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UT Extension

New Faces Arrive at the Department of Animal Science

Retirements had a big effect on the Department of Animal Science in 2013, as some familiar faces moved on to greener pastures. Richard Heitmann, dairy nutritionist, and Fred Hopkins, Extension veterinarian, have, at least officially, left us. Thankfully, some new faculty who will likely have an impact on dairy farmers for many years have arrived. In this article, you'll get a brief introduction to Agustín Ríus, the new dairy nutritionist with a split research and teaching appointment, and Lew Strickland, the new Extension veterinarian with a joint appointment in the Department of Animal Science and the College of Veterinary Medicine.

Agustín Ríus

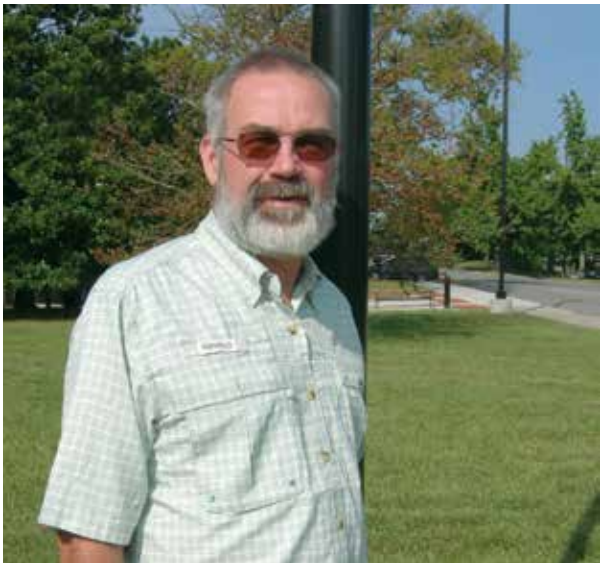
Ríus was born and raised in sheep country in the southern part of Argentina. His interest in animal science led him to study veterinary medicine after graduating from high school. He moved to La Plata to attend the College of Veterinary Medicine in La Plata National University (Argentina). After receiving his degree in veterinary medicine, he focused his career on ruminant physiology and nutrition. Ríus moved to the U.S. Department of Agriculture's Dairy Forage Research Center in Madison, Wis., where he was involved in investigations to elucidate the effect of calcium on phosphorous metabolism in lactating dairy cows. After his time in Wisconsin, he moved to the University of Illinois at Urbana-Champaign to pursue a master's degree in the Animal Science Department.

Ríus obtained his doctorate at Virginia Tech in Blacksburg, Va., where he investigated nitrogen and energy metabolism in dairy cattle. Shortly after finishing graduate school, Ríus joined DairyNZ in New Zealand as a research scientist where he conducted applied and basic research in pasture-based dairy cattle.

Ríus' research objectives consist of developing a basic and applied research program with a focus on nitrogen and energy metabolism in lactating dairy cows exposed to heat stress. More specifically, Ríus strives to understand better nitrogen utilization and partitioning in urine, feces and milk in heat-stressed cows to establish nitrogen requirements in these animals. These studies will determine rumen degradable protein and amino acids requirements to sustain milk production and reduce urinary nitrogen in heat-stressed cows. Ríus' efforts will provide clues to better understanding nitrogen metabolism in cattle and will offer alternatives to reduce feeding costs and dairy footprint, which in turn will benefit the dairy industry of Tennessee.

Dr. Lew Strickland was raised on his family's dairy farm in east central Alabama and continued to work there for 12 years after he graduated high school. He earned a B.S. in animal dairy science and a DVM from Auburn University. He practiced large animal veterinary medicine in Cleveland, Tenn., for five years and then was in a dairy practice in central Pennsylvania for two years. He returned to Auburn University to earn a master's degree and become board certified in reproduction. After completing his

residency, he served as the interim extension veterinarian at Auburn University from 2010 to 2011. Since 2011, he has owned and operated his own large animal practice.



