

Two Pipe Sap Ladder - A Promising Alternative

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BACKGROUND INFORMATION

The sap ladder technique of lifting sap has recently become a popular topic for many maple producers. A sap ladder is a simple, relatively inexpensive tubing system that lifts sap to a higher level of mainline without a significant loss of vacuum. The only requirement is that the tubing be on a vacuum system.

A sap ladder may allow vacuum to be introduced into portions of a bush where it would otherwise be ineffective or too costly. In some locations the need for additional pumping stations may be eliminated and remote areas may be accessed that were previously untapped. A sap ladder may also improve the effectiveness of tubing installations in areas where the bush is very flat or sloped slightly upwards towards the sugar camp.

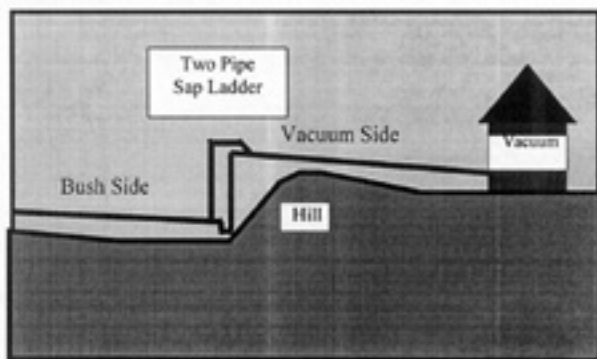


Diagram of 2 Pipe Sap Ladder Mainline Set Up

the bush is very flat or sloped slightly upwards towards the sugar camp.

The idea of the sap ladder has been around for a number of years with maple producers experimenting with various types of sap ladders in their own sugar bushes. A small-scale research project was initiated in Ontario in the spring of 2002 to learn more about the effectiveness of different types of sap ladders. This research will continue in the 2003 maple season. Data is collected during the maple season so that results will represent the functioning of the sap ladders in relation to true sap flow. The sap ladders tested in the research experiment were as follows:

1. Star Ladder - series of 6 way star manifolds with 5/16" lines for a vertical lift
2. Two Pipe - two lines, 1 1/4" in this experiment with a trap at bottom, as a vertical lift
3. Diffuser - single vertical piece of mainline with a smaller diameter line within (to separate air and sap) as a vertical lift
4. Booster - booster tank at lowest point, with two vertical pieces of mainline, one for sap and one for vacuum (basically type #2 but with a booster) for a vertical lift

These lifts were 8 feet high on a 1 1/4" mainline with approximately 1000 taps. Observations from the first year of the study indicated that the second option, the two pipe sap ladder, may have the most potential as an effective means of

lifting sap. The two pipe sap ladder will be discussed more fully in this information note.

STRUCTURE AND FUNCTION

A two pipe sap ladder consists of a structure of two vertical pipes connecting the lower and upper sections of mainline.



Two Pipe Sap Ladder

Preliminary observations on the functioning of the two pipe sap ladder, as seen in Figure 2, were made from the research in Ontario in 2002. It was initially thought that the sap would lift in the pipe on the vacuum side and that air would travel through the pipe on the bush side. Results were not as expected. The sap ladder appears to function by a pumping action generated within the two vertical lines. The pipe on the vacuum side of the lift initially fills about two thirds full with sap. This sap then exhibits a continuous pumping action, vigorously pushing sap up the other line. As the sap in the line closest to the vacuum rapidly falls to within about a foot of the bottom, sap is simultaneously pushed up the other line without falling back or churning. This process occurs rapidly and continuously. The turbulence of the pumping

action of the sap was much greater than expected.

Transfer of vacuum appeared to be effective because there was no vacuum loss between the upper and lower ends of the lift. The sap ladder worked effectively with vacuum at 14" of mercury but 18-20" would probably be ideal. Further testing is needed to determine a range of effective vacuum levels.

The mainline and the ladder itself were made of 1 1/4" line in the Ontario research installation. The most effective line diameter for a two pipe installation will depend on the diameter of the mainline and on the quantity of sap that must be lifted. A lift made of 1 1/4" line may be effective for around 500 to 1000 taps but definite parameters have not been established.

This sap ladder is unique in that it has a trap type bottom. It is not known if this design is necessary for the turbulence of action that was observed within the ladder. A two pipe sap ladder with a straight bottom will be included in research in the spring of 2003. It is not known what the height limit may be for this type of sap ladder. Further research is necessary to determine what height of a lift above 8 feet can be achieved effectively.

MATERIALS

A variety of materials can be used to build a two pipe sap ladder as long as the basic structure is maintained. Clear PVC piping was used in the research experiment so that it was possible to visually monitor sap action within the ladder. The disadvantages of clear PVC piping is that it is more expensive and more likely to break if sap were to freeze within it than traditional polyethylene mainline tubing. An advantage of using clear or coloured PVC piping is that the elbows and Y connectors may be glued to the piping, allowing for simple assembly. Polyethylene mainline tubing may be used with polyethylene or stainless steel connectors and hose clamps but the resulting structure may be less rigid.

For the two pipe installation (8 foot lift) used in the Ontario research installation the materials were as follows:

- 2 - hose clamps
- 23 feet of clear 1 1/4" PVC line
- 5 - 1 1/4" 90o elbow (PVC)
- 1 - 1 1/4" 45o elbow (PVC)
- 1 - 1 1/4" Tee (PVC)
- 2 - 1 1/4" adapter (poly)



Top Portion of Two Pipe Lift



Bottom Portion of Two Pipe Lift

A vacuum gauge may be included at each end of the sap ladder to monitor the effectiveness of vacuum transfer.

A valve at the bottom of the sap ladder would allow for the emptying of any remaining sap in the ladder, preventing possible breakage from sap freezing within. A vacuum valve would release sap in the absence of vacuum. The drawback of this type of valve is that sap will be lost at times when the sap is running but the vacuum is not on. Alternatively, a ball valve may be used which can be opened and closed as necessary.

RESEARCH

The research currently underway in Ontario is supported by the Ontario Ministry of Agriculture and Food (OMAF), the North America Maple Syrup Council (NAMSC), the Ontario Maple Syrup Producers Association (OMSPA), and Wheelers Maple Products.

The sap ladder research will continue in the 2003 maple season with

increased emphasis placed on the two pipe sap ladder. Follow up will be carried out to determine specific mechanics and limitations.

MORE INFORMATION

For more information on sap ladders or to contribute information from your own experiences, please contact:

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