

MAPLE SUGARBUSH QUESTIONS & ANSWERS

1. **What is a Sugarbush?**

A Sugarbush is a group of Sugar Maple trees growing in the same area and used to produce maple syrup or maple sugar. This might mean 2000 trees used for commercial syrup production, or might refer to the 5 trees you tap in your backyard.

2. **Does maple syrup come directly from the trees?**

No. Sap comes directly from the tree. People must collect and boil the sap, concentrating it and changing it into syrup.

3. **How do you know when to quit boiling? How do you know you have syrup?**

Boiled sap becomes finished syrup when the sugar concentration reaches 66%. Syrup makers test for this in several ways:

a) With a candy thermometer. As water boils off leaving sugar solids behind, the sap thickens and boiling temperature rises. When sap boiling temperature reaches seven degrees Fahrenheit above the boiling point of pure water at that place on that day, turn off the heat...you have syrup.

b) With a hydrometer. This instrument floats in sap at varied depths depending upon how dense the fluid is....just as a person floats higher in the salty ocean than in a freshwater lake. When it floats at the right level...zippo, you've got syrup.

c) By the "apron test". A scoop is dipped into the boiling sap then held upright to drain. Formation of a large thin apron instead of mere dripping indicates finished density syrup.

d) By the "blob test". A spoonful of boiling fluid is dipped into a bowl of cold water. If the spoonful disperses or floats around suspended, continue boiling. If it forms a single blob and sinks to the bottom, you're done.

Did you notice how much the precision of these methods varies?

4. **How does sap get made?**

Leaves are the tree's food factory. Sugar is produced in the leaves by photosynthesis. The sugar becomes sap by being mixed with water transported up from the ground via conducting tubes in the roots and stems. This sap is then moved around inside the tree either to storage sites or where it is needed.

5. **What does the tree use sap for?**

Sap contains the sugars that fuel a tree's growth and maintenance needs. During winter when the tree is dormant sap produced the previous summer is stored in the trunk and limbs as starch. When spring arrives buds break open and start to grow new twigs and leaves. Sap is moved around to these points of growth where its sugars provide the required energy.

6. **What conditions make the maple sap run?**

Sap flows result when temperature changes, especially when the temperature is rising past the freezing point. Ideal conditions are cold nights in the teens Fahrenheit, warming to daytime temperatures in the high thirties.

Pressure changes inside the tree's tissues force the sap from storage cells out into the vascular transporting tissues. By drilling the taphole you have cut through these vascular

tissues like so many soda straws. As a result the sap leaks out the hole, down your spile, and into your bucket. Drip - drip - drip.

In Duluth the sugaring season lasts about three weeks, usually between mid-March and mid-April.

7. How much sap comes out of a single taphole, and how much syrup will that make?

The amount from each taphole varies with weather conditions, health of the tree, tap placement, soil moisture, and leaf productivity the previous summer.

Out of a single tap you might get anywhere from two gallons to twenty gallons. The average for a season is about eight gallons, which translates after boiling to about one quart of syrup. Rule of thumb: put in four taps for each gallon of syrup you hope to make each season.

8. Does the tree get hurt?

Yes, and don't let anyone fool you by saying otherwise. Trees are hurt by the tapping activity, but if done properly tapping can occur for over fifty years without killing a tree.

Most of the damage we do is not the result of taking the tree's food. Experiments in which eight to twelve times the normal amount of sap was removed yearly for five years did not detectably slow the annual growth rate. The damage we do is directly related to the number of taps we use.

Each taphole is a wound that the tree must heal. Unlike ourselves trees heal their wounds by sealing off instead of repairing the damaged tissue. Every hole we make in a Sugar Maple represents a certain amount of tissue that will never be functional again for either nutrient/water transport or food storage. Until sealed off the new hole also serves as an access route for diseases and boring insects.

9. Then why do we tap maples if we know it hurts them?

It hurts a carrot or potato just as much when we eat them, and it hurts a beef cow much more because we have to kill the cow to eat it. We survive by eating other plants and animals. We also use plants and animals to make clothing and build houses. That's acceptable; that is life.

Making maple syrup, however, does not imply killing. Done properly, tapping maples is more like eating apples from a tree, blueberries from a bush, eggs from a chicken, or milk from a cow. We use part of the organism but leave it alive too. We harvest food sustainably.

10. How long does it take the tree to heal?

It depends on how big the wound is and how vigorously the tree is growing. A vigorous tree will seal over a new taphole that same year. Slower growing trees might take three years to seal over the hole. Since new growth proceeds inward from the wound's edge a larger wound will take proportionately longer to heal.

