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LIVING

Sweet treat faces sour future

Sugar maples and their syrup threatened by warmer temperatures

The annual gathering of the sweet sap of the sugar maple has always been a powerful symbol of this time of transition between winter and spring. Accordingly, a visit to a sugar bush is a wonderful way to witness spring's arrival. Being knowledgeable about this wonderful tree and about the story of the sap itself can only enhance the experience.



Drew Monkman
OUR CHANGING SEASONS

The delicious syrup made from the sap is not the only gift the sugar maple has to offer. It provides first-rate wood for all sorts of purpose and graces us with eye-pleasing symmetry and stunning spring and fall colour. Like all maples, every bud, leaf and twig has an identical partner growing on the opposite side of the branch – if, of course, it hasn't been broken off. Even the tree's winged fruits are paired together in a U shape.

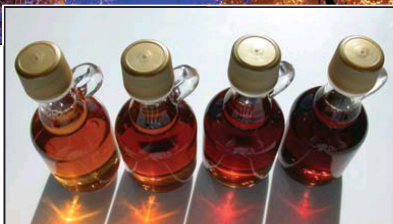
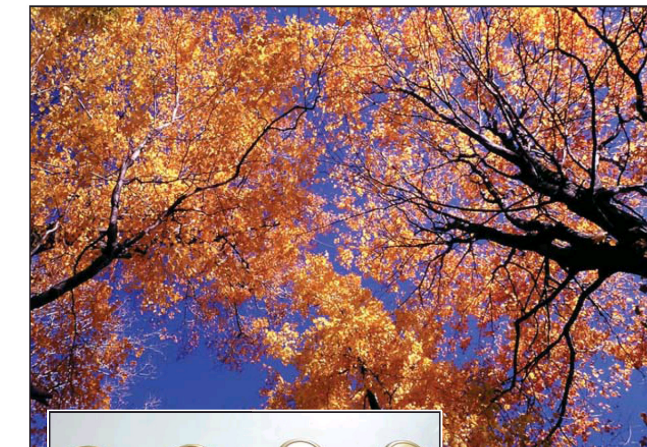
By early May, sugar maples are shrouded in a pastel cloak of thousands of yellow flowers that soon fall and cover sidewalks, driveways and roadsides in floral confetti. And, come October, the scintillating oranges and yellows of the leaves set city streets and country vistas ablaze like no other tree can do.

SUGAR AND WATER MIX

As with all trees, the sap of the sugar maple is a mixture of sugar that has been stored in the wood and water and minerals that have been taken up from the ground. Although sap is present in the tree all year long, it is only sweet enough to make into syrup for a few weeks each spring. To understand the whole process, we have to go back to last summer. Chlorophyll, the "magical" green pigment of the leaves, uses energy from the sun to convert carbon dioxide and water into sugar and oxygen through the process of photosynthesis. The sugar is converted into starch and serves as the tree's food reserve to fuel growth. Excess starch is stored in the wood and, over the course of the winter, converted to sucrose. As spring approaches, the sucrose dissolves into sap to be used to fuel the tree's new spring growth. A good sap year there depends to a large extent on the growing conditions of the previous summer.

The sugar content of sugar maple sap is generally 2% to 3% but can be as high as 7%. Although other maples, such as the red and the silver, can also be tapped, their sap is not nearly as sweet, nor does it have as pleasing a flavour. Amino acids in the sap of the sugar maple give the syrup its distinctive taste.

Sap collection proceeds in fits and starts depending on the vagaries of the weather. It can last for a week to nearly a month. In order to have strong sap flows, a suitable temperature cycle of warm days (20°C to 7°C) and cool nights (-4°C to 6°C) must develop. When the days are warm, pressure in the trees increases. This causes a sap flow from all directions – not just from the roots up but also from the upper branches down. As long as the tree's internal pressure is greater than the atmospheric



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ic pressure outside, the sap will move. The sap flows through an area of the outer tree trunk called sapwood, where actively growing cells conduct water and minerals from the roots to the branches. To gather the sap, a hole about eight cm long is made in sapwood and a tap is inserted. The hole can be thought of as a "leak" in the tree to which sap flows. At night, when the temperature drops to below freezing, the tree's internal pressure becomes less than the surrounding air pressure. Suction develops and water and minerals are sucked up into the tree by the roots. The tree is essentially recharging itself, allowing for sap to flow during the next warm period.

TECHNOLOGY HELPS

In the modern era, plastic tubing brings the sap directly from the trees to the evaporator house. Vacuum pumps facilitate the flow of the sap and reverse osmosis machines remove a portion of water before the sap is boiled. All of these measures have greatly improved the processing efficiency. To produce high quality syrup, the sap must be boiled down as soon as possible after it is taken from the tree. Consequently, it is common for sugar makers to be up all night boiling sap, especially if the "run" is strong. It generally takes 30 to 40 litres of sap to produce one litre of syrup. As soon as the buds begin to expand and open, however, the sap becomes off-flavoured or "buddy" and is no longer gathered.

