Future Generations University

MAPLE INITIATIVE

Research, Learning, Action for Inclusive & Sustainable Change Worldwide

3/16 inch TUBING WITH CHECK VALVES TRIAL

2018

Conducted in partnership with the West Virginia Department of Agriculture

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In 2018 a research area was established at Dry Fork Maple Works. The designated area had been recently thinned, and two parallel mainlines were run up the hill from the Dry Fork sugarhouse. The mains were run up the hill instead of along the contour in order to integrate environmental and species changes that occur with elevation change. The plan was to experiment with different sap collection treatments using each mainline differently. As can be seen in figure 1, the forest stands on both lines were essentially the same.

In 2019, the Dry Fork Maple Works moved to new management and access to the site and the workers who were doing the meter reads to gather data on sap flow was lost. The sap collection system was then dismantled and reassembled at Experience Learning's Sweetwater farm, where it was used in the birch sap study.

One successful season of data was collected using the Dry Fork research area during the 2018 sap flow. 5/16-inch check valve (CV) spouts, sold by Leader Evaporator, have been on the market for quite some time. The 2018 season was the first year that 3/16-inch spouts were available. At the Dry Fork site, the effectiveness of 3/16-inch CV spouts in limiting drawback of contaminated sap into the tree was tested. Contaminated sap drawback causes a hastening of tap hole closure.

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.

BACKGROUND

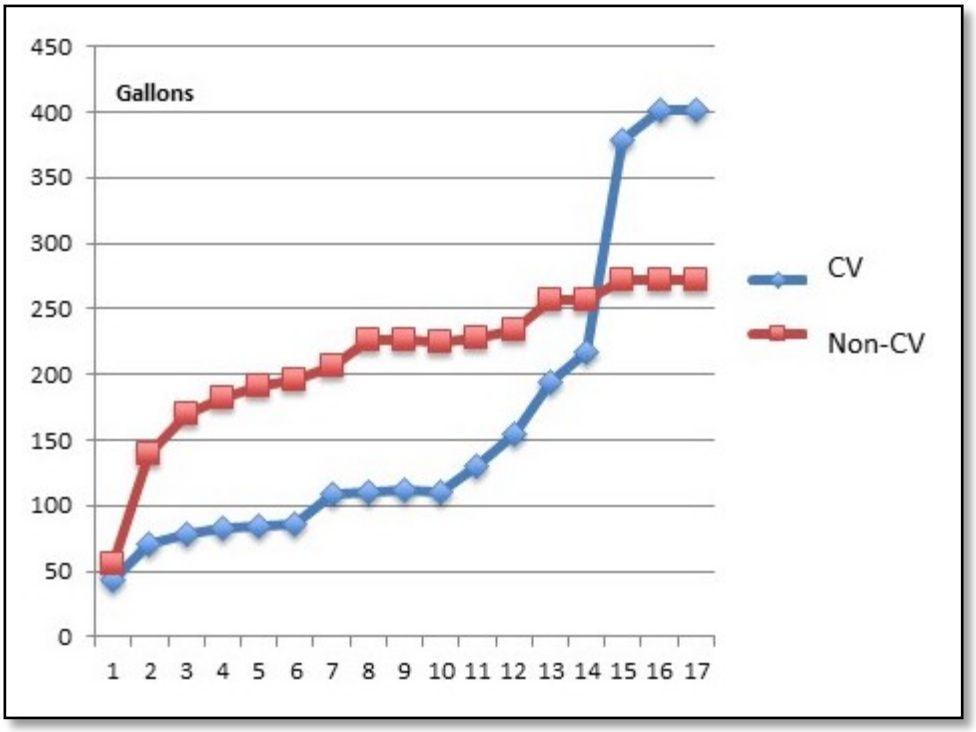
In a normal sap flow event, trees exude sap during the above freezing period and replenish that lost water by "sucking" it up from the roots during the below freezing period. If on a tubing system, during this negative pressure period they tend to draw sap back into the tree from the dropline. Sap, once it enters the droplines, is quickly contaminated with microbes. When they are drawn back into the tree, tap hole closure is initiated. The problem is compounded in 3/16-inch tubing because, unlike 5/16-inch tubing, the smaller diameter collection tube remains full of sap. A Cornell study found that up to 12 feet of sap in a 3/16-inch tube can be drawn back into the tree during this recharge time.

CV spouts are one proven method of limiting this drawback with 5/16 inch tubing. The question was: will they also be effective with 3/16-inch tubing that is full of sap?

STUDY RESULTS

Shown in figure 2 below.

Figure 2. Check valve spout study results



Sap flow in both lines was monitored with water meters. Each time the meters were read was a numbered observation. These readings were not taken at any specific time interval.

As can be seen in the first recorded observation, the meters read essentially the same. In the second observation the Non-CV more than doubled the production of the CV spouts. Initial thinking was that the check valve must be limiting sap flow. However, the next 8 observations show essentially the same flow in the two lines, as can be seen in the graph by the parallel lines. It is important to note, during this time, temperatures remained above freezing, reaching up to 70 degrees. Following this period, sap flow weather resumed with below freezing nights followed by thaws each day.

After the warm spell, and beginning with observation #10, the flow of the two lines differed dramatically. The CV line responded to the ideal sap flow weather by producing much more sap over the next 5 observations. The line without CV spouts continued to produce sap at the

same rate as during the less productive warm spell. This line never regained significant sap flow. By the end of the season, the CV line had produced 37% more sap than the non-CV line.

This difference is evidence that the check valves were effective in closing off the tap hole during times of negative pressure. The limited the amount of contaminated sap drawn back into the tree, because of the check valves, slowed the rate of tap hole closure and ultimately allowed more sap to be collected.

The Non-CV spouts allowed for sap drawback during the warm spell, initiating tap hole closure. When the ideal freeze/thaw cycles of sap flow weather returned, tap holes were not opened up enough to resume significant sap emission.

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