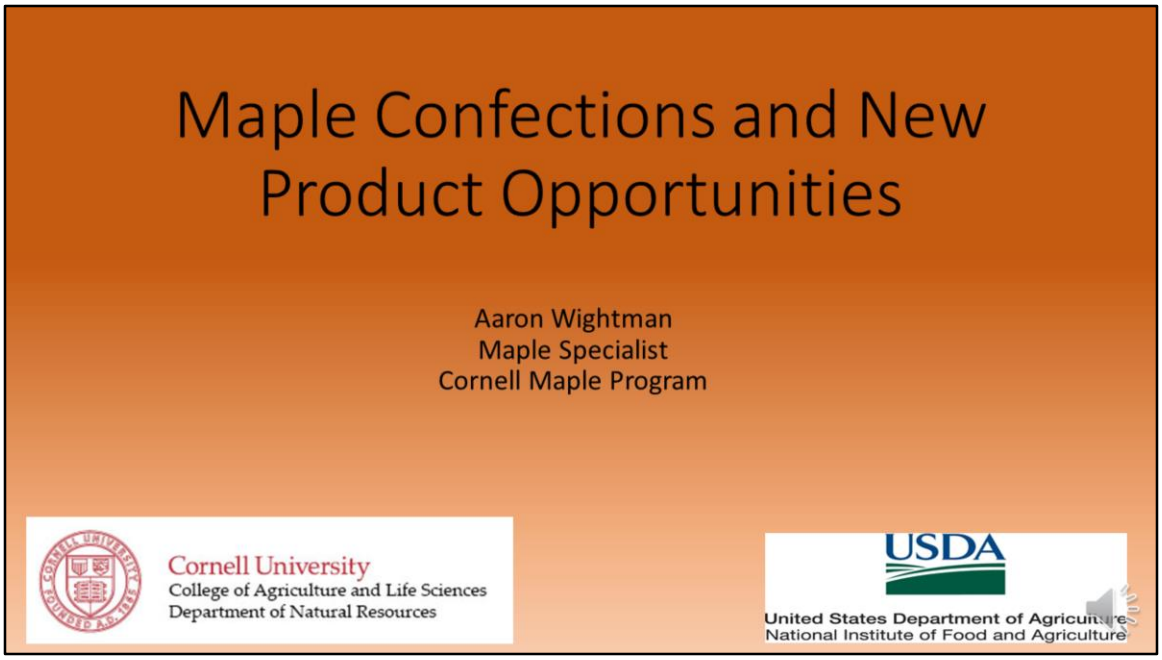
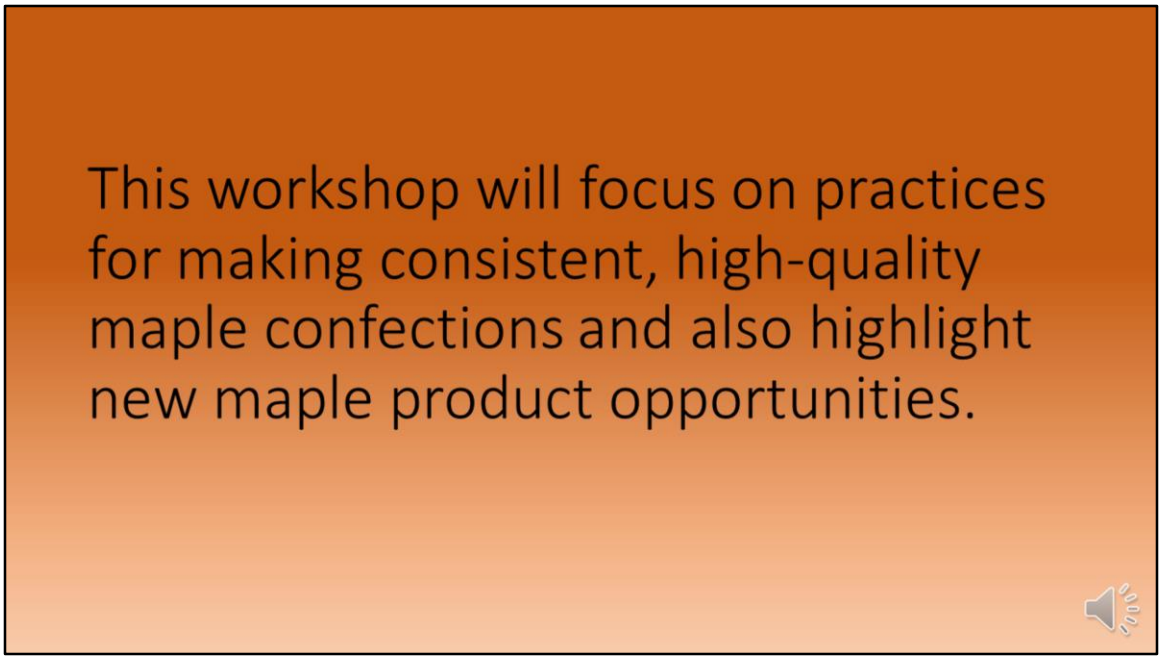


Hello. My Name is Aaron Wightman. I am a maple specialist at Cornell University. In this presentation we will talk about traditional maple confections, as well as emerging new product opportunities.



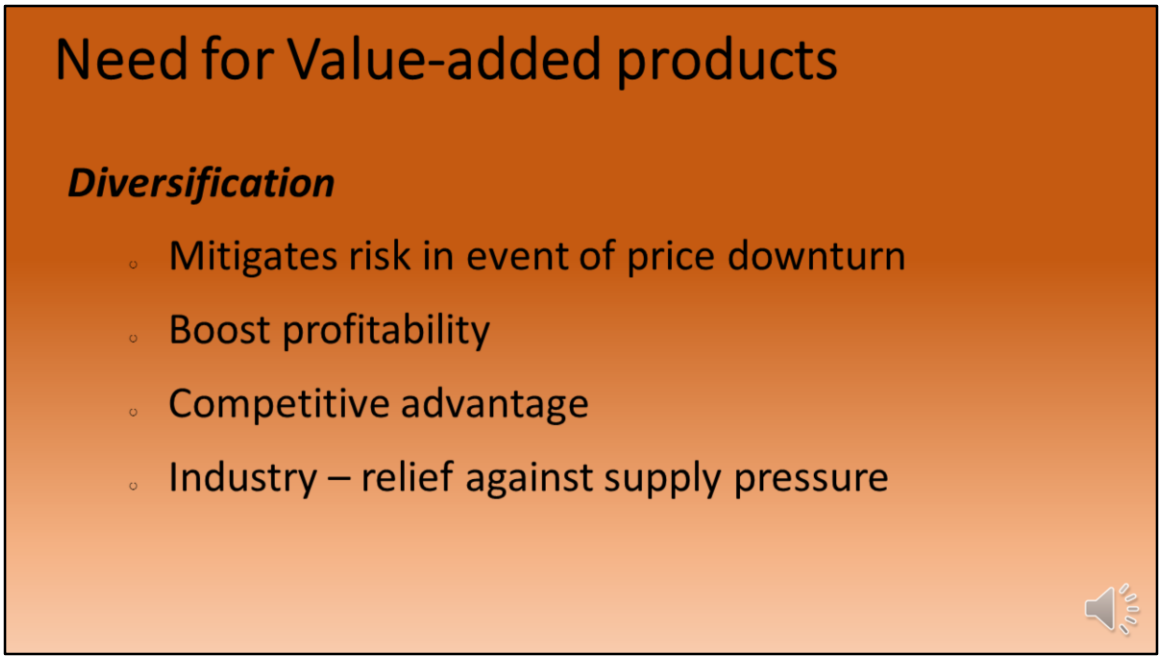
First we will talk about several kitchen science concepts that are important to producing confections. We will then focus on applying this understanding to produce consistent high-quality products. Lastly I will provide an overview of several new market opportunities for your maple products.

More specifically, we will discuss how making confections can help sustain your maple business. Then we will go over 5 fundamental concepts that will give you the tools to produce quality confections every time without failed batches or guess work.

We will also discuss:

- Emerging market opportunities
  - Evolving consumer attitudes
  - Shifts in markets
- New product development
  - Soda
  - Beer
  - Wine
  - Kombucha

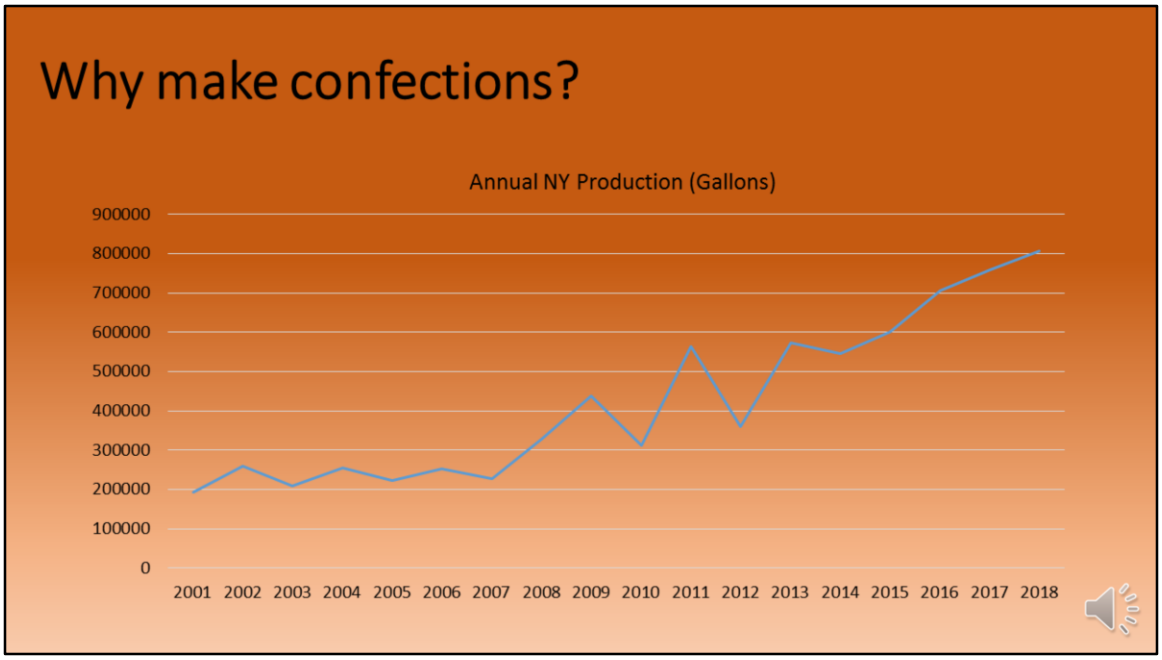
Next we will look at changes in market trends and consumer preferences and how those impact the market position of maple. Finally, we will look at opportunities to utilize maple in 4 lucrative sectors of the beverage industry.



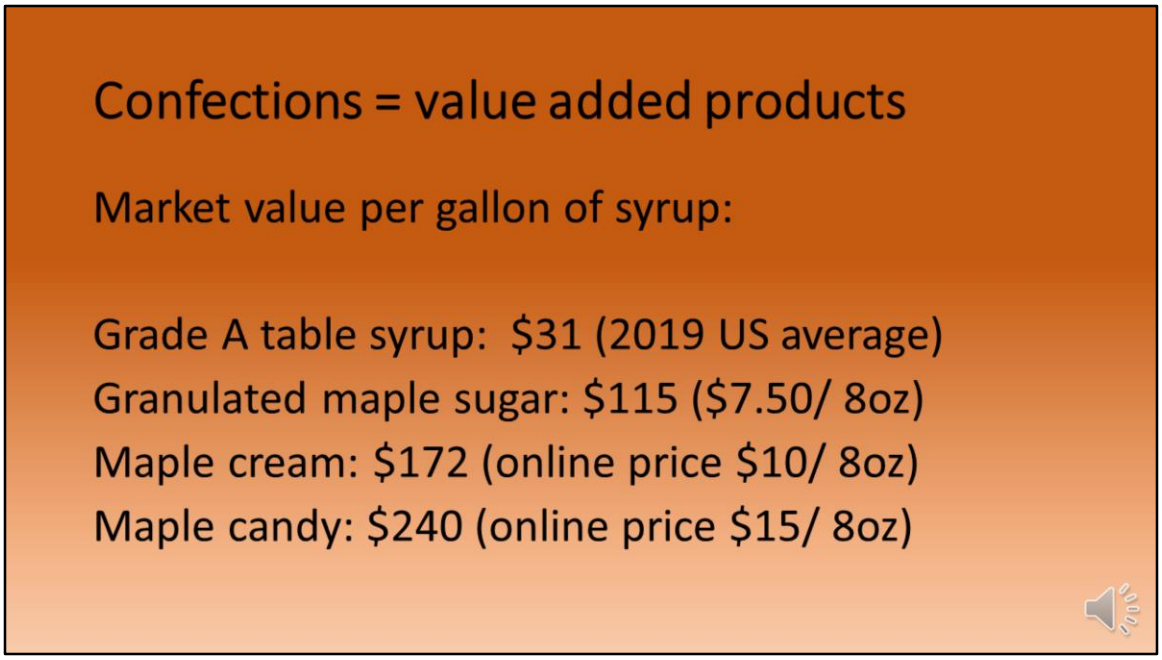
You've already invested considerable time and labor in making top quality maple syrup. So why invest more resources in transforming it into other products? One benefit is diversification of your product line. This accomplishes several things. First, having multiple products insulates your business against downturns in price. If maple syrup prices drop dramatically you may have some protection if you make maple candy, for example, and candy prices hold steady.

Confections can also boost profits by increasing profit margins and by giving customers more options to choose from when buying your maple products. Having more products can also give you an advantage over competing producers who just offer syrup.

Another benefit of diversification is protection against supply driven price decreases. The basic law of supply and demand states that prices will decrease if increases in supply outpace increases in demand.



This graph illustrates the rapid increase in production over the past 18 years in New York State. As you can see, maple syrup production has increased 4x during this period. Other states have seen a similar trend. Although demand has also increased somewhat, there is evidence that this abundant supply is beginning to drive down prices. By making confections, you direct syrup out of this supply stream and into other markets.



Let's take a closer look at the potential for increasing profit margins. The price for maple syrup in this slide is based on USDA statistics for the average national price in 2019. The prices for these 3 confections were based on averages of the top five google shopping search results for each item. These prices show a substantial potential increases in profit margin. In this example, the price per gallon of syrup is almost 8 times higher for candy than it is for syrup.

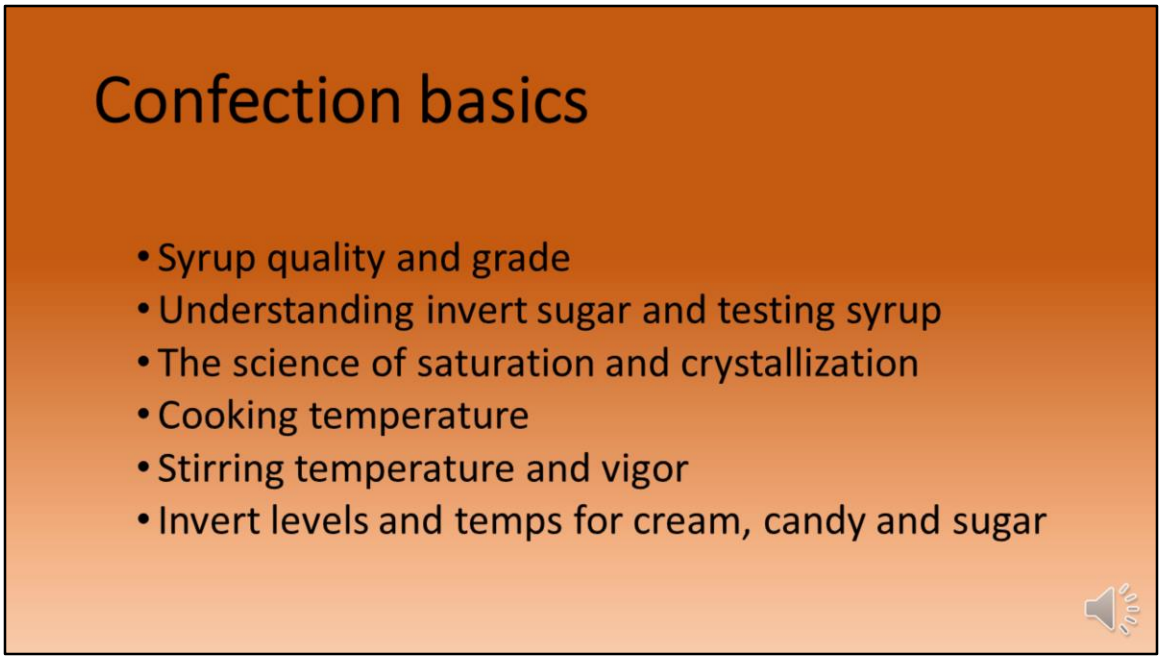
Margin on Value-added products

- Shrinkage (loss of product weight through additional cooking)
- Additional labor
- Packaging
- Energy
- Capital investment

Even after accounting for these costs, profit margin is commonly much higher than for syrup

The prices on the previous slide are already corrected for shrinkage, which is the loss of volume caused by cooking syrup to a higher density. Other variables that determine profit margins include labor, packaging, energy use and the cost of specialized equipment. These costs will vary from business to business, but in general, confections yield a profit margin significantly higher than syrup.

