Maple Cream Shelf Life Extension
SARE Project Number FNE02-449
Farmer /Grower Grant
Interim Report
February 22, 2003

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Note:

With this report I am requesting a five-month extension to the original grant completion date of February 2003. Reason for extension request is new found information might enable yet a more successful conclusion for our project in extending the shelf life of maple cream at room temperature. This report summarizes our results to date.

We have successfully completed one of our two goals, preventing mold, and our second goal of eliminating product separation is under accelerated shelf life testing currently with encouraging results to date.

Project Goals:

Pure maple cream, a maple syrup value-added product normally manufactured by small maple syrup farmers, has a shelf life of less than one month if stored at room temperature. The maple cream may mold and physically separate into its maple syrup component during this period. The current product requires refrigeration to achieve an acceptable shelf life of 6 months. This requirement significantly reduces marketability, distribution and availability of the product to the consumer. The storage and handling requirements also increase the final cost to the consumer. As a result, production, consumption and farmer profit is limited.

Our goal is to develop a process to attain 6 month shelf life at room temperature. One major limitation is that pure maple cream requires packaging at room temperature and therefore can be contaminated with microorganisms present in the environment. To limit the molding problem that occurs on the surface, we propose to evaluate packaging under UV exposure, adding calcium carbonate as a processing aid and flushing the headspace with nitrogen, carbon dioxide and steam. In addition, we will study the standardization of the maple syrup to optimal sugar composition prior to cream preparation in order to minimize the physical separation during the product shelf-life.

We will evaluate the various processes utilizing farmer capable equipment and applying accelerated shelf life testing techniques to prove one or more of the proposed preservation concepts.

Updated Farm Information:

Lyle Merle is a full time maple syrup farmer. He farms 400 acres of owned and rented sugarbush (sugar maple grove). Lyle's farm has been in the family for 75 years. Lyle has produced maple syrup for 40 years. He is also the secretary of the New York State Maple Producers Association

Chuck Winship is a part time maple syrup farmer. He farms 220 acres of which 110 acres are wood lot with sugarbush on 40 of those acres. The 2003 season will be the first for this particular woods. He has been producing maple syrup for 2 years. Chuck is the academic and legislative liaison for the New York State Maple Producers Association.

Both Lyle and Chuck are maple syrup retailers and derive a significant portion of their revenues from maple cream sales.

Cooperators and their roles in the project:

Dr. Randy Worobo

Microbiologist
Assistant Professor
NYS Ag. Exp. Station, West North Street, Geneva, NY 14456-0462

Dr. Worobo's role was to provide expertise and equipment to evaluate the various options for preventing mold growth in the maple cream product

Dr. Olga Padilla-Zakour

Director NE Center for Food Entrepreneurship, Assistant Professor of Food Processing
NYS Ag. Exp. Station, West North Street, Geneva, NY 14456-0462

Dr. Padilla-Zakour's role is to provide expertise and equipment to evaluate the various options to prevent product separation during room temperature storage.

What did we do:

To address the mold problem, various techniques were investigated that included:

1. Food preservatives (potassium sorbate)
2. Ultraviolet light decontamination of surface & closure
3. Flame sterilization of product surface
4. Steaming of headspace to create and anaerobic environment
5. Carbon dioxide headspace flushing
6. Nitrogen gas headspace flushing
7. Addition of sodium bicarbonate to generate a carbon dioxide headspace in the container

The incidence of mold spoilage in maple cream is relatively low and to more accurately assess the effectiveness of the various treatments, mold from spoiled maple cream samples was collected, cultured and used as an inoculum to the various maple creams treated with the various treatments. A consistent inoculum of vegetative mold was added to each of the treatments. As a control, maple cream prepared under the same conditions was inoculated with the same level of vegetative mold spores.

