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Notes From the World Dairy Expo

Within my role as the Extension dairy specialist, I had the opportunity to attend this year’s World Dairy Expo in Madison, Wis. Beyond seeing the latest in equipment for all aspects of the dairy farm and some outstanding cows, heifers and calves in the show ring, one of the most interesting activities was the virtual farm tours. These tours featured the Cinnamon Ridge Farm from Donahue, Iowa, and Drumgoon Dairy from Lake Norden, S.D. Each of these tours offered different insights on the direction in which the United States dairy industry is headed and the challenges it faces.

Cinnamon Ridge is a sixth generation dairy farm in Eastern Iowa, run by the Maxwell family. This farm was an interesting example of what a dairy farm could be for multiple reasons. First, it is a diverse operation. In addition to the 260-cow dairy operation, their site is home to a 10,000-head swine operation, a beef cow and embryo operation, egg production, cheese plant, restaurant, retail store and event center. Despite the farm’s diversity, the real reason that they were featured was their embrace of robotic technologies for their milking herd. They included both robotic milkers and feed push-up, which according to the Maxwells, work in conjunction and this interpersonal dynamic is key to the success of the robotic approach. The routine push-up of feed throughout the night stimulates dry matter intake, which in turn encourages the cows to visit the robotic milker following a nighttime meal. This process increases the total number of daily visits to the robot from each cow, resulting in a more effective use of the robot throughout the day.

Increased visits to the milker on a per cow basis also helps to increase the herd’s rolling average (currently around 21,000 pounds) and moves the Maxwells closer to their goal of having the top Jersey herd in the U.S. In addition to taking advantage of the relationship between automatic feed push-up, frequency of milking and milk production, they also shared that the benefit of this arrangement led to a calmer herd that was easier to work with. The suspected reason for this outcome was the elimination of the need to push cows into the milking parlor twice daily.

The last aspect of robotic milking that cannot be overlooked was that they have eliminated the need for employees to cover the milking shifts and the variety of problems and challenges that go along with that. Beyond these gains in production and labor, the one factor that makes this farm’s incorporation of technology an interesting example to consider is the role that the utilization had in keeping the next generation on the farm. The Maxwells' older daughter returned to the farm following college and now runs the dairy operation. The younger daughter also expressed a desire to come back to the operation following college as well. Further information on this farm can be found at http://www.tourmyfarm.com.

Drumgoon Dairy Farm is owned and operated by the Elliot family. This farm is unique for two reasons. First, the Elliots relocated their dairy operation from Northern Ireland to South Dakota in 2006. This not only involved moving across the Atlantic Ocean to the middle of America but also shifting from managing a small pasture-based operation of around 120 cows to a TMR-based dairy, using primarily purchased feeds, of around 2,000 cows. This transition has gone smoothly, as they were in the process of expanding to 3,000 milking cows. The primary motivator for their move was that regulations and land prices made expanding their Northern Ireland operation impossible. Their story reveals two conclusions. First, despite the recent challenges with feed costs and milk prices, the U.S.

remains an attractive place to dairy farm. Second, more states might need to consider South Dakota's programs for actively recruiting dairy farmers from abroad as a means to increase their farm numbers. This approach can help keep farm numbers on the increase, making the region an attractive place to conduct business for all of the supporting industries that dairy farms rely on. Mr. Elliot believes that his farm is in a way a very large hotel within which his clientele (i.e., his cows) rent space. Each cow needs to be evaluated to make sure that they are paying their way, and, if not, then they may need to move into a new career. He also acknowledges that a high culling rate is not sustainable over the long run, so if too many cows are not truly "paying" their way then he needs to figure out why.

In conclusion, there is a lot that can be gained from a variety of sources at the World Dairy Expo. I would encourage everyone involved in dairy farming to try to make it up to Madison at least once to participate.

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Winter Considerations for Reducing Stable Fly Populations

Although fly season ends in October, it is never too early to start thinking about stable fly and other pest fly control on dairy farms. In fact, using proactive measures during fall and winter months can make your job easier and less costly when controlling stable fly populations, especially because overwintering stable fly populations can lead to higher fly pressure the following spring.