One challenge maple producers face is that traditional methods for producing maple confections do not result in batches with consistent quality. They involve guess work that can lead to variability, failed batches and other inefficiencies. In order to boost profitability new methods must be adopted to maintain quality and improve efficiency.



In order to adopt improved production methods, it is first important to understand the factors that impact product quality and production efficiency. The five most important factors are syrup quality, invert sugar content, crystallization science, cooking (or finishing) temperature, and the temperature and vigor of stirring.

Syrup Quality

Most traditional confections concentrate and amplify flavors

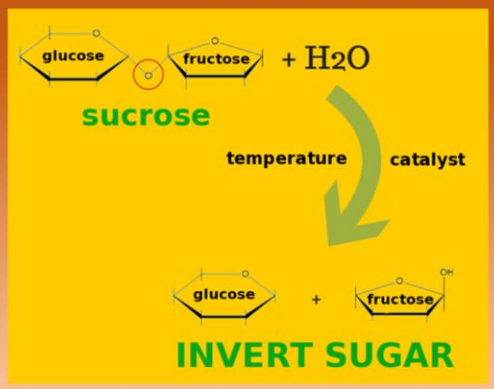
- Learn to identify quality issues, especially off-flavors
- Confections do not typically cover up off flavors

- Sour – spoiled sap
- Buddy – tootsie roll
- Contaminants – bleach, detergents, paint
- Dirty filters – musty, moldy
- Defoamer – greasy feeling on teeth
- Scorch – smokey, charred

Most important is choosing properly graded, high quality syrup. It is nearly impossible to make quality sugar, cream or candy from low quality syrup. Rather than covering up off-flavors, the additional concentration required to make confections amplifies defects. For example, a slightly sour syrup yields a very noticeably sour maple cream. If you haven't already done so, spend some time tasting a variety of syrups and learn to identify the common flavor defects listed on this slide. Review your sap handling and cooking processes to identify potential sources of trouble.

Invert sugars

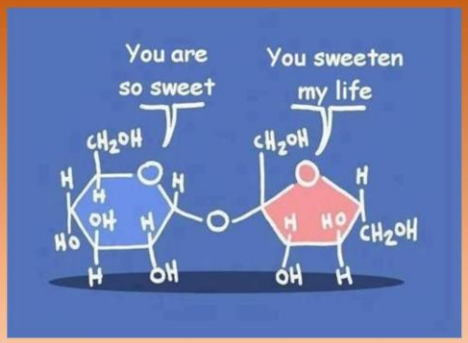
Understanding and measuring invert sugar levels is key to making quality confections



After syrup quality, the second critical factor for making quality confections is invert sugar levels. Understanding what invert sugars are, how they affect product quality and how to measure them is key to making quality products.

Sugar composition in maple syrup

All maple sap sugar starts out as a compound sugar called sucrose. It is made from two smaller sugars called glucose and fructose that are linked together by a chemical bond

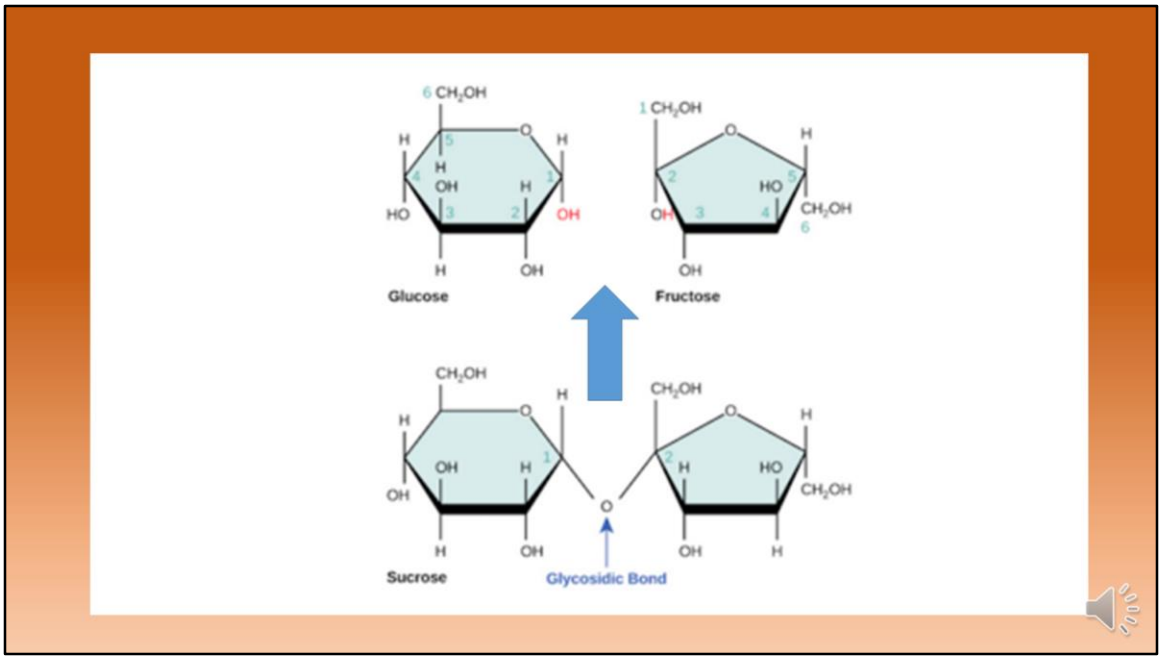


Sucrose = glucose + fructose

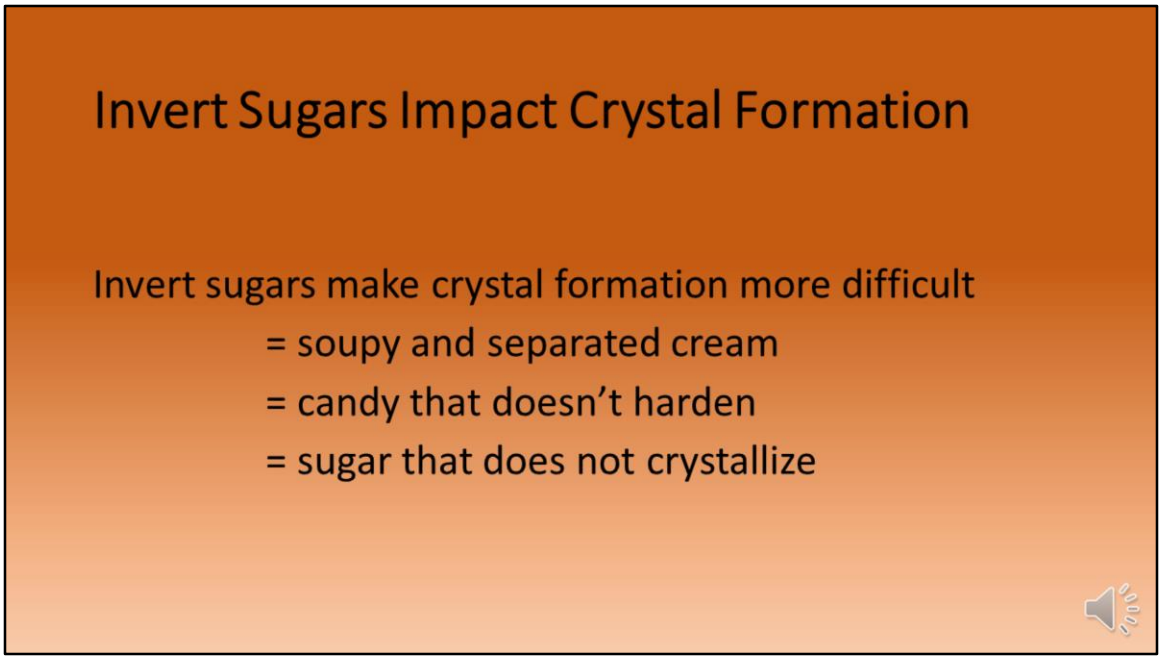
Sucrose is the only kind of sugar present in maple sap as it emerges from the taphole. Sucrose is a compound sugar molecule that is formed from two smaller sugars held together by a chemical bond. The smaller sugars are glucose and fructose.

Yeast and bacteria break sucrose down into the invert sugars, glucose and fructose Glucose and fructose are *invert sugars*

Sap collection systems are always contaminated with yeast and bacteria. These microorganisms break down some of the sucrose into glucose and fructose. The glucose and fructose are what we refer to as “invert sugars.” Invert sugar levels in syrup can range from nearly 0% to over 20% and tend to go higher later in the sugaring season.



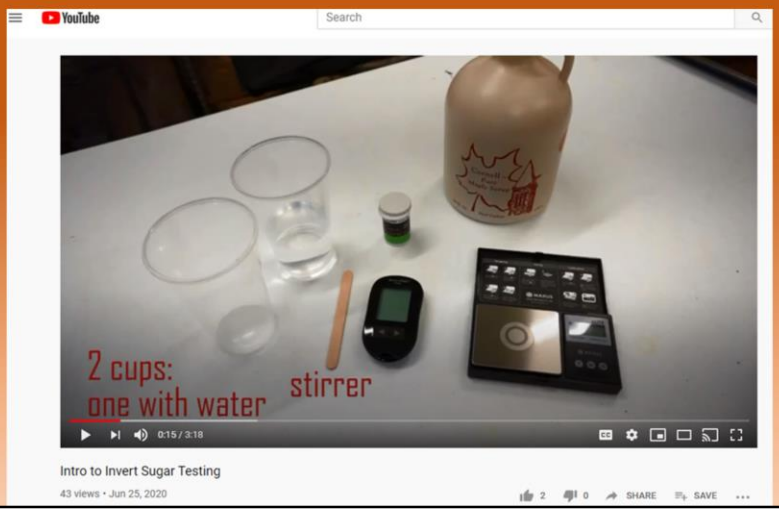
This diagram further illustrates the conversion of sucrose into invert sugars. The amount of invert sugars created depends on the abundance of yeast and bacteria present in the sap, how long the sap sits before processing and temperature. Long storage times at high temperature with heavy microbial loads will result in high invert syrup.



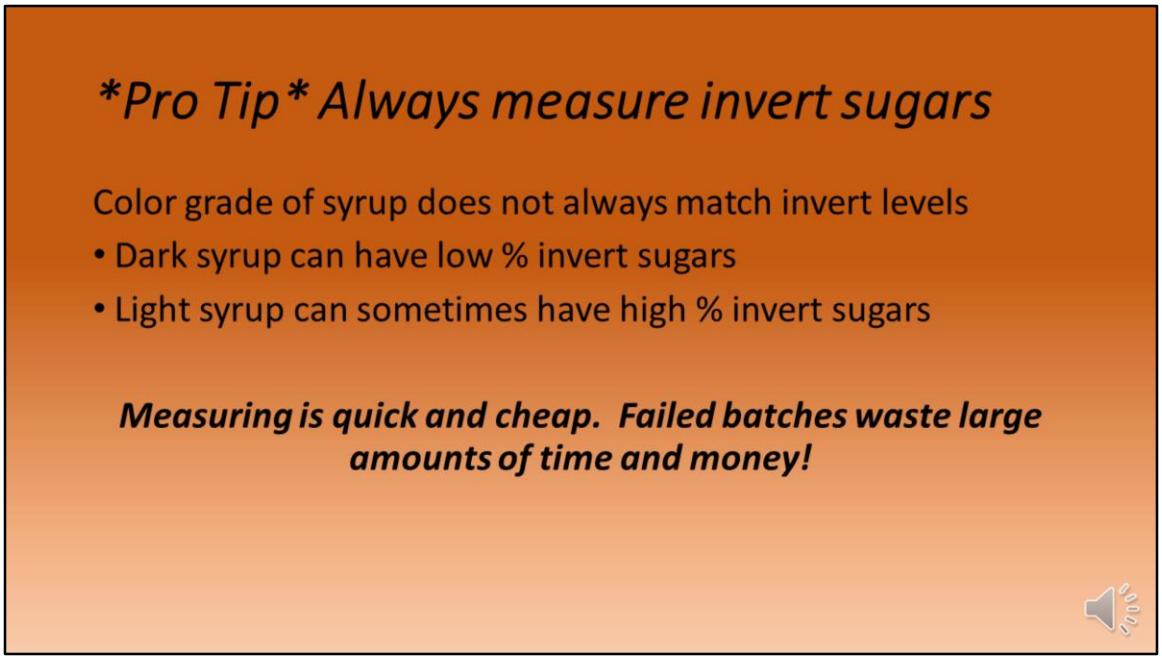
What is the impact of invert sugars on crystal formation? Crystals are a bit like legos. They fit together and grow best when all the parts have the same shape. In syrup, sugars make up the building blocks of crystals. When most of the sugar is sucrose, crystals form easily. When there are invert sugars present, the mix of different shaped sugar molecules makes crystal formation more difficult.

Invert sugars are one of the main reasons for failed batches of maple confections. If the invert level is too high, the result is often soupy cream, gooey candy and uncrystallized sugar.

Measuring invert sugar is easy

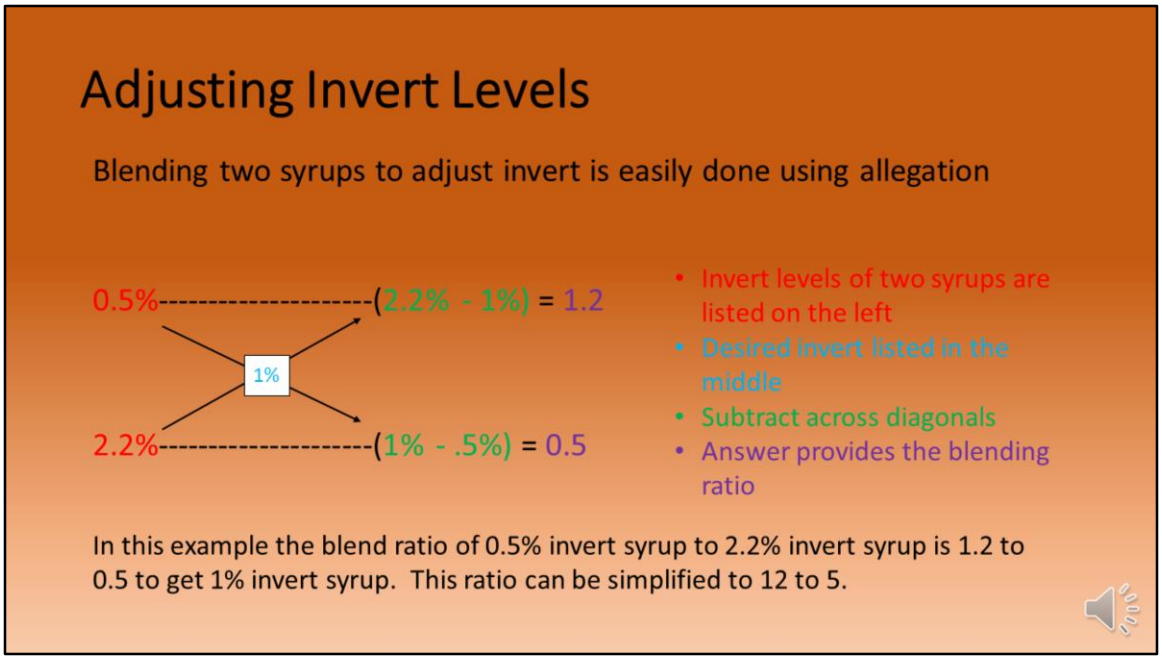


Fortunately, measuring invert sugar levels is relatively easy, inexpensive and only takes a few minutes. If you haven't done so already, please take a moment to watch the YouTube video linked on the workshop registration website. You can also find the video by searching for the Cornell Maple Program channel on YouTube.