11. Why isn't sap of other trees used to make syrup?

It is. Several other species of maple can be tapped including Black Maple., Norway Maple, Red Maple, Silver Maple, and Box Elder. Of these, only Black Maple has sap averaging as sweet as Sugar Maple. Sap from the others might only have half as much

sugar, meaning you have to boil it twice as long.

These are averages, however, and the better non-Sugar Maples often produce higher sap sugar concentrations than do poor Sugar Maples.

12. How about birch trees?

Birch, walnut, and butternut all will lead a sweet fluid sap when tapped in the spring. If collected and boiled these saps will make edible syrup, each with a distinctive flavor. Sugar is less concentrated in these saps than even in the Silver and Red Maples, so they are seldom used.

At UMD's Sugarbush we usually tap one birch tree. Characteristically this tree's sap begins to run about one or two weeks after the maples begin, and only after the nearby ground is snow-free. Once begun, however, it seems to drip day and night as opposed to maples which drip only during the day.

13. What is the maple sap made of?

Mostly sugar and water. As it comes from the tree maple sap is a sterile, crystal clear liquid that tastes sweet. None of the brown color or flavor we identify with maple syrup is in the sap. Fructose comprises 96% of all solid matter in sap, and 99.9% of all the sugar. Other solid material present in minute amounts include organic acids (esp. malic acid), calcium, and potassium.

14. How much sugar is in the sap?

Sugar Maple sap averages 2.0-2.5% sugar. The percentage varies from year to year, from start to end of the sapflow season, and between different trees. Some of these differences are known to be genetic, others are due to environment. 1-5% sap sugar is a normal range within a sugarbush. The season's sweetest sap runs normally occur early.

15. Where does the maple flavor and color come from?

Both are the result of chemical reactions that take place between substances in the sap as it boils. Neither the exact nature of these reactions nor the identity of the reacting substances are known. That is why chemists have been unable to create an artificial maple syrup flavor that even remotely tastes like the real product.

16. Why don't we make syrup from the sap sticking on the outside of pines and firs and spruces?

This isn't sap; it's resin. Resins are not the tree's food like maple sap is. A tree first makes sugar by photosynthesis, then uses those sugars to make resin. Instead of nourishing new plant growth resins serve more to protect the tree from invading insects and diseases that would otherwise cause harm.

17. What other trees grow with Sugar Maples?

In the UMD Sugarbush there are also Yellow Birch, Paper Birch, Northern Pin Oak, Quaking Aspen, Balsam Poplar, Black Spruce, Balsam Fir, White Pine, American Elm, and Black Ash.

18. How can you tell a maple tree?

With barks. Borrow a friend's dog to translate.

19. No really...how can you distinguish which tree's to tap?

Maples and ash trees are likely the only deciduous trees you'll see in a sugarbush with opposite branching patterns. All others branch alternately. Young maples have smooth gray bark; young ash bark will be scaly or corky. Generally, Sugar Maples grow in better drained areas; Red and Silver Maples grow with ash in "wet feet" areas. Maples branch often producing a bushy top; ash branch sparingly, usually with shorter side branches from a single main stem. Maple leaf scars meet at a point as they wrap around the twig.

20. Who first made maple sugar?

We have no way of knowing who was first, but maple sugar is a uniquely American product and the native Indians were already making it as a staple food when Europeans arrived.

21. How did the Indians discover maple sugar?

Native cultures pass knowledge down through generations by oral tradition so no written record exists. Some legends speak of accidental discovery by tasting sapsicles from broken branches, or by using maple sap drippings as cooking water.

22. Why did they bother to make maple sugar when honey could be found already made by the bees?

There was no honey on this continent until European colonists brought honeybees with them in the 1600's. Maple was the easiest sugar source available to native North American people.

23. How did the Indians collect sap without drill bits, metal spiles, and plastic buckets?

Our current sugarmaking technologies are very convenient but certainly not necessary. Indian cultures were resourceful; they used local materials to meet their everyday needs.

Instead of drilling small holes they had to make larger notches in the trunks, then direct the sap with wooden troughs or chips into bark basket or wooden bowl collecting vessels. Some cultures made pottery that would have been useful for gathering sap.

24. But how did they boil sap without metal pots?

Three methods are generally cited:

a) Ice removal. IN sap left exposed at night the water would separate from the sugar and freeze. Come morning this ice would be thrown away. Presto!...by doing this on successive nights they could remove 50% or more of the water before even starting a fire.

b) Boil in birch baskets. Water boils and evaporates at a temperature just over 200 degrees Fahrenheit but paper has to reach 550 degrees Fahrenheit to ignite and burn. Sap boiling in a folded birchbark container would keep the bark cooler than 550 degrees and prevent it from burning. Much boiling could be done this way.

c) Hotrocks. Some accounts say rocks were heated over a fire then repeatedly immersed in sap to boil it away. This seems an unlikely explanation. The resulting product would be about one part sugar to four parts carbon deposit and wood ash. Not particularly tasty or nutritious.

