The University of Vermont PROCTOR PAGE

News from the University of Vermont Proctor Maple Research Center

# Should droplines be replaced when using check valve adapters or spouts?

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The Leader Check Valve Adapter (CVA) and Leader Clear Check Valve Spout (CVS) are designed to reduce the amount of sap backflow (sap movement back towards the taphole during pump shutdown, leaks, or releaser dumps).

Such backflow events in tubing systems not using CVA/CVS can move microbial contaminants in the tubing system back into the taphole, inducing the natural "walling off" wound response in trees, commonly known as "taphole drying." The result is reduced sap flows in the second half of the sap flow season, and lower sap yields.

In addition to using CVA or CVS, the use of new (seasonal) spouts annually, periodic replacement of droplines, and (perhaps) tubing and spout cleaning can also reduce the negative impacts of sap backflow. The effects of all of these practices on sap yield and net profits varies as a function of the gain in sap yield and the cost of implementing these strategies.

Although replacement of droplines (including spouts) will almost always result in the highest sap production, frequent dropline replacement is fairly costly, thus net profits can be lower than other approaches, or even be negative (a net loss) depending upon the circumstances. A prime example of this occurred in the 2012 season, when record high temperatures rendered most sanitation strategies considerably less effective.

A detailed analysis of timing of dropline replacement when using standard (non-Check Valve) spouts was presented in an earlier article (Perkins 2014, "How often should you replace droplines?", The Maple News, February 2014).

In general, a replacement interval of three (3) years produced good results, although the frequency of replacement can be shortened or lengthened depending upon sap yield, sap value, and drop cost.

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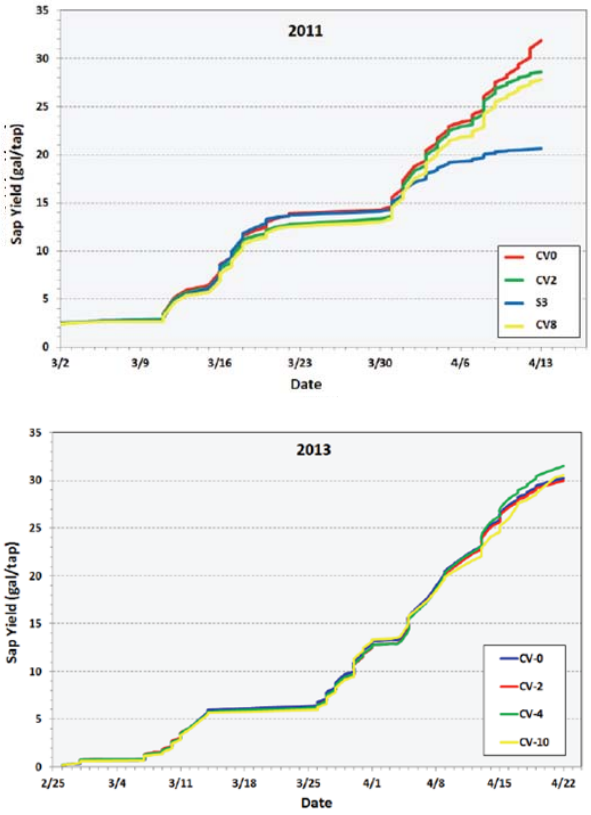


**Figure 1 (right).** Cumulative sap yield by dropline age for systems in 2011 (top) using the Leader Check Valve Adapter (CV) and regular spouts (S) on various ages of droplines and 2013 (bottom) using the Leader Clear Check Valve Spout (CV) with various ages of droplines. The age of the dropline is indicated by the number. 0 = new dropline, 2= two seasons use, etc.



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Since CVA and CVS can largely reduce or eliminate sap backflow and the associated problem of taphole drying, the question of whether, or how often to replace droplines when using this technology is frequently asked.

We have conducted a number of studies at the University of Vermont Proctor Maple Research Center over the past several years that speak to this question, but studies conducted during the sugaring seasons of 2011 and 2013 address this issue most directly.

