Boiling it Down

by Winton Pitcoff

Collect More Sap *Without Vacuum Pumps*

Like most industries, the maple syrup industry has grown largely thanks to the introduction of new technologies. Reverse osmosis machines, vacuum pumps, high-efficiency evaporators and check valve spouts have all helped to increase production and quality while decreasing costs for sugar makers. However, recent research has found that a decidedly low-tech practice may help sugar makers make more syrup.

Tim Wilmot, University of Vermont Extension maple specialist, has been surveying sugar makers about their practices for more than a decade, and he took note of the growth in vacuum systems and developments in new pumps and releasers. "I became aware that there had been almost no research in recent decades on increasing sap yield for producers not using pumps," he says.

Vacuum pumps create negative pressure in tubing systems, essentially sucking the air out of the tubes and pulling the sap through them. Producers using vacuum systems typically collect a great deal more sap than those relying on gravity to bring sap from trees to collection tanks.

In gravity tubing systems, natural vacuum can build up as a result of the weight of the sap moving through the tubing. To make the vacuum more effective, that weight needs to increase. In trying to increase the effectiveness of gravity tubing systems, Wilmot experimented with tubing of different lengths and diameters, installing it at different grades, and even climbing ladders to set taps as high as possible (an admittedly impractical method for producers).

After a year of collecting data, Wilmot found that he was getting "spectacular" vacuum levels when using 3/16-inch-diameter tubing, instead of the typical 5/16-inch-diameter tubing, on a sloped system. By reducing the amount of room that sap had in the tubing by more than 60 percent, Wilmot found that there was less room for air, and the buildup of sap would fill the pipeline and move more quickly, creating greater vacuum at the trees. Even single droplines from trees to buckets using the narrower tubing resulted in better yields.

His early findings prompted a small grant from the North American Maple Syrup Council Research Fund, which allowed him to purchase more equipment and conduct side-by-side tests to compare production levels for the smaller tubing with traditional systems. "It seems counterintuitive that you would get more sap with smaller tubing," he acknowledges, but that's just what he found.

The smaller lines not only produce more sap than the larger ones, they also run longer because the vacuum holds for longer, since it takes less sap to fill the tubing. In addition, the sap moves so much faster than in a larger line that it arrives at the tank colder, keeping it fresh longer. Wilmot thinks that the speed of the sap also accounts for the fact that he hasn't seen clogging from wood chips or other debris.

The best vacuum pump systems can reliably produce 27 inches of vacuum, and Wilmot says that a properly installed gravity tubing system using 3/16-inch tubing can match that. Some sugar makers who use pumps have also tried using the smaller tubing and found that it helped boost their vacuum levels, Wilmot notes. While it's more difficult to find a leak in a gravity system than when using a pump, a vacuum gauge installed at the top of the line will help sugar makers locate problems, he says.

"One of the things this has done is help me to explain to producers using gravity the need to learn the same techniques as those using pumps," Wilmot says. "Even without a pump, this is a vacuum system, and sugar makers need to replace their spouts every year, be really diligent about finding leaks and cleaning tubing, and change their tubing periodically."

When is a gravity vacuum system not the right choice? Obviously, a slope is necessary for the sap to flow through the system, so flatlanders can't rely on these methods. It's also not good for producers who would rather not have to spend time in the woods during the season checking for leaks, since leaks can be harder to diagnose without a pump. And Wilmot says producers who have already invested in good systems that use pumps shouldn't necessarily tear everything out and switch to the smaller tubing.

Working with the smaller-diameter tubing posed some challenges at first, Wilmot says. Most tools are made for the larger tubing sizes, there were few fittings available for 3/16-inch tubing, and it does require a bit more support than the larger-diameter lines to keep it from sagging.

Even finding tubing was challenging initially, but after speaking to some maple equipment manufacturers, he convinced them to make a few rolls to help with his experiments. Thanks to the success of Wilmot's research and the growing interest from sugar makers, the 3/16-inch tubing is now readily available. Since more sugar makers have been using the smaller tubing and sharing their results with each other, the system is being refined, and fittings and other parts are becoming easier to find.

There are some side benefits to the smaller tubing as well. The rolls are lighter and easier to carry through the woods, for one, and the price is somewhat less expensive than the 5/16-inch tubing. Costs are also reduced because more taps can feed into each line, reducing the amount of costly mainline needed in a system.

Along with cost, Wilmot says the biggest benefit of natural vacuum on gravity systems is reliability—unlike pumps that use electricity or gasoline, "gravity never shuts down."

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