Final Technical Report

FCEB Project #55

Florida Cattle Enhancement Grant Application

Title: ***A new supplementation strategy for beef heifers in Florida***

AWD15802

Investigators: Philipe Moriel, Joe Vendramini.

Project Overview

Our study will: **(1)** increase reproductive success of beef heifers in FL by boosting weight gain before the start of the breeding season; **(2)** improve our understanding of the differences on the metabolism and microbial population of heifers under different supplementation strategies, which will assist on designing future studies and achieve greater performance levels; and **(3)** generate novel information to further assist stakeholders on nutrition for young beef females, and ultimately, expand their annual calf production.

Deliverables	Progress
Heifer per diem	100% completed.
Heifer plasma hormones	100% completed.
Heifer fecal and vaginal samples	100% completed.

% completion by August 15, 2024 = 100%

Specific aims: Our proposal will address FCA Priorities: **Reproduction efficiency, herd nutrition, and *Bos indicus* genetics.** We will use a novel supplement ingredient (*Bacillus*-based probiotics) to significantly increase overall heifer performance with a relatively small investment cost ($10.40 per heifer). Probiotic is a live microorganism (in this case, bacteria) that provides health benefits to the host, such as increased forage digestion and intestinal health. Thus, our study will: **(1)** increase reproductive success of beef heifers in FL by boosting weight gain before the start of the breeding season; **(2)** improve our understanding of the differences on the metabolism and microbial population of heifers under different supplementation strategies, which will assist on designing future studies and achieve greater performance levels; and **(3)** generate novel information to further assist stakeholders on nutrition for young beef females, and ultimately, expand their annual calf production.

Significance and preliminary results (Year 1)

Our previous study funded by the Florida Cattlemen Enhancement Board demonstrated that average final pregnancy rates were 82% for heifers that achieved puberty BEFORE the start of the breeding season compared to 36% for heifers that achieved puberty DURING the breeding season. Multiple nutritional strategies can be used to induce puberty in heifers before the start of the breeding season. One of these strategies is adding specific feed additives, such as probiotics, that may increase feed digestibility and growth performance in beef cattle.

A probiotic is defined as a live microorganism (bacteria or yeast) that provides health benefits to the host. The expectation of a probiotic is to promote the development of a healthy microbial population predominated by beneficial bacteria, prevent intestinal pathogen colonization, enhance gut tissue maturation and integrity, and improve mucosal immunity (de Lange et al., 2010). The use of probiotics to improve gut health has been widely studied in human nutrition, but in less extent in beef cattle. Some bacteria, such as *Bacillus*, have anti-inflammatory properties leading to improved animal performance.

Specific strains of *Bacillus* have shown benefits in broilers and dairy cattle (Rhayat et al., 2017). *Bacillus*-based probiotics are relatively inexpensive (3.5 cents per animal per day) and capable of improving forage digestion in dairy cattle (Pan et al., 2022). In addition, *Bacillus*-based probiotics can be easily top-dressed or mixed with cubes, molasses, or loose meal supplements at small dosage, which facilitates storage and implementation by producers. However, ***limited studies using this new type of probiotics have been conducted with beef cattle, particularly Bos indicus-influenced cattle in subtropical environments***.

In 2023 (year 1), our group at the Range Cattle REC (Ona, FL) conducted the first year of a study evaluating the use of *Bacillus*-based probiotics for developing replacement beef heifers and its impacts on growth and reproductive responses. Contrary to what we expected, heifer growth performance did not differ between treatments, and heifers achieved similar average daily gain (ADG) before breeding and during the entire study (Table 1). **However, adding probiotics to concentrate supplementation increased the percentage of pubertal heifers before the start of the breeding season and numerically increased conception rates to artificial insemination (Table 1).** Heifer lifetime productivity is positively correlated with the percentage of heifers breeding early in their first breeding season. In general, heifers that breed early in their first breeding season calve early, wean heavier calves, and have greater pregnancy rates and longevity for the next 6 generations compared to those breeding late in the breeding season. Adding probