HOARD'S DAIRYMAN

The National Dairy Farm Magazine

www.hoards.com May 25, 2014

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The value of cow cooling just keeps growing

"Dairy Heat Stress Road Show" spreads the word.

by Hoard's Dairyman staff

LIKE a magician's hat, the surprises coming out of dairy heat stress research seem to be endless.

Each new study brings more evidence that heat stress is either a direct cause of, or a contributing factor to, some of the biggest and most constant financial drains that dairies suffer. And as the data mounts, it reemphasizes what milk producers have been told for decades: that cow cooling is among the best management investments they can make.

Both messages – the far-reaching negative effects of heat stress on cows and the far-reaching positive effects of cooling them – were the focus of the just-concluded "Dairy Heat Stress Road Show."

Funded by a five-year grant from USDA, the project was a joint Extension research and outreach effort between the University of Florida, Texas A&M University, the University of Arizona, and the University of California, Davis.

A key part of the project was to hold one-day seminars to summarize the latest research findings for dairy farmers in the areas of cow comfort, heat stress assessment tools, nutrition and new technologies. Seminars were held in 2012 in Puerto Rico, Florida, Texas, Arizona and California and were repeated in the same locations this year.

Few dairy management practices have been proven as beneficial, and as many times, as cow cooling. But despite the overwhelming mountain of evidence, it continues to be a hard sell to some producers.

Whether it's because of denial ("we don't have much heat stress here"), short-sightedness ("cooling is too expensive"), or complacency ("it's normal for production to drop here in summer, so we just deal with it"), the bottom line is that both dairy owners and their cows are suffering.

But they don't have to.

Producer assumptions about when heat stress begins is one hurdle to overcome. Another is thinking that how you perceive cool and warm is also how cows perceive it.

When is warm actually hot?

Producers who group cows by production are a big step ahead in understanding why heat stress is worse for some animals than others.

THI (temperature humidity index; the "feels like" combination of temperature and humidity) has been widely used in the dairy industry to measure when heat stress losses begin to occur and to roughly estimate their severity. Extremely high temperatures are dangerous by themselves but humidity is the most dangerous ingredient, which is why cows in tropical areas face the greatest risk of heat stress.

Initially, mild heat stress was regarded to begin at a THI of 72. However, additional research determined that milk production losses begin after just 17 hours of exposure to a THI of 68. Dead cows can be expected at THIs of 99 or more, while hospital cows are at risk above 80.

But even 68 is only a guideline. Bob Collier, professor and former chairman of the Department of Animal Sciences at the University of Arizona, said that number was based upon research with cows making 77 pounds of milk per day. In reality, high producing cows experience heat stress sooner than that.

How much sooner has not yet been determined, but there is growing evidence that the THI number is 65. Collier believes it is even less for very high producing cows, such as those that peak well over 100 pounds. Feed intake is the reason why.

High producing cows eat more, and as it is converted into milk more internal heat is produced. Cows can't sweat to dissipate heat, which is why they thrive in temperatures in the 40s. It is also why very high producing cows start feeling heat stress before some people think about taking off their coats.

The list of best places for cow cooling has always started with the wash and drip pens because they are high-humidity areas with restricted airflow where, at least twice a day, cows are packed together more densely than anywhere else on the dairy.

That same principal – put cooling in relatively small areas where all cows eventually visit – is why Collier said just-fresh and high production pens are other ideal places to put more room, shades, fans, misters and water troughs. Every animal in the herd will benefit from these upgrades at least once in their lifetime, making them investments that will pay dividends year after year.

Milk losses aren't the worst

Todd Bilby, dairy technical services manager for Merck Animal Health, said producers commonly underestimate the cost of heat stress because they only consider milk production. Other mistakes dairies commonly make are to start cooling too late and to stop too early. Producers who dairy in hot, dry environments also tend to believe that heat detection and A.I. are pointless during the summer, which he said is simply false.

"Reproduction losses are actually more costly than milk losses," Bilby emphasized, noting that research in both Israel and the U.S. has confirmed that milk production is not affected as much by heat stress as reproduction is.

Lower rates of heat detection, conception and pregnancy are the biggest reasons why reproduction losses are more costly. Not knowing when cows are experiencing heat stress is part of the problem, but a variety of tools are available that can help. Some even allow dairy managers to approach heat stress management on a cow-by-cow basis rather than a pen-by-pen basis.

Activity monitors, rectal thermometers, data loggers and reticulorumen boluses are all good tools for identifying heat stress, but so is visual observation. Bilby said feed and water intake and activity all diminish when cows are under heat stress, while open mouth panting and salivation increase. One very good thing to keep an eye on is cows' respiration rate.

He said cows that are not experiencing heat stress will have respiration rates of 60 or fewer breaths per minute. Cows under severe heat stress will have 120 or more breaths per minute. Rates in between are symptoms of varying degrees of mild and moderate heat stress.

Should we cool dry cows?

It didn't take long for the presentation by Geoffrey Dahl, chairman of the Department of Animal Sciences at the University of Florida, to make the answer to this question extremely obvious: an emphatic "Yes!"

And the timing for doing so could not be better, since current record high milk prices give milk producers the opportunity to make such an investment. Just as Collier made a case for cooling just-fresh and high production pens, Dahl said dry cow cooling is also an investment that will benefit every animal in the herd for as long as the system operates.

