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How Is Your Milking Efficiency? Part 1

Ronald Erskine, DVM, PhD
Rhyannon Moore-Foster, DVM, PhD
College of Veterinary Medicine
Michigan State University

In order to reduce mastitis and maintain milk quality, producers need to maintain milking equipment in good working condition. Adequate effective reserve, consistent pulsation, replacement of liners, and proper system vacuum levels are important factors that lead to effective milking of cows. However, milking efficiency should be considered from two other perspectives, the amount of time the milking cluster is attached to the udder (unit on time) and the percent of unit on time that milk is flowing at or near maximum. When milk isn't flowing while the unit is attached, it is not only inefficient, but more importantly, damages the teat tissue, which may increase the risk of mastitis and decrease milk yield.

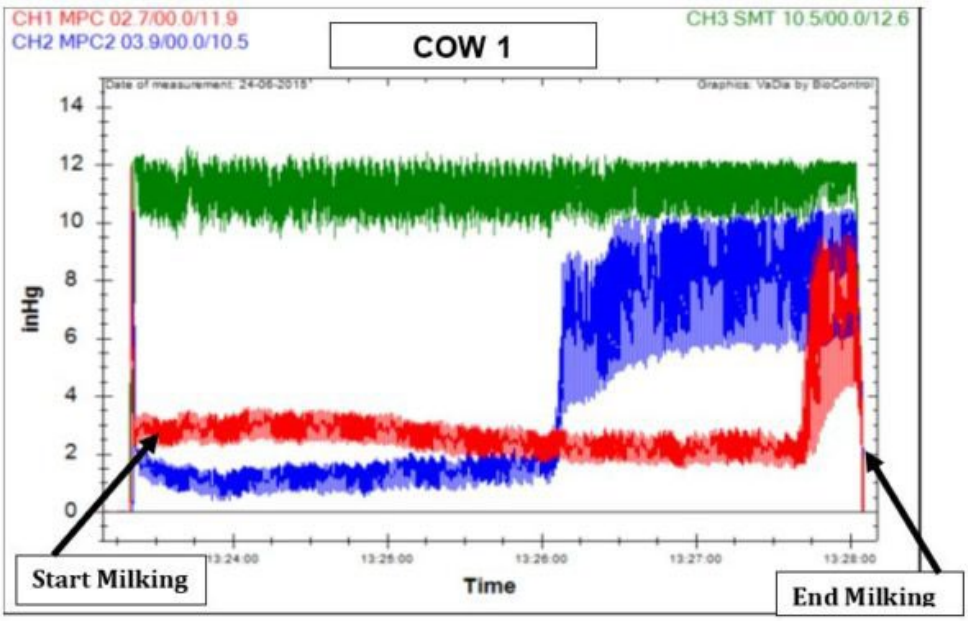
A large majority of dairy farms have their milking equipment evaluated and maintained on a routine basis. Although proper equipment function is necessary for milking efficiency, it does not necessarily guarantee it. Two management areas that could lead to poor milking efficiency are milking routines that don't achieve consistent milk letdown and overmilking. Either one of these problems can leave cows 'high and dry' for a period of time, and expose teats to high vacuum levels. In this article, we'll discuss the first of these issues, poor milk let down or what is commonly called bi-modal milking.

During stimulation of teats before milking, nerves carry an "electric signal" to the brain. On receiving the signal, the brain then releases oxytocin into the blood and then to the udder. It takes about 1 to 2 minutes for oxytocin levels to increase in blood to optimally contract muscle cells that surround the milk ducts, which then squeeze the milk down towards the teats. The two important points about this oxytocin release are enough stimulation (at least 10 seconds of actual physical touching) of the teats and the duration of the 'lag time', that is, the time interval between when teats are first stimulated until the cluster is attached. Unfortunately, with increasing herd size, the number of cows that can be milked through the parlor per hour, or parlor turnover rate, is often identified as one of the choke points of herd capacity. Thus, parlor efficiency is emphasized at the expense of milking efficiency.

How would you know if this is happening in your herd? One method is to measure milk flow with digital vacuum recorders (VaDia®, Biocontrol NA). VaDia units record vacuum in the mouthpiece chamber (at the opening of the liner) and in the cluster. VaDia units don't measure milk flow directly, but give us a qualitative snapshot on milk flow. A simple way to interpret VaDia results relative to milk flow is:
High Milk Flow = Low vacuum in the liner or cluster
Low Milk Flow = High vacuum in the liner or cluster.