About Stable Flies

The stable fly is one of the most significant pests that is attracted to dairy cattle in the United States. Stable flies require a blood source (for protein) and can be identified when biting cattle with a long proboscis parallel to hair growth on the animal's lower legs. Accumulated bites on cattle can cause decreased feed efficiency and milk production. Stable fly feeding causes cattle to kick, stomp and swish their tails in an attempt to dislodge the flies. Cattle may begin to show decreased production when there are as few as 10 flies per cow.

The stable fly life cycle includes egg, larva, pupa and adult. Stable fly breeding takes place in old manure, especially when it is mixed with decaying organic material such as spilled feed or hay. The entire stable fly life cycle from egg to adult takes about three weeks, and adult stable flies live around 20 to 30 days. Both male and female flies feed on blood, and a female can lay 200 to 400 eggs in her lifetime. Adult stable fly populations in Tennessee usually peak from March through May with a second smaller peak from August through October. In confinement facilities, stable flies remain active throughout the winter periods. It is possible that larvae persist during these winter months, then pupate and emerge in the spring as temperatures increase. Stable flies develop in old manure in protected areas of the barn, such as under fence lines, near water sources, or in flush lanes in freestall barns, rotting or spilled straw, haylage, and silage as well as in sites previously used for round bale feeding.

Adult stable fly (photo credit: Dave Paulsen)

Controlling Stable Flies in Winter Months

Control efforts are often focused during stable fly peak activity (late spring through fall); however, taking a proactive approach during nonpeak activity (fall through early spring) can save time and money when fly season begins. In order to reduce stable fly populations on the farm during peak fly activity, it is essential to practice good sanitation, even during fall and winter months.

- Manure should be routinely removed from sheltered areas, especially after heavy rainfall or snowmelt, which can lead to manure accumulation. One winter project is grading out cattle pens, sheds and other housing areas as well as filling in any low spots so that manure and water will drain away from animals. Grading of flush lanes in freestall barns should also be evaluated to ensure that water flows easily, and built-up manure should be scraped weekly.

- Outside of confinement facilities, round bale feeding sites should be located in well-drained areas and be moved periodically to reduce excessive buildup of wasted hay. These sites can produce up to 200,000 adult flies, which can then disperse to additional sites. In a 2005 study at Kansas State University, hay wasted by cattle during winter feeding acted as ideal larval habitat during the following spring and summer. Hay overfeeding should be avoided to reduce the amount of material that accumulates on the ground and increases costs. If hay residue is still present at the end of winter, it can be composted to kill any maturing fly larvae from the generated heat. It also is important to clean and dispose of wasted hay before April since most fly production occurs in May and June.

Using good sanitation practices before and during fly season reduces the number of stable flies and saves both money and time. Reducing winter fly populations will reduce the number of early spring flies. Once flies have emerged and become an economic problem (greater than 10 stable flies per cow), appropriately labeled insecticides can be used to reduce fly numbers.

Evaluating Fly Control Efforts

It is important to monitor stable fly populations on the farm to determine if insecticide treatment is needed and if current control methods are effective. One very easy way of determining the impact of stable flies is by performing fly counts on animals. Leg counts are performed by counting stable flies on the two front legs of 15 cows. According to the University of Arkansas Cooperative Extension Service, if the average number of flies per cow is greater than 10, then cow weight gain and milk production may be affected and insecticide use may be necessary. Stable flies also can be monitored using alsynite traps covered with a sticky material. These traps allow farmers to monitor fluctuations in fly populations and compare fly numbers as different management strategies are applied throughout the season. Thinking ahead this winter by focusing on sanitation in cattle barns and feeding areas can make your job easier and your cattle more comfortable during the upcoming fly season.

Broce, A., J.M. DeRouche, J.P. Harner, and L. Zurek. 2005. Managing stable fly production at pasture feeding sites. Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

Broce, A.B., J. Hogsette, and S. Paisley. 2005. Winter feeding sites of hay in round bales as major developmental sites of stomoxys calcitrans (diptera: muscidae) in pastures in spring and summer. J. Econ. Entomol. 98:2307-2312. doi:10.1603/0022-0493-98.6.2307.