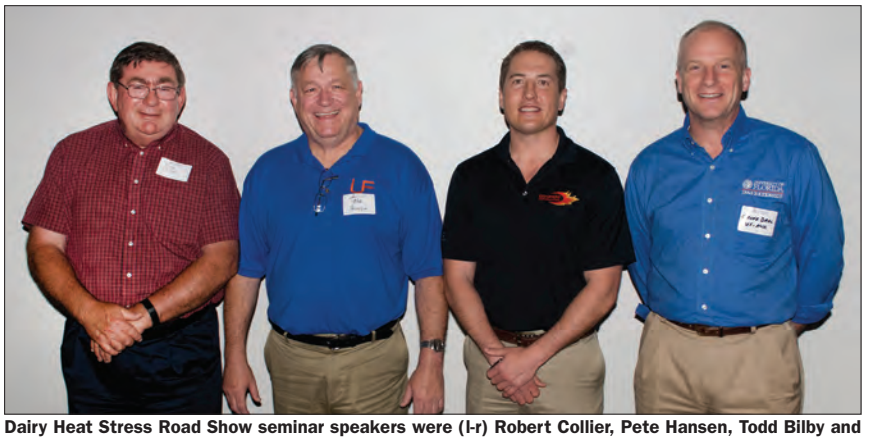
The most basic benefit of hospital pen cooling is simple: more cows stay alive to either reenter the herd or to walk onto the truck to go to slaughter. With dry pen cooling, the nearest and dearest benefit to dairy producers' hearts is seen in the parlor in the next lactation. However, its paybacks also touch virtually every other area of the dairy, from the calving pen to the calf area to the breeding pen to the culling list.

Studies with mature cows show that six weeks of dry pen cooling moves them to a higher production curve after calving, which persists throughout the entire lactation and amounts to more than 10 additional pounds of milk per day.

That's because the negative effects of heat stress on dry cows linger for about two months after calving. Dahl said cooling encourages dry cows to eat more, which results in better body condition and higher immune function at calving and translates into fewer calving problems and less mastitis and other diseases. In addition, cooled dry cows also rebreed faster and require fewer services.

Calves from cooled cows benefit too. They have higher birth weights, higher colostrum immunoglobulin (IGG) absorption levels, and stronger immune systems. Preweaning mortality is lower, they reach breeding size faster, and they make more milk in their first lactation.

Dahl said the reason why cooled



Dairy Heat Stress Road Show seminar speakers were (l-r) Robert Collier, Pete Hansen, Todd Bilby and Geoffrey Dahl. The seminars were held in Puerto Rico, Florida, Texas, Arizona and California.

dry cows do so well in the milking parlor was identified in a 2011 study: they had twice the number of new mammary epithelial cells after calving than heat-stressed cows.

He agreed that having some cooling during the dry period, such as in the close-up and maternity pens, is better than nothing, but research clearly shows that cooling during the entire dry period generates a much bigger response.

"In our series of studies [in Florida] over a six-year period we saw a 5 to 7 kilograms (11 to 15 pounds) per day improvement in milk yield in the next lactation when cooling was initiated at dry-off and maintained for a six-week dry period," he explained.

In contrast, he said a study in 2006 found that cooling cows for only the last three weeks of the dry period produced an increase of just 1 to 2 kilograms (2.2 to 4.4 pounds) more milk per day during lactation.

"Those final three weeks aren't enough," said Dahl. "It had some positive effects, but cows need cooling during the entire dry period."

The effect of cooling on bred heifers is an area that has not yet been studied, but Dahl said if he operated a dairy he would do it – and for longer than three weeks.

"Cooling dry cows is an easily implemented management intervention that should lead to improved animal well-being, production and health, and in turn to higher financial returns to the dairy," he said.

Can genetics help?

Breeding cows that have more resistance to heat stress is already possible on a small scale and will become increasingly necessary in the future, said Peter Hansen, a distinguished professor of Dairy Science at the University of Florida. He is confident it will happen.

Mapping the approximately 22,000 different genes in bovine DNA was completed in 2009. Identifying the treasures they contain will be a slow process. A few are already known, but Hansen said more will be needed because the outlook for rising temperatures means cows' susceptibility to heat stress will climb as well.

"In the southeastern and southwestern U.S., the number of days per year that high temperatures are above 90 degrees is expected to increase from 60 to over 150 by the end of the century," he pointed out.

But even without higher temperatures, heat stress is expected to pose a growing challenge to dairy producers. That is because of the long trend of approximately 300 more pounds of milk production per cow per year that results from better genetics and better management.

Hansen emphasized that genetic selection tools we have today clearly have the potential to develop cows with more heat stress resistance, including breeds like Holsteins that originated in northern Europe and have low heat stress resistance in general. The proof is outlier animals that always turn up in heat stress research studies.

Hansen cited a 2009 Florida study that took rectal temperatures of over 1,000 cows in mid-afternoon during 90°F weather. It found that individual cows varied from 101.1°F to 104.0, which is a huge range.

"Clearly, some cows are better at regulating their body temperatures than others," he said. "The question is, to what extent is that variation due to genetics?"

At least one researcher thinks it is quite a bit. Analyzing the data from that study, he estimated the heritability of low rectal temperature at 0.17. Hansen noted that while this is much lower than the heritability for milk production (0.30), it is about twice the heritability for somatic cell count.

Unfortunately, it is already known that there is a high negative correlation between rectal temperature and milk production: cows that are heat tolerant make less. But Hansen still sees opportunities.

One is the introduction of heat-resistant genes from other breeds through traditional genetic methods like crossbreeding and upgrading. Transgenics – transferring specific genes from different species, such as from very heat tolerant Brahman beef cattle – is another.

One of the known cattle traits for heat resistance is already being studied: the so-called "slick" or short hair coat gene. It has already been introduced into some Holsteins in Puerto Rico, and into Carora dairy cows (a cross between Brown Swiss and native Criollo) in Venezuela.

"The impending challenge to the world's food supply caused by global climate change will provide the impetus for using technology to manipulate cow genetics and physiology to reduce the impact of heat stress on the efficiency of milk production," Hansen predicted. *WEST*