The "Main Bush" of UVM PMRC is divided into four different sections serviced by their own tubing system. Each system is a dual-conductor system. All systems operate off the same Busch 1142, 5 HP, 3-phase vacuum pump operated by a variable frequency drive set at 26" Hg.

The pump is continuously operated for the entire season. All mainlines terminate in Bernard single or double-vertical releasers equipped with a wireless electronic counter system.

The sap volume per releaser dump is determined via annual calibration with water and a flowmeter with the system under vacuum. The number of counter dumps for each system is recorded once or twice each day that the sap runs, and is multiplied by the appropriate releaser calibration to determine daily sap flow.

All the mainline systems are tapped each season within a two-three day period in mid-February prior to the beginning of sap flow. Tapholes were drilled 1.5" deep (2011) or 2" deep (2013) with a Lapierre 5/16" bit. The experiment was aimed at examining the effect of dropline age on sap yield when CV adapters or spouts were used. In 2011, three of the systems had new Leader Check Valve Adapters installed.

Droplines were either new (CV0), in their second season of use (CV2), or in their eighth season of use (CV8). The fourth system had a standard 5/16" spout that had been in use for three seasons on a dropline that was also in the third season of use (S3). In 2013, the Leader Clear Check Valve Spout was used in all four systems on droplines that were either new (CV0), in the second season of use (CV2), in the fourth season of use (CV4), or in the tenth season of use (CV10).

Systems that had been previously used were cleaned after the first few seasons with air water, or were cleaned only by having sap sucked out by leaving the pump on when the spouts were pulled (dry-cleaning) in the latter few years of operation.

The results for the four dropline treatments in the two seasons are shown in Figure 1.

For the 2011 season, sap collection began in early-March and continued until April 13th. Sap yields for all three systems using CVA (average of 29.4 gal/tap) were significantly higher than for the system using the standard spout (20.6 gal/tap). Of the systems on new CVA, the sap yield for the system with new drops was marginally higher, with an average of 3.6 gal/tap more than the systems with droplines that were either 2 or 8 yrs old.

Thus at sap values in the range of $0.30-0.50, the use of a new drop would result in a gross profit of $1.08-1.80/tap. However, after factoring in the cost of the materials and labor for construction and installation of the drops, the net profit of using new drops ranges from negative $0.47 (a net loss) to positive $0.33/tap (a net gain). Clearly the expense of installing a new dropline when using new CVA does not result in a clear advantage.

In 2013, sap flow started on February 26th and continued intermittently until April 22nd. Total sap yield showed no significant difference due to dropline age, ranging from 30.0-31.5 gal/tap when CVS were used. Given the fact that the system with new droplines did not outperform the systems with older droplines when using CVS, the use of a new dropline resulted in a net loss of approximately $1.40/tap. Typically we would expect that sap yield on used droplines would be considerably lower if non-CVS were employed.

In a nearby study, we found that used and uncleaned droplines with used spouts produced nearly 30% less than droplines with CVS on the same pump. Used droplines with new, non-CVS spouts produced 13.5% less sap than the droplines with CVS under the same circumstances.

For this study, if CVS were not used, we would expect that the 2 yr-old droplines would have produced around 26 gal sap/tap if new, non-CVS were used, while the 10-yr old droplines would have produced about 20 gal sap/tap on new standard spouts.

As a result, we can conclude that changing droplines when using CVS does not improve sap yield, at least out to the maximum dropline age tested (10 yrs), but do pose a significant advantage over either used spouts or new spouts when employed on used droplines.

Therefore, the timing of dropline replacement when CV adapters or spouts are used depends more upon how well the tubing and fittings (other than spouts) are holding up than on the desire to increase sap yield.

If tubing is starting to break down, or tubing is pulling off fittings (due to plastic fatigue), then droplines should be replaced. The timing of this will vary considerably depending upon the quality of the dropline material, thus maple producers are advised to keep a close eye on any failures that happen in older 5/16" tubing system, particularly if they seem to be concentrated on a single cause.


**This material is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, through the Northeast Sustainable Agriculture Research and Education program under subaward number LNE13-326.**