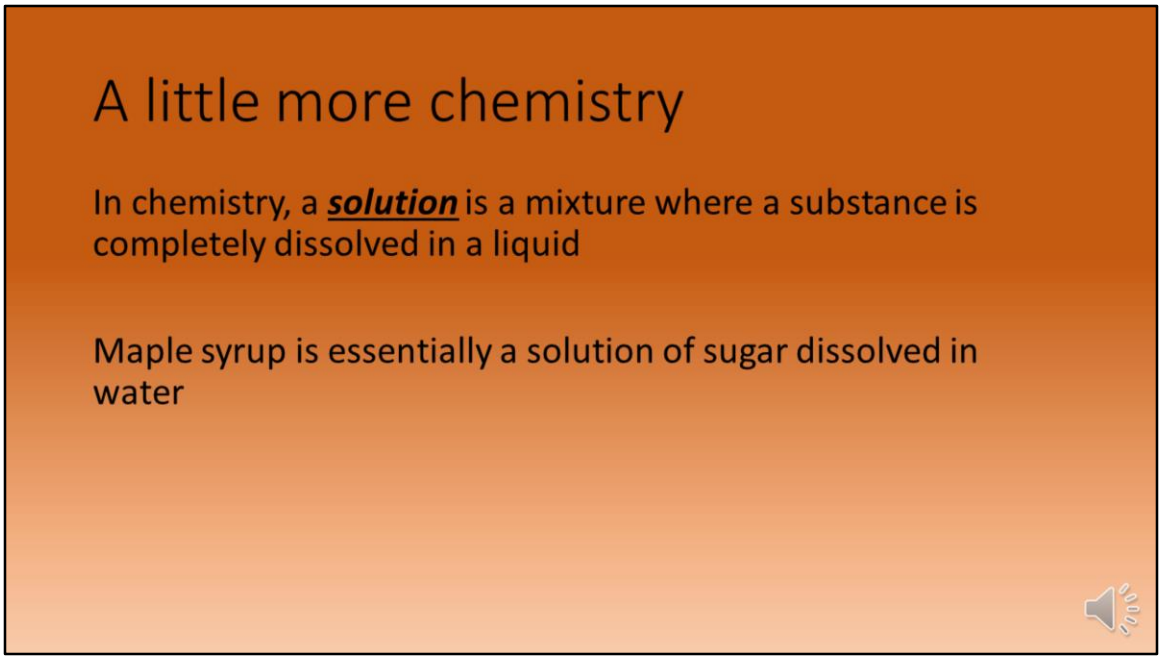


Traditional methods rely on color grades to choose syrups for making confections. The underlying assumption is that light syrup has low invert and dark syrup has high invert levels. Tests have found this is not always true. A variety of factors in the syrup production process can result in light syrup with high invert levels or dark syrup with low invert. For example, this year in Cornell's research sugarbush we produced several barrels of dark syrup with an invert level of 1.2%. This was caused by a sugar sand buildup that created a hot spot in the flue pan. The added heat increased the level of caramelization which darkened the syrup. Without this issue in the evaporator, the syrup would have been amber. Conversely, air injectors in the front pans of an evaporator can lighten high invert syrup into the amber or golden grade categories.

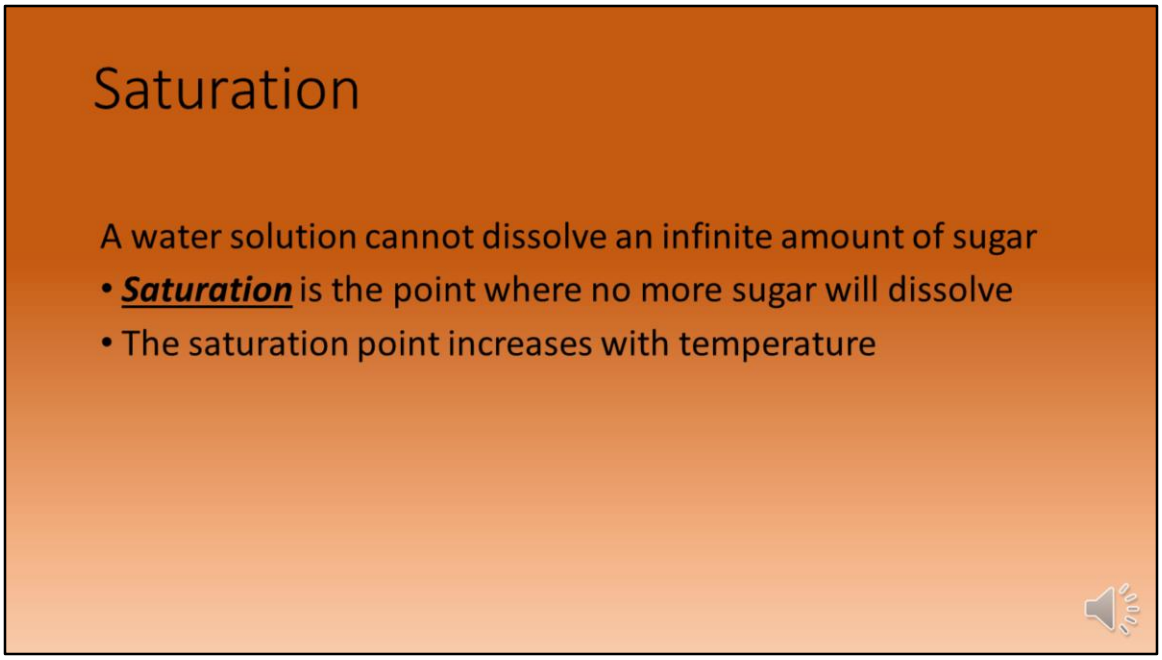
So always take time to measure your invert sugar level. Measuring inverts is quick and cheap. Failed batches waste large amounts of time and money.



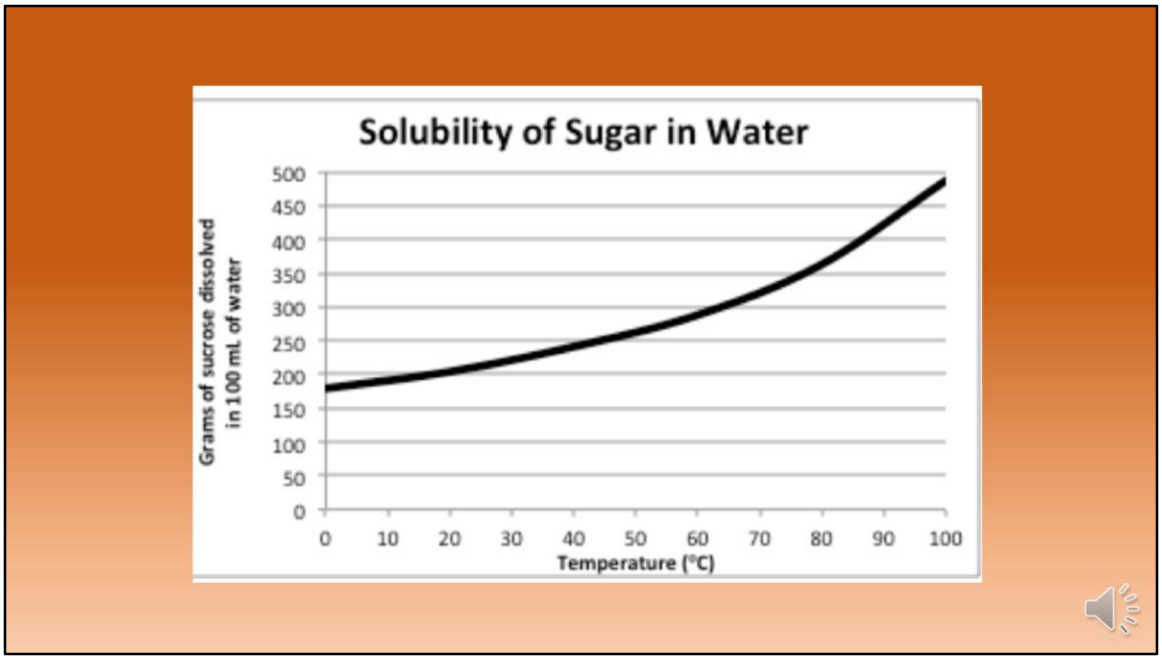
Sometimes it is necessary to blend two different syrups to achieve the desired level of invert sugars. The blend ratio can quickly be determined using an allegation table. In this example, the invert levels of the two syrups to be blended are in red. The desired invert level is in blue in the middle of the table. The blend ratio is determined by subtracting across the diagonals as seen in green. The answer in purple is the blend ratio. In this example it would take 12 parts of 0.5% invert syrup blended with 5 parts of 2.2% invert syrup to create a 1% invert syrup.



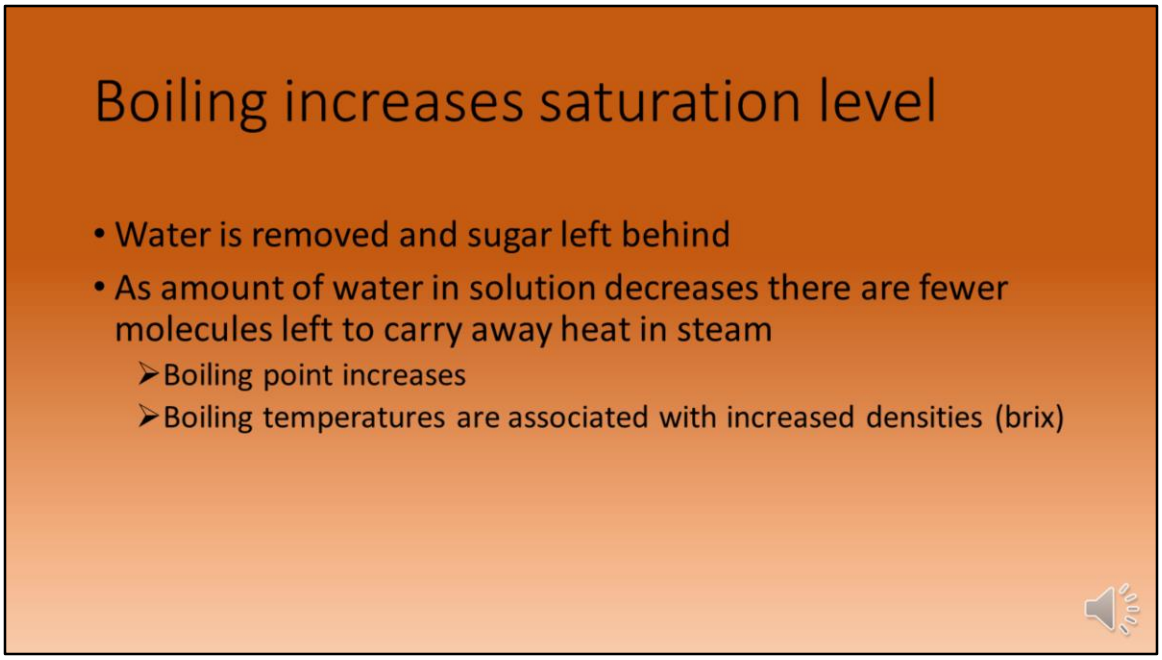
Now for a little more chemistry. Two additional factors important to confection quality are saturation and crystallization. First, it is important to understand that maple syrup is basically a solution of sugar dissolved in water. The term “dissolved” means that all the sugar exists as single molecules suspended in water.



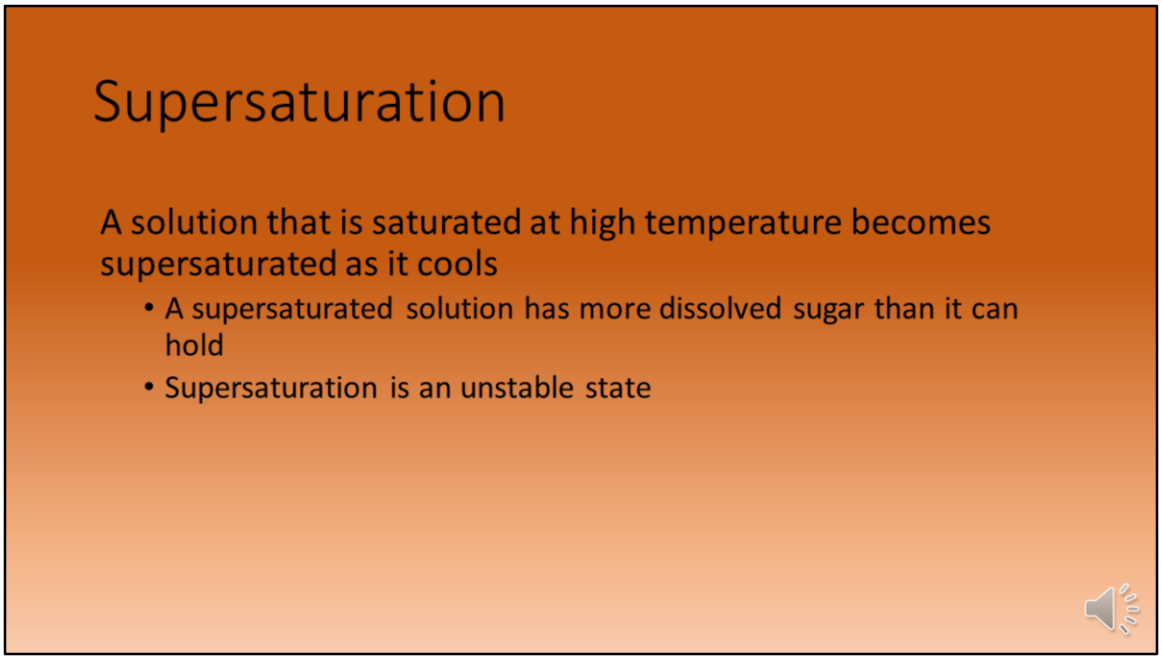
A water solution cannot dissolve an infinite amount of sugar. Imagine adding one teaspoon of white sugar at a time to a cup of water and stirring until it dissolves. At some point the next teaspoon added will not dissolve no matter how long you stir. At that point, the liquid is saturated. The saturation point varies with temperature. A hotter solution can dissolve more sugar and a cold solution can dissolve less.



This chart illustrates the change in saturation point as temperature increases for a solution of sugar and water.



A related concept is the idea of increasing the sugar concentration in a solution by boiling and removing water. When we cook syrup to ever higher temperatures, we are creating high levels of saturation.



One implication of the temperature affect is that a saturated solution at a high temperature, suddenly has more dissolved sugar than it can hold as the temperature drops. This state is called “supersaturation” and is an unstable state.

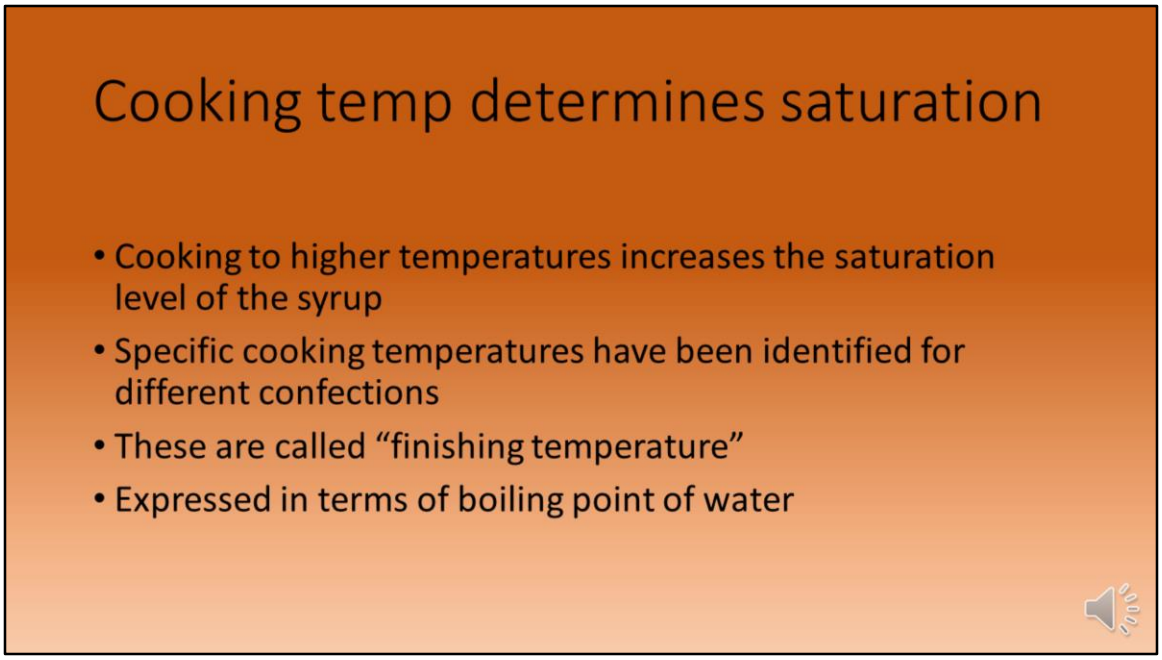
Crystal Formation

In the unstable, supersaturated state a shock like stirring causes sugar to come out of solution and form crystals

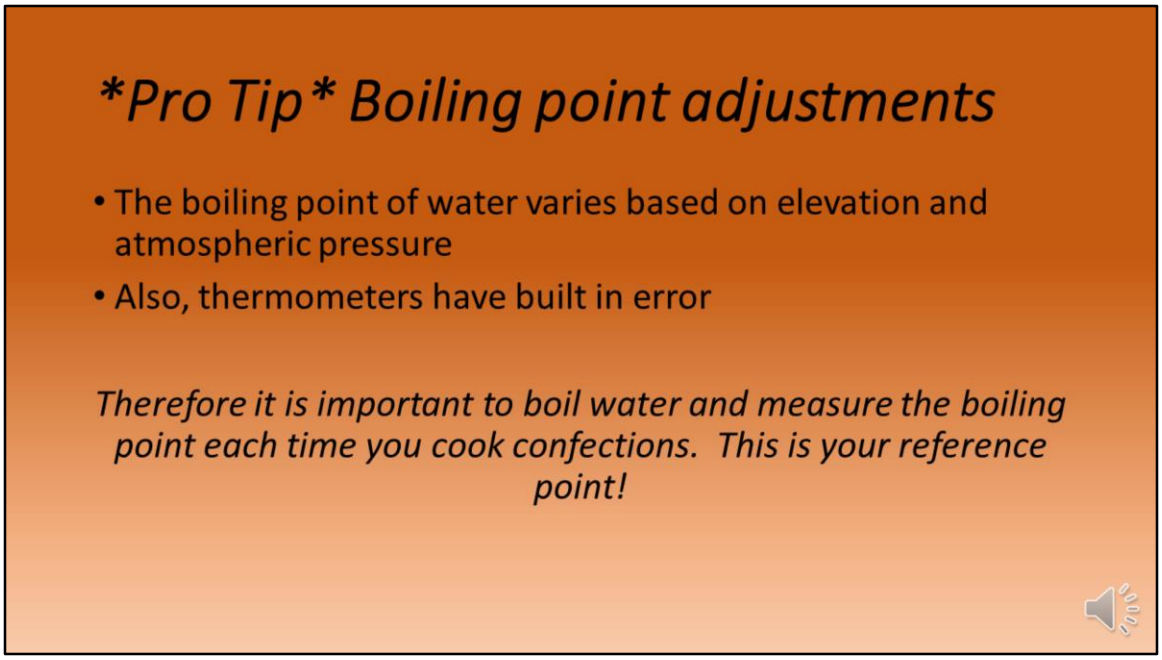
Sugar will come out of solution and form a solid to correct for this unstable state. Some form of mechanical shock, such as vibration or stirring, can initiate the formation of solid sugar in the form of crystals. The change can be slow, or sometimes quite dramatic as in the case of maple granulated sugar where crystals form quite suddenly in a puff of steam.

