

# Silicone liner performance as a function of material

Published at the 2005 National Mastitis Council, 44th Annual Meeting, Orlando, FL.

## Abstract

Silicone milk liners have been on the market for a number of years, yet have often been slow milking and detrimental to teat end health. This study focused on the performance of a silicone milk liner in early development. The liner's milking performance as a function of flow and yield was measured over 3,000 milkings and then compared against competing brands. When used on a system with settings tailored to the liner, results of this study are contradictory to previous findings. The silicone liner consistently performs better than other most liners on the market and outperforms other silicone liners in terms of milk speed, yield and teat end health. Following 3,000 milkings, the silicone liner had less surface degradation than other liners, indicating that satisfactory milking performance can be achieved with a liner made of material that is longer lasting than other liners currently on the market.

## Introduction

The use of silicone in milking machine liners is becoming more prevalent in the dairy industry. Silicone is a food grade material often chosen due to its resistance to surface fissures that can house bacteria and because it absorbs substantially less butterfat than other materials. Some types of silicone are 3-A approved, a designation reserved for products with manufacturing processes and materials that meet exacting cleanability standards. In addition to the sanitary benefits, silicone blends absorb energy differently than organic liners, which helps combat performance changes as a result of age. Studying the performance of silicone liners will help determine how the physical benefits of silicone relate to dairy production.

## Objective

The objective of this study was to determine the performance characteristics of a silicone liner in the process of being developed. The liner is characterized by newer silicone using FDA approved ingredients for food contact. The liner shape is different than previous offerings, being round with external ribs in the normal open milking position and triangular in shape as it

collapses on the teat. The liner is equipped with a patented non-clogging vent located in the short milk tube of the liner.

## Material and Methods

Tests were conducted on two breeds of dairy cows (Holsteins and Jerseys) at the Lauren AgriSystems research facility near Berlin, Ohio. There was an average of 338 Holstein cows in the trial and 240 Jerseys. Milking was done in a double 12 Germaine® parlor equipped with S.A.E. Afikim® electronic meters. The operating vacuum at the pump was maintained at 13.9 inHg (inches of mercury) or 47.1 kPa at a pulsator rate of 60 pulses per minute and a pulsator ratio of 65:35, milk to rest.

## Analysis

Data on machine-on-time, yield, average flow and peak flow rate was collected daily for over 3,000 milkings with the silicone liner. Surfaces of the liner were observed under a scanning electron microscope (Hitachi® Model 2600 N) for roughness or cracks, at intervals of 500 milkings. The liners were measured for their Critical Collapsing Pressure Difference (CCPD) and their Touch Point Pressure Difference (TPPD) in a new and used condition with a Dwyer® mercury column. The data was analyzed using standard statistical analysis methods.



## Results

Performance characteristics are presented in Tables 1 and 2. The silicone liner is able to be used at least 3 times longer than a conventional liner. This results in lower cost per milking and fewer liner changes, which saves labor. Based on scanning electron micrograph data, the interior barrel surface of the liner remained smooth after 3,000 milkings. The CCPD of four liners averaged 2.0 inHg (6.77 kPa) when new and 1.4 inHg (4.74kPa) after being used for 3,000 milkings. The TPPD of four new liners averaged 9.9 inHg (33.52 kPa) and 7.6 inHg (25.73kPa) after being used for 3,000 milkings.

## Discussion

The performance of the silicone liner did not degrade over time as is reported with many liners. Milking performance indicators at 1000 milkings were almost identical to those at 3000 milkings with both breeds of cows tested. A smooth interior surface was also retained throughout the trial proving that cleanability would not suffer with aging. Cow comfort was reported as being favorable during the trial. The silicone liner is longer lasting than the traditional rubber liners and performance is steady throughout its lifespan. Cost savings and overall improved milking performance should be expected with its use.

**Table 1**

*Milking performance of a silicone liner after 1,000 milkings with two breeds.*

	Holsteins (N= 337)				Jerseys (N= 230)			
	Avg. <sup>1</sup> Flow	Peak <sup>1</sup> Flow	Yield <sup>2</sup>	Milking Time <sup>3</sup>	Avg. <sup>1</sup> Flow	Peak <sup>1</sup> Flow	Yield <sup>2</sup>	Milking Time <sup>3</sup>
<b>Lb</b>	5.88	9.56	28.07	4.71	5.07	8.24	21.78	4.27
<b>Kg</b>	2.67	4.34	12.73	4.71	2.30	3.74	9.88	4.27
<b>SE</b>	0.111	0.185	0.665	0.085	0.107	0.233	0.576	0.089

<sup>1</sup>Per minute    <sup>2</sup>Yield per milking    <sup>3</sup>Minutes per milking

**Table 2**

*Milking performance of a silicone liner after 3,000 milkings with two breeds.*

	Holsteins (N= 339)				Jerseys (N= 249)			
	Avg. <sup>1</sup> Flow	Peak <sup>1</sup> Flow	Yield <sup>2</sup>	Milking Time <sup>3</sup>	Avg. <sup>1</sup> Flow	Peak <sup>1</sup> Flow	Yield <sup>2</sup>	Milking Time <sup>3</sup>
<b>Lb</b>	6.14	9.86	29.697	4.87	4.97	7.68	21.19	4.26
<b>Kg</b>	2.79	4.47	13.47	4.87	2.25	3.48	9.61	4.26
<b>SE</b>	0.103	0.198	0.603	0.078	0.099	0.167	0.527	0.777

<sup>1</sup>Per minute    <sup>2</sup>Yield per milking    <sup>3</sup>Minutes per milking

## References

Boast, D., M. Hale, D. Turner, E. Hillerton, N. Middleton, and I. Ohnstad. 2003. Variation in the Rubber Chemistry and Dynamic Mechanical Properties as Liners Age. Proc. 100 Years with Liners and Pulsators in Machine Milking. pp. 65. International Dairy Federation. Bulletin #388/2004.

Hilerton, E., D. Boast, N. Middleton and I. Ohnstad. 2003. Changes in Milking-Liner Performance with Age. Proc. 100 Years with Liners and Pulsators in Machine Milking. pp. 35. International Dairy Federation. Bulletin #388/2004.

Nordegren, Sven-Ake, 1980. Cyclic vacuum fluctuations in milking machines. Dissertation, University of Hohenheim, Germany. pp 77.



*We are your milking partner.  
Contact us to learn more.*