25. Without bottles or cans how did they carry their maple syrup and keep it from spoiling?

Maple syrup is still 34% water and will spoil unless sealed or refrigerated. Indians solved this problem by removing more water; enough so the sugars would crystallize into solid form. They had three kinds of maple products:

- a) Grain sugar, stirred in a trough until it granulated like our white can table sugar,
- b) Cake sugar, poured directly into molds and left to crystallize slowly into a solid chunk without stirring,
- c) Gum sugar, hot liquid poured directly onto snow, solidifying rapidly but keeping a soft, taffy like consistency.

In these forms maple sugar could be easily transported in birchbark containers called "mokuks", and would not spoil.

26. What other differences in the use of maple syrup are there between traditional Indian cultures and contemporary American society?

To some Indians maple sugar was a dietary staple and making it was a seasonally traditional way of life for the entire family. For them it was also used medicinally and ceremoniously.

In today's America maple products are too expensive to be staples. Most have never tasted pure maple syrup, and very few have ever had the good fortune to be involved in its production.

27. Okay, I'm ready, how do I tap a tree?

You choose. Some people tap their trees gently with bamboo fly-fishing rods for hours or even days. Of course, they never get any sap.

A better way is to drill a 7/16" diameter hole about 2.5-3.0" deep into the trunk of a large maple. The hole should angle upwards slightly so sap will drain out instead of pooling inside the hole. Pooled sap will freeze on cold nights, expands, and push the spile loose. Then the next day's flow will leak out around the edges and run down the bark instead of into your bucket. Angle your hole slightly upwards.

A spile is then pounded snugly into the hole and a collecting bucket hung on the spile. When snugging the spile pound firmly but no hard; pounding hard can damage the cambium growth layer and retard the healing process several years. For the same reason (to protect the cambium) tap your trees only on days when the temperature is at least a few degrees above freezing.

28. Why did you say to drill into the truck of a "large maple"?

Small diameter maples suffer too much physical damage from tapping will die after only a few years. The diameter of a maple at breast height should at minimum be fully 10" before you consider tapping it.

29. Can I put more than one bucket on a single tree?

Maybe, but probably not. For vigorous trees with large crowns the rule is:

- 10"-16" diameter....one tap
- 16"-23" diameter....two taps
- over 23" diameter....three taps

But be aware! It takes a mighty old tree to take more than one tap, and less vigorous trees should be tapped more conservatively than this rule.

30. How fast do Sugar Maples grow? How old until they are big enough to tap?

The adage goes that people who plant trees are working for their children and grandchildren. That is certainly true with Sugar Maples. If you plant seeds this year it would be about fifty years before the trees were big enough to tap, and about one hundred years before they were big enough for two buckets.

The North Shore is about as far north as Sugar Maples grow in Minnesota. The very short growing season here means they enlarge more slowly than in Minneapolis, and much more slowly than in Iowa or Missouri.

31. What limits the Sugar Maple from growing farther north?

It's difficult to say with certainty, but step out here on the branch and let's speculate a bit. We know that below about -40 degrees Fahrenheit (= -40 degrees Celsius) maple trees crack open. In the spring these frost cracks become long open wounds from which is lost many times more sap than we gather from a 7/16" diameter drilled hole.

Such nutrient loss is significant and likely retards tree growth. The large wound also provides easy access for disease organisms and wood-inhabiting insects.

A Duluth Sugar Maple, then, which already grows slowly because of a short summer, will have two other factors retarding growth rate and increasing likelihood of early death. At some latitude the climate becomes too severe for Sugar Maples to live long enough and grow large enough to reproduce. Duluth is just about at that limit.

No one has demonstrated this explanation but it seems like a fair guess.

32. How many times can I use the same taphole?

Once; only once. Remember hearing that, "You can't have your taphole and drain it too"? As soon as you drill a hole the tree begins to heal itself. With a few weeks the wound will be sealed off on the inside. If the tree is vigorous its cambium layer will grow completely across the hole during a single growth season, closing it off the way your eyelid protects the eye.

33. Where is Mrs. Butterworth's sugarbush?

It's a well kept secret and old Mrs. B. is smart enough to keep her real maple syrup for personal home use. The product she sells is actually colored corn syrup masquerading as a product of maple trees.

Mother Nature says read the label, trust your tastebuds, and don't get fooled.