In this slide, the glass syrup bottle was filled with syrup cooked above the correct density. Over time, sugar came out of solution and formed solid crystals in the bottle.

Most traditional maple confections are produced in this way – by creating a highly saturated syrup with high temperature cooking, then promoting crystal formation through stirring.



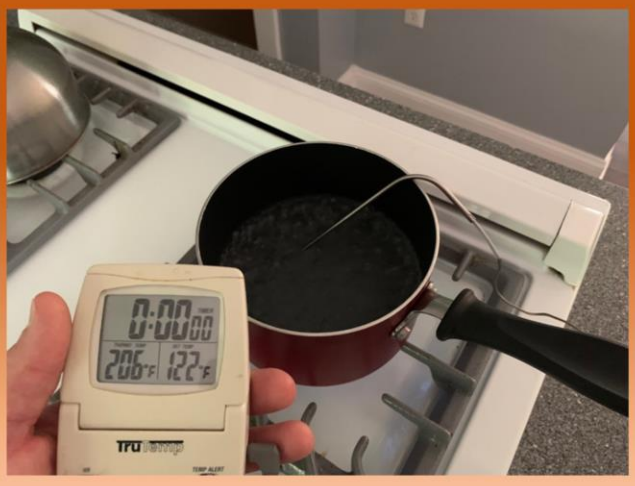
As boiling temperatures increase, the amount of water in a solution decreases and the saturation level increases. Higher levels of saturation promote the formation of larger crystals. Target finishing temperatures have been determined for each type of maple confection to create crystals of the appropriate size. For example, the crystals in maple cream are small and have a smooth mouth feel, while the crystals in granulated sugar are much larger.



It is important to note that the boiling point is not a fixed number. It varies based on atmospheric pressure and elevation. In addition, all thermometers have some amount of built-in error. Therefore, it is very important to check the boiling point of water each time you make confections.

All thermometers have a %error. Averaging between multiple thermometers does not correct for this!

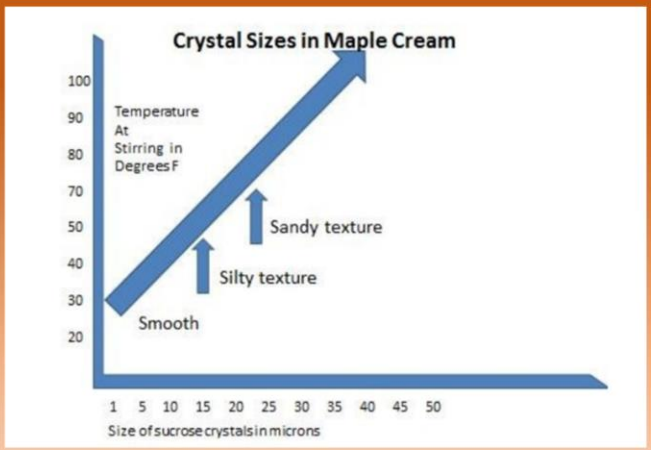
One common mistake is using multiple thermometers and taking the average of their measurements to determine the correct finishing temperature. Averaging errors does not provide an accurate finishing temperature. Use one, good quality thermometer and base your finishing temperature on the boiling point of water measured with that thermometer.



- Most thermometers have a fixed margin of error
- Always off by the same amount
- Stick with one thermometer and "calibrate" based on boiling point of water

Sticking with one thermometer is simpler and provides a more accurate finishing number. My favorite thermometer consistently measures low. As you can see in the slide, water is boiling at 206 degrees F. However, it is consistent and reliable. When I use it to measure the boiling point, then cook syrup to 22 degrees above the boiling point, I get smooth maple cream every time.

Stirring temperature and crystal size



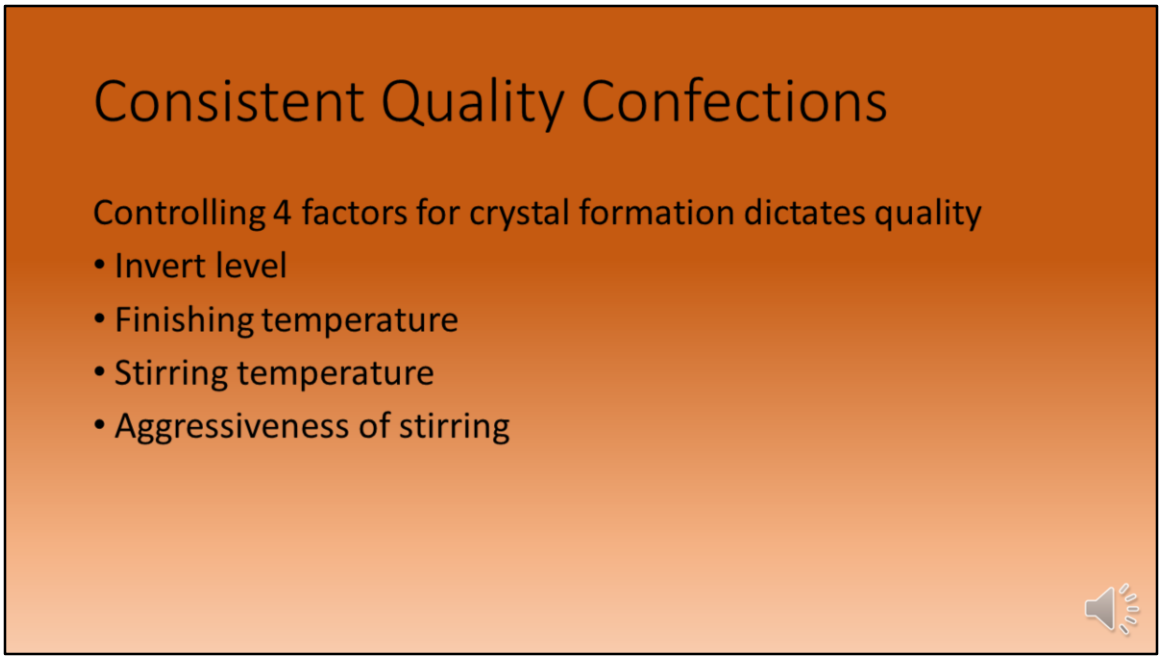
One final consideration for temperature, is the temperature of the time of stirring to initiate crystal formation. In a hot solution, molecules have more kinetic energy, which means they are moving faster. This faster movement allows the molecules to find more molecules to bind to and build a bigger crystal. Conversely, molecules move more slowly in a cold solution and therefore kind find fewer molecules to bind to and forma smaller crystals.

Stirring intensity and crystal size

The faster, more powerful or shocking the stir is the smaller the crystal will be. A gear pump machine, depending on speed, will usually make a smoother cream than a turn table or the candy machine

In addition, the intensity of the stirring shock also determines crystal size. High intensity stirring results in smaller crystals.

In summary, high intensity stirring al low temperature results in small crystals. Low intensity stirring at high temperature results in large crystals.



So how do we apply this knowledge to the production of consistent quality confections? All of this information can be boiled down to 4 factors: invert level, finishing temperature, stirring temperature and aggressiveness of stirring. When these four factors are controlled, the guess work is eliminated and you can make confections of the desired quality every time.

Through extensive experimentation, the proper levels for these four factors have been determined. This information is provided in the Cornell Maple Confections Notebook which is linked in the workshop website.

Now let's apply this knowledge to the 3 most common traditional maple confections: cream, candy and sugar.

Maple Cream

Maple cream is a value-added product that is made from pure maple syrup. The name maple cream, also referred to as maple butter or maple spread, would imply that dairy products are involved, but they are not. Maple cream is made by additional concentration by evaporation, quick cooling, stirring and then packaging at room temperature.

Maple cream is a smooth spread made from pure maple syrup. Good quality maple cream is characterized by a creamy texture and smooth mouth-feel.

Maple Cream

Ideal Invert Level	1.4% to 1.6%
Finishing Temperature	Boiling point water + 22^0F to 24^0F
Stirring Temperature	< 75^0 F
Aggressiveness of Stirring	Aggressive mechanical

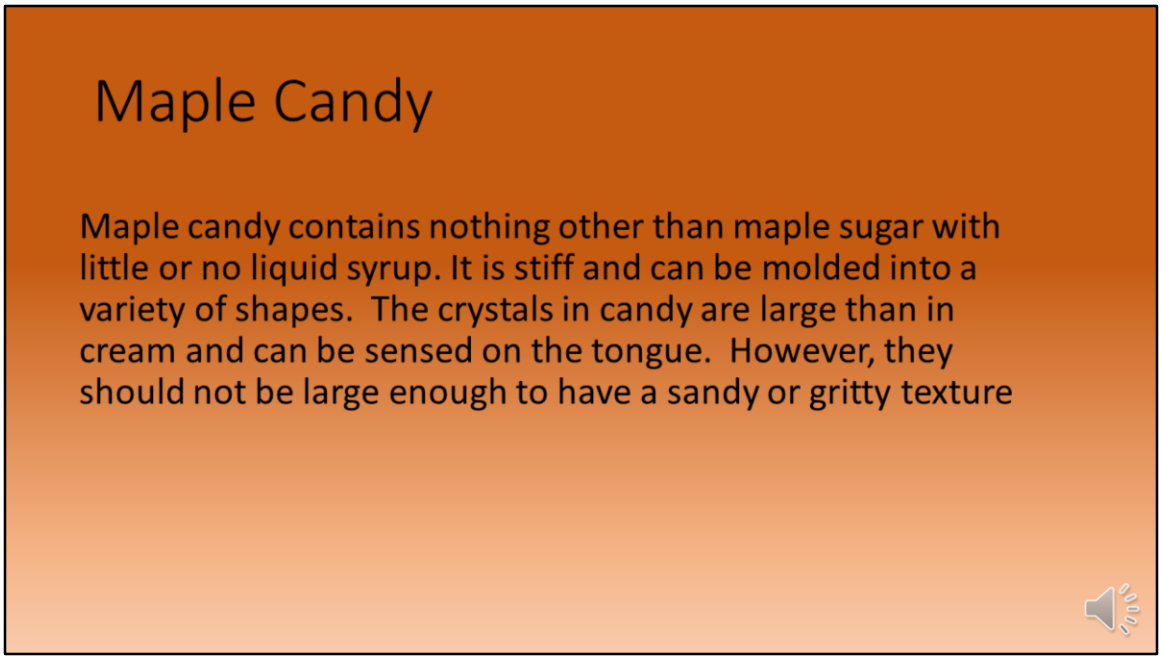
Making good quality cream, first requires low invert syrup, ideally in the 1.4 to 1.6% range. The ideal saturation level is achieved by boiling to 22 degrees above the boiling point of water. Good quality cream can still be made from syrup with invert levels 1 or 2% above the ideal range by raising the finishing temperature 1 or 2 degrees.

In order to achieve a smooth texture, small crystal sizes are important. This is achieved by cooling the cream to below 75 degrees F and stirring vigorously. Cooling the syrup to this temperature may take many hours. It may be helpful to plan on a 2 day process where the syrup is cooked on day 1, cooled overnight, and stirred on day 2. Stirring too soon at too high a temperature will result in grainy cream.

Pro Tip Seed Crystals

- Crystals can "learn" a size and shape from other crystals
- Save a jar of your smoothest cream
- Put a little in your later batches before stirring to "teach" the new cream crystals to grow in the same way

One way to promote small crystals is to seed the syrup for the current batch of cream with a dab of syrup from an old batch of cream. Crystals in the current batch will mimic the shape of the crystals from the old batch and make a cream of the same consistency. The seed crystals should be added at the beginning of the stirring process.

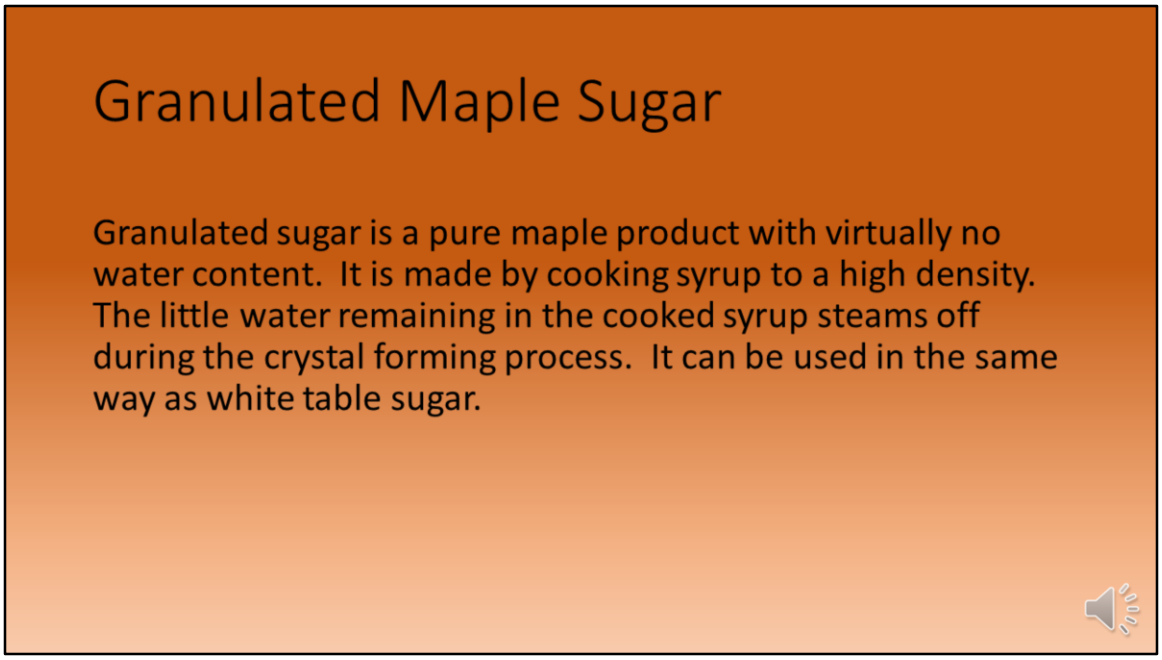


Maple candy is a solid confection produced from pure maple syrup. It is shaped and hardened in candy molds. While the crystals are slightly larger than those in maple cream, high quality maple candy still has relatively small crystals, resulting in a smooth mouth feel.

Maple Candy

Ideal Invert Level	1.0%
Finishing Temperature	Boiling point water + 32^0F to 34^0F
Stirring Temperature	170^0F to 200^0F
Aggressiveness of Stirring	Moderate hand or mechanical

Achieving the desired consistency required the use of low invert syrup cooked to 32 to 34 degrees F above the boiling point of water. The cooked syrup must be cooled slightly to achieve smaller crystal sizes. High invert syrup results in soupy batches of candy that do not solidify. Stirring at too high a temperature results in a grainy texture. Hand stirring and machine stirring can both make quality candy. However, hand stirred candy tends to be more grainy, while candy made in a simple or gear pump machine is typically smoother.

