Nutrition P+L+U+S

Volume 9, Issue 4 October 2012

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Robotic Milking Rewrites The Nutritional Playbook

The adoption of robotic milking systems in North America creates a new set of challenges for dairy nutritionists. In many cases, the now-traditional total mixed ration (TMR) has been replaced by the partial mixed ration (PMR), with the remainder of the ration supplied as concentrate in the milking stall.

Canadian consultant and researcher Jack Rodenburg with DairyLogix, Woodstock, Ontario, Canada, says feed is the key motivator to entice cows to enter the milking box several times a day. “Cows will happily enter the robot if they feel well; have good access and healthy feet; and receive a reward for doing so,” he explains.

Rodenburg, who advises dairies on barn design and general management support for robotic systems, says the goals of traditional dairy feeding typically include:

- Meeting the nutritional requirements of the cow in a way that ensures she is healthy.
- Maximizing milk — and sometimes milk component — production.
- Using feed ingredients that are economical.
- Using labor-efficient and cost-effective feed-delivery systems.

“With robotic milking, there is a very important fifth goal: enticing the cow to visit the robotic milking stall regularly and frequently,” he advises.

There are two general approaches to feed rewards in robotic systems: forced traffic or voluntary milking/free traffic. Forced traffic relies on a variety of configurations of one-way gates that separate the resting area from the feeding area, with a trip through the robot as a requirement — either before or after feeding. This strategy can utilize a standard TMR, and has been shown to have lower “fetch rates,” or the need to retrieve cows that do not use the robot. On the other hand, it can lead to longer wait times, reduced number of meals, reduced feed intake and reduced resting time.

Voluntary or free traffic systems allow the cow to access feeding and resting areas with no restriction. Such systems promote more trips through the robot, and subsequently more frequent meals, higher milk production, improved udder health, better hoof health and longer resting periods in well-managed herds. The biggest downside is a higher fetch rate for cows that don’t enter frequently enough.

While he acknowledges that both systems can work with very well with good management, Rodenburg prefers free traffic systems. “When things go less than perfect, forced traffic COWS pay the price, in terms of fewer meals, longer standing time, and subsequent complications with acidosis and laminitis. On the other hand, free traffic FARMERS pay the price, because they physically have to fetch cows,” he explains. “I think problems are addressed more quickly when people are inconvenienced versus cows.” Plus, reasons free-traffic cows are not using the robot — which may be health-related — can be more quickly identified when someone has to personally seek them out.

The other, important upside to free-traffic systems is the ability to feed cows individually, via programming of concentrate quantities delivered by the robot. While this capability delivers complexities of its own, Rodenburg says it has tremendous value in terms of both cow performance and feed cost control.

He recommends a highly palatable, pelleted feed for delivery of concentrate — including cow-friendly ingredients such as molasses, beet pulp, brewer’s grains, distiller’s grains, corn, soybean hulls or meal, and animal-vegetable fat blend. Less palatable (and not recommended) ingredients are fish meal, blood meal, and tallow. Pellet strength also is important, so that fines are not refused and left in the robotic feeders. During start-up and transition to robotic systems, Rodenburg advises top-dressing pellets on the bulk ration for eight to 12 weeks beforehand to acclimate cows to their taste and texture. Typical eating rate for pelleted concentrates is 0.45 to 0.65 pounds per minute. Because cows spend six to eight minutes in the stall per milking, maximum concentrate fed during milking is 2.5 to 3.5 pounds or 7.5 to 10.5 pounds per day for cows visiting three times a day. The protein and energy supplied in the concentrate is then commensurately removed from the bulk PMR fed free-choice. Focusing on adequate effective fiber in the PMR also is advised to promote active cows.

The ability to feed cows as individuals was one of the factors that have made robotic systems attractive to Chad Kieffer, nutritionist with Purina Animal Nutrition based in Utica, Minn. Kieffer’s family dairy uses a robotic system to milk their 300-cow herd. He consults with other herds that have adopted them, and more that have interest in switching to robots.

“Feeding in a robotic system allows you to reward the cows that need it, and feed cows what they deserve,” says Kieffer. “At the same time, you save feed expenses by not overfeeding the lower end of the herd.” Since completing the full transition to robots earlier this year, Kieffer’s herd has reduced labor requirements by 40 percent and lowered herd SCC from 300,000 to 200,000 cells/mL. At the same time, cows have nearly returned to their pre-robotic milk production levels of about 90 pounds per cow per day.