Lew Strickland

Strickland is currently the new Extension veterinarian in the Animal Science Department. He plans to work with producers throughout the state to help improve the overall health of their herds through educational programs and farm visits as needed. He has an interest in milk quality and has worked with producers in the past concerning these issues. He also has an interest and experience working with producers in reproductive management of their herds. He looks forward to meeting agents and producers throughout the state. If you have any questions, please do not hesitate to contact him by phone at 865-974-3538 or email lstrick5@utk.edu.

Internal Teat Sealants: Are They Worth the Added Cost?

Mastitis impacts dairy producers daily through treatment costs, loss in milk production, reduced fertility and culling or death. These issues make mastitis prevention a priority for producers. Antibiotic dry cow therapy can be used successfully to treat infections at dry-off while reducing the risk of new infection during the dry period. However, research indicates that 50 percent of teat canals may still be open 10 days after drying off (Williamson et al., 1995). Open teat canals leave cows at risk for infection, as bacteria can enter through an open canal. Therefore, an artificial teat sealant may help prevent new infections caused from bacteria entering through unclosed teat canals.

Researchers in Australia conducted a meta-analysis (a research method of combining results of different studies to determine patterns) to assess the efficacy of internal teat sealants (Orbeseal or Teatseal). A meta-analysis is performed by searching various scientific search engines using specific search terms. Only randomized studies with comparable treatment groups were considered for inclusion. Further, groups had to be composed of lactating dairy cows, including reported data on intramammary infection and clinical mastitis. A total of 17 intramammary infections and 21 clinical mastitis trials and comparisons were used in the meta-analysis. Using this data, researchers determined the number needed to treat, or NNT, with the teat sealant in order for one cow to benefit from the treatment. The lower the statistic, the more effective the treatment. For example, if the NNT is 1, then one cow needs to be treated to prevent one case of mastitis. However, a number of 10 indicates that 10 cows must be treated for one case of mastitis to be prevented.

When using a teat sealant alone (no antibiotic dry cow treatment), the intramammary infection risk decreased by 73 percent compared to those cows without a teat sealant. However, combining all studies, using a teat sealant with or without an antibiotic dry cow treatment reduced the risk of intramammary infection by 39 percent compared to antibiotic dry cow treatment alone or no treatment at all. For every seven cows treated with an antibiotic dry cow treatment, one occurrence of intramammary infection was prevented compared to untreated cows. Further, for every 20 cows treated with both a teat sealant and antibiotic dry cow treatment, one occurrence of intramammary infection was prevented compared with cows treated with an antibiotic dry cow treatment alone.

Using the teat sealant in combination with an antibiotic dry cow treatment reduced the risk of clinical mastitis by 29 percent compared with using an antibiotic dry cow treatment alone. The application of a teat sealant alone reduced the risk of clinical mastitis by 48 percent compared to no treatment at all. Additionally, 21 cows would need to be treated with a combination of antibiotic dry cow treatment and teat sealant to prevent one case of clinical mastitis compared to antibiotic dry cow treatment alone. Thirteen cows would need to be treated with a combination of antibiotic dry cow treatment and teat sealant to prevent one case of clinical mastitis compared to no treatment at all.

Teat sealants used at dry-off can be an effective means for preventing intramammary infections and clinical mastitis during the dry period, whether used with antibiotic dry cow treatment or alone. However, results will vary depending on current intramammary infection and clinical mastitis rates and the specific needs of each herd. Thus, each farm should determine whether the decreases in mastitis will financially benefit them enough to justify the cost of using the teat sealant. For farms with mastitis problems at dry-off and at calving, the use of a teat sealant is a viable preventative option.

For further reading or complete data, refer to the following:

Rabiee, A.R. and I.J. Lean. 2013. The effect of internal teat sealant products (Teatseal and Orbeseal) on intramammary infection, clinical mastitis, and somatic cell counts in lactating dairy cows: A meta-analysis. J. Dairy Sci. 96(11):6915-6931.

Williamson, J.H., M.W. Woolford, and A.M. Day. 1995. The prophylactic effect of a dry-cow antibiotic against Streptococcus uberis. New Zealand Veterinary Journal 43(6):228-234.