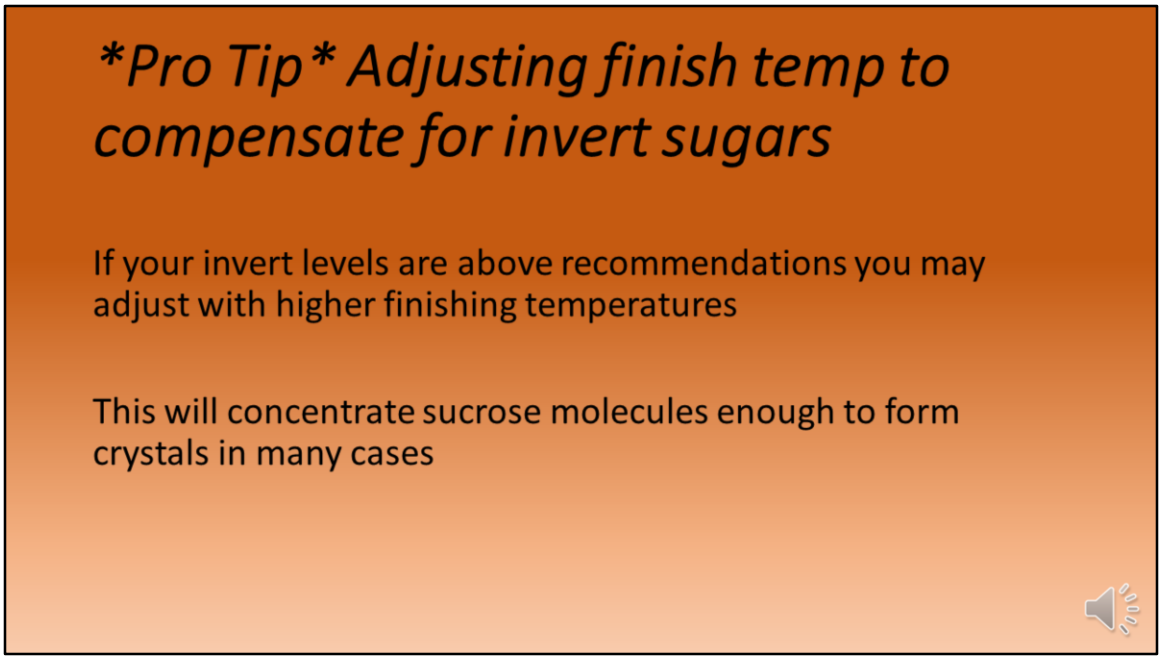


Granulated sugar is also a pure maple product, but one from which nearly all of the water is removed. Most of the water is removed by cooking to a high temperature. Additionally, when the mixture is stirred and begins to crystallize, the phase change from liquid to solid releases heat which steams away much of the remaining water. This released heat is called the heat of crystallization. High temperature and low intensity stirring allows for the creation of large crystals.

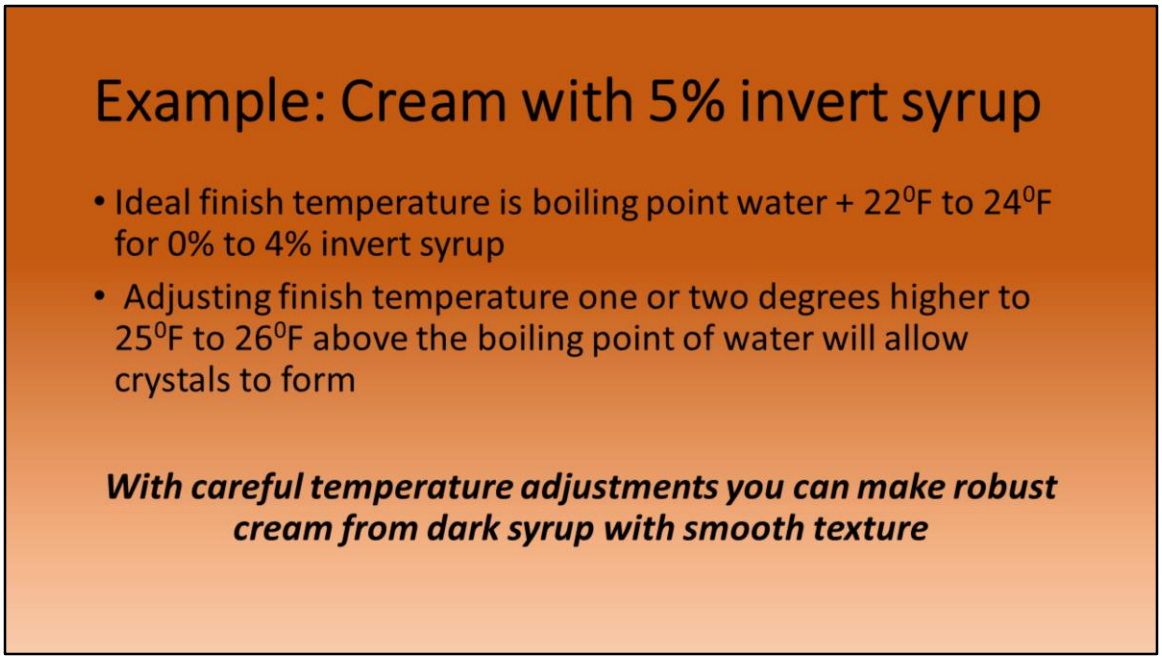
Granulated Sugar

Ideal Invert Level	0.4% to 2.0%
Finishing Temperature	Boiling point of water + 45^0F to 50^0F
Stirring Temperature	200^0F
Aggressiveness of Stirring	Hand or slow mechanical

As you can see, making granulated sugar with the traditional method requires relatively low invert syrups cooked to a high temperature.



If you wish to make confections, but do not have access to low invert syrups, do not despair. It is possible to make good quality confections by adjusting the finishing temperature higher to compensate for invert levels. There is no detailed guidance on this method currently available, so some experimentation is required. As a rule of thumb, adjust the finishing temperature upward one degree for each percentage the syrup is above the desired invert level.



For example, a 5% invert syrup is 1% above the ideal finishing temperature for cream. Therefore, the finishing temperature should be adjusted 1or 2 degrees above the recommended finishing temperature.

New recipe for maple sugar

- High invert, strong flavored syrup will not crystallize into granulated sugar using traditional methods
- However, new methods make it possible to process dark syrups into sugar

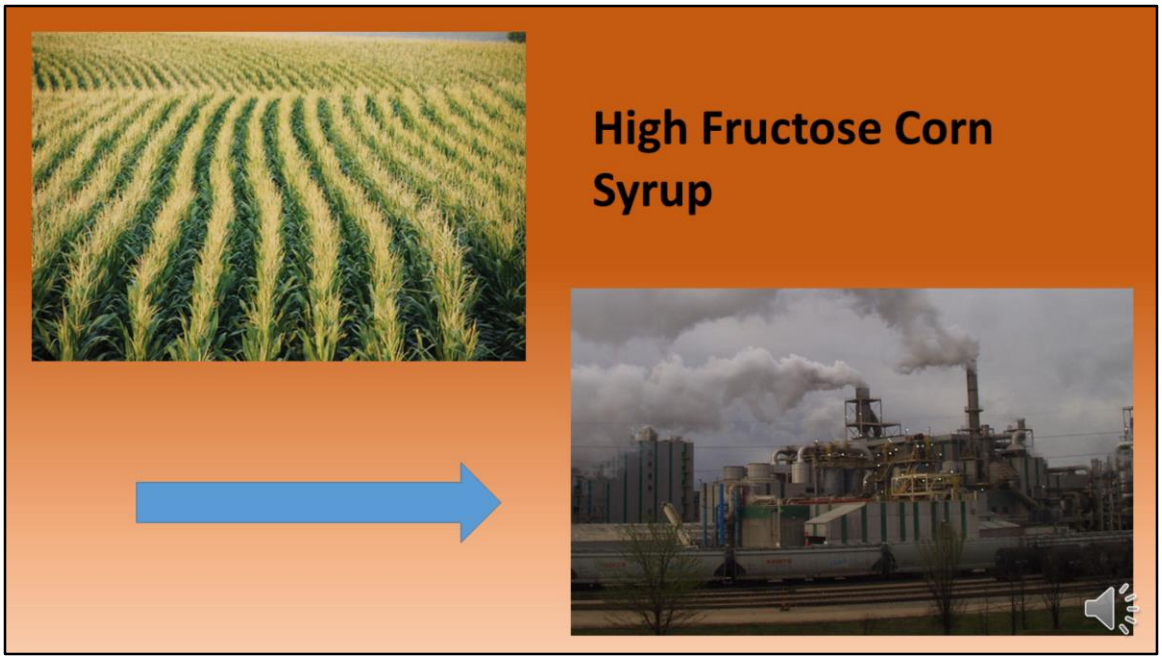
One new product developed by the Cornell Maple Program is sugar made from high invert syrup. This method can be used to make sugar from syrup of any invert level. This allows for the production of high flavored sugar from very dark syrup. The methods requires syrup to be carefully cooked to 80 degrees above the boiling point of water, allowing it to harden into a solid, then grinding the hard candy into a powder.

The powder can then be sifted into different size classes. It is important to note, that this form of sugar does not have a crystal structure. Therefore it has different physical properties. For example, it is more likely to attract water than crystalized sugar. For more information, please watch the YouTube video linked on the worshop website.

In addition to these traditional maple products, maple syrup has the potential to be used to produce many other, high-value products. The Cornell Maple Program is actively involved in developing new products and opening new market opportunities to maple producers.

These opportunities include candy, food, beverages, sports supplements, beauty products and more.

Maple has many attributes that match growing trends in the marketplace. Today's consumers look for foods that are sustainably and locally produced with natural ingredients. They look for products that have a clean label, meaning that the ingredient list includes recognizable foods instead of synthetic ingredients that read like the inventory in a chemistry lab. Maple syrup is an all-natural food that holds an edge above alternatives such as high fructose corn syrup.



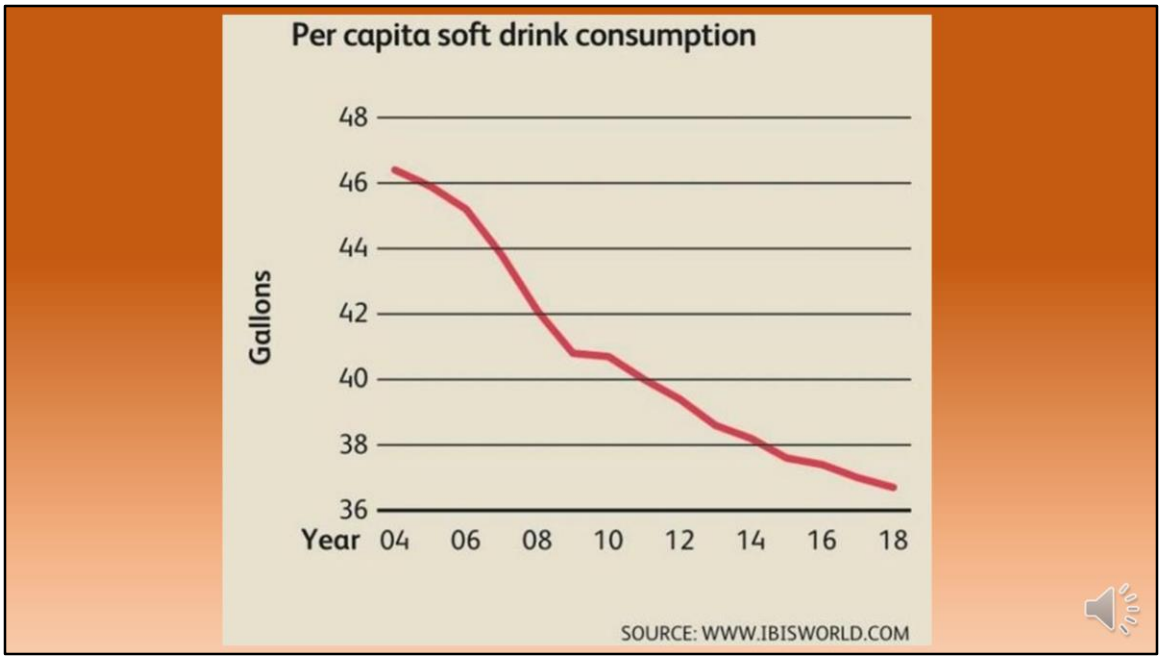
Let's take a closer look at high fructose corn syrup. Corn is not grown in a natural setting. It is grown in monocultures in heavily cultivated fields that require inputs of fertilizer and pesticides. These fields create pollution and have little ecosystem value. Processing corn into sugar requires significant energy and chemical inputs.

In contrast, maple trees grow in intact, natural ecosystems that support wildlife, help create clean air and filter water to help maintain a healthy water cycle. Processing syrup does not require chemical inputs and modern technologies like reverse osmosis limit the required energy inputs.

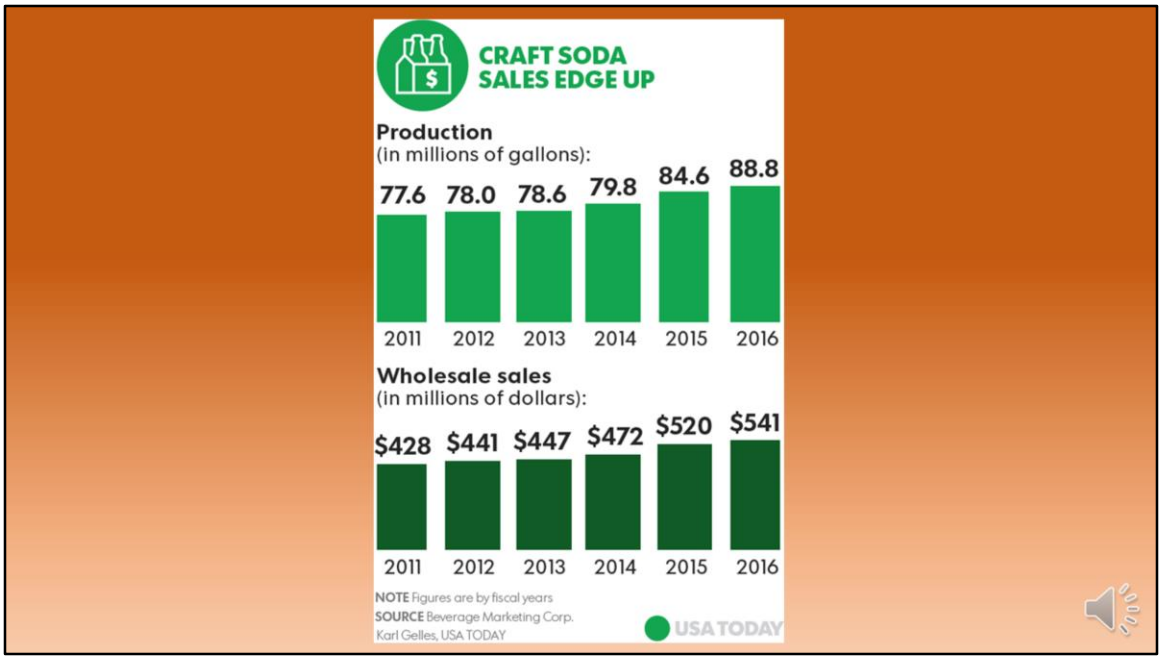
Consumers find this to be an appealing alternative to high fructose corn syrup and other sweeteners.

With this is mind, the Cornell Maple Program has been working to find new product opportunities for maple. Our approach to developing new products follows this general format: First we brainstorm ideas, then do background research to see if which concepts are feasible and have merit. We then do small pilot studies test proof of concept. Ideas that seem workable are then extended into more rigorous research projects that involve research and industry collaborators. When possible, we produce samples and conduct market tests. All results are shared in the public domain for all to use.

One product we have researched is maple soda. This doesn't necessarily mean maple flavored soda. Rather, we have developed soda recipes that use maple syrup as the only sugar source and have flavors that are compatible with maple.



The opportunity for maple in the soda market is considerable. Although sales are declining for mainstream brands, this market segment still records annual sales in the hundreds of billions.