Bruce, W.N., and G.C. Decker. 1947. Fly control and milk flow. J. Econ. Entomol. 40:530-536.

Gerry, A., N.G. Peterson, and B.A. Mullens. 2007. Predicting and controlling stable flies on California dairies. University of California Agriculture and Natural Resources.

Loftin, K.M., J.A. Pennington, and S.M. Brazil. 2008. Fly control for organic dairies. University of Arkansas Cooperative Extension Service.

Stewart, S. 2007. Tennessee Dairy Cattle Pest Control Profile. USDA Southern IPM Center.

Taylor, D.B., R.D. Moon, and D.R. Mark. 2012. Economic impact of stable flies (diptera: muscidae) on dairy and beef cattle production. J. Med. Entomol. 49:198-209.

— Christa Kurman and Becky Trout Fryxell

Is Gravel a Suitable Bedding for Calves?

Providing dairy animals of any age a suitable living environment is critical for reducing stress, lowering the risk for disease, and meeting consumers' expectations of humanely raised food. Preweaned calves, despite representing the future of the farm, are sometimes a forgotten group, as they do not contribute directly to the income of the farm. They can be overlooked unless a major issue with overall health and mortality rates demand an evaluation of their environment. Furthermore, the increasing cost and decreasing availability of traditionally used bedding materials, such as sawdust or wood shavings, often causes difficulty when using these substrates with which to bed calves. However, the type of bedding used can impact calf behavior and growth rate.

Earlier research on this issue has produced mixed results, making science-based recommendations for appropriate bedding substrates to use within calf housing impossible. To address this uncertainty and evaluate a new practice being adopted in New Zealand (and one that is commonly used for calves in Tennessee), a group of researchers from the AgResearch organization in New Zealand published the results of their evaluation of the use of river stones as a bedding material on the behavior, cleanliness, weight gain and skin temperature of preweaned Friesian-cross calves in the journal Applied Animal Behaviour Science.

The calves were all born in the spring (August to October in the southern hemisphere), removed from their dam within 24 hours of birth and assigned to one of two treatments. In this study, the control treatment was 8 inches of sawdust, and the experimental treatment was bedding with approximately 8 inches of river stones (stones were roughly an inch long with smooth, rounded edges). The calves were housed in group pens and fed roughly 0.8 gallons of milk once daily (at 7 a.m.) from a 10-teat feeder. They also had unlimited access to a grain supplement throughout the study. The response to treatment was evaluated both during the week of enrollment and five weeks later to assess both an initial response as well as one following acclimation to the bedding surface. The behavior of the calves was determined using continuous video data for either a 10- or 24-hour period. The amount of weight gained was calculated from an initial weight collected during week one and a second during week six. Skin temperature was recorded by dataloggers attached to the calves on the rump, leg and chest.

During the study, temperatures were around 50 F with relative humidity averaging 69 percent. Overall, there was no difference in the dry matter content or the surface temperature between the sawdust or river stone bedding. There were minimal differences between the behaviors of the two groups of calves; during the final week, calves on the river stone bedding spent 4.5 percent less time lying down. Otherwise, the behavior of the calves did not differ between the two bedding surfaces. Weight gain was unaffected by treatment with no differences observed either in weight at weeks one or six or in the total amount of weight gained during that time. Additionally, the calves were very clean on both bedding surfaces with no calf scoring greater than 1 at any point in the study. The calves' overall health was excellent for both surfaces, and there were no reports of disease, lameness, injury or leg lesion during the six-week study. The skin temperature recorded from the calves' chests was 3-4 F cooler than those with sawdust bedding.

Overall, these data indicate that either river stone or sawdust can be used for bedding of calves during the preweaning phase. The calves in the study behaved quite similarly, their growth rates were not different, and their hygiene and health were similar. The only aspect that differed could be a positive or negative factor depending on the time of year. The lowered skin temperature of the calves' chests may indicate a lowered body temperature. For calves born in the late summer, this drop in temperature may be beneficial and help reduce some heat stress. However, for calves born in the late fall or winter, supplemental bedding with straw may be needed (or another type of insulation material) to ensure that those calves do not experience cold stress.

