2013 Maple Tubing Research

By Stephen Childs, NYS Maple Specialist

Sap stops running at the end of the maple season for one of two reasons: First, the weather no longer provides any more freeze thaw cycles necessary for sap flow. Second, the very small vessels in the wood in the tap hole become plugged with bacteria and yeast blocking the flow of sap. Since the second reason is the only variable the producer can control we continue to look for improvements in equipment and cleaning methods. In 2013 a variety of spout and tubing cleaning and replacement options were tested to determine the extent of sap yield changes that would result. Most of these tests were done at the Cornell Arnot Research Forest.

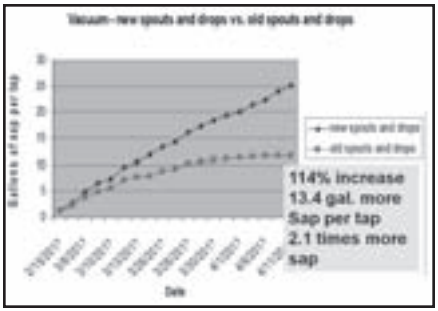
There seem to be two important means by which tap holes become contaminated with bacteria and yeast that a maple producer can provide some reasonable method of control. First, the spout that is driven into the freshly drilled taphole must be sanitary. Sanitary meaning that it is either new or has been completely sanitized with a chemical sanitizer, heat or other sanitizing action. Second, as the tree alternates between positive internal pressure when it is above freezing and negative (vacuum) internal pressure when it first drops below freezing, sap is sucked back into the tree through the spout and out of the tubing which if it has been in use for more than a season or two is often loaded with a population of bacteria and yeast. To avoid tap hole contamination due to this pulling of sap back into the tree either the back flow must be blocked as with a check valve or the inside of the spout and dropline must be sanitary. Sanitary tubing means new or having been sanitized with chemicals, heat or other method of cleaning. Below are photos of the pressure changes in a maple tree due to temperature changes. The first shows about 26 psi positive pressure when the temperature was above 40 degrees F the morning after a freeze. The second shows about 10 inches of vacuum developed in the tree during a period of freezing during the maple season.

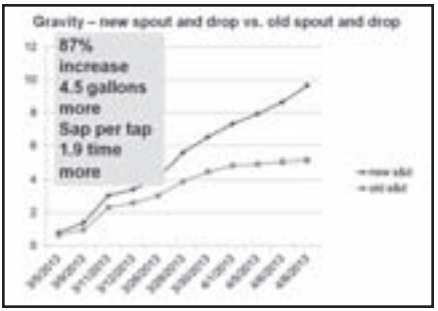
Picture 1

Picture 2

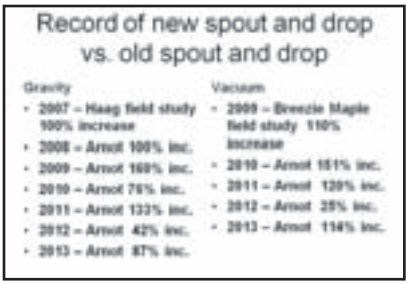
Study treatments except where noted were a direct comparison between a check and a described treatment each with three replications, each replication with 4 to 6 taps, both treatments in the same tree, spaced about 10 inches apart at the same elevation and same basic orientation. The check was usually represented by an old spout and old drop, having been used each season for at least 10 years or in a few cases by a new spout and new drop.

The 2013 season started early with our first measureable sap run occurring on February 15th followed by a long cool season lasting well into April. In the vacuum systems tests the vacuum level was consistently between 21" and 22" Hg. The standard test of comparing yield from a new spout and drop vs. an old spout and drop (used for at least ten years) was also used as a comparison this year. This test was conducted at between 21" and 22" of Hg and the old and new spouts were black plastic. In 2013 the new spout and drop produced about 25 gallons of sap per tap while the old spout and drop yielded about 12 gallons of sap per tap for an increase of 114% or 13.4 more gallons of sap per tap with the new spout and drop. The gravity system with the same test we didn't see measureable sap flow until March 5th. Here the new spout and drop yielded 87% or 4.5 more gallons of sap per tap than the old spout and drop.



