

UPDATE ON THE MAPLE TUBING SANITATION RESEARCH IN ONTARIO

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In the Spring of 1998, a research project was initiated at the College d'Alfred sugar bush to develop alternative sanitation methods for maple producers using plastic tubing systems¹. The research project was continued in 1999 and will continue for a third season in Spring 2000. Although the results are only preliminary, the development of alternative sanitation methods that may reduce reliance on chlorine is looking very promising.

Plastic tubing systems are often used to minimize labor costs associated with collecting large volumes of sap on modern maple operations. They also reduce traffic in the sugar bush. But these advances in technology brought new challenges for producers in the area of sanitation.

Microbes Grow in Sap

Tubing collection systems may become so contaminated by microbes that the market value of the final products is affected. Even newly installed tubing systems may become loaded with microbial contamination. Some researchers think that the presence of a moderate population of bacteria and yeast may even be necessary to fully develop the maple flavor.

Very high levels of microbial contamination in the sap usually result in darker, stronger tasting syrup. Bacteria

may adhere to the inner surface of the tubing and surround themselves with polysaccharide gum which protects them from sanitation agents, making it more difficult to control their populations.

Sanitation Methods

When the weather warms up and the sap appears cloudy with high microbial loads, it may be necessary to perform a sanitation treatment **during** the season. Diluted chlorine bleach (500 ppm or 0.05%) is currently the only recommended sanitizing agent in Ontario for maple tubing systems. While it can help to maintain lighter grades, it may leave undesirable residues in the syrup as well as in the environment. To ensure a pure maple product, the first sap flow is often discarded after treatment. These limitations have made maple syrup producers seek more acceptable, yet efficient sanitation and cleaning methods.

The alternative sanitizers under consideration are hydrogen peroxide and strong acids. Hydrogen peroxide (H₂O₂) is essentially a water molecule with an extra oxygen atom that readily dissociates. Oxygen, a strong oxidizer, destroys the microbes and reduces organic matter, leaving no apparent residues (except that many products contain a stabilizer in very minute amounts). The mineral acids, on the other hand, must be rinsed carefully. The acid wash may lift some of the mineral deposits which harbor bacteria, provided the contact time is long enough.

¹Research at the College d'Alfred Looks at Solutions for Maple Tubing Contamination, Maple Digest 11A: 25-27.

To Sanitize Or To Clean

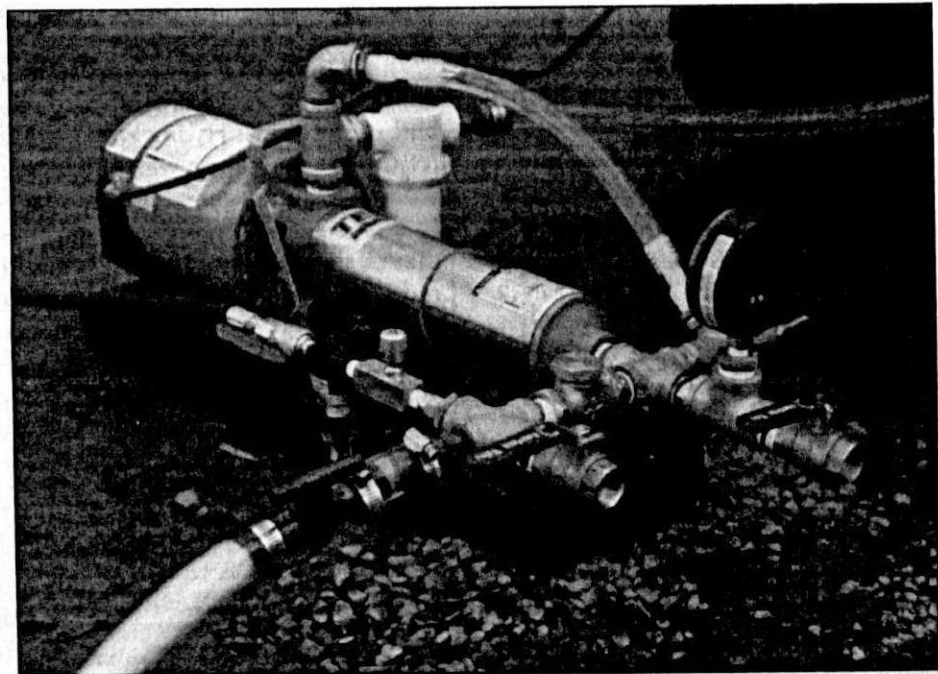
Sanitizing really means reducing excessive microbial loads. It is usually done during the season using diluted sanitizers and short contact times in the tubing. Cleaning of the tubing is more involved, as the aim is to remove the contaminants (the soil) that adhere to tubing inner walls, and would more likely be performed after the season has ended, using vigorous washing with compressed air and/or stronger chemicals, possibly combined with longer residence time in the tubing.

