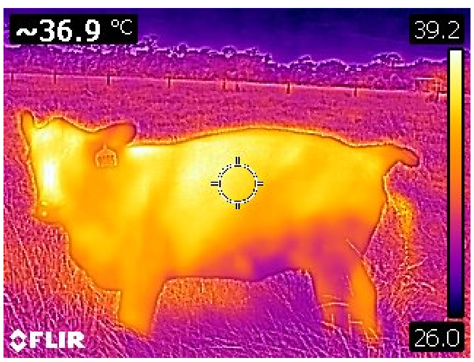
Boosting reproduction without increasing feed costs of beef heifers in Florida

Philipe Moriel, Assistant Professor – Beef Cattle Nutrition and Management
Range Cattle Research and Education Center, Ona, Florida

Published in *The Florida Cattleman and Livestock Journal*, November 2020



Approximately 45% of U.S. beef cows are located in southern and southeastern states where *Bos indicus*-influenced cattle and extreme heat conditions predominate. A major limiting factor for reproductive success of *Bos indicus*-influenced beef heifers is the late attainment of puberty due to genetics, environment (i.e. heat stress), and nutrition. Heat stress is detrimental to cattle metabolism, growth, reproduction, health, and welfare and may become a greater challenge in the future due to the potential impact of global climate change. Environmental conditions are considered thermoneutral when thermal-humidity index (**THI**) $\leq$ 70, mild heat stress when 70 $\leq$ THI < 74, heat stress when 74 $\leq$ THI < 77, and severe heat stress when THI $\geq$ 77. Figure 1 shows the average, minimum and maximum daily THI values obtained at the University of Florida/IFAS - Range Cattle Research & Education Center (Ona, FL). From June to October 2019, average THI values were within or above the threshold considered as heat stress. Also, maximum THI values often reached severe heat stress levels. These challenging conditions during summer partially explain the poorer average daily gain of heifers, despite the greater nutritional composition of forage during Summer vs. Fall.

The cow-calf industry in Florida relies on warm-season forages as the main source of feed for beef cattle. This forage type often does not meet the requirements of growing heifers, even if herbage mass is not a limiting factor. Nutritional analysis of 637 samples of forages commonly grown in Florida (bahiagrass, bermudagrass, stargrass, and limpograss) and reported that most of these grasses contained between 5 to 7% crude protein (**CP**) and 48 to 51% total digestible nutrients (**TDN**), on the basis of dry matter (**DM**). Developing heifers require diets with at least 55% TDN and 8.5% CP on a DM basis to achieve adequate growth rates ($\geq$ 1.0 lb/day). Nevertheless, successful reproductive performance can still be obtained if heifers become pubertal before the initiation of breeding season. In this article, we will provide a summary of our on-going study to optimize growth and reproduction of *Bos indicus*-influenced beef heifers in tropical/subtropical environments.

Growth Pattern (Stair-Step Strategy)

Modifying the growth pattern during the post-weaning phase has been used to promote reproductive success of *Bos taurus* heifers. Previous studies developed *Bos taurus* beef heifers to achieve an even weight gain from weaning until breeding (EVENGAIN) or achieve a low weight gain from weaning until 45 days before breeding followed by a high weight gain in the final 45 days before breeding (LOW-HIGH). Both groups were fed enough nutrients to achieve 65% of the expected mature body weight by the start of the breeding season. The strategy of low weight gain followed by high weight gain is called **Stair-Step strategy** and is usually implemented to explore compensatory gains that occur when nutrition level is increased immediately after a period of nutrient restriction. In that study (Lynch et al., 1997), LOW-HIGH heifers had greater first-service conception rate compared to EVENGAIN heifers (71% vs. 56%). Although final pregnancy rates did not differ between these two treatments (88% vs. 88%), the greater first conception rates of LOW-HIGH heifers led to increased percentage of heifers calving early in their first calving season, which has been associated with greater lifetime productivity and longevity. Hence, the Stair-Step strategy may allow producers to further improve the reproductive performance of their heifers without increasing feed costs. ***It is important to highlight that the studies described above used Bos taurus heifers. It is unknown if this strategy would generate similar results in heifers developed in the Florida, particularly due the Bos indicus genetic contribution and the hot and humid Summer/early-Fall period delaying puberty attainment.*** Our on-going study (funded by the FL Cattlemen Enhancement Board) is exploring the Stair-Step strategy for developing Brangus heifers and our group has some exciting results to share with you.

