ADSA Southern Section Symposium: Strategies for Managing Reproduction and Udder Health in Heat-Stressed Dairy Cows

605 Optimization of breeding decisions for dairy cattle subject to long periods of seasonal heat stress. A. De Vries*[1], F. Du[1], K. D. Gay[1], T. R. Bilby[2], J. Block[3], and P. J. Hansen[1], [1]*University of Florida, Gainesville,* [2]*Texas AgriLife Research and Extension, Stephenville,* [3]*OvaTech LLC, Gainesville, FL.*

Long periods of heat stress in the Southeast United States have persuaded many dairy producers to adopt a different breeding policy in the warm summer compared with the cooler winter. During heat stress, often cheaper semen is used or breeding is stopped altogether. Major reasons are difficulty in getting cows pregnant or the desire to avoid calving in the summer, and the availability of grass on pasture based farms. Policies are known to vary widely. The objectives of this project were (1) to develop an economic decision aid that can evaluate different seasonal breeding policies and find an optimum policy given dairy farm constraints, and (2) compare policies including the transfer of sexed female embryos (ET) to dairy cows in the summer, and (3) evaluate the use of sexed semen when it is available year round. A large Markov chain dairy herd simulation model combined with linear programming was developed. The model simulated heifers and cows from birth to the end of the ninth parity, using weekly steps. Seasonality was modeled as 52 periods per year. Heat stress was assumed to affect milk yield production, fat yield production, fertility, involuntary culling, and death risk. Decision variables were 3 types of breedings, culling, and which heifer calves to keep. Available constraints included the number of milking cows, total cows, a closed herd, and sale or purchase of pregnant heifers. The profitability of ET in the summer vs. conventional AI depended on the constraint imposed. In an open herd with all heifer calves sold, a total cow constraint, no delayed inseminations, and all breedings in the summer with ET, the ET policy resulted in a loss of $4 per milking cow per year. In a closed herd with optimal decision making regarding breeding type and a milking cow constraint, the value of the ET option was $88 per milking cow per year. The milking cow constraint also resulted in the use of more sexed semen in heifers during the summer and even in cows during the fall. In summary, optimal breeding decisions depended largely on dairy farm constraints, in addition to the effects of heat stress on animal performance.

Key Words: heat stress, breeding decision, dairy

606 Strategies to improve reproductive performance during heat stress in lactating dairy cows. T. R. Bilby*, *Merck Animal Health, De Soto, KS.*

Heat stress (HS) negatively affects all aspects of dairy cattle production. Decreased milk production and reproduction losses during the summer substantially affect the economic potential of dairy farms. The annual economic impact of HS on US animal agriculture has been estimated at $2 billion, with the dairy industry alone accounting for $900 million of this loss. Consequently, strategies should be initiated to lessen the severity of HS on both reproduction and milk production to improve cow performance and farm profitability. With the continued increase in milk production per cow, sensitivity of the dairy cow to elevated climatic conditions has increased. Higher milk production associated with an increase in dry matter intake enhances metabolic heat production which aggravates thermoregulatory competence of lactating dairy cattle. Several experiments have shown that milk production declines during summer months with a greater reduction in fertility. Intensive cooling of cattle still remains the superior strategy for improving reproduction. However, strategies in addition to proper cooling can be implemented to mitigate the negative effects of HS on reproduction dairy cattle. Increased demands for factors such as glucose and IGF-I during HS to sustain milk production may compromise early embryo development, in turn, increasing embryo loss. Recent research on manipulation of embryos in vitro with hormonal supplements has illustrated beneficial effects on fertility post transfer during summer. In addition, the percent of heifers born was increased due to the use of sexed semen for in vitro embryo production. The use of reproductive hormones to by-pass the low estrous detection, improve ovulation, and (or) increase progesterone concentration during summer has shown promise in negating summer fertility decline. Utilizing natural service sires during summer may reduce fertility due to the effects of HS on male fertility. In conclusion, different hormonal, managerial, and reproductive techniques can be employed to reduce the severity of HS in lactating dairy cows.

Key Words: dairy cattle, heat stress, fertility

607 Management and dietary manipulations during heat stress periods to improve lactation and reproduction. J. E. P. Santos* and C. R. Staples, *University of Florida, Gainesville.*

