Bouncing babies arrive for heat-stress research

Jim Lyle

By Linda Breazeale

They look like normal calves frolicking at Mississippi State University's Dairy Research Unit, but researchers are hoping their genetics may hold the keys to understanding heat stress in dairy herds in the South.

While most dairy breeds in the United States are *Bos taurus*, which are more adapted for temperate climates, some efforts have been made by producers to crossbreed with Brahman, which are *Bos indicus* and more adapted to tropical climates. Those efforts at crossing were geared toward avoiding the summer slump in milk production and improving fertility rates during the hottest months. Unfortunately, the sacrifice in milk production has not made Brahman crosses viable for the dairy industry in the United States.

"The practice of crossing Holsteins and some of the minor *Bos indicus* breeds has not been researched extensively with respect to the southern dairy industry," said Scott Willard, MAFES animal and dairy scientist. "While crossbreeding with common heat-tolerant *Bos indicus* breeds like the Brahman may not produce the intended results from the standpoint of milk production potential, other tropically adapted minor breeds of *Bos indicus*, which have higher levels of milk production, may impact farm profitability and specifically cow fertility during summer heat stress."

Willard is leading MSU's efforts in a multistate research project investigating the feasibility of another *Bos indicus* breed popular in Brazil: the Gir, sometimes spelled Gyr. When crossed with Holsteins in Brazil, they are referred to as Girolando cattle.

"We intend to investigate the effects of heat stress on reproductive performance in dairy cattle with these composite genetics (Gir x Holstein). We will look at milk production and quality, reproductive performance and heat tolerance in our production environments here in Mississippi," Willard said.

Girolando in Brazil produce 8,000 to 11,000 pounds of milk per lactation (about 300 days), but Willard said he hopes Holstein genetics, nutrition and management practices in the United States can improve on that rate. Holsteins in Mississippi produce about 21,000 pounds of milk per lactation.

"We also want to go beyond traditional investigative methods and look at what is happening at the molecular level. We

Will Smith

Willard, center, and research assistants make a hip measurement on a Gir calf.

Jim Lytle

should be able to see how genes are affected under heat stress," Willard said. "Molecular mechanisms have not been evaluated in crossbred dairy cattle as extensively as they have in crossbred beef animals. The crossbred dairy cattle will be used for molecular studies evaluating the physiological and genetic basis for heat tolerance."

As the crossbred offspring get older, Willard said MSU will collect embryos for in vitro studies and investigate the production performance characteristics of these cattle under different environmental conditions. Researchers will screen them for genetic markers that may code for heat tolerance beyond the obvious traits such as looser skin, longer ears and other *Bos indicus* traits that aid in their ability to get rid of excess heat.

MSU is teaming up with the University of Florida, the University of Georgia, the University of Wisconsin, the University of Tennessee, North Carolina State University, and the U.S. Department of Agriculture's Agricultural Research Service, as well as other project collaborators in Brazil. The $1.6 million research is supported by USDA's Cooperative State Research, Education and Extension Service (CSREES) Grant through the Initiative for Future Agricultural and Food Sciences (IFAFS) program.

"Other universities are doing parallel studies regarding embryo research. All of this research will be a long-term commitment for the universities involved," Willard said. "Milk performance data will not be available for three years from the first crossbred cattle, and it will be five years before the next generation yields milk data."

At MSU, 34 mature Holstein cows have been bred with Gir semen and a similar number were bred with Holstein semen for comparative purposes. In the first couple of years, MSU researchers will be gathering vital statistics on every stage of development, from embryo to the calves' growth characteristics to fertility rates in the next generation. Even bulls will be kept for several years of evaluation.

"Measurements on the calves will be taken from birth through puberty to get a handle on their growth characteristics compared to purebred Holstein calves," Willard said. "We're also interested in when the half-bloods will mature relative to Holstein heifers and bulls and will characterize various aspects of their reproductive physiology as they make this transition."

Subsequent studies will incorporate breeding of Holstein cows during summer months with Gir semen versus Holstein semen to evaluate conception rates (tropical versus temperate genetics).

"We believe these investigations will lead to in vitro studies of crossbred embryo heat stress responses and the molecular mechanisms mediating these responses," Willard said.

Ideally, Willard hopes to find higher summer conception rates than purebred Holsteins experience.

"Conception rates for Holsteins in cooler weather is 35 to 45 percent on first service, but during the hottest months, the success rate is closer to 20 percent," Willard said. "We have real problems in the Southern region when heat stress occurs. While breeding to Gir may not be the answer, it may help us understand from the whole animal to the molecular level how our cows might deal with it better."