— Randi Black, rblack12@utk.edu

How Maternal Cravings Change Before and After Calving

Identifying signs that indicate when a cow is about to calve is very important. Normal signs are udder firmness, vulva swelling and pelvic relaxation, which may show up to two weeks prior to calving or up to seven hours before calving, so they are not reliable determinants alone. Because these signs vary in length before calving, other tools are needed to help determine when calving is close. These tools can make the process easier for both the cow and the producer.

A recent study published in the Journal of Dairy Science was conducted at the University of British Columbia's Dairy Education and Research Centre in Agassiz, BC, Canada. It focused on describing changes regarding rumination and feeding behavior four days prior to calving and two days after calving. Eleven mature Holstein cows were enrolled in the study and were observed for a baseline period (five to six days pre-calving), four days pre-calving (96 hours) and two days post-calving (48 hours). Stocking density was kept at 100 percent for the duration of the study. Pre-partum cows were housed in a group pen with free stalls then moved to a fresh pen after calving. Each

free stall was bedded with a mattress and 5 cm of sand. Before calving, cows were fed a close-up total mixed ration (TMR) that consisted of 44 percent alfalfa hay, 33 percent corn silage and 22 percent mineral and concentration mix. After calving, cows were changed to a regular TMR lactation diet that consisted of 51 percent mineral and concentration mix, 29 percent corn silage, 11 percent grass silage, 5 percent alfalfa hay and 4 percent grass hay.

Data collection focused on visual signs of labor, rumination, feed intake, time spent feeding and time of calving. Pre-partum cows were observed multiple times a day for vulva discharge, relaxation of tail ligaments and milk let-down. Rumination was determined by attaching an HR-tag with a built-in microphone that records the sounds of rumination and was previously validated as an effective means of measuring daily rumination time. Daily matter intake was determined by using the Insentec feed bin system that uses a transponder on the cow to open the feed bin, allowing for the duration of the visit and the amount of feed consumed to be recorded. The Insentec feed bin system uses a weighing system to measure the amount of feed taken, and the transponder allows for the system to identify the cow. Exact calving time was observed by using a camera connected to a digital recording system.

Relative to the baseline, rumination decreased by 15 percent 24 hours prior to calving and decreased by 31 percent 24 hours post-calving. Despite the decline, rumination increased rapidly four hours post-calving. Rumination returned to the pre-partum baseline 24 to 48 hours after calving. Other changes observed were a decrease in daily matter intake (by 8.4 + 4.2 lbs) in the 24-hour period before calving and a decrease in time spent feeding (66.2 + 15.7 min) in the 24-hour period before

calving compared with the baseline. Daily matter intake and time spent feeding increased over six hours following calving, but time spent feeding remained lower than the pre-partum baseline for two days after calving.

Rumination and feeding measurements can be a useful tool in identifying cows approaching calving. It is important in identifying those close to parturition, so that the producer may make conditions as comfortable as possible to provide ease while calving. Although using rumination and feeding measurements may be useful, they are not yet able to be applied on the farm, as they are not accurate enough to use 24-hour summaries to predict calving time.

For further reading, please refer to:

K. Schirmann, N. Chapinal, D.M. Weary, L. Vickers, and M.A.G. von Keyserlingk. 2013. Short communication: Rumination and feeding behavior before and after calving in dairy cows. J. Dairy Sci. 96:7088-7092.

— DeAnna Ingle, hingle1@utk.edu

Bedding Could Reduce the Occurrence of *Cryptosporidium parvum*

Illness is a source of stress for dairy calves and producers since it negatively affects calf growth as well as future performance in the herd. It also can be a financial stress on the farm. Pre-weaned heifer deaths, most often caused by scours and digestive disorders, account for the highest percentage of deaths on dairy farms. *Cryptosporidium parvum* is a one-celled organism that usually affects calves between 1 and 4 weeks of age and is one of the leading causes of diarrhea. Symptoms associated with infection include watery diarrhea, straining and lethargy. The disease is highly contagious and can even infect humans; there is no treatment beyond supportive care. Prevention is the only effective means for controlling the impacts of *Cryptosporidium*.