Humans aren't the only ones interested in maple sap and syrup. Red squirrels have long known about the maple's sweet secret. If you visit a sugar bush, watch for signs of squirrel activity such as tiny incisions in the limbs, dripping sap or hanging "sapicles." Using their sharp incisors, squirrels will puncture the bark of maple branches to initiate a sap flow. They wait a day or so for the water in the sap to evaporate, and then return to eat the syrup.

INSECT ATTRACTION

On warm days, a sugar bush can also be a great place to observe insect activity. Flowing maple sap attracts a wide variety of insects including bees, ladybird beetles, three spotted sawfly moths (*Eupistia tristigmata*) and mourning cloak butterflies. Mourning cloaks can sometimes be seen lapping up sap oozing from the stumps of trees that have been cut down over the winter.

Birds, too, enjoy sap. The aptly named yellow-bellied sapsucker, a migratory woodpecker that arrives back in the Kawarthas in April, will often drill a series of horizontal, pit-like holes in the bark of maples, birches, hemlocks and other trees. The sapsuckers feed from the sap that seeps from the drillings and on the insects that are attracted to the sap. When early May rolls around, ruby-throated hummingbirds, too, will visit sapsucker holes for both sap and insects.

Unfortunately, there is a lot of concern for the future of the sugar maple.

The list of threats is long. First of all, sugar maples are more susceptible to pollution than other maples. These include air pollutants – many a result of acid rain – such as sulphur oxides, nitrogen oxides, chlorides, and fluorides. Over the past four decades, sugar maple abundance has declined in some regions of New England and southeastern Canada, due largely to acidification of calcium poor granitic soils such as those of the Canadian Shield. Sugar maple stands that grow in calcium-rich soils, like those of the southern Kawarthas, benefit from a natural buffer against soil acidification. However, recent research has now concluded that excess nitrogen from acid rain slows the microbial decay of dead maple leaves on the forest floor. This, in turn, results in a build-up of leaf litter that creates a physical barrier for maple seedling roots seeking soil nutrients.

NATURAL BARRIER

"The thickening of the forest floor has become a physical barrier for seedlings to reach mineral soil or to emerge from the extra litter," says ecologist Donald Zak, a professor at the University of Michigan School of Natural Resources and Environment and co-author of an article published online December 8, 2011, in the Journal of Applied Ecology. Salt, too, spells trouble. Decades of using de-icing salts on city streets and country roads have greatly reduced the sugar maple's role as an attractive road or street side tree.

Buckhorn MapleFest

There will be numerous maple syrup displays at the traditional sugarsub and throughout the community as well as a pancake breakfast, hay rides, music and pioneer activities like log cutting and tree tapping.

The event at McLean Berry Farm runs for three weekends: March 17/18, March 24-25 and March 31/April 1.

From Peterborough, drive north on Water St. (County Rd. 29) to Buckhorn Rd. (County Rd. 23). Continue north for 15 km. to Curve Lake Rd., turn right and drive one km. to the McLean sugarsub.

Along with the barrage of chemicals affecting the maples, we can also add the pressures brought to bear by a host of insect pests including gypsy moths, tent caterpillars and pear thrips. The spectre of a future Asian long-horned beetle invasion is also frightening. This species showed up in Toronto in 2003; however, thanks to aggressive control measures, it has not yet become widespread in North America.

Once insect pests or pollutants have weakened trees, their demise is often accelerated by severe windstorms and freezing rain events, both of which are becoming more common as our climate changes. Invasions of insect pests are themselves positively correlated to climate change, as is an increase in white-tailed deer populations. Deer love to eat sugar maple saplings. In a study published in May, 2011, in the Journal of Forest Ecology and Management, researchers from Michigan State University documented that in many places, the sugar maple saplings that should be thriving following harvesting of maple trees are instead ending up as a deer buffet.

TOO FEW COLD DAYS

Sugar maples require a "cold recharge period" – several weeks of below freezing temperatures – for the sap to convert the starch the tree has stored during the summer months to the sucrose that will power its budding in the spring. It is the sucrose that gives the tree's sap its sweetness. For the sap to flow from the trees, you need cycles of cold nights (so the sap freezes) and warm days.

However, over much of the northeastern United States, the sugar-tapping season is shrinking each year – in some places to as little as a week of appropriate temperatures. Some people already foresee a future where the sap, and the syrup it produces, barely flows.

"In the '50s and '60s, 80% of the world's maple syrup came from the U.S., and 20% came from Canada," said Barrett N. Rock, a professor of natural resources at the University of New Hampshire. "Today it's exactly the opposite. The climate that we used to have here in New England has moved north to the point where it's now in Quebec." To be fair, part of the reason so much production has moved northward is because of generous Quebec government programs to support the maple syrup industry in that province. Nevertheless, as the winter of 2011-2012 – and especially the last few days – has shown us, the climatic conditions that sugar maples and maple syrup production depend upon are no longer a sure thing.

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