Rodenburg says he only sees more progress in the ability to precisely manage cows using robotic systems in the future. New software will soon allow for more targeted feed allocation to individual cows based on grain and milk prices, along with each cow’s current milk production

and composition. Daily recording of bodyweight and concentrate consumption will make individual-cow feeding even more accurate.

“Robotic milking his here to stay,” says Rodenburg. “With it comes a whole new host of challenges and opportunities to feed cows to the best of our — and their — abilities.”

CONSULTANT'S CORNER

Lessons From Feeding Cows In Robotic Systems

By Chad Kieffer, Purina Animal Nutrition LLC, Utica, Minn.

I have been working with herds using robotic milking systems for about two years, and last year we made the first installation of robots at our 300-cow family dairy. We installed our fourth and fifth robots this year to complete the full conversion of our milking system. Along the way, I’ve learned some valuable lessons about the nutritional and behavioral differences of managing cows in these systems, including:

1. **Palatability is key.** Motivation for a cow to visit the robot is usually not due to the pressure of her udder, but the want and need for concentrate. We have found that pelleted feed in the robots works the best in terms of desirability and ease of delivery. I have seen some systems in Canada that successfully use high-moisture corn — although this is a little riskier approach in terms of handling, feeding thru the robot and keeping fresh

2. **Ration formulation is different.** Compared to traditional, parlor-milked herds, feeding robotic-milked herds starts with an approach more similar to component-feeding/top dress herds. Setting up a proper feed table is based on milk increments. First, I balance the PMR for 15 to 20 lbs. of milk under what is currently the herd’s tank average, and make up the rest in concentrate supplied by the robot. Then, the feed table is set up based on DIM and milk production. This varies based on the herd and can be adjusted as needed.

3. **Feed costs are roughly equal.** High-producing cows can cost more in the robot because we are feeding them for exactly what they require. But there is a savings on lower-producing, later-lactation cows, who do not receive as much feed in the robot. As a whole, feed costs balance out, and usually are on par with the feed investment of parlor-milked herds. With the use of Dynamic Feeding in the robot we will be able to reduce the ration cost even more and make it more economically appealing in the future.

4. **Feeding is more tailored to every animal.** My experience has been that cows fed in robotic systems return to positive energy balance more quickly after calving because they receive a diet that precisely addresses their individual wants and nutritional needs. Likewise, there are fewer overconditioned, late-lactation cows. This translates into a host of benefits, including fewer metabolic problems, less dystocia and improved fertility.

5. **Cows in robotic systems get more rest.** Because they are not standing in holding areas for several hours a day or traveling long distances to and from the parlor, robotic-milked cows have more time to rest and eat the PMR. While we need more hard data in this area, I estimate that the robotic-milked cows in my own herd and those of my clients spend an additional two to three hours a day lying and resting compared to traditional parlor herds.

6. **Aim for one refusal per cow per day.** Cows should enter the robot slightly more often than necessary, with one extra trip per day as the goal. If they are refused any more frequently than this, they are likely not receiving enough energy in the PMR. Any less is an indication of too much energy in the PMR, a cow-comfort issue, or some other issue.

MATERNITY PEN

Is Lameness A Transition Cow Disease?

Lameness is a serious health and welfare concern for dairy cows in all stages of lactation. But a growing body of evidence suggests that the transition period may be a “trigger phase” for lameness.

Kathryn Proudfoot, researcher at the University of British Columbia, cites the following factors that could make the transition period critical to hoof health:

- Physiological changes during transition that reduce the resiliency of the hoof.
- The timing of the progression of some hoof conditions is consistent with the transition period. For example, most claw horn lesions occur in the few months after calving, but there are a few months between the time a claw horn lesion starts to develop and the time it appears on the hoof, suggesting that it likely began near the transition period.
- Behavior during the transition period can predict lameness later in lactation. Proudfoot and her colleagues found that cows diagnosed with claw horn lesions seven to 15 weeks after calving spent more time standing and “perching” in their stalls during the two weeks prior to calving, compared to cows that did not experience lesions (see Figure 1). They theorize that standing behavior can compound physiological changes in the hoof that occur around the time of parturition.