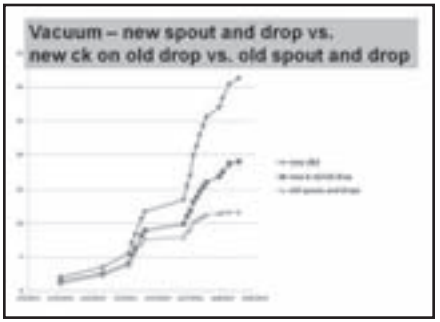


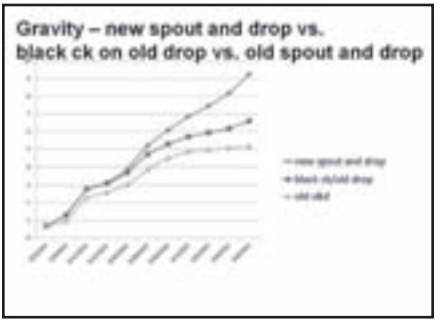
The chart below shows how these treatments have compared over the last 7 years of testing both on gravity and vacuum.



In 2013 several tests were conducted using check valve spouts. A new spout and drop was compared with a new check valve spout on an old drop (in use more than 10 continuous seasons) at the 21" to 22" Hg vacuum: new spouts were black plastic. Here the average yield of the new spout and drop was about 32 gallons of sap per tap and the check valve on the old drop yielded about 19

gallons of sap per tap for a difference of 65% or 12.4 gallons of sap per tap more with the new spout and drop. The new black check valve out-yielded the average old spout and drop in the same woods by 7 gallons of sap per tap for an increase of 63%. The results with the same treatments on gravity were simular. With the new spout and drop out performing the new check valve on an old drop by 35% and the new black check valve spout on an old drop out performing the average old spout and drop by 33%.



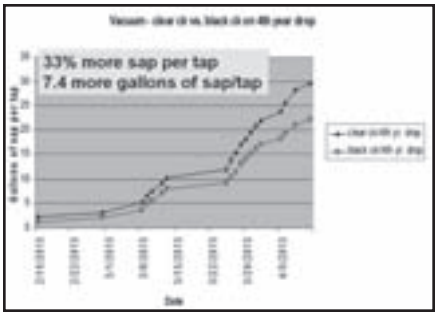


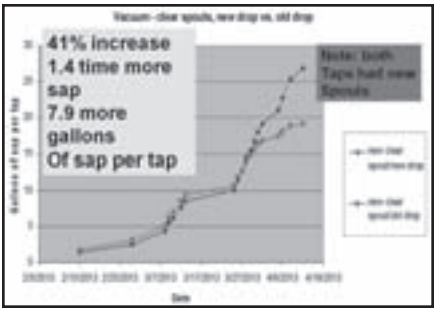
History of Check Valve Tests

- Vacuum
- 2013 65% increase
- 2012 20%
- 2011 101%
- 2010 114%

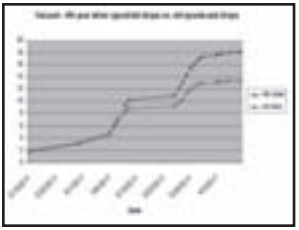
- Gravity
- 2013 33% increase
- 2012 18%
- 2011 77%
- 2010 47%
- 2009 43%

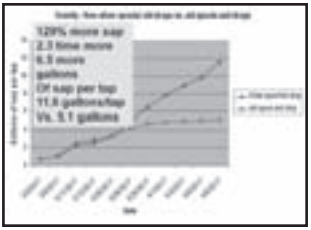
Also the new clear check valve was tested against new black check valves. In this test both new check valves were on fourth season drop lines. In this case the new clear check valve treatment outperformed the new black check valves by 33% yielding an average 7.4 more sap per tap. A new clear poly carbonate spout with new tubing was compared to a new clear poly carbonate spout on an old drop. In this test the new clear spout on a new drop out performed the new clear spout on an old drop by 41% or 7.9 more gallons of sap per tap.

