAGING RECORD

Date Boiled	Gallons Sap	% Sap	Grade A Light	Grade A Medium	Grade A Dark	Grade A Extra Dark	Commercial Grade	Total Syrup	Date Packaged	Batch Code #
Totals										
	Sap	%	Light	Medium	Dark	Extra Dark	Commercial	Syrup		

Producer:_____

Sugarhouse/Address:_____

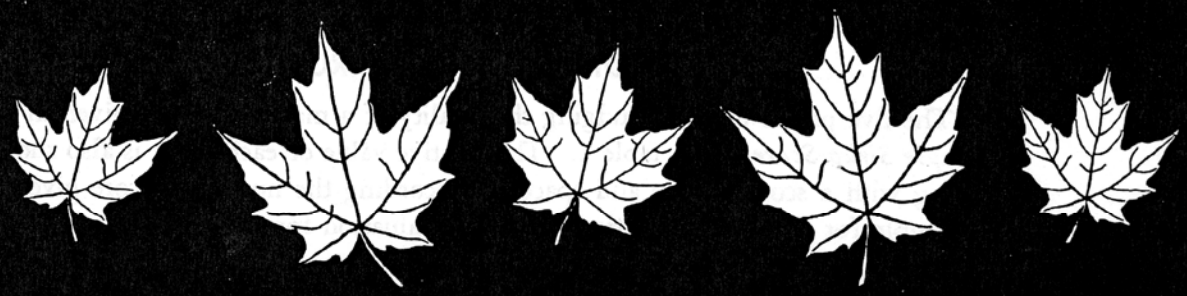
ANNUAL SUGARING RECORD

Season Year	Season Start	Season End	Total # Taps	Total Gal. Syrup	Total Pounds	Season Notes:

Producer:_____

Sugarhouse/Address:_____

New York State College of Agriculture CORNELL EXTENSION BULLETIN 1065



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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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 lease 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 it 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 charactertistic 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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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_____

		Score	
		Partial	Total
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	_____	_____
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 (attractiveness – protection)	(10) points		
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	Soft 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).

Maine Department of Agriculture Food and Rural Resources
Division of Quality Assurance and Regulation - David E. Gagnon, Director

MAPLE SYRUP CONTEST SCORE SHEET

Entry number:_____ Class: Light, Medium, Dark, Extra Dark Score:_____

66.1-68.9.....30 Points

65.1 = 20 points	**69.0 = 29 "**
65.2 = 21 "	**69.1 = 28 "**
65.3 = 22 "	**69.2 = 27 "**
65.4 = 23 "	**69.3 = 26 "**
65.5 = 24 "	**69.4 = 25 "**
65.6 = 25 "	**69.5 = 24 "**
65.7 = 26 "	**69.6 = 23 "**
65.8 = 27 "	**69.7 = 22 "**
65.9 = 28 "	**69.8 = 21 "**
66.0 = 29 "	**69.9 = 20 "**

Anything BELOW 65.1 Brix – DISQUALIFIED
Anything ABOVE 70.0 Brix – DISQUALIFIED

Points

Color – 25 points _____
Best color – 25 points, next 24 points
-1.0 for each graduation in color

Flavor – 30 points _____
Best flavor – 30 points
-1.0 for each graduation in flavor

Clarity – 15 points
Best crystal clear – 15 points _____
-1.0 for each graduation in clarity
Sugar crystals or foreign matter
10 points maximum

Grand total
Added after scoring the sample _____

Name: _____
Address: _____
_____ Date:_____

New Hampshire Maple Syrup Judging Score Sheet

SCORE_____ PLACE_____

ENTRY #_____ GRADE_____

EVENT_____ DATE_____

DENSITY - Highest Score - **30 Points**

(Degrees Baume at 60 degrees F.)	(Circle)
36.0 to 37.0	30
35.5 to 35.9	25
37.1 to 37.5	25
37.6 and above	0
35.4 and below	*

SCORE_____

FLAVOR - Highest Score - **35 Points**

Judged in order of best to poorest in flavor.
.5 to 5 points deducted from score of one preceding.
Seriously damaged flavor per NH standards *

SCORE_____

CLARITY - Highest Score - **20 Points**

Crystal clear and clean. 20
Deductions based on degree of cloudiness, presence of foreign matter, sediment, nitre, sugar crystals, etc.
Not clean *

SCORE_____

PACKAGE - Highest Score - **15 Points**

Attractive, clean container. 15
Deductions based upon degree of unattractiveness to include stains, damaged or rusty cap, etc.
Package does not meet contest requirements 0

SCORE_____

Color darker than Dark Amber *

*** Disqualifies entry**

Comments:

Judge/s_____

_____

_____

NHDAMF/BurMkts 10.12.00

MAPLE SYRUP SCORE SHEET

VERMONT

DATE _____

Entry # _____

Class _____

DENSITY Baume Range 36° - 37° Each tenth of a degree below 36° lowers score 5 tenths of a point	Hydrometer Test at 60°F _____ * Below 35.7° Baume _____ * Above 37.0° Baume _____	_____ cuts
FLAVOR Judged in order of best to poorest in flavor. Deduct 5 tenths of a point for each placing behind top entry.	* Off-Flavor _____	_____ cuts
COLOR Judged in order of lightest to darkest color. Deduct 5 tenths of a point for each placing behind top entry.	* Too Dark for Grade _____	_____ cuts
CLARITY Sample must be clear.	* Excessive Cloudiness _____	_____ cuts
		_____ Total Cuts
		SCORE

* Disqualifies Entry

Judges: _____

_____

NEW YORK STATE FAIR
MAPLE SYRUP SCORE SHEET

Entry no._____ Class_____ Score_____

			Score
DENSITY.....Highest Score	(25) points		
68 & up Brix	15	____	
67.0 - 67.9	20	____	
66.5 - 66.9	25	____	
66.0 - 66.4	20	____	
Below standard density	DISQUALIFY		____
CLARITY.....Highest Score	(15) points		
Crystal clear	15	____	
Sugar crystals (settled)	-5	____	
Cloudy	-10	____	
Cloudy plus debris	DISQUALIFY		____
FLAVOR .....Highest Score	(35) points		
Best	35-31	____	
2nd best	30-26	____	
3rd best	25-21	____	
4th best	20-16	____	
5th best	15-10	____	
6th best	9 - 5	____	
Unacceptable	DISQUALIFY		____
COLOR.....Highest Score	(20) points		
Best	20	____	
2nd best	17	____	
3rd best	14	____	
4th best	11	____	
5th best	8	____	
6th best	5	____	
Off Grade	DISQUALIFY		____
PACKAGE.....Highest Score	(10) points		
Label Requirements	5	____	
Container Attractiveness	5	____	____

Grand total _____ *(9/17/14)*

NEW YORK STATE FAIR
MAPLE SUGAR CANDY, CREAM & CRUMB SUGAR SCORE SHEET

Entry No._____ Class _____ Score_____

		MAPLE SUGAR CANDY (Uncoated/Crystal coated) -Circle one-	CREAM	CRUMB SUGAR
APPEARANCE – Highest score		(20/25) pts.	(30) pts.	(10) pts.
No white (dried) areas		5_____	x_____	x_____
Form-good		5_____	x_____	x_____
Color-consistent throughout		5_____	10_____	5_____
No debris/foreign material		5_____	5_____	5_____
No separation- on surface		x_____	10_____	x_____
No air bubbles- throughout		x_____	5_____	x_____
Visible crystal coating		5_____	x_____	x_____
TEXTURE-Highest score		(40) pts.	(50) pts.	(30) pts.
Hardness (Fancy molds-soft) (Granulated-no hard lumps)		10_____	10_____	10_____
Crystallinity (Candy/cream-no crystals/smooth) (Crumb sugar-not too powdery)		10_____	10_____	10_____
Smoothness		10_____	10_____	x_____
Consistency (Granulated-no wet clumps)		10_____	10_____	10_____
Spread ability-stick test		x_____	10_____	x_____
FLAVOR-Highest score		(35) pts.	(35) pts.	(35) pts.
Best	35-31	_____	_____	_____
2nd Best	30-26	_____	_____	_____
3rd Best	25-21	_____	_____	_____
4th Best	20-16	_____	_____	_____
5th Best	15-10	_____	_____	_____
Unacceptable	Disqualify	_____	_____	_____
PACKAGE-Highest score		(10) pts.	(10) pts.	(10) pts.
Label Requirements		5_____	5_____	5_____
Container Attractiveness		5_____	5_____	5_____

GRAND TOTAL (SCORE) _____

(9/17/14)

NEW ENGLAND MAPLE GRADER SCHOOL
MAPLE SYRUP GRADING FLOW SHEET

DIRECTIONS: Rate all samples for color, clarity, density, and flavor, following the steps below.

SAMPLE #: _____

Step #1

Sample Density

Step #2

Sample is Clear
Yes_____ **No**_____

Step #3

Sample Flavor
Fancy/Light Amber _____ **Medium Amber** _____ **Dark Amber** _____

Grade B/Extra Dark _____ **Commercial** _____ **Off Flavor** _____

Step #4

Compare to color grading kit and determine correct grade.

Fancy/Light Amber	Medium Amber	Dark Amber	Grade B/Extra Dark	Commercial
_____	_____	_____	_____	_____

Final Grade of Sample

Fancy/Grade A Light Amber	**Grade A Medium Amber**	**Grade A Dark Amber**
_____	_____	_____
Grade B/Extra Dark	**Commercial**	**Rejected**
_____	_____	_____

New York Maple Grading School – Grading Flavor

Sample	Flavor OK	Off-Flavor	Type of Off Flavor
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

New York State Maple Grading School - Syrup Preference Exercise

Maple Syrup Samples

A	B	C	D

Rank in Order of 1 – Best through 5 - Worst

Comments

New York Maple Grading School – Grading Color

Sample	Classification	Testing Kit	Background Color
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			