Interestingly, providing bedding may help reduce the incidence of scours caused by *Cryptosporidium*. Housing calves in a clean area may reduce the occurrence of *Cryptosporidium* on dairy farms by providing a soft, absorbent bedding that helps keep calves as clean and dry as possible. During a 2004 study at the University of Arkansas that housed calves on gravel, sand, rice hulls, straw and wood shavings, calves on gravel or sand had around twice as many treatment days for scours compared to calves on the other surfaces. A 2012 study at Cornell University determined that bedding choice might be important in controlling *Cryptosporidium* infection. Calves housed on dirt flooring were at higher risk for infection with *Cryptosporidium* than calves housed on a bedded surface. In another study performed at the University of Liverpool in 2008, calves were more susceptible to *Cryptosporidium* infection when housed on shallow bedding (0 to 2 inches deep) when compared to calves housed on deep bedding (4 to 6 inches deep).

Results obtained for the incidence of scours on nonabsorbent bedding surfaces, such as gravel or sand, may be due to decreased calf cleanliness (calves on these surfaces were dirtier) and increased exposure of calves to wet bedding. Another possibility is that housing calves on a nonabsorbent surface allows fecal score to be observed more easily, leading to more cases of scours being diagnosed and treated. Bedding depth may reduce the risk of *Cryptosporidium* infection because deep bedding increases calf hygiene and provides a barrier between the calves and environmental contaminates. Providing bedding at least 4 inches deep may help protect calves from infection by acting as an environmental barrier and by keeping calves clean and dry. In addition to providing a clean housing area, it is important to ensure that calves receive good quality colostrum in a timely manner to provide immunity against *Cryptosporidium* infection as well as other illnesses.

For further reading, please refer to:

Brook, E., C.A. Hart, N. French, and R. Christley. 2008. Prevalence and risk factors for Cryptosporidium spp. infection in young calves. Vet. Parasitol. 152:46-52. doi:10.1016/j.vetpar.2007.12.003

Hodges, R. Cryptosporidiosis in calves. http://www.vet.kstate.edu/VHC/agpract/articles/Crypto.pdf

Panivivat, R., E.B. Kegley, J.A. Pennington, D.W. Kellog, and S.L. Krumpelman. 2004. Growth performance and health of dairy calves bedded with different types of materials. J. Dairy Sci. 87:3736-3745.

Szonyi, B., Y.-F. Chang, S.E. Wade, and H.O. Mohammed. 2012. Evaluation of factors associated with the risk of infection with Cryptosporidium parvum in dairy calves. Am. J. Vet. Res. 73:76-85. doi:10.2460/ajvr.73.1.76

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Milking Frequency: What Are the Implications?

Milking frequency is a major issue in dairy management. Much is already known about the benefits of milking three times per day versus two times per day. Studies have demonstrated these benefits with results showing that cows produced more milk (with increases between10.4 and 21 percent), had lower somatic cell counts, and tended to maintain the reduction throughout lactation (Dahl et al., 2004; Smith et al., 2002). However, little is known about the behavioral changes associated with increasing milking frequency. In order to produce larger volumes of milk, cows must consume more feed, potentially altering daily time budgets. Also, the additional time in the holding pen and milking parlor will reduce the time available for daily activities, including resting, eating and ruminating. This alteration in priorities may have serious implications. One study showed that after being deprived of both lying and feeding, cows prioritized lying over feeding (Metz, 1985). Therefore, cows returning from the parlor may prefer to lie down instead of eat, potentially impacting milk yields.

A research group based in Ontario, Canada, set out to determine the associated behavioral changes when milking frequency increased from two times per day to three times per day. Twelve Holstein dairy cows (seven first lactation and five 2+ lactation) producing 82.9 pounds of milk were divided into two groups of six. Each group was assigned a treatment (two times per day milking or three times per day milking) for 21 days. After the 21-day period, cows were then assigned to the opposite treatment. At the specified time of milking, cows were moved into the holding pen and milked using a Lely robotic milking unit. Fourteen days out of the 21-day treatment were allotted to adaptation to the treatment, and seven days were allotted to data collection. During the seven days of data collection, researchers collected information about time spent at the bunk during each feeding visit, amount of feed consumed, rate of feed consumption and daily milk production. Milk samples were collected during the last three days of each treatment to determine milk fat and protein.