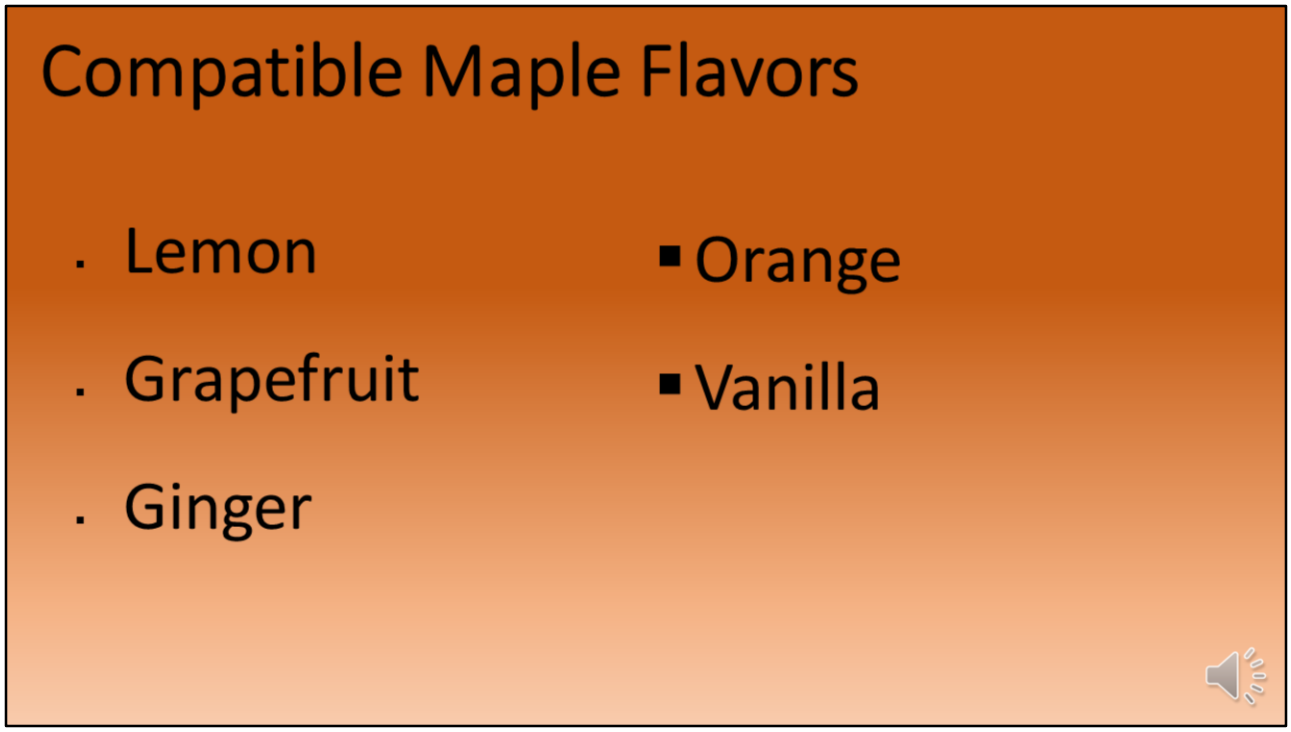


More importantly, while the mainstream soda market contracts, the craft soda industry has grown considerably. Craft sodas include artisanal and small-batch beverages that tend to be produced by smaller local businesses. Consumers who are drawn to this market also tend to find maple appealing.

Development Process

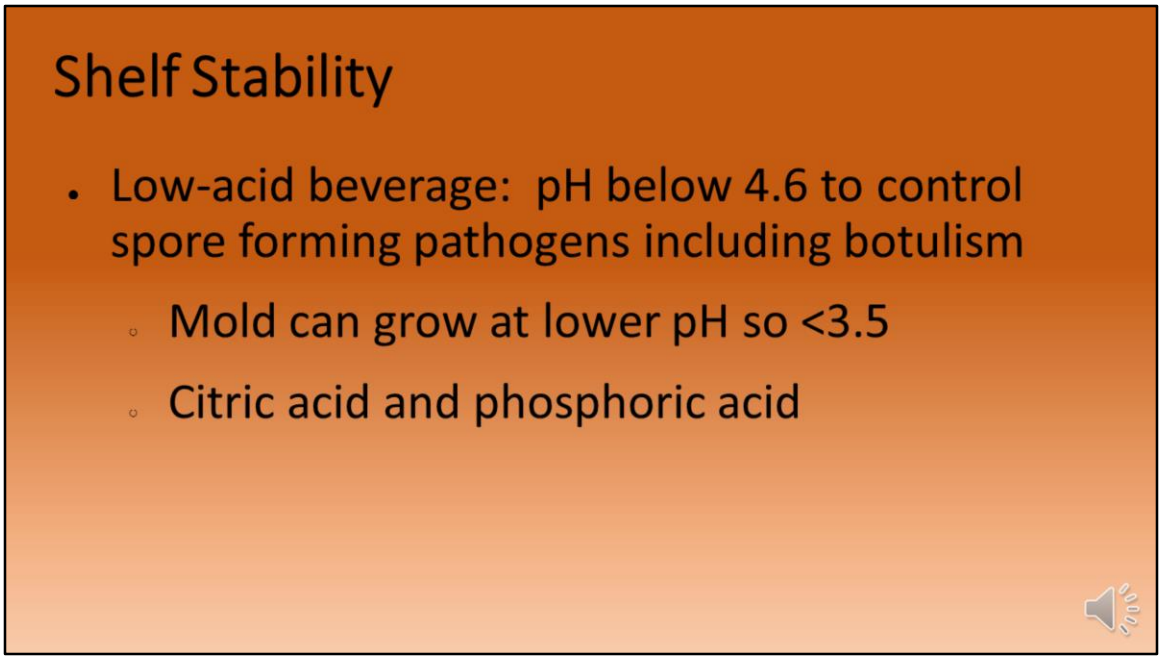
- Flavor
- Shelf stability
- Efficient process

Developing a soda for either mass appeal or the craft beverage market requires the same basic steps. First, a recipe with favorable flavor must be developed. Then that formulation must be tested and altered to ensure shelf stability so the soda is safe for consumption and does not spoil in storage. Lastly, the soda must be efficiently produced and distributed.



Cornell has conducted multiple sensory trials to evaluate flavor compatibility. Some of the most favorable flavor profiles include lemon, ginger, orange, vanilla and grapefruit. Other flavors such as raspberry and blueberry have shown less promise but may work with further recipe development.

Recently, Cornell has developed two recipes that have been used in commercial production. Both the maple orange crush and maple lemon ginger beer pictured above have been successfully bottled and sold in the marketplace.



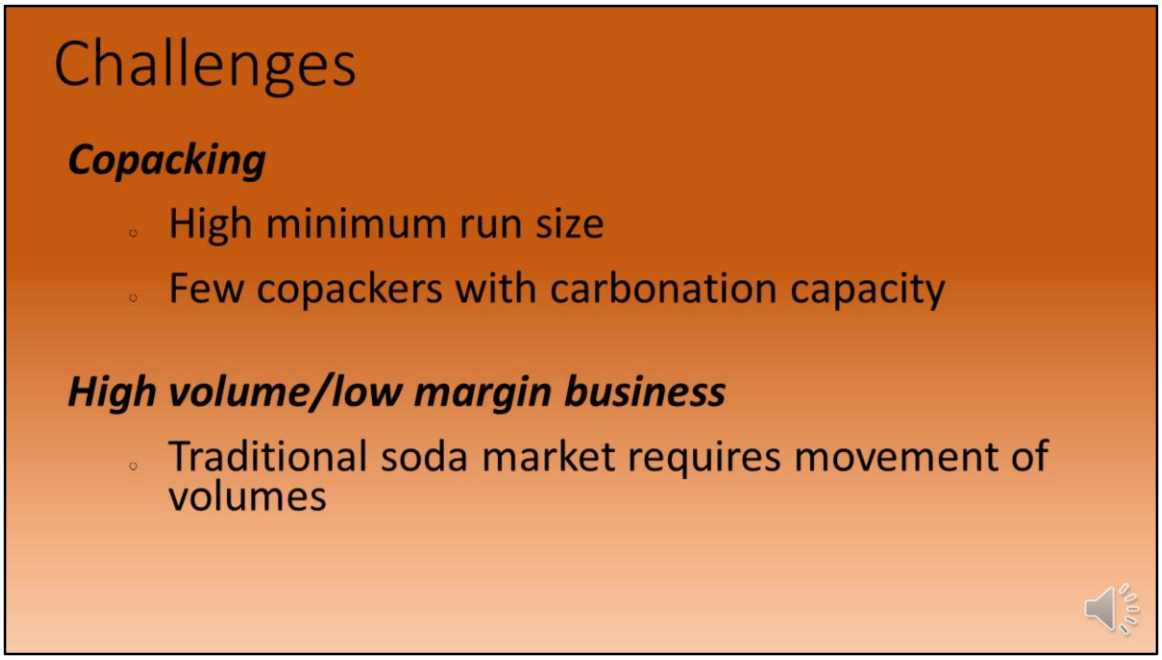
In order to achieve shelf stability, these sodas required acid additions to prevent the growth of botulism and mold.

Shelf Stability

- Preservatives: inhibit microbial growth
  - Sodium benzoate - inhibits bacteria and mold
  - Potassium sorbate – inhibits mold and yeast

For sodas that will spend time at room temperature it is also important to add preservatives that further inhibit mold growth. These preservatives do have some impact on flavor.

In order to be legal for sale, the recipe and production process for soda must be approved by an FDA certified process authority. These certifiers will review the process and make sure the food is safely formulated, processed and shelf stable. A scheduled process approval will be issued to approved foods and beverages. A google search will direct you to certified process authorities in your region. The Cornell Food Venture Center in Geneva, NY serves as a process authority for central NY.

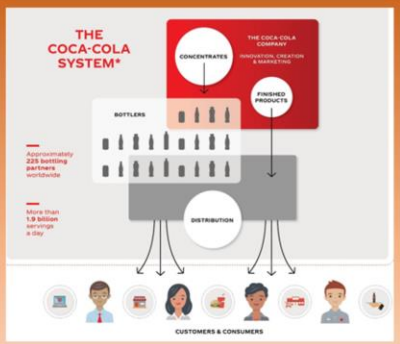


Two barriers to the soda market are the availability of bottling facilities and the volume of product required to make an acceptable profit margin. Many bottlers, sometimes called copackers, have large minimum run requirements.

Challenges

Distribution

- Moving high volumes requires sophisticated distribution network



Distribution is another barrier to entering the soda market. Mainstream soda companies employ a vast and sophisticated distribution system in order to make a profits on a small per unit margin.

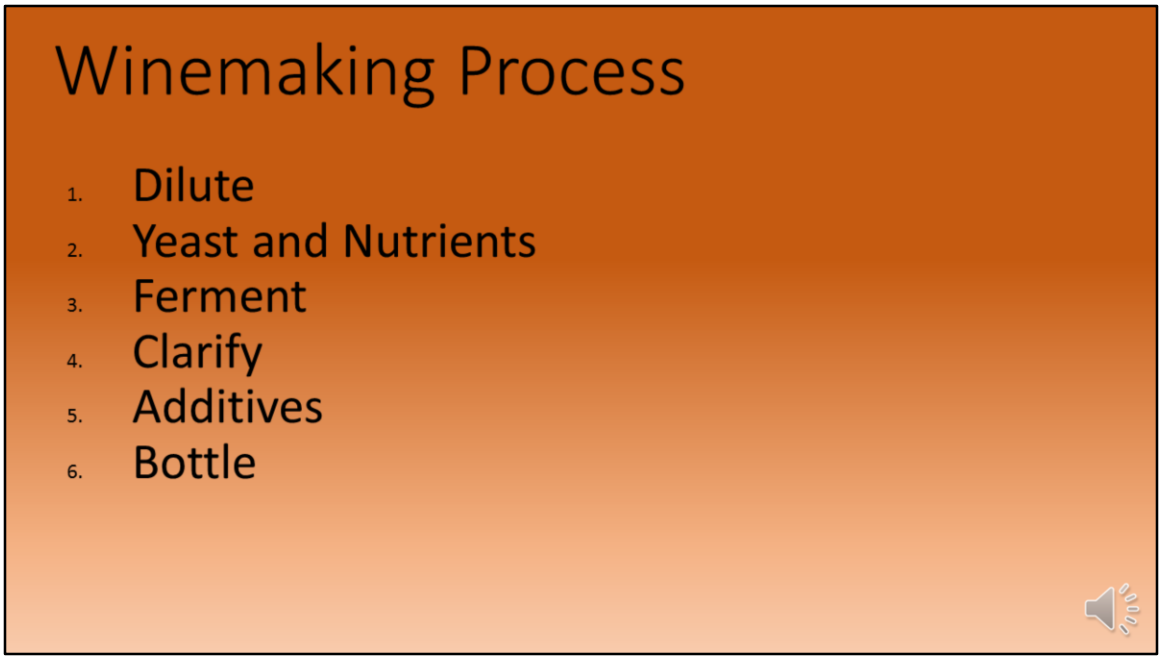
Nevertheless, some smaller bottling facilities do exist and maple producers have been able to capitalize on this opportunity. In this example, Roxbury Mountain Maple has worked with a small copacker and is selling maple sodas for $4 a bottle at markets in New York City.

Wine

Maple syrup and sap can be fermented into a high quality wine

Can also be co-fermented with grapes, other fruits and honey

Another lucrative opportunity for maple producers is the wine industry. Last year, sales of maple products in NY were somewhere between $30 and $50 million by most estimates. Compare that to the NY wine industry which generated nearly $5 billion in economic activity in 2019. Although the conventional standard for wine is an alcohol fermented from grapes, maple syrup can also be used to make a high quality wine. As consumer interest in wine continues to grow, the demand for novel and non-traditional options grows as well.

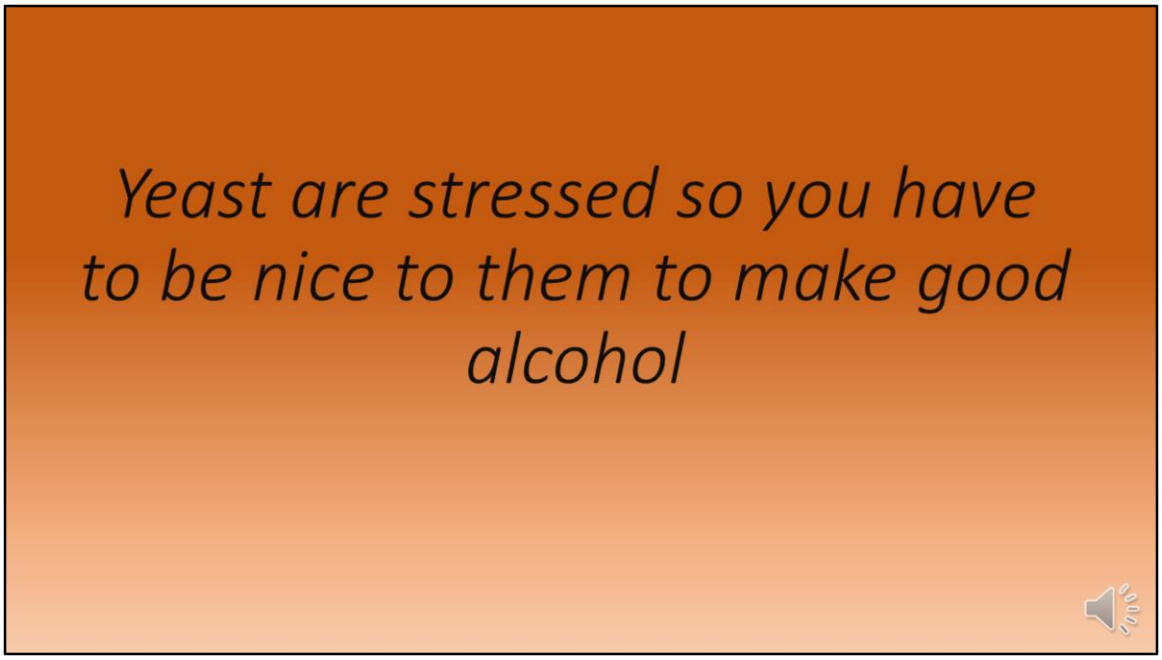


However, it is important to note that a refined process is required to make good maple wine. Yeasts find the fermentation environment created by maple to be more stressful than that created by grape juice. If done improperly, maple wine can taste rotten or astringent. Care must be taken at each step of the winemaking process to create a quality product.

