



# The University of Vermont

## UVM TODAY

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### Remaking Maple

New method may revolutionize maple syrup industry

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*Last year, the value of Vermont maple syrup was more than \$26 million. UVM professors Abby van den Berg and Tim Perkins have revealed an invention that can yield vastly more syrup per acre than what producers currently get from the forest. It starts by cutting the top off a maple sapling. (Photo: Sally McCay)*

Four years ago, Tim Perkins and Abby van den Berg cut the top off a maple tree. As researchers at the University of Vermont's Proctor Maple Research Center, they wanted to learn more about sap flow.

Instead, they discovered an entirely new way to make maple syrup. "It's revolutionary in some ways," says Perkins.

Their new technique uses tightly spaced plantations of chest-high sugar-maple saplings. These could be single stems with a portion — or all — of the crown removed. Or they could be multiple-stemmed maples, where one stem per tree can be cut each year. Either way, the cut stem is covered with a sealed plastic bag. Under the bag, the sap flows out of the stump under vacuum pressure and into a tube. Voilà, huge quantities of sap.

In short, these plantations can allow maple syrup production in a farm field.

Typically, a traditional sugarbush produces about 40 gallons of maple syrup per acre of forest by tapping, perhaps, 80 mature trees. With this new method, the UVM researchers estimate that producers could get more than 400 gallons of syrup per acre drawing from about 6,000 saplings.

The new technique has the potential to enhance business for existing syrup producers, the researchers think, and defend Vermont's maple industry from threats that range from climate change to spiking land costs to Asian long-horned beetles.

### From the ground up

"We didn't set out to develop this system," says van den Berg. "We were looking at ways to improve vacuum systems." But, during a spring thaw, the tapped tree, from which they had removed the crown, just kept yielding sap under vacuum pressure. And more sap and more sap.

"We got to the point where we should have exhausted any water that was in the tree, but the moisture didn't drop," says Perkins. "The only explanation was that we were pulling water out of the ground, right up through and out the stem." In other words, the cut tree works like a sugar-filled straw stuck in the ground. To get the maple sugar stored in the trunk, just apply suction.

While the cut plantation saplings will regrow branches and leaves from side shoots — and can be used year after year — "the top of the tree is really immaterial for sap flow under vacuum-induced flow," Perkins says.

"Once we saw that we could get yields without tops it was — wow! — this changes the basic paradigm," says van den Berg. Large, mature trees are no longer needed to provide the sugar. "It became clear that we could deal with an entirely new framework," she says.

### Parallel production

Maple syrup production is a rich part of Vermont's working landscapes. Some people make it their full-time profession, using hundreds of acres and tens of thousands of taps. Others supplement farm income or other work with smaller sugaring operations. At all scales, maple syrup producers face increasing challenges.

One of the most pressing is the rising cost of land. "There is a great deal of expansion in Vermont's maple syrup industry right now, and forestland prices have gone up a lot," says Perkins. "This can help those producers who are at the stage where they can't afford to go out and buy a few million dollars worth of land to be a full-time producer." But they could add some acres of plantation production — for more syrup with less land.

"If you are using 10 acres of abandoned farmland or a regenerating forest that you already own, this technique makes a lot of sense," says van den Berg. With lower start-up costs, and quicker expansion (or contraction) of one's business, "it's another way to help us maintain the traditional working landscapes of Vermont," she says, letting people continue to make a living — and remain — on their land.

The researchers estimate that the cost of production using the plantation technique will be roughly the same as current methods. Though the sap yield per acre is much higher on a plantation than a forest, so, too, are the potential costs of equipment, labor and maintenance. "I think you're going to find sugarmakers who are doing both," says Perkins, "standard sugarbush and plantation."

### Coming threats

With climate change, this dual approach may become increasingly attractive — even a matter of business survival. "If this region is going to warm more — then with a plantation we don't have to rely as much on strong freeze/thaw cycles," to get sap flowing, Perkins says, "because these smaller trees freeze faster and thaw faster."

Any form of maple syrup production relies on freezing temperatures to transform starch in the wood into sugar. But in larger trees, it's much more important to generate sap pressure from a freeze/thaw cycle, van den Berg explains, than in a plantation system with small trees that can rely predominately on vacuum-assisted flow.

"The spirit of this work is to augment and help out existing producers," she says/ "With a semi-wild harvest you're always going to have limitations." One of which may be a deadly limitation in the form of an invasive pest. Though Asian long-horned beetles are not currently found in Vermont, they are infesting trees in Ohio, Massachusetts, New York and Ontario. They kill mature maple trees, and so federal and state officials have been vigorously cutting and burning any trees where the beetles are found. "This pest likes big trees," Perkins says, "they don't like saplings."

