TECH NOTES

Highlights from the USDA Dairy Heat Stress Road Show

OKEECHOBEE, FL (12/3/13) – Heat stress may not be top-of-mind for many of the nation's dairy producers this week, but it was definitely the 'hot topic' at the Dairy Heat Stress Road Show. Sponsored by USDA in collaboration with several universities, this educational program takes the latest information on the impact and management of heat stress to audiences across the country and to Puerto Rico.

What's at Stake. It has been estimated that heat stress-related losses top $80 per head annually in affected environments. And as production levels increase, cows become increasingly susceptible. Losses are seen in milk volume (often 15-25%), components, and fertility. Dr. Robert Collier, University of Arizona, reviewed the combination of direct and indirect impacts that come into play. Heat stress causes cows to produce less casein, directly reducing milk protein. Delayed reductions in overall milk production are seen when high effective temperatures during pregnancy result in smaller calves and reduced placental and mammary development. Multiple other changes in metabolism occur as over0heated animals work to maintain homeostasis, including endocrine responses and adoption of alternative metabolic pathways. Imbalances can be induced by factors such as potassium loss through sweat, and the increased bicarbonate loss via urine that is triggered by panting.

The presentation given by Dr. Geoff Dahl, University of Florida, specifically looked at potential costs of heat stress experienced during the dry period. Based in part on a recent series of experiments, Dr. Dahl is firmly convinced that employing strategies to cool heat-stressed dry cows is a cost-effective practice. Their research group showed that unmitigated heat stress at this time has significant negative impacts on subsequent milk production, herd health, reproduction, and lifetime performance of *in utero* calves. Multiple contributors have been identified, including hormonal levels and responsivity, epithelial cell proliferation (fewer with heat), less feed intake, reduced use of NEFA from body reserves following calving (which causes more glucose to be used for functions other than milk production), and measurable reductions in several indicators of immune function. Extensive records from a commercial dairy were used to quantify some of these heat stress impacts in a real-world setting.

When comparing lactations of cows that were dry in either cool or hot times of the year, "cool" cows produced 1,215 lb more milk, even though they spent more time producing milk during the hottest times of the year. They also had reduced incidence of common health issues (mastitis, retained placenta, and respiratory problems). Equally notable was the fact that the "cool" cows – despite higher milk production and a hotter breeding season—had fewer days to breeding, fewer days to pregnancy, and fewer breedings overall. On top of all that, evaluations showed calves born to dams who were heat stressed during late gestation were smaller at birth and did not make that weight up before weaning, and had altered energy metabolism and immune capacity. In other words, they were "programmed" to be less productive for life.

The conclusion: *Cooling dry cows is an easily implemented management intervention that should lead to improved animal well-being, production and health, and in turn higher financial returns.*

Defining a Problem. Dr. Todd Bilby, Merck Animal Health, presented a list of visible signs that producers can utilize to determine how widespread heat stress may be in their herd: reduced dry matter intake, increased respiration rate, reduced water intake, and less time spent laying. But determination of need for active management needs to be based on more precise information. Of these visible behavior changes, respiration rate can actually be measured rather simply, and used to categorize level of heat stress. Unstressed cattle should have a respiration rate of less than 60 BPM (Breaths Per Minute). At anything above that, milk and reproductive losses will begin. "Moderate stress" is defined as greater than 85 BPM, and can be accompanied by some animal losses. Severe heat stress, with respiration at over 120 BPM, cannot be sustained and must be ameliorated as quickly as possible.

Technologies are available to collect and analyze other potential measures of heat stress. Some are currently most applicable for research settings, but others have found a fit in some commercial operations. These include activity monitors to estimate laying bouts, data temperature loggers which can be inserted for extended periods attached to CIDR® devices, electronic boluses, infrared laser guns and thermograph cameras. There are also multiple apps available to simplify calculation of a Thermal Heat Index (THI), which can flag the need for heat reduction efforts.

<u>Effective Responses.</u> Basically, dairies have the opportunity to adjust the ration or adjust the environment in response to heat stress. Historical practices include shade; fans (but only if the air is cooler than the animal!); sprinklers (if not too humid to prevent significant evaporation); avoiding crowding; minimized holding time; and, adjusting feed management to provide a greater portion of the ration in the evening, include buffer, and take extra care to minimize separation and sorting.

Some ongoing research, as reported by Dr. Collier, is looking at the feasibility of cooling cow bedding to facilitate heat transfer away from the animals via conduction rather than evaporation. This may fit particularly well in humid areas. Basically, they are working on a design that places heat exchangers, which move very cool water through panels, in or under the bedding. Potential advantages would be less water and electricity use than traditional fans and misters, but more work will be needed to come up with an efficient exchange system and an equipment set-up that is compatible with barn scrapers.

Dr. Pete Hansen, University of Florida, also presented information on areas of current research involving technologies to reduce the impact of heat stress.

- Utilize genomic tools to take advantage of heat-tolerant genetics without sacrificing milk yield potential;
- Introduce specific genes, such as the 'slick gene,' or utilize other genetic modification technology, to enhance heat tolerance of dairy animals;
- Introduce specific genes via targeted, more traditional breeding selection;
- Use of proven feed additives (although efforts to date have had limited success);
- Antioxidant feeding (possibly carotene or melatonin);
- Utilizing embryo transfer within a program that ensures the embryo is still in the lab, rather than actually present inside a heat-stressed recipient, at the point in its life where it is most susceptible to heat damage. While effective, this is currently cost-prohibitive.

Heat stress can be a major threat to profitability, but strategies exist – and new ones are being developed – to reduce its impacts on production, reproduction, and health. Dairies need to individually assess what tools hold the most promise for their situation, for all animals in the herd.