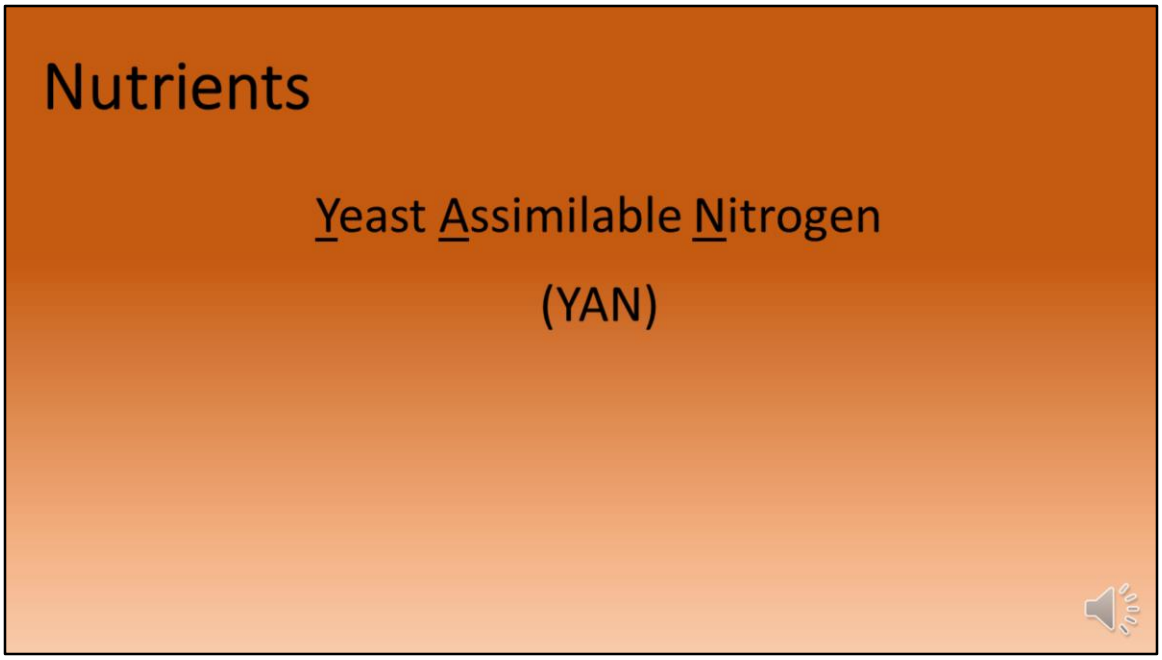
Choosing a yeast strain

Dilution	Yeast	Sensory Analysis
1:2	71B	tastes like syrup, sweet, lower alcohol
	EC1118	marshmallow aroma, watery, sour, green apple
	V1116	nutty, slightly tart, good complexity
	ICV-D254	sweet perception, classic maple, spice, maple cream, butterscotch,
	BA11	sweeter, maple flavor
1:1	71B	potent maple flavor,
	EC1118	bright citrus, potent maple flavor
	V1116	sweet, orange rind, caramel apple, orange blossom, walnut, classic maple

The Cornell Maple Program has teamed with the Cornell Department of Food Science to create refined winemaking guidelines for maple syrup. One critical part of that research involved testing different yeast strains and dilution rates. Several yeast strains performed well with maple. In particular, strain V1116 consistently produced quality wine that retained notes of maple flavor. This yeast can be purchased at most winemaking equipment suppliers.



In our research, we also found that maple syrup alone lacks the nutrients required by yeast for a healthy fermentation.



The most important nutrient for yeast is nitrogen, which is sometimes referred to by the acronym YAN which stands for Yeast Assimilable Nitrogen.

Not all nutrients are created equal

Free amino nitrogen – health food

However, yeast also require other nutrients that maple syrup does not provide. Therefore it is best to use a complete nutrient additive such as Fermaid K.

Additives

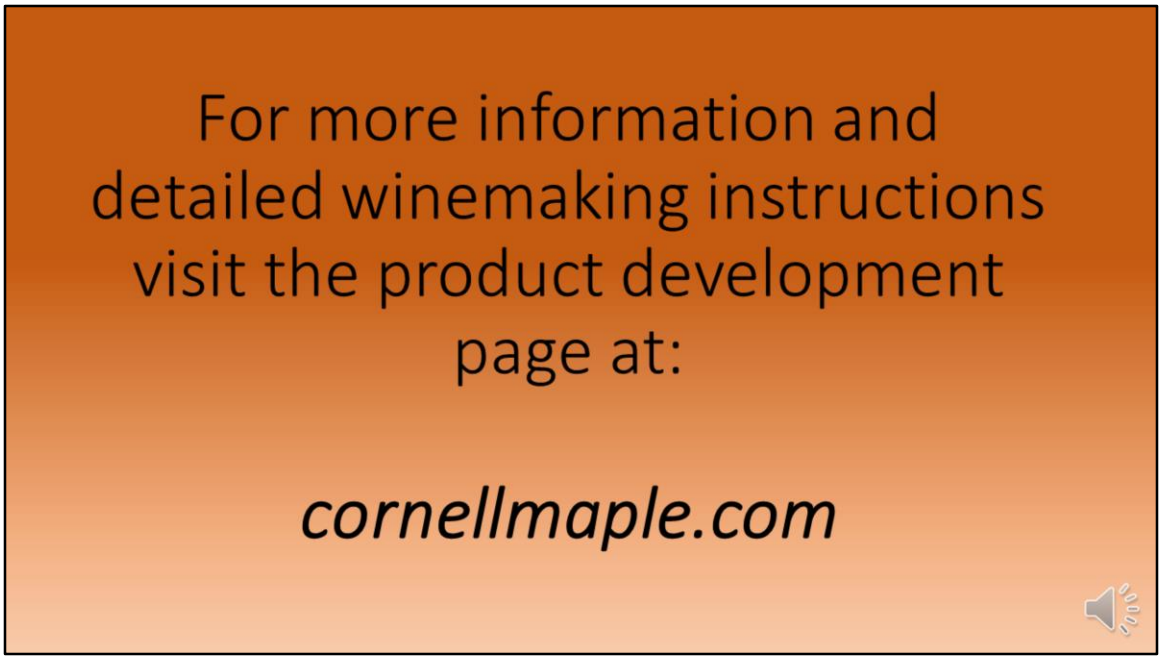
- Acid – tart and sour flavors
  - Tartaric
  - Malic
  - Citric

The flavor of maple wine may be too simple or syrupy for some wine drinkers. This can be resolved with amendments that make the flavor profile more sophisticated. One option is the addition of acids. Acids add tartness. They also help preserve wines that will be aged before drinking.

Additives

- Tannins – dry, astringent flavors
  - In grape wines come from seeds, skins and oak barrels
  - Artificial additives, chips or powder

Even when fermented to dryness with less than 1% residual sugars, maple wine tastes quite sweet. Oaking the wine through cask aging, wood chips or a liquid oak tannin adds bitterness to counteract the sweetness and create a balanced flavor.



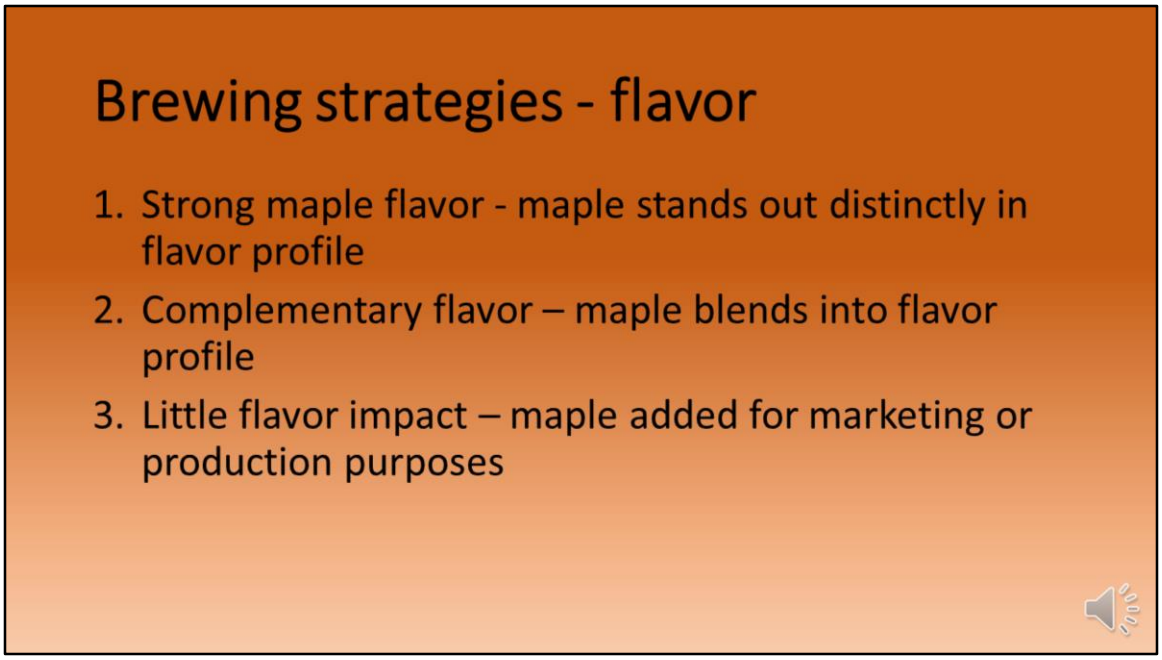
More information about maple wine, including regulations and licensing requirements, visit the product development page at www.cornellmaple.com

Maple Beer

Variety of styles

- Dark beers: porters, stouts, strong ales
- Medium beers: ales
- Light beers: lagers
- Others: sours, saison, experimental

Maple beer is not a new concept. However, it has only been produced in limited amounts and often featured in low quality beers. Our goal at the Cornell Maple Program is to develop a variety of strategies for making high quality beers with a maple component. Our research has focused on options for beer styles from several categories ranging from dark to light and also alternative styles like sours and saisons.



For each of these beer styles we applied the following strategies. The first strategy is infusing the beer with strong maple flavor with significant additions of dark syrup and sugar. The second aims to make maple flavor a component that blends with the overall flavor profile of the beer but does not dominate it. The last strategy is to use maple in the formulation but not in a way that significantly impacts flavor. The idea with this strategy is to allow beer to cash in on the market appeal of maple as a locally and sustainably produced ingredient.

Brewing Strategies – Strong Flavor

- Maple flavor can be lost in fermentation and overwhelmed by other beer flavors
  - Add maple later in the fermentation process
  - Add maple after fermentation
  - Use dark syrup

Maple Porter

Maple flavor is very compatible with the flavors of darker beers such as porters and stouts. However, those dark beers have strong flavors that can easily overwhelm maple. Therefore, in order to make the maple flavor stand out, a few things must be done. First, maple syrup needs to be added later in the fermentation process. For example, with a maple porter, its best to add syrup to the wort 4 or 5 days into the fermentation. This prevents volatile maple flavors from being blown out the airlock during the vigorous stages of primary fermentation. The second thing is using dark and very dark syrups with robust flavor. The last strategy is to use strong flavored maple syrup as the priming sugar. Priming sugar is added to beer just before it is bottled in order to create carbonation. Because the bottle is sealed immediately after the sugar is added, the flavor is trapped in the beer.

Brewing Strategies – Medium flavor

- Maple flavor can be preserved by adding syrup after the initial, more vigorous, part of the fermentation is over
- Dark syrup is best

Maple Nut Brown Ale

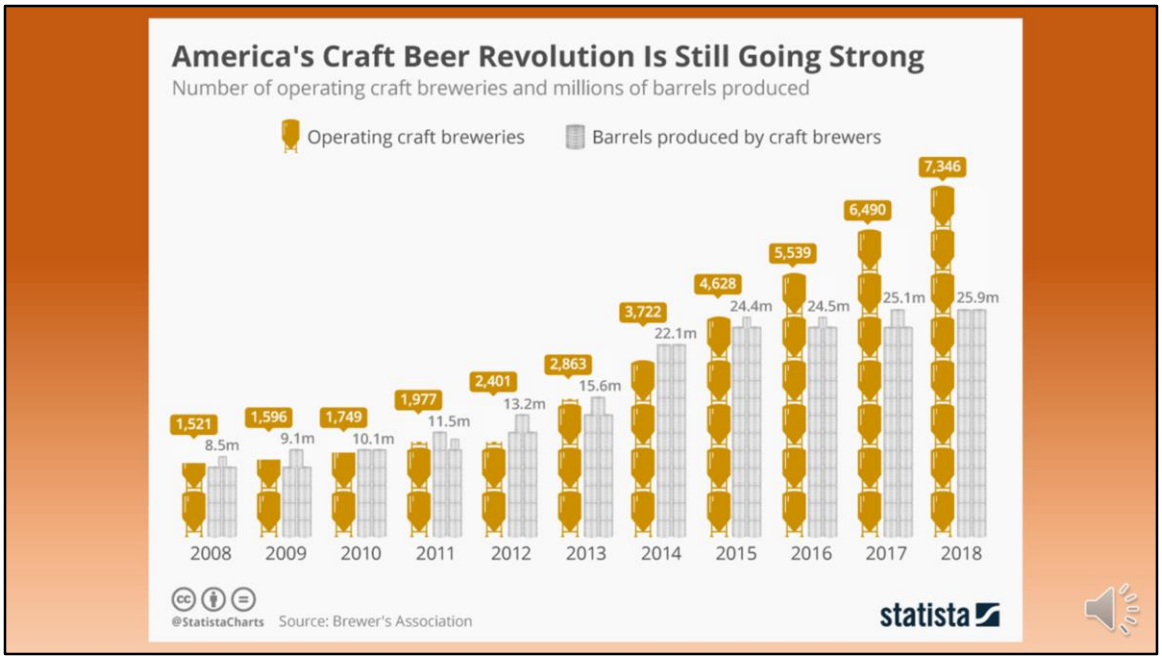
Maple can add to and enhance the overall flavor profile of a beer without dominating it. Sweet caramel notes work well to balance bitterness and the vanilla-like compounds in maple can add a creamy mouthfeel in the suds when a beer is first poured. We've found maple work well with a nut brown ale homebrew kit to add a rich layer of maple to the flavor. To do this, leave out one pound of the malt syrup in the initial wort mixture. After 4 days of fermentation, stir 1.75 cups of dark maple syrup. To further enhance the flavor, use maple sugar instead of corn sugar for the bottle conditioning. The maple flavor won't overwhelm the flavor, but it is in the flavor mix and creates a unique and delicious Nut Brown Ale.

Light Flavor

- Even with a small amount of maple flavor, adding syrup can add market value
- "Made with real maple syrup"
- One option: use maple sugar as a priming syrup to carbonate beer
  - Adds subtle flavor but is a feasible alternative

IPA primed with maple sugar

A final strategy is to use maple as an adjunct sugar without the intention of significantly impacting the flavor of the beer. One way to do this is use maple sugar as a priming sugar. For example, the pictured IPA was made from a brew kit. Half of the brew was primed with corn sugar and the other half with maple sugar. In taste tests less than half of participants could detect maple flavor and the two beers scored almost equally. However, 60% of those questioned said they would be more likely to buy the IPA primed with maple after a short presentation comparing the ecofriendly merits of maple with corn sugar.

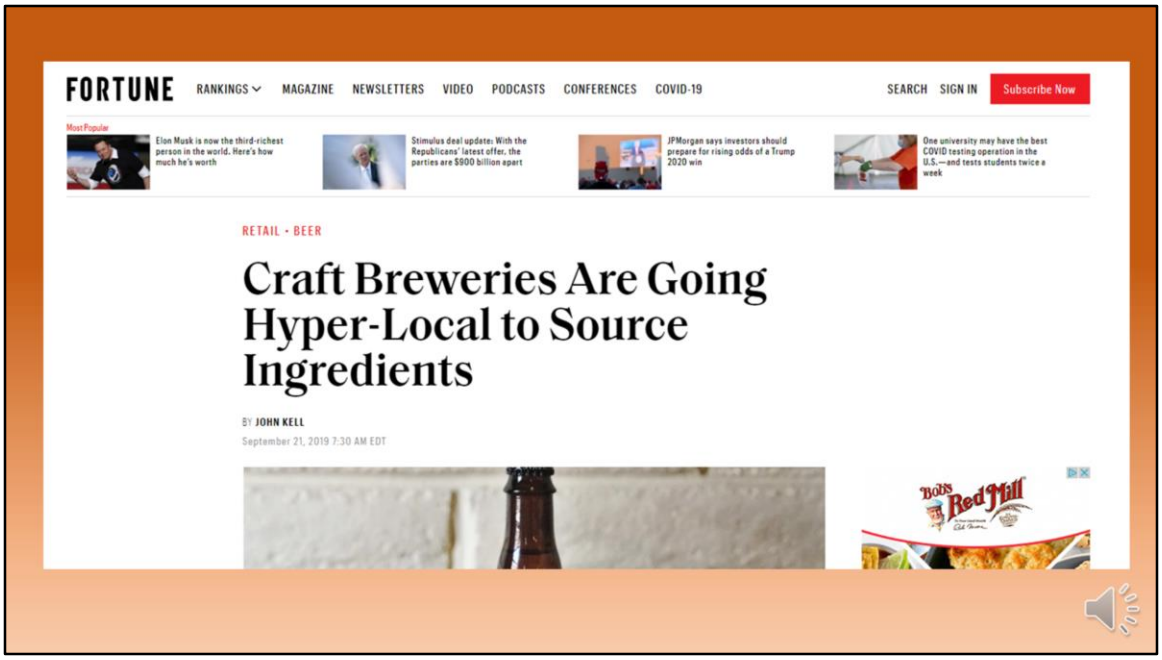


The beer market in the united states has shifted dramatically in the past ten years away from commercial breweries that emphasized bland pilsners and toward craft breweries that make smaller batches of flavorful, artisanal beers.