Dairy cows undergo hyperthermia during heat stress which causes a dramatic reduction in nutrient intake and absorption. Nevertheless, only half of the loss in production is attributed to reduced dry matter (DM) intake. Reduction in DM intake is thought to reduce heat production within the digestive tract, perhaps as a compensatory mechanism to reduce heat load in hyperthermic cows. Hyperthermia and reduced DM intake decreases rumen contractility and increases retention time of feeds, thereby increasing the risk of acid accumulation in the rumen. Cows exposed to high ambient temperatures have increased respiration rate, which can result in respiratory alkalosis and excessive loss of CO_2, thus reducing the amount of salivary buffers produced. Dairy cows exposed to heat stress also have depressed reproductive performance. In general, most dietary interventions during heat stress that have resulted in benefits to lactation have only had minor effects on reproductive performance. An often neglected area is the immediate prepartum period. Recent research at the University of Florida has demonstrated that cooling pregnant cows either during the entire nonlactating period or only during the last 4 weeks of gestation has long-lasting effects on the subsequent lactation. Providing evaporative cooling at temperature and humidity index >65 reduced body temperature approximately 0.3 to 0.4°C for 7 to 10 h during the afternoon which seems to be sufficient to elicit positive pre- and postpartum responses in cows. Cows cooled prepartum had increased mammary cell proliferation, which is thought to mediate some of the improvements in lactation performance. Increments in lactation performance due to evaporative cooling prepartum have ranged from 3 to 5 kg/d more milk during the first 15 to 40 wk postpartum. The same benefits from cooling dairy cows prepartum have not been observed for reproductive performance. Nevertheless, heifers born from cows receiving evaporative cooling prepartum had altered immune function and improved lactation.

Key Words: heat stress, nutrition, reproduction

608 Milk somatic cell counts in Southeast dairy herds. K. L. Anderson*[1], E. Wemple[1], K. Ingawa[2], M. Correa[1], R. Lyman[1], and K. Mullen[3], [1]*College of Veterinary Medicine, North Carolina State University, Raleigh,* [2]*Dairy Records Management Systems, Raleigh, NC,* [3]*College of Agriculture and Life Sciences, NC State University, Raleigh.*

The objectives of this study were to examine herd average milk SCC from Southeast (SE) dairies to assess potential compliance with the 400,000/mL European Union (EU) SCC standard and to determine if seasonal SCC patterns were present. Recent efforts to reduce US levels for maximal bulk milk SCC to 400,000/mL were not successful. However, beginning in early 2012, milk products shipped from the US to the European Union (EU) must come from milk documented to have an SCC ≤400,000/mL. The USDA National Animal Health Monitoring System has published data that indicate that dairies in the Central, Upper Mideast, Midwest and Southwest regions produce milk that averaged <400,000/mL SCC, with the presence of distinct seasonal increases during the summer and fall. Data from the Southeast (SE) US region were not available in the USDA study. Therefore, SCC records from dairies in 12 SE states were obtained from Dairy Records Management Systems (Raleigh, NC) for the period from March 2009 to February of 2011 and mean SCC by month were determined. Mean monthly SCC of dairy herds in several SE states were often >400,000/mL and exhibited a distinct seasonal pattern, with peak mean levels occurring from July to October. To determine associations between elevated SCC and individual mastitis pathogens, microbiology was completed on 4988 quarter milk samples from 1,247 cows from 14 North Carolina dairies with a range of low to high bulk milk SCC. Statistical associations between specific mastitis pathogens and elevated SCC were determined using either Chi-Square or Fisher's Exact test. *Staphylococcus aureus*, *Streptococcus* spp., and mixed major pathogens were significantly ($P < 0.0007$) associated with increased individual cow SCC (>400,000/mL). Dairies in the SE face challenges to lower SCC and will need to use strategies to control specific mastitis pathogens such as *Staphylococcus aureus* and environmental streptococci.

Key Words: milk, SCC, Southeast

609 Management practices to reduce heat stress, prevent mastitis, and lower somatic cell counts in dairy cows and heifers. S. C. Nickerson*, *University of Georgia, Athens.*

This presentation discusses various management practices for abating heat stress in dairy cattle to maximize cow comfort, reduce udder infections, lower SCC, and improve milk production. Hot and humid environmental conditions along with solar radiation, animal crowding, insect pests, and poor ventilation add to the stress already imposed on the productive capacity of the dairy cow. Collectively, these sources of stress are associated with an increased prevalence of mastitis, elevated SCC, lowered milk quality, and reduced yield. Methods to manage heat stress include a balanced diet, provision of adequate shade to alleviate solar radiation, and cow cooling in the forms of chilled drinking water, commercial coolers, corral manger misters, mechanical refrigeration, cooling ponds, and shower and fanning stations in the premilking preparation holding areas and exit lanes. Unfortunately, use of water is problematic because it is an excellent transport medium for mastitis-causing bacteria, especially those from environmental sources. In addition, warm, humid conditions are ideal for the growth of environmental streptococci and coliforms; thus, the environmental load with mastitis-causing organisms markedly increases. As such, proper management of bedding, alley ways, and premilking udder hygiene to minimize bacterial exposure to teats is critical during the summer months of the year to maintain milk quality. Strict monitoring of udder health, bedding management, and pre-milking cow prep through routine bulk milk and individual cow cultures and SCC, and recording of all clinical mastitis cases are essential. In addition, bred heifers, representing the future milking herd, should be managed to reduce the stress associated with horn flies during the hot summer months, which are instrumental in the spread of staphylococcal mastitis.

Key Words: heat stress, mastitis, somatic cell count