To read the complete article, go to:

Sutherland, M.A., M. Stewart, and K. Schutz. 2013. Effects of two substrate types on the behaviour, cleanliness and thermoregulation of dairy calves. Applied Animal Behaviour Science. 147:19-27.

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Training May Not Just be for Athletes Anymore

Transition back into the milking herd with the associated changes in physiology, diet, housing system, housing group, management, etc., is one of the most stressful times for any dairy cow. For first lactation heifers, these stressors are all compounded by the addition of being in close proximity to humans for possibly the first time since being calves as well as adjusting to entirely new management routines.

They will also be exposed to the milking parlor and the practices associated with milking for the first time. These circumstances can be problematic for many reasons, but the most important aspect related to milking is that it may result in the disruption of milking (due to kicking off the cluster), increased risk of injury to the milk (due to increased activity or kicking in the parlor), and an increased risk of mastitis in early lactation.

A series of studies from the past few decades demonstrated that positive handling of heifers prior to calving can reduce their stress response, which results in less fear of humans and more efficiency in the milking parlor. One of the easiest ways to test for fear of humans is to use an avoidance test, which assesses the response of a cow to either an approaching or stationary human. Cows that are less responsive to or more willing to approach a human produce more milk and more milk fat and milk protein. A group of researchers from the AgResearch organization in New Zealand evaluated the effect of preconditioning heifers to the milking procedure before calving and assessed their behavioral and physiological responses to milking. The results of this study were published in the Journal of Dairy Science.

Heifers were enrolled in this study based on their response to a human avoidance test, which consists of walking slowly towards an unrestrained heifer to determine the closest distance that can be achieved without the heifer moving away, in their home paddock that was conducted before calving. The 20 most responsive and the 20 least responsive were enrolled in the study. At the same time, these heifers were subjected to a restraint test (recording a heifer's response to two minutes of restraint within a squeeze chute), an evaluation of exit speed (the time required to cover a fixed distance following release from the chute), an avoidance distance test in a novel area (same as above only performed in a novel area), and a voluntary approach test (this test consists of recording the closest distance that a heifer will come towards a seated human). The second set of tests was repeated following training sessions with half of the heifers and again after calving.

The training procedure for this study consisted of three phases. First, the heifers were brought into the holding area and encouraged to voluntarily enter a rotary parlor. Once they were loaded onto the parlor, the heifers were introduced to the noises of the milking parlor (primarily the milking system), had spray teat dip applied, and were touched in the udder region. Finally, these same procedures were repeated with the addition of more extensive handling of the udder and teats. All procedures were repeated three times. Following calving, the effect of training was determined by (1) an oxytocin challenge (after voluntary milk release, heifers were treated with 2 mL of oxytocin and residual milk was collected), (2) changes in cortisol during the milking process, and (3) productivity over the first eight months in milk.

Training had little effect on the heifers' behavioral response. Instead, they generally responded more positively (i.e., decreased approach distances and exit speeds) over the three replications of the testing. This result also may be confounded by the fact that the last test occurred after calving. Heifers that were classified as lower responders to the initial avoidance test also were less responsive to the subsequent testing. The trained heifers produced less milk, kicked more and had the highest somatic cell count during the first five days of milking. They also did not benefit from training over the first eight months of lactation. However, trained heifers did have a lower cortisol response to milking than untrained heifers. The highly responsive heifers also had a higher cortisol response than the low-response heifers.

Overall, training did have some advantages, but these benefits were often dependent on the temperament of the heifer. For example, the low-response trained heifers allowed an approaching human to come the closest at the end of the training sessions, but the high-response, trained heifers were the group that voluntarily came the closest to a seated human. Regardless of these minor behavioral changes, due to the limited benefit for milking performance these data do not support investing time in training heifers.

To read the complete article, please see the following:

Sutherland, M.A., and F.J. Huddart. 2012. The effect of training first-lactation heifers to the milking parlor on the behavioral reactivity to humans and the physiological and behavioral responses to milking and productivity. Journal of Dairy Science. 95:6983-6993.