Craft Brew trends

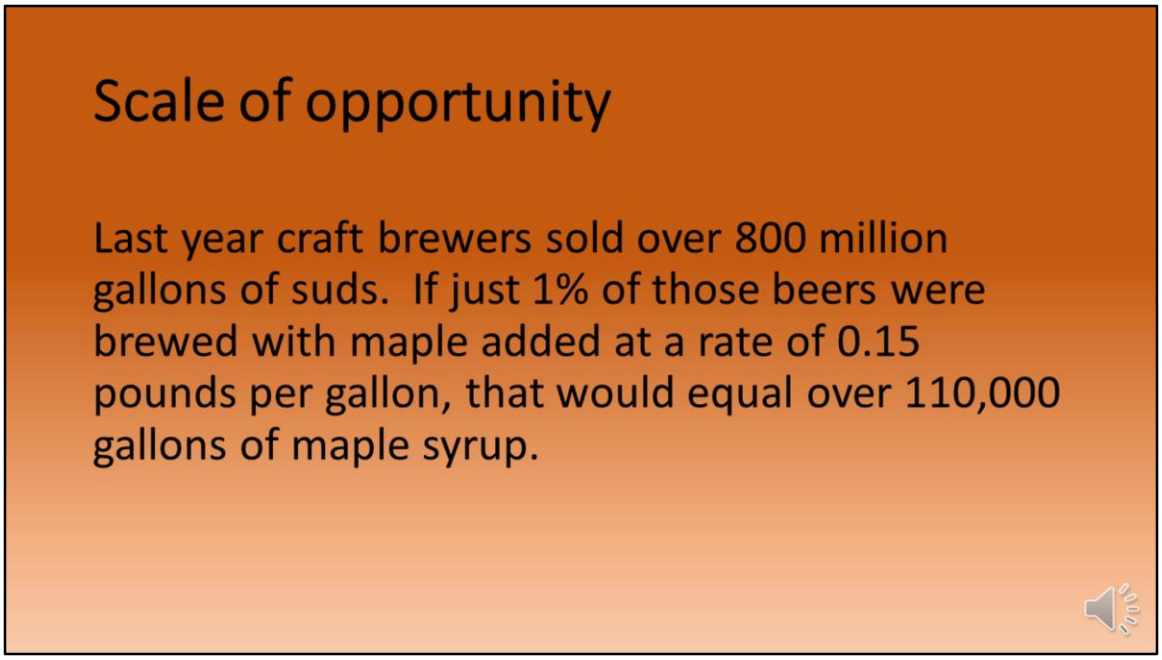
- Diversification
- Innovation
- Locally sourced ingredients
- Natural and environmentally friendly labelling

As craft breweries have become more common, these businesses have begun diversifying their offerings to better compete in a crowded marketplace. One emerging trend is an emphasis on local, natural and environmentally friendly ingredients. Maple fits very well with this trend.



The local ingredient movement has even caught the eye of Fortune magazine.

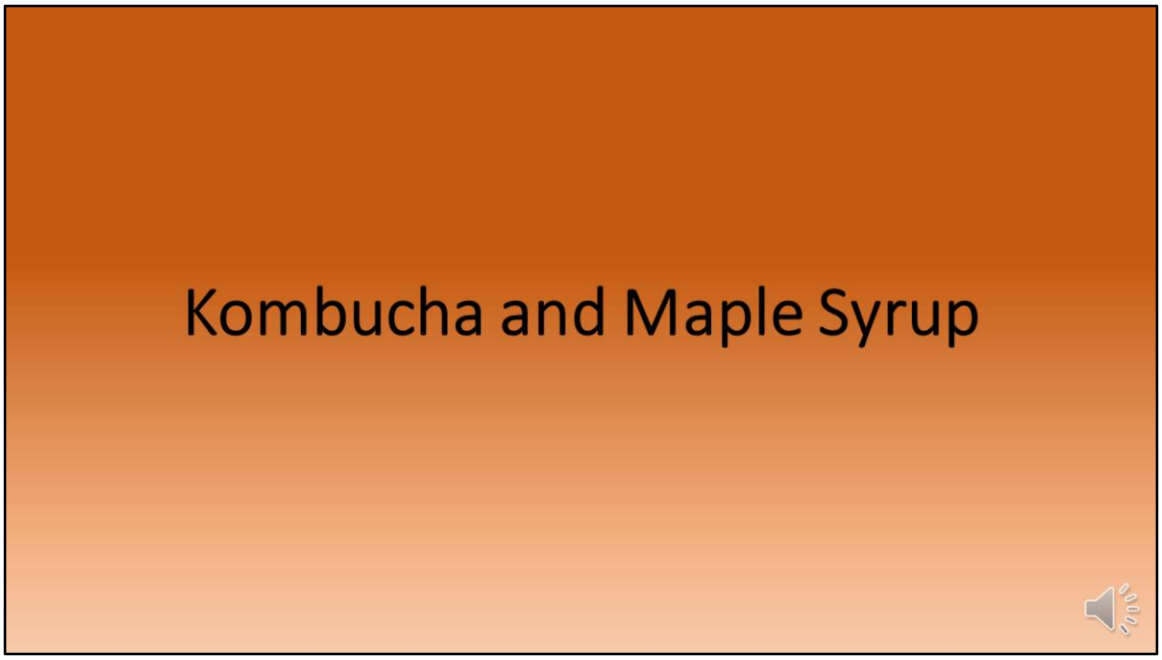
Many breweries, like this business in Hamilton, NY deeply incorporate the “natural” marketing message into their business. As you can see, this brewery has an aesthetic much like a sugarhouse.



Beer is big business. They key is to gain mainstream acceptance for beers made with maple. Instead of having consumers stumble across maple beer as a novelty, we to develop a demand for it so that consumers go to the store or the pub with the intention of buying it. One way this happens is when maple producers seek out partnerships with local breweries.

Home brewing is also a potential market for maple producers. Homebrewing is a growing business and homebrewers are among the boldest experimenters in the brewing community. Many towns and cities have local brewing clubs that have regular meetings and presentations. Consider asking your local club for a chance to talk about maple in brewing and provide free syrup samples for them to experiment with.

Consider trying your own hand at homebrewing. Many suppliers offer inexpensive starter kits and recipe packs with easy-to-follow instructions. Experiment with your own styles of maple beer. Its fun, easy and a great way to generate interest among your friends.



One final opportunity I would like to introduce is maple kombucha.

What is Kombucha?

- Fermented Sweet Tea
- Perceived as healthy
- Probiotic, antioxidants, organic acids
- Alternative to soda: less sugar, but with flavor and fizz

If you are unfamiliar with kombucha, I highly recommend trying it. Kombucha is a fizzy, tart, refreshing beverage made by fermenting sweetened tea. It has purported health benefits due to its probiotic and antioxidant properties

Kombucha: the next big thing

Within a few years sales of kombucha are projected to surpass $2 billion annually. It is a specialty item that often sells for $3 to $4 for a 12 ounce bottle.

Basic Ingredients

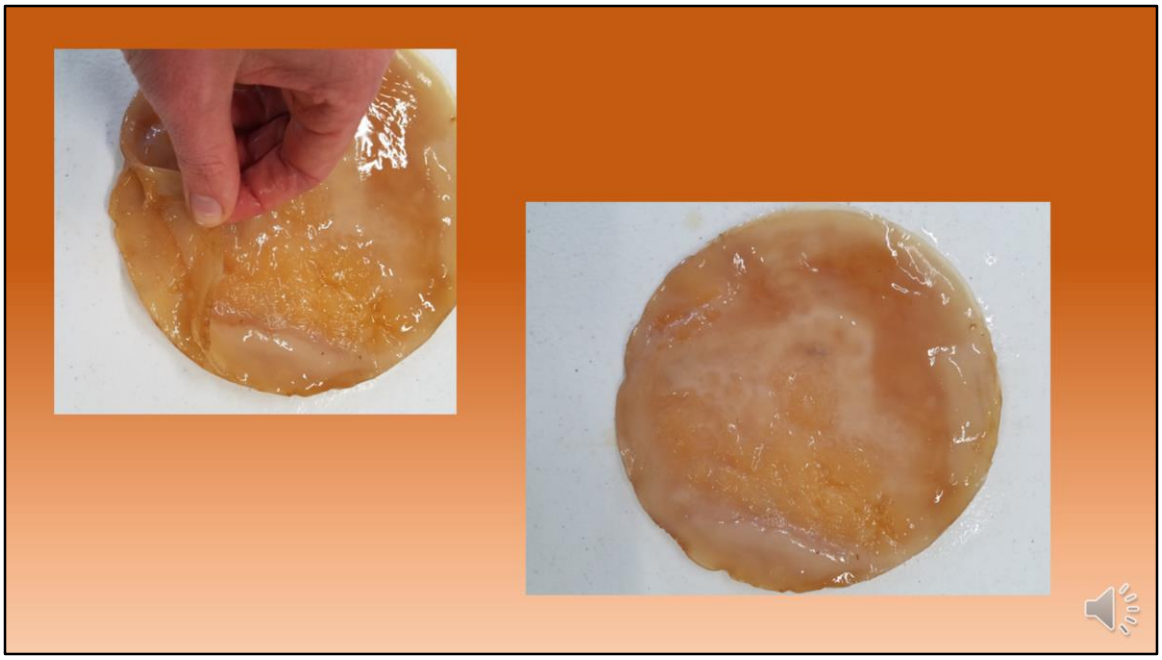
- Sugar provides the fuel
- Tea provides the nutrition: caffeine and N
- Warm water provides the shelter
- Inoculant – Finished Kombucha (Scoby)

Making kombucha is fairly simple and many people get started with an inexpensive home brewing kit. The basic ingredients are sugar, tea, water and a scoby.

What is a Scoby?

- Symbiotic Colony Of Bacteria and Yeast
- Pellicle: cellulose by-product made by acetobacter & gluconacetobacter
- Similar to vinegar

The word “scoby” is an acronym that stands for symbiotic colony of yeast and bacteria. The scoby is a collection of living microorganisms that ferment the tea. It is similar to a vinegar mother.

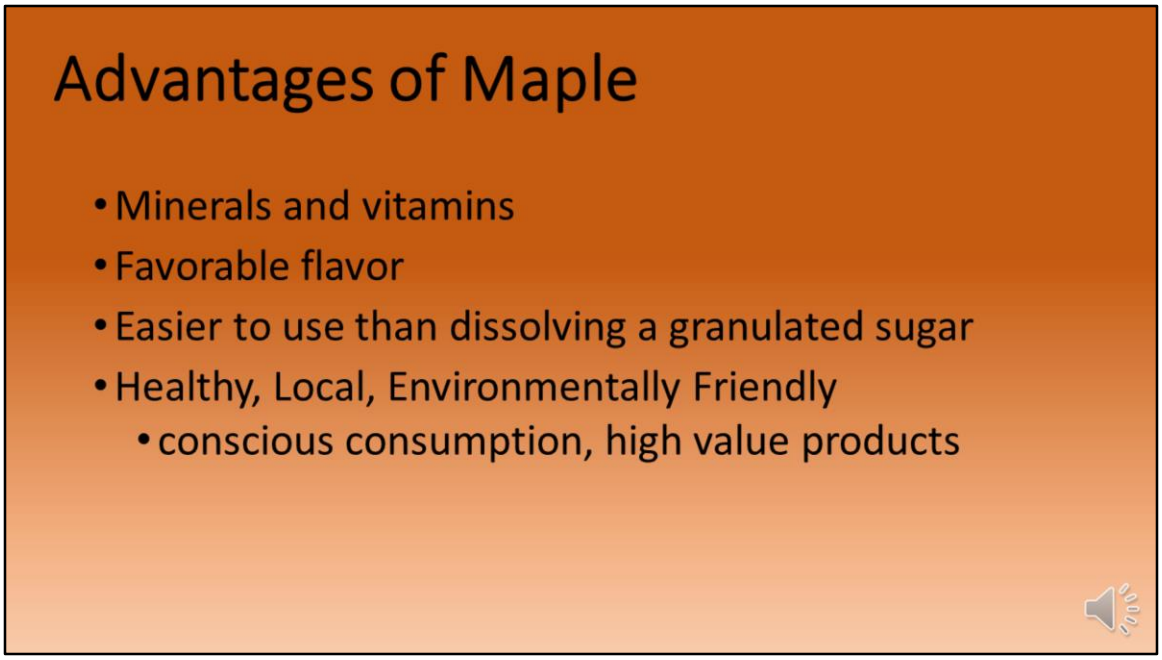


The scoby looks like a slimy brown disc that floats on top of the kombucha as it ferments. It can be re-used to make multiple batches.

Fermentation

- Yeast eat the sugar and produce alcohol
- Bacteria eat the alcohol and produce organic acids
  - Acetic acid, gluconic acid, glucuronic acid, citric acid…

The scoby contains both yeast and bacteria. The yeast convert sugar into alcohol, then the bacteria convert the alcohol into a variety of acids which give kombucha its characteristic tart flavor.



Typically, kombucha is made with cane sugar, but maple syrup works just as well. Using maple has health advantages over can sugar and is perceived to be a superior sweetener by many consumers for the reasons already discussed.

Secondary Fermentation

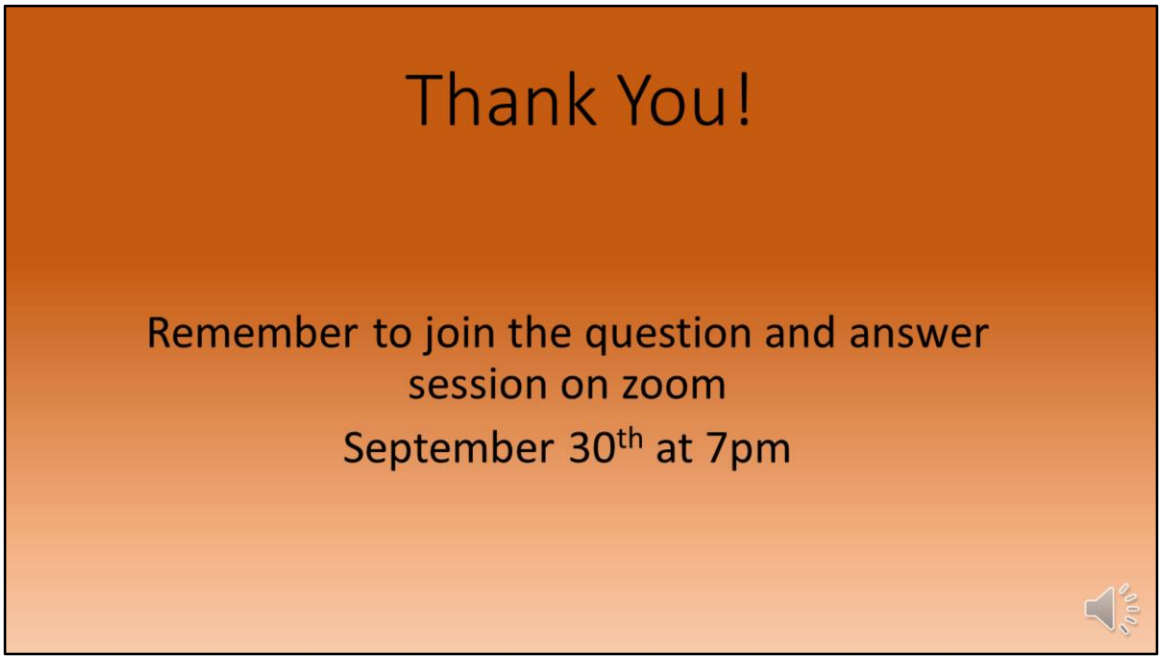
- Process for creating carbonation
- In the absence of oxygen, the yeast consume the sugar and create carbon dioxide

After a 1 to 2 week fermentation period, the kombucha can be infused with flavors from added fruits and spices. At this point a small amount of additional sugar is added and the bottle is sealed. In the absence of oxygen, the yeast in the scoby converts the sugar into carbon dioxide to create fizz in the beverage. It also creates a small amount of alcohol.

The Cornell Maple Program has developed numerous maple kombucha recipes including the maple pomegranate formula pictured above. It was delicious!

For more information on all of these value-added maple products, including detailed instructions for brewing your own kombucha, visit the product development tab at Cornellmaple.com.

Looking ahead, there are many new options for maple products on the horizon. Cornell is already working on formulations for chocolate, sports supplements, soap, mead, hard cider and others. Maple is a versatile and valuable product with limitless possibilities. Don't be afraid to experiment and think outside the box. Also, feel free to share your ideas with the Cornell Maple Program. We are always looking for new research opportunities.



Thank you for viewing this presentation. I hope it provided information that will help your maple business. Remember to join the live discussion on zoom. A link is included on the course materials website.