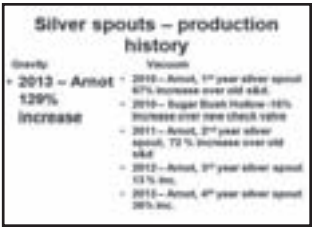




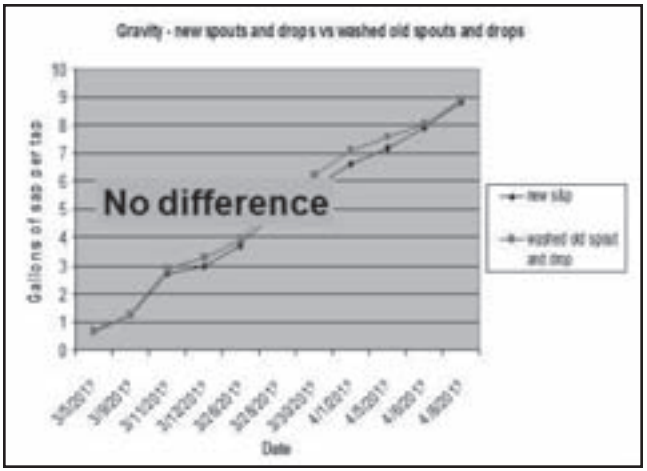
In 2013 fourth season silver spouts on old drops on vacuum were compared to old spouts and drops. The four year silver spouts still out performed old spouts and drops by 32% or 4.4 more gallons of sap per tap. In the gravity test the first year silver spouts on old drops out yielded old spouts and drops by 129% or 6.5 more gallons of sap per tap. The history of silver spout results is also posted below.





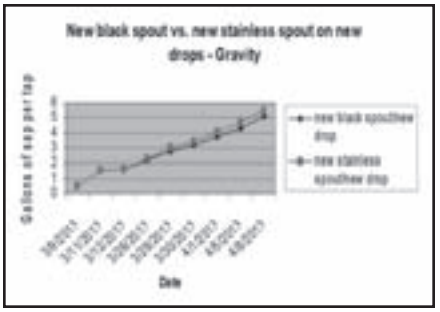


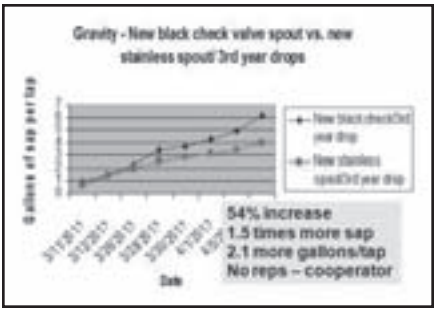
In 2013 a test was conducted to compare a new spout and drop with old tubing which had an extensive cleaning and sanitizing. Old spouts and drops had been in continuous use for 15+ years and they were washed first with detergent and water, rinsed, followed by 10 minutes of 10% chlorine treatment, rinsed and followed by a 20 minute, hydrogen peroxide treatment and finally rinsed and drained. Results showed washed old tubing preformed as well as the new spout and tubing with washed yielding 8.9 gallons of sap per tap, the new yielding 8.8 gallons sap per tap.



A couple of additional tests were conducted to evaluate stainless steel spouts. First new stainless spouts on new drops were compared with new black spouts on new drops. The result was no production difference. In another gravity test new black check valves were compared to new stainless steel spouts both on third year drops. In this case the new black check valves on third year drops out performed new stainless spouts on third year spouts by 54% or 2.1 more gallons of sap per tap. This test was conducted on a cooperator site and was not replicated.

Finally new stainless spouts on second year drops were compared to second year stainless spouts that had only been rinsed with water and not sanitized on second year drops. New spouts out performed unsanitized stainless spouts by





35% or 1.7 more gallons of sap per tap. This shows the value of a clean sanitary spout vs. a water rinsed used stainless spout.

In conclusion, these kinds of tests continue to show clearly that a variety of tap hole sanitation practices significantly increase sap production per tap. Each sanitation practice creates its own level of added investment and labor. Each producer must decide which practice if any fits that operation's production goals, available labor and available capital to add this value to their operation. Plans are to have more tests conducted in the 2014 maple season. Industry support for this kind of work is also welcome.