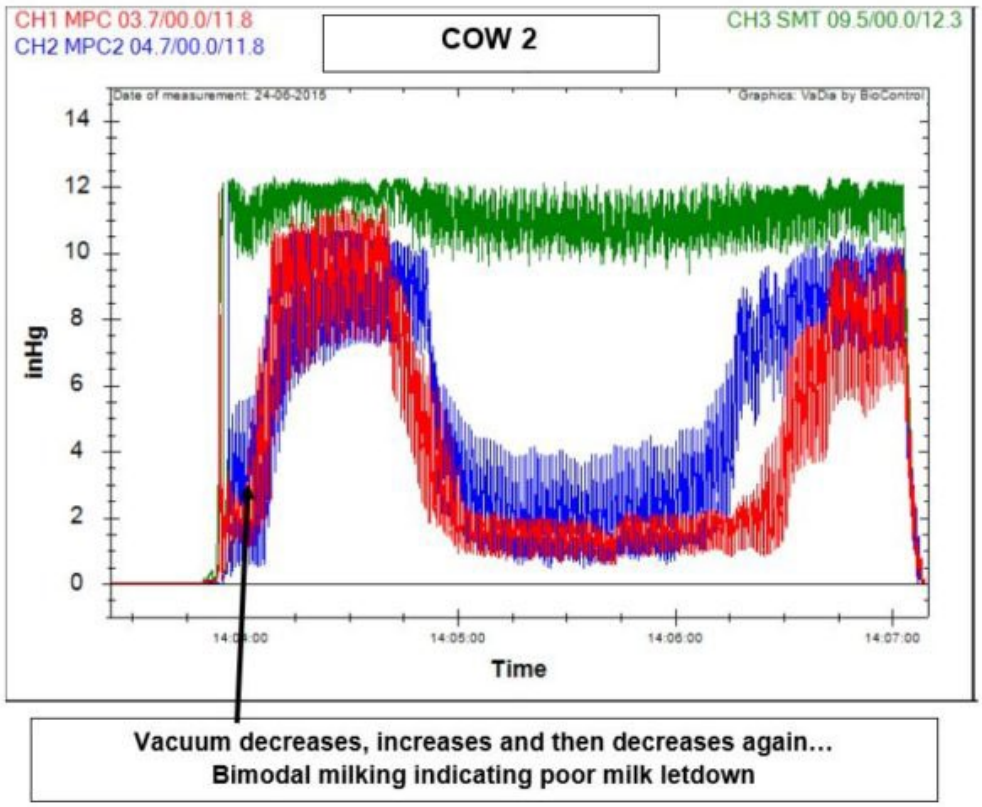
VaDia units can measure vacuum levels at four different places on the cluster simultaneously. We often measure vacuum in the mouthpiece of a front and rear liner, near the cluster and in a short pulsation tube.

In the example below, Cow 1 was ready to milk; the vacuum in the liner mouthpiece near the teat (red and blue lines) dropped quickly (less than 10 seconds after the unit was attached) and remained low until each teat was finished milking (the front quarter [blue line], finished before the rear quarter [red line]).



Vacuum (red line - rear teat; blue line – front teat) in liner mouthpiece drops to low level immediately after unit is attached. Cow was ready to milk!!!

What about Cow 2? Vacuum in the liner mouthpiece and cluster (green line) decreased, but then increased to near maximum levels, and finally decreased again. This cow was not ready to milk, milk flow was low for more than a minute after the milking unit was attached, signifying bimodal milk letdown.



So how does bimodal milking relate to milking efficiency? For cow 1, milk was flowing for about 4 minutes and 30 seconds of the total unit on time of 4 minutes and 45 seconds. Thus, the efficiency of this milking was 95%. For cow 2, milk was flowing for about 2 minutes of the total 3 minutes and 15 seconds the unit was attached, or a milking efficiency of about 60%. Why does this matter?

Recent research from Wisconsin found that when teats are subjected to high vacuum (as in the case for cow 2) blood is congested within the teat, the diameter of the teat canal decreases, which then decreases milk flow (Penry et al., 2018). This can be detrimental to the heath of the teat tissue and possibly impair both immune defenses of the teat as well as milk yield. In the case of cow 2, in order for all of her milk to be harvested during the milking, she would have had to compensate with a higher milk flow rate in a shorter duration of time, despite the anatomical changes to her teat during high vacuum, which is unlikely.
A proper premilking routine should result in at least 90% of cows with immediate milk let down after cluster attachment, and milk should be flowing 95% of the time while the cluster is attached. In a subsequent article, we will discuss the other problem that leads to poor milking efficiency, overmilking.

Penry, J. F., et al. 2018. A method for assessing liner performance during the peak milk flow period. J. Dairy Sci. 101:1-12.