A total of ten 8 ounce containers was used for each treatment. The mold was added to the jar and mixed with sterile mixing tools and then the various treatments were applied. For the potassium sorbate treatment, the mold was added after the addition of the preservative. An initial level of the mold spores was determined by plating onto acidified Potato Dextrose Agar (pH 3.5). The samples were placed at 30°C and visually observed for mold growth on the surface without opening to avoid secondary contamination or destroying the treatment conditions. The incubation temperature is an accelerated shelf life study that results in a double of the actual holding time at room temperature (20°C). The samples were examined after 1 and 2 months of holding at 30°C. Observation of mold growth on the surface indicated a "positive" result and the number of positive mold samples for each treatment was recorded.

Initial studies with all the treatments clearly indicated that only potassium sorbate and carbon dioxide provided promising treatments to control the growth of mold. These two treatments were further investigated to determine effective control levels of potassium sorbate and longer carbon dioxide headspace flushing. Three different levels of potassium sorbate were used (250, 500 and 1000 ppm) with freshly prepared maple cream and subsequently inoculated with the same maple cream mold spoilage organism. The samples were then incubated at 30°C for 2 months which is equivalent to 4 months at room temperature. The results of this further study clearly indicated that carbon dioxide headspace flushing provided no protection against mold spoilage resulting in 100% spoilage of all samples. However, all levels of potassium sorbate (250, 500 & 1000 ppm) showed no evidence of mold spoilage for all maple cream samples. Since 250 ppm was the lowest level of potassium sorbate used in this study and showed no evidence of mold spoilage, lower levels may provide sufficient protection but this requires additional verification outside of the scope of this project. The maple cream samples containing the various levels of potassium sorbate were evaluated for their organoleptic qualities. No differences were noted in 250 or 500 ppm but an off-flavor was denoted with the 1000 ppm potassium sorbate maple cream samples.

To address the Separation into liquid upper layer and solid lower layer problem, various techniques were investigated that included:

We evaluated the use of the enzyme invertase to produce various concentrations of invert sugars in the maple syrup prior to cream making. The idea is to concentrate the syrup further to reduce the water activity below 0.7, providing a two-fold benefit: inhibiting the growth of molds due to the reduced water content and minimizing the physical separation of the cream. Concentrations of invert sugar from 5 to 50% were tested, with 5-10% found acceptable from the taste, appearance and color point of view. Our current test is a 10% invert sugar concentration of the final product after an exposure of pure maple syrup to an enzyme.

Results and Accomplishments:

Molding:
In summary, potassium sorbate even at low levels of 250 ppm was identified as a potential treatment to provide protection against mold spoilage that is associated with maple cream product.

Product separation:
After two weeks of accelerated shelf life testing we are experiencing no product separation.

Site Conditions that may have effected the results:

No positive or negative results were observed that could be attributed to our farms or the growing seasons for the maple syrup produced.

Economic Findings:

The addition of potassium sorbate will increase the cost of the product less than $0.05 per pound of finished product and does not require any unique equipment. The use of an enzyme to increase the invert sugar content cost is unknown exactly currently as we are still adjusting concentrations. Total cost is expected to be less than $0.10 per pound of finished product and will not require any equipment not already available on a typical maple syrup farm.

Next Steps and other findings:

The next step is to complete the current accelerated shelf life test on the high invert sugar maple cream samples. Assuming the successful completion of this test we will create a "how too" description for publication.

We are very encouraged with our results and believe we have determined the solutions to an age-old problem of short shelf life for pure maple cream.

Continued use of practices:

We fully intend to use our results to increase our sales of maple cream. No revisions planned except for marketing our shelf stable product.

Out reach program:

The results will be presented to the October 2004 N.Y.S. Maple Tour, the October 2004 International Maple Institute Conference, and the January, 2004 N.Y.S. Maple producers maple conference. The January 2004 Maple Syrup Digest will have a report

A Good Manufacturing Practices document for maple cream production will be written in a simple format for producers to use. The document will be available in electronic format to be downloaded or printed from a proper web site.

Respectfully submitted,
Chuck Winship
February 22, 2003