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You No Longer Need to Milk It: Lower Feed Costs With Residual Feed Intake

Many producers struggle with feed costs, which have grown over the past few years. Using feed more efficiently would likely result in an increased benefit for the bottom line of any dairy operation. One possible way to increase feed efficiency is to identify those members of the herd that more effectively convert feed into milk or growth. Residual feed intake, which reflects the difference between the actual intake required to result in a gain in body weight that can be measured and the intake predicted to obtain that same gain, is a tool that could help increase feed efficiency. Despite this prediction, the identification of animals with a low or negative residual feed intake is problematic as it requires an accurate assessment of individual animal intakes and growth to evaluate, which is difficult to measure in commercial operations beyond the pre-weaning phase of heifer development.

A research group from DairyNZ Ltd. addressed the feed efficiency issue by conducting a study on residual feed intake and behavior, the results of which were recently published in the Journal of Dairy Science, to evaluate the possibility of using observable behaviors as a means to identify low residual feed intake heifers. The objective of the study was to evaluate the relationship between residual feed intake and feeding behavior. Holstein-Friesian calves (n = 1,049) were enrolled in this study over a period of three years and data were collected for 42 to 49 days. The study was conducted in an outside feeding facility where the calves were fed dried, cubed alfalfa. The amount of feed eaten by each heifer was measured by using a feed bin placed on a load bar while the heifer was identified by an electronic identifier. Calves were housed in groups of eight, but only one calf was able to access feed at a time.

Throughout the study period, many categories were observed: (1) the daily dry matter intake, (2) daily feeding time, (3) the number of meals eaten in a day, (4) average meal duration, (5) amount eaten at each meal, and (6) at what time the meal was eaten. Each of these categories was recorded every three days to establish residual feed intake and feeding behavior over the six to seven weeks of data collection. The feed intake data were then used to calculate residual feed intake. After determining the residual feed intake for these heifers, the most and least efficient 10 percent of the animals were used to evaluate the differences between the groups' feed intake and feeding behavior.

As would be expected, feed intake was highly correlated with both average daily gain and residual feed intake for all the calves enrolled in the trial. However, the measurements related to feeding behavior were not correlated with either average daily gain or residual feed intake. Regarding residual feed intake, overall the most efficient calves consumed significantly less feed (appromximately 4 pounds) to achieve the same growth rate and ending body weight as the least efficient calves. Regarding feeding behaviors, the most efficient animals differed in the number of meals per day (six vs. eight), feeding duration (2.7 hours per day vs. 2.85 hours per day), feeding rate (roughly 14 percent less per minute), and meal duration (spent roughly five minutes longer consuming each meal). The most efficient also ate gradually throughout the day, while the least efficient animals tended to feed more in the afternoon.

Residual feed intake shows a great deal of potential for improving profit in that it can help the producer lower the cost for feed input and help determine the most efficient feed utilizers in the herd. While knowing that the most feed efficient group in the herd could help cut the cost of input and obtain a high output at the same time, the results of this study suggest that behavior indicators may be a poor means of accomplishing this goal. Unfortunately, residual feed intake remains a task that is not easy to perform on the farm and observing feeding behavior does not provide enough information to identify the most efficient of the herd.

For further reading, please refer to the following:

Green, T.C., Jago, J.G. Jago, K.A. Macdonald, and G.C. Waghorn, 2013. Relationships between residual feed intake, average daily gain, and feeding behavior in growing dairy heifers. J. Dairy Sci. 96:3098-3107.

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Innovations in Monitoring Udder Health

The golden standard of udder health has always been somatic cell count. Somatic cell count, or SCC, is a measure of leukocytes in the milk that indicates milk quality. Higher-quality milk contains fewer somatic cells and has a longer shelf life. The increases in somatic cells are typically associated with infection. As bacteria enter the mammary gland through the teat canal, somatic cells rush to the site of infection and attempt to fend off the bacteria using natural defenses. This action creates an acute increase in SCC within the udder. This acute increase does not last long, as the life of many somatic cells are short-lived in the mammary gland. Subclinical infections within the udder may be associated with this acute rise in SCC, as they are quickly cleared by the immune system and do not cause clinical symptoms. Conversely, clinical infections are associated with prolonged infection and cause clinical symptoms. Many cows with clinical mastitis may not have an elevated SCC, because bacteria will reside within the udder and cause flare-ups.

