Check valve spouts with 3/16-inch tubing

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SUGARMAKER KRIS MARSH, owner of Country Roads Maple Glenville, W.V. during Mountain State Maple Days February 22. 90 people toured his sugar camp.

In June 2015 Tim Wilmot ("The prophet of 3/16") came south from the Proctor Maple Research Center to give a talk to The West Virginia Maple Syrup Producers Association on research he had been conducting on 3/16-tubing and its creation of a natural vacuum.

Tim's talk changed the trajectory of the maple industry in "The Mountain State of West Virginia."

The idea of developing a vacuum without a pump was immediately appealing to syrup makers where most of their trees are way beyond the last power pole.

And, the fact that all you really needed was slope (of which we have plenty) to get it going seemed too good to be true.

At that time, I was working with the Dry Fork Maple Works.

The Dry Fork was running a 5/16-inch tubing system with check valve (CV) spouts.

The efficacy of CV spouts in reducing the draw back of microbial laden sap into tap holes during freeze periods on 5/16 tubing has been shown in numerous studies by Proctor and Cornell.

With the proliferation of natural vacuum systems in West Virginia, we were interested to see if the same was true for 3/16?

Whereas in 5/16 tubing systems the droplines and laterals most often contain sap and gasses, in a tight 3/16-inch system the tube is most often full of sap from tap hole to mainline.

Research at Cornell has shown that sap in up to 12 feet of the line can be drawn back into the tree during freezing, negative pressure, periods. That is a lot of contaminated sap.

In addition to this draw back of sap into the tree, West Virginia is often subject to warm spells in the middle of the sap flow season.

Periods when daytime temperatures can reach the 70's.

The "double whammy" of the cyclic drawback of a normal sap flow event and the extended thaws prematurely dries up tap holes and ends the season.

In 2017 Leader Evaporator Co. began producing 5/16 CV spouts designed for 3/16-inch tubing.

Working with the West Virginia Department of Agriculture, and with Specialty Block Grant (16-SCBG-WV-002) funding, we decided to test the effectiveness of these new CV spouts against our "double whammy."

Study methodology:

Two parallel and adjacent ¾-inch mainlines were run up-slope through a uniform maple stand. Three-sixteenth inch laterals and drops were run, and 115 trees tapped into each mainline. Stand characteristics are shown in Figure 1.

Line A was tapped with Leader clear polycarbonate CV spouts and Line B was tapped with Leader clear polycarbonate non-CV spouts.

We limited the tapping intensity to one tap per tree. Both lines were metered, with cumulative sap flow readings taken as the season progressed.

It took us a while to get this experimental system set up and working properly, so we missed collecting data on the year's early runs.

Also, the X axis on Figure 2 below are not specific dates but observations taken at the same time on both lines from mid-February through to the end of the season in early April.

Study results:

Figure 2. Check valve spout study results

As seen in Figure 2, the first observation had each line producing virtually the same amount of sap. To our surprise, the second reading had the non-CV line (B) producing almost double the sap of the CV line (A).

It seemed as though either resistance from the check valve in the spout was inhibiting the flow, or the trees on line B were just way outproducing the trees on line A.

The sap flow associated with this second reading was at the beginning of one of our West Virginia sap season warm spells.

We did not have a freeze-up for the next 9 days, and 3 days in a row the daily high temperature rose to over 70 degrees F.

From observation 3 to observation 10, sap trickled in from both lines at pretty much the same rate, as shown by the parallel slope on both lines of Figure 2.

Following the warm spell, we returned to more typical sap season temperature fluctuations with freezing nights and warm days.

As you can see in Figure 2, the CV line responded to this good sugaring weather (observations 11-15) by increasing the rate of sap flow.

The non-CV line, on the other hand, continued its low flow rate with the slope of the accumulative sap flow line remaining constant through the end of the season.

By the end of the season the CV line had produced 37% more sap than the non-CV line.

The increased sap flow on the CV line following the warm spell indicates that the check valve spouts were effective in reducing the draw back of contaminated sap that leads to tap hole closure.

When pulling taps at the end of the season we found that 20% of the check valves were malfunctioning, but that they were always stuck in the open position.

So, by seasons end they were not limiting draw back, but they were also not in a position to inhibit sap flow.

To be successful, researchers and syrup producers in West Virginia and other southerly syrup producing regions are developing strategies for living with their climate, and especially for making it through those warm spells.

This study shows that CV spouts are effective on 3/16-inch tubing, giving us one more strategy to keep our sap flow season going.

Figure 1. DRY FORK RESEARCH AREA STAND CHARACTERISTICS

	Line "A"	Line "B"
	CV (check valve spouts)	Non - CV
No. of Trees	115	115
Mean Diameter at Breast Height	13.3 in.	13.5 in.
Total Basal Area	115 sq. ft.	118.9 sq. ft.
BA/Tree	1.00 sq. ft.	1.03 sq. ft.