Similar to previous studies, cows milked three times per day increased milk production 6.4 pounds per day compared to cows milked two times per day. However, 2+ lactation cows milked twice a day tended to have a higher milk fat percentage than all first lactation cows and 2+ lactation cows milked three times per day. As expected, 2+ lactation cows ate 8.4 pounds of dry matter more than first lactation cows. Further, the first lactation cows that were milked three times per day ate more than the first lactation cows milked two times per day. A tendency for cows milked two times per day to spend less time eating but eating more quickly existed. Milking time can be a motivator for cows to move to the feed bunk and eat. Being milked fewer times a day and, therefore, having less motivation to move to the feed bunk more often may influence the rate and size of meals.

Milking frequency also altered meals. First lactation cows milked three times per day consumed smaller meals (1.4 more meals) in less time throughout the day. This finding may be related to an increased motivation to eat, usually brought on by milking. Although meal behavior changed due to milking frequency, no effect on lying time per day, number of lying bouts, time spent standing idle or rumination time was noted.

Producers wishing to transition to a management system milking three times per day may see additional benefits associated with the change. Cows may produce more milk and could show improvements in SCC. However, producers should expect increases in feed cost associated with a greater dry matter intake. Producers should also anticipate a change in meals, understanding that smaller, shorter and more frequent meals may not indicate a health concern but, instead, a behavioral adaptation.

For further reading or complete data, refer to the following:

Dahl, G.E., R.L. Wallace, R.D. Shanks, and D. Lueking. 2004. Hot topic: Effects of frequent milking in early lactation on milk yield and udder health. J. Dairy Sci. 87(4):882-885.

Hart, K.D., B.W. McBride, T.F. Duffield, and T.J. DeVries. 2013. Effect of milking frequency on the behavior and productivity of lactating dairy cows. J. Dairy Sci. 96(11):6973-6985.

Metz, J.H.M. 1985. The reaction of cows to a short-term deprivation of lying. Applied Animal Behaviour Science 13(4):301-307.

Smith, J.W., L.O. Ely, W.M. Graves, and W.D. Gilson. 2002. Effect of milking frequency on DHI performance measures. J. Dairy Sci. 85(12):3526-3533.

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It's Getting Hot in Here: Heat Stress Effects on Rumination

All cattle in the southeastern states experience heat stress. The detrimental consequences from extreme heat can affect many aspects of dairy production, and feeding behavior is one significant aspect. Heat stress occurs when core body temperature exceeds that of the normal physiological range. This increase in temperature causes heat loss in cows to increase through increased water intake, increased loss of body fluids from panting and sweating, reduction in fecal and urinary losses, and heat production to diminish through decreased dry matter intake. Along with all of these changes, rumination and blood flow to the rumen epithelium are reduced.

Producers do not always know the internal core body temperature of their cows, but the temperature-humidity index, or THI, is a useful tool in determining body temperature. The THI indicates when a cow becomes more susceptible to heat stress in the environment. Figure 1 displays the ranges of mild to moderate stress, moderate to severe stress, and severe stress with an easy-to-use diagram. Producers can use this diagram as a guide to understanding when they may need to provide heat abatement to cows. Rumination, or a reduction of rumination, can indicate heat stress, too.