All healthy udders contain some level of somatic cells, typically less than or equal to 100,000 cells/mL (DVG 2002). The presence of these cells in healthy udders suggests that they play more roles than simply fighting infection; they may assist in upholding the integrity of the mammary gland (Shafer-Weaver et al. 1996). Additionally, somatic cells are the only cell population to vary in cell type between healthy and diseased udders (Pilla et al. 2012), implying that healthy udders may have a different composition of somatic cells than diseased udders; this knowledge could be an additional tool in diagnosing udder infection.

Researchers from Georg-August-University Göttingen in Göttingen, Germany, set out to determine if there was a relationship between udder health and leukocyte composition of milk, specifically CD2+ T lymphocytes and CD21+ B lymphocytes. The study was conducted in two parts: Study 1 examined healthy (SCC ≤ 100,000 cells/mL from 20 Holstein cows) and diseased (SCC > 100,000 cells/mL from eight Holstein cows) quarters. Researchers collected SCC, bacteriological content of milk, differential cell count (number of CD2+ T lymphocytes and CD21+ B lymphocytes), and percentages of T and B lymphocytes. Study 2 validated Study 1 by repeating the study.

Higher percentages of CD2+ T lymphocytes existed in healthy quarters (SCC ≤ 100,000 cells/mL), which were negative for bacteria cultures. Conversely, CD2+ T lymphocyte percentages were low in diseased quarters. An opposite relationship was determined for CD21+ B lymphocytes; healthy quarters, which were negative for bacteria culture, contained fewer CD21+ B lymphocytes and diseased quarters. With these relationships, the researchers created a CD2/CD21 index. As with many indexes, the purpose was to create an easy system for determining healthy vs. diseased quarters. The index is the ratio between CD2+ and CD21+ percentages in each quarter. Cows with healthy quarters resulted in a higher CD2/CD21 index compared to cows with diseased quarters. Therefore, quarters displaying a high SCC and infected with pathogens result in a low CD2/CD21 index. Further, researchers determined that a CD2/CD21 index greater than 10 was generally associated with healthy quarters that were not suspicious for pathogen infection.

Although SCC is the golden standard for milk quality and udder health, additional tools can only help with the detection of infection and disease. The CD2/CD21 index establishes a secondary tool for milk quality. Cows with healthy, uninfected udders exhibit a CD2/CD21 index greater than 10, while cows with low SCC and pathogen infection or cows with diseased udders exhibit a CD2/CD21 index less than 10. This index is new, and, therefore, not readily used in the industry. However, it may soon become a standard among farmers and milk buyers alike and may help aid farmers in better detection of subclinical and clinical mastitis.

For further reading, please refer to:

DVG. 2002. Leitlinien zur Bekämpfung der Mastitis als Bestandsproblem. in Sachverständigenausschuss "Subklinische Mastitis". DVG, Giessen, Germany.

Pilla, R., D. Schwarz, S. Koenig, and R. Piccinini. 2012. Microscopic differential cell counting to identify inflammatory reactions in dairy cow quarter milk samples. J. Dairy Sci. 95(8):4410-4420.

Schwarz, D., A.L. Rivas, S. König, U.S. Diesterbeck, K. Schlez, M. Zschöck, W. Wolter, and C. P. Czerny. 2013. CD2/CD21 index: A new marker to evaluate udder health in dairy cows. J. Dairy Sci. 96(8): 5106-5119.

Shafer-Weaver, K.A., G.M. Pighetti, and L.M. Sordillo. 1996. Diminished mammary gland lymphocyte functions parallel shifts in trafficking patterns during the postpartum period. Pages 271-279 in Proc. Proceedings of the Society for Experimental Biology and Medicine. Society for Experimental Biology and Medicine (New York, NY). Royal Society of Medicine.

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