Experimental design: The experiment was conducted at the UF/IFAS Range Cattle REC (Ona, FL) from September 2019 to June 2020 (Year 1) and is currently being replicated from September 2020 to June 2021 (Year 2). In September of each year, 64 Brangus heifers were allocated into 1 of 16 bahiagrass pastures (4 heifers/pasture). Treatments were assigned to pastures (8 pastures/treatment) and consisted of: control heifers supplemented with concentrate DM at 1.50% of body weight from September until the start of the breeding season in December (day 0 to 100 of the study; **CON**); or stair-step heifers initially offered concentrate DM at 1.05% of body weight from September to October (day 0 to 50 of the study), and then, concentrate DM at 1.95% of body weight (DM basis) from October until the start of the breeding season in December (**SST**; day 50 to 100 of the study). In average, both treatments consumed concentrate DM at 1.50% of body weight from September to December (22% CP and 73% TDN; DM basis).

Preliminary results: As designed, total supplement DM offered to heifers from August to December did not differ between treatments in year 1 (**Table 1**). In terms of growth, average daily gain from day 0 to 50 did not differ between treatments but was greater for SST vs. CON heifers from day 50 to 100 (Table 1), leading to greater overall average daily gain for SST vs. CON heifers. Hence, growth performance of grazing heifers was boosted by the stair-step strategy without increasing feed costs, and such differences in growth performance are likely explained by the results observed for intravaginal temperatures.

Intravaginal thermometers were inserted into heifers to determine the internal body temperatures during September and November. In September (heat stress period), SST heifers had significantly lower intravaginal temperatures from 9:30 am to 6:00 pm compared to CON heifers (**Figure 2**), which is likely a result of lower heat increment and partially explains the lack of treatment effects on heifer average daily gain from day 0 to 50. In November (no heat stress period), supplement DM amount did not affect (*P* = 0.39) intravaginal temperature of heifers, which likely prevented energy waste to cope with heat stress and allowed the greater average daily gain of SST vs. CON heifers.

Percentage of pubertal heifers at the start of the synchronization protocol did not differ between treatments. However, SST heifers had greater final pregnancy rates compared to CON heifers (Table 1). We are repeating this study for another year to confirm these results, but based on data from year 1, **the Stair-Step strategy may be a great opportunity to boost growth and reproductive performance of grazing *Bos indicus*-influenced beef heifers in Florida, without increasing feed costs.**

References

Lynch, J. M., G. C. Lamb, B. L. Miller, R. T. Brandt, Jr, R. C. Cochran, and J. E. Minton. 1997. Influence of timing of gain on growth and reproductive performance of beef replacement heifers. J. Anim. Sci. 75:1715–1722.

Table 1. Growth, reproduction, and supplement intake data (Year 1 only) of control heifers supplemented with concentrate DM at 1.50% of body weight from September until the start of the breeding season in December (day 0 to 100 of the study; **CONTROL**); or stair-step heifers initially offered concentrate DM at 1.05% of body weight from September to October (day 0 to 50 of the study), and then, concentrate DM at 1.95% of body weight (DM basis) from October until the start of the breeding season in December (**Stair-step**; day 50 to 100 of the study).

	Treatment			
Item	**CONTROL**	**Stair-step**	**SEM**	***P*-value**
Body weight, lb				
August	**534**	**534**	4.7	0.98
Mid-September	**603**	**602**	4.7	0.90
November	**666**	**684**	4.7	0.01
Average daily gain, lb/day				
Aug to mid-Sep	**1.39**	**1.37**	0.09	0.87
Mid-Sep to Nov	**1.23**	**1.61**	0.09	0.01
Aug to Nov	**1.31**	**1.49**	0.07	0.07
Total supplement DM offered, lb				
Aug to Nov	**891**	**904**	7.8	0.26
Pubertal November, %	**71.9**	**82.1**	6.77	0.30
Pregnant final, %	**71.9**	**89.5**	6.76	0.07