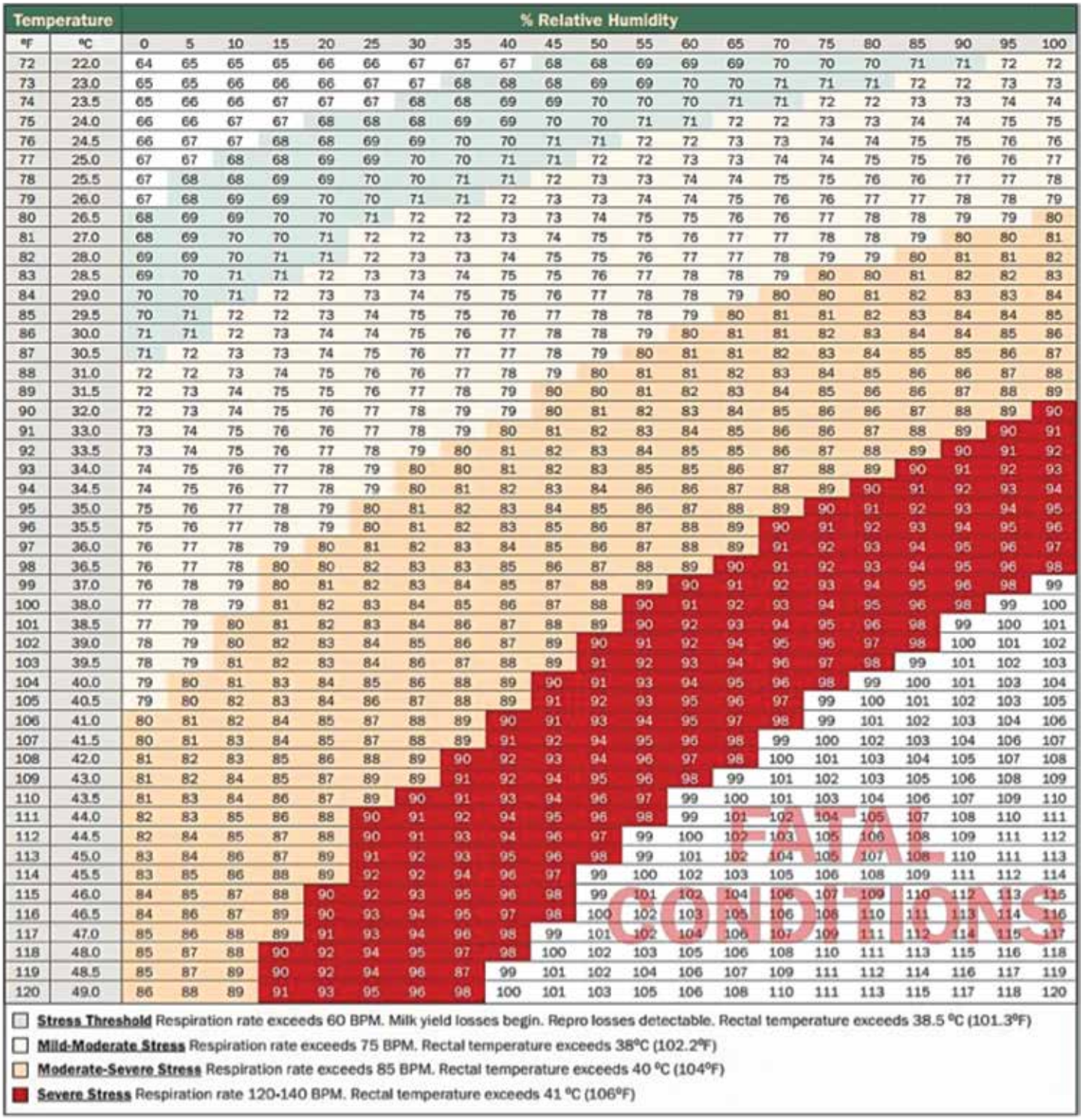
Italian researchers from the Università Cattolica del Sacro Cuore set out to determine how heat stress affects rumination activity and, further, how the change in rumination affects milk production. Twenty-one Holstein cows (11 primiparous and 10 multiparous) were housed in freestall barns at the Vittorio Tadini experimental farm near Piacenza, Italy. Primiparous cows averaged 70 pounds of milk per day, while multiparous cows averaged 77 pounds of milk per day. Mean daily THI, daily minimum THI and daily maximum THI were calculated throughout the 10-week trial (June 15-Aug. 25). Average daily feed intake, feed chemical composition (moisture, fat, crude protein, neutral detergent fiber, acid detergent fiber, acid detergent lignin, starch and ash), and feed particle size also were determined.

The HR-Tag (developed by SCR Engineers Ltd.) recorded rumination time using a microphone that recorded when a bolus was regurgitated. The data logger sat on the left side of the neck on a neck strap and summarized the data in two-hour intervals. Researchers also collected blood samples during heat waves and low temperatures to assess blood parameters in different microclimates. Blood was analyzed for energy metabolism (plasma glucose and BHBA), protein metabolism (plasma urea, creatinine and total protein, alkaline phosphatase, aspartate aminotransferase, and D-glutamyltransferase), mineral metabolism (sodium, phosphorus, magnesium, calcium, zinc, potassium and chloride), and acute phase proteins (haptoglobin and ceruloplasmin) to determine changes in blood parameters with changes in heat stress and rumination.

All trial days consisted of a maximum daily THI greater than 72, implying that there were opportunities for cows to enter a heat-stressed condition. Rectal temperatures and respiration rates were lower when THI was less than 80. Further, rectal temperatures only increased past 102.2 F when THI was greater than 85. Cows ate an average of 51 pounds of feed per day. On average, cows lost -0.3 pounds of milk per day, which contributed somewhat to a correlation between milk yield and daily rumination time ($r = 0.43$). This correlation represents an increase in milk production with an increase in daily rumination time.

Average daily rumination time was 501 minutes per day, with the majority of rumination occurring during the nighttime hours (63.2 percent). Researchers determined a negative correlation between daily rumination time and maximum daily THI, meaning that daily rumination time decreased 2.2 minutes for every THI unit increase above 76. Researchers also noted a relationship between rumination time and dry matter intake during the subsequent one to three days, but not on the actual day, implying that rumination is not immediately affected by diet consumption. Few relationships were discovered between blood variables and THI. Plasma glucose and BHBA, both related to energy metabolism, and sodium levels associated with mineral metabolism, decreased with increasing THI. Conversely, protein metabolism variables plasma urea and creatinine increased with rising THI.

Heat stress can influence protein, energy and mineral metabolism, along with dry matter intake and rumination. These can all influence the bottom line — milk production. However, producers cannot assess blood parameters quickly while observing cows, but rumination behavior is easy and quick to evaluate. Observing a decrease in rumination on a herd level early can inform the producer of a potential issue with heat stress and allow for action to be taken before significant reductions in milk production arise.



Temperature		% Relative Humidity																				
°F	°C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	72	72
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72	72	73	73
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	77
78	25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77	77	78
79	26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77	78	78	79
80	26.5	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79	79	80
81	27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79	80	80	81
82	28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81	81	82
83	28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	82	83
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85	29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
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100	38.0	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	98	99	100
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113	45.0	83	84	86	87	89	91	92	93	95	96	98	99	101	102	104	105	107	108	110	111	113
114	45.5	83	85	86	88	89	92	92	94	96	97	99	100	102	103	105	106	108	109	111	112	114
115	46.0	84	85	87	88	90	92	93	95	96	98	99	101	102	104	106	107	109	110	112	113	115
116	46.5	84	86	87	89	90	93	94	95	97	98	100	102	103	105	106	108	110	111	113	114	116
117	47.0	85	86	88	89	91	93	94	96	98	99	101	102	104	106	107	109	111	112	114	115	117
118	48.0	85	87	88	90	92	94	95	97	98	100	102	103	105	106	108	110	111	113	115	116	118
119	48.5	85	87	89	90	92	94	96	87	99	101	102	104	106	107	109	111	112	114	116	117	119
120	49.0	86	88	89	91	93	95	96	98	100	101	103	105	106	108	110	111	113	115	117	118	120

Figure 1. Heat Index Chart. Hoard's Dairyman.

It may be advantageous for producers to monitor herd level rumination daily to track changes in rumination, especially during hot weather.

For further reading, please refer to:

Soriani, N., G. Panella, and L. Calamari. 2013. Rumination time during the summer season and its relationships with metabolic conditions and milk production. J. Dairy Sci. 96(8):5082-5094.

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