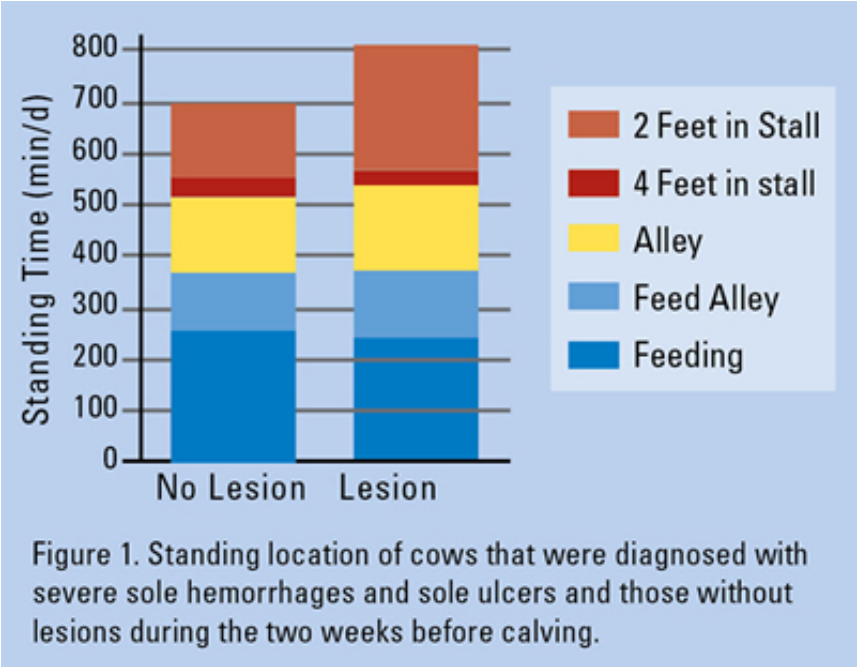

Figure 1. Standing location of cows that were diagnosed with severe sole hemorrhages and sole ulcers and those without lesions during the two weeks before calving.

BEYOND BYPASS

Keys To Amino Acid Balancing

Balancing for amino acids can be a daunting task for dairy nutritionists, and one that often is ultimately deemed to be unrewarding. Robert Patton, PhD, consulting nutritionist with Nittany Dairy Nutrition, Mifflinburg, Pa., says nutritionists often become frustrated when working with amino acids because they see limited-to-no results from the exercise. “There are a number of intricacies that can affect the outcome of amino acid balancing,” says Patton. “Just trying it once or twice and saying it doesn’t work is not sufficient. The practice does have value, but proper implementation is crucial.”

One of the critical components to amino acid balancing is measuring dry matter intake (DMI) in each group of cows. Without that information, it is impossible to accurately balance for amino acids in the entire herd, says Patton. “The ‘one-group TMR’ approach defeats the purpose of balancing for amino acids,” he states. “Those rations are formulated for high-producing cows, which typically make up 15 to 20 percent of the herd. That high-end group will respond to amino acid balancing. But the rest of the herd is essentially overfed, and this majority of cows will dilute the impact of amino acid balancing and drag down feed efficiency.”

He suggests the three situations in which amino acid balancing has real value are:

- In reducing protein consumption and subsequently feed costs.
- Balancing fresh-cow diets, both to minimize body condition loss and to increase milk production.
- To increase milk protein.

Amino acid balancing is possible using all three of the most widely used dairy nutrition models (AminoCow, CPM and NRC). But, Patton says, it is not a straightforward process, and there are details in each program that must be mastered to achieve optimal results. Extra calculations may be required. “Pick the model with which you are most comfortable and learn to use it to achieve the results you are expecting,” Patton advises. “Investment of your time and study to understand the complexities of amino acid balancing will be rewarding to both you and your dairy clients.”

Read more of Patton’s insights on amino acid balancing.

QUALITY CORNER

Rumen Protected (RP) Lysine Products For Balancing Amino Acids

When we think about balancing amino acids in diets of lactating dairy cow, we first and foremost think of the amounts and ratio of lysine and methionine in the predicted metabolizable protein supply. Both of these amino acids are now commercially available in various “protected” forms.

The methionine products have been in use for considerably longer than the lysine products, and this has allowed scientists and nutritionists some time to get a better handle on which products work under which circumstances, and what to look for in terms of response. For the lysine products, it looks as if the learning curve is still fairly steep. The quality of a RP lysine product could be considered to be its ability to withstand the rigors of feed mixing and delivery, as well as the environment in the rumen (that’s the purpose of the supposed “rumen

protection"), and still deliver a measurable response in terms of cow performance. Research at the Miner Institute in Chazy, N.Y., presented by Ji et al. at the 2012 ADSA Joint Annual Meeting, detailed marked differences between commercial RP lysine products. For some products, as much as 50 percent of the lysine was released from its "protection" in a short period of time, just by sitting statically in contact with a TMR. Furthermore, some products only retained a small portion of their protective characteristic after just a short exposure to a rumen environment. Differences such as these will eventually sort themselves out through more research, and more importantly, through more evaluation of the products on the farm.

HAPPENINGS

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