Jacques Couture, a maple syrup producer in Vermont's famed Northeast Kingdom, and chair of the Vermont Maple Sugarmakers Association, sees how this new technique might help producers be more nimble or recover from trouble. "One of the really interesting aspects (of the plantation approach) is the possibility to establish some maple syrup production in a much shorter time-span than is the current norm," he notes.

"If we had a natural disaster such as a widespread hurricane or some insect pest that would wipe out a large percentage of the maple stands," he says, "this might appeal to some who were affected as an alternative way of getting back into production sooner than the normal 40-plus years for trees to grow to tap-able size as we know it today." Plantation saplings could be ready in seven years.

Another potential advantage of agricultural-style maple plantations is, well — they're agricultural. "We can control the system much better by fertilization and irrigation," Perkins says. "One of the limiting factors on sap production in the spring is soil moisture. Typically we have enough in Vermont — but during years where it's a very dry winter we may not have enough," he says, and that hurts production.

### Unknown outcomes

Still, despite the potential for more predictable and profitable management of maple sugar operations that plantations might bring, much remains unknown about the implications of this research. "It's too early to make any predictions," says Eric Sorkin, a producer of organic maple syrup from Cambridge, Vt., who was briefed on the new project.

"Any time something comes along which fundamentally undermines the status quo, there will be clear winners and losers — and that is what this could be," he says. "This could lead to a fundamental shift in the way we make maple syrup, so certainly there will be people who benefit from it." But just who benefits is hard to say, and many other changes are afoot in the industry and the world that make the impact of plantations hard to foresee.

"I don't think there will be a sudden shift; the lifecycle doesn't permit it," Sorkin says. But if over the next 20, 30, 40 years, the plantation technique is combined with efforts to select seedlings with improved "sweetness" (that is, the amount of sugar they yield) or faster growth, this could give plantation syrup a distinct market advantage.

"If you can grow these sweet trees that have twice the sugar content, then your price of production drops in half," Perkins says. "In 20 or 40 years from now this method could be considerably less expensive than the standard methods used now."

For Sorkin, the future seems unclear. "If this leads maple syrup from a semi-wild crop to something farmed, plantation-style, I think that would be tremendously sad," he says. "And that would have implications for multi-generational operations and landscape-scale implications for the working forest in the Northeast. But that's a huge, huge 'if.'"

To date, the UVM researchers have made one presentation to a conference of maple syrup producers about their research and applied for a patent. Perkins will make another presentation this week. The new equipment needed for plantation syrup is not yet on the market. "This is research," van den Berg says, "and there's a lot more research to be done before we know what the implications of this research will be." It could be that plantations become the lifeline for multigenerational operations and allow small-scale and family landowners to retain ownership of working forests instead of going broke or selling them off for development. "This could prevent condos," says Perkins.

### Forest futures

The cultural mythology around maple syrup production is strong and deeply sentimental. Even brand-new books on the modern maple syrup industry have cover images of trees covered with metal buckets and plaid-shirted woodsmen toting sap behind horses and sleighs.

Except as tourist attractions and a kind of rural theatre, this method of producing syrup is mostly gone, having been displaced by efficient networks of plastic tubing, reverse osmosis devices that quickly remove water from sap, and vacuum pressure pumps to bring sap out of trees to storage tanks.

"Tubing was going to destroy the industry; reverse osmosis was going to destroy the industry; vacuum was going to destroy the maple industry. We've heard this again and again," says Tim Perkins. But the opposite is true, he says. "The maple industry is at the strongest it's ever been because of all these changes." Plantation maple syrup may be next.

"The natural progression of the industry is to look at more controlled ways of managing resources," says Sorkin. "Whether it's good or not, only time will tell."

For Perkins, the past of other Vermont forest businesses provide clues about possible futures. "Today, no one thinks at all about going to cut a Christmas tree in a tree plantation," he says. "But fifty or seventy years ago you didn't do that. You went to the woods. Nobody

planted Christmas trees. And then somebody said, 'well, it would be a lot easier if we planted Christmas trees' — and now the Christmas tree farm is our heritage."

"We don't know whether this will happen with maple," Perkins says, "but this new method is a tool for producing maple syrup that we didn't have before."

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BY JOSHUA E. BROWN



*A new sap collecting technique invented at the University of Vermont. It could work for maple—or walnut, birch, or even palm trees. (Photo: Sally McCay)*