Some Highlights of the 1999 Season's Testing

During the 1999 maple season we performed three "in-season" sanitation treatments, using the same method as last year: a relatively short contact time in the tubing (10 min-

utes) and diluted sanitizers. The four sanitation methods evaluated during the season were: a water wash with compressed air (no chemical option), chlorine bleach at 500 ppm, hydrogen peroxide at 1000 ppm, and an acid wash (Tub-O-Net® at 0.4%). The three chemical sanitizers were used without compressed air. A 500 ppm chlorine dilution is obtained by diluting 1/2 L of 10% bleach in 100 L of water. Each treatment was immediately followed by a water rinse to ensure that no residues were left in the tubing.

In order to perform the water wash, a specialized tubing washer system was purchased from Mr. Glen Goodrich's Maple Farm in Vermont (see photo). Better control was obtained with the air-water pressure washer than last season. The turbulent water wash did act as a sanitizer by removing an excess microbial load,



and was as efficient as the chemical sanitizers.

That second season of testing confirmed the hypothesis that temperature during sap flow has a tremendous effect on maple sap microbiology. Since Spring 1999 in Eastern Ontario was warm with a few cool days, sap flows were slow and the sap heated up inside the tubing. High microbial loads resulted, mostly in the million bacteria per milliliter.

Recent research in Quebec has shown that good quality maple syrup may still be made out of sap containing up to 10,000,000 bacteria per milliliter, the microbes may become encrusted on the inside of the tubing and favor further contamination of sap. A lower contamination level would leave the tubing in a much cleaner state.

Despite weather conditions conducive to high microbial loads, all sanitation treatments (with a short 10 minutes contact time) were efficient in reducing the contamination levels. The reductions, ranging from 53% to 98%, were not as large as expected (99% wipe out). The aim was not to completely eliminate the microbial population (which is very difficult), but to keep them at a controllable level.

A taphole closure survey conducted during the summer also revealed that the lines treated with a chemical sanitizer seemed to have a more rapid closure than the line treated with just water. These are strictly preliminary results that need to be confirmed for a second season, as many other factors are at play.

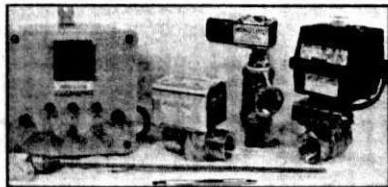
Conclusions

The 1999 results emphasized the effects of spring weather pattern on the

contamination levels of maple sap in tubing systems. These results must be confirmed by another year of testing in Spring 2000. Hopefully, we will have weather conditions that will allow to testing the sanitation methods over a range of more typical conditions. Further studies will look at longer contact time (30 min.) of the sanitation treatments in the tubing in order to achieve better control of microbial populations, despite unfavorable conditions.

This research project received support from the following organizations: Ontario Maple Syrup Producers Association, North American Maple Syrup Council, Agricultural Adaptation Council of Ontario, Eastern Ontario Model Forest Group, Ontario Ministry of Agriculture, Food and Rural Affairs and CDL Maple Sugaring Equipment, Inc.

The research reports are available from Mr. Dave Chapeskie, R.P.F., OMAFRA Provincial Agroforestry Specialist, (613) 258-8302.



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