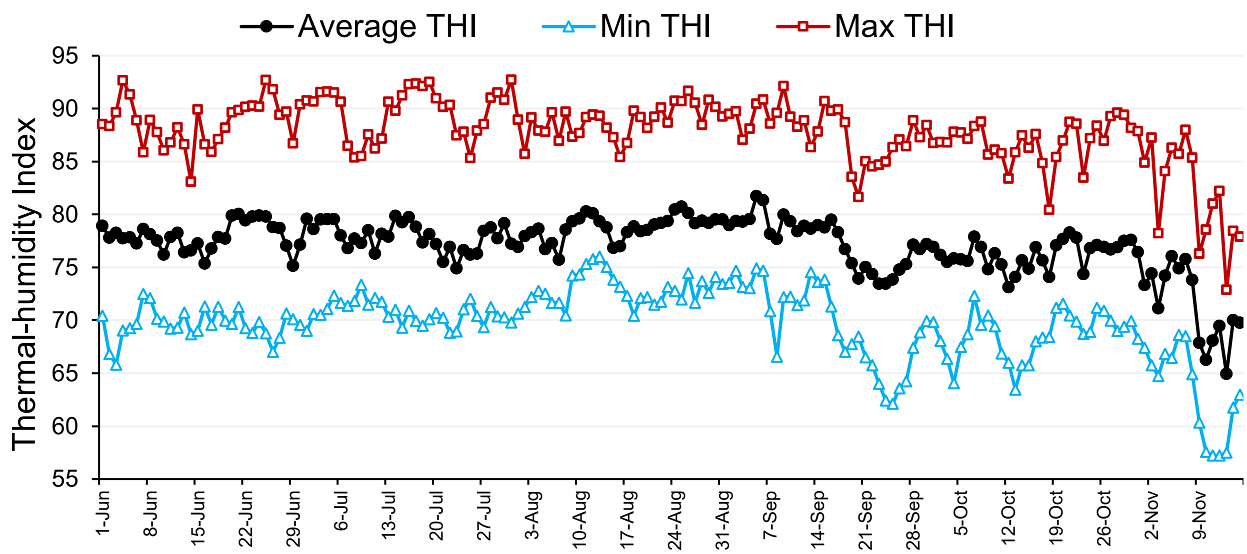


Figure 1. Daily average, minimum and maximum thermal-humidity index (THI) values observed from June to November 2019 at the Range Cattle Research and Education Center. THI = (1.8 × Temperature + 32) – [(0.55-0.0055 × Relative Humidity) × (1.8 × Temperature – 26)].

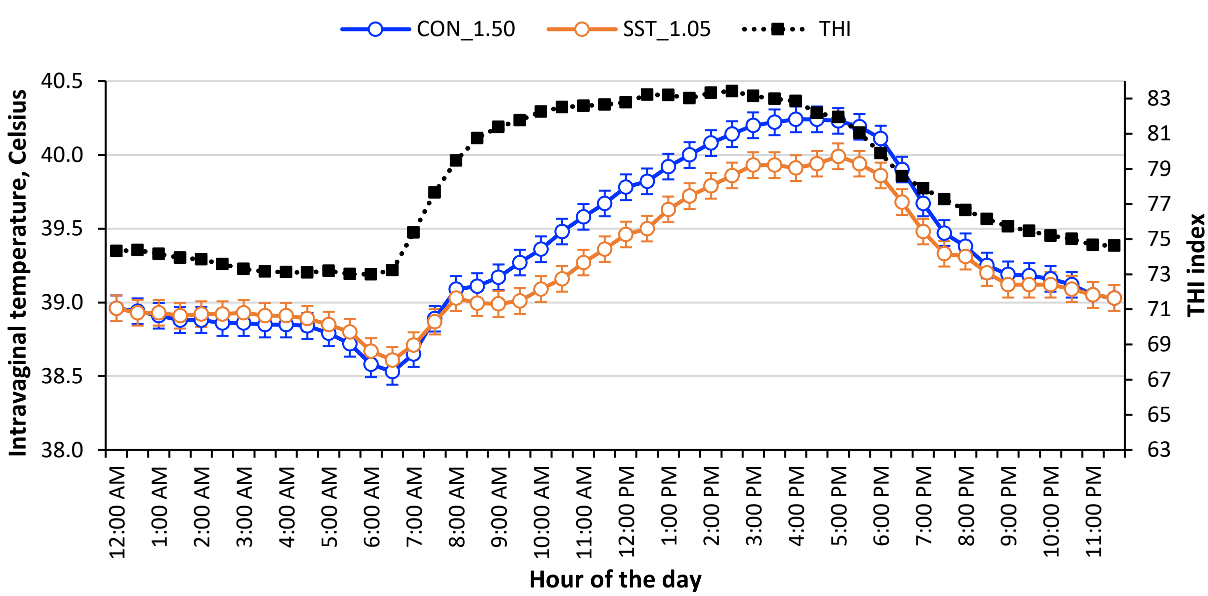


Figure 2. Average intravaginal temperature (September) of control heifers supplemented with concentrate DM at 1.50% of body weight from September until the start of the breeding season in December (day 0 to 100 of the study; **CON**); or stair-step heifers initially offered concentrate DM at 1.05% of body weight from September to October (day 0 to 50 of the study), and then, concentrate DM at 1.95% of body weight (DM basis) from October until the start of the breeding season in December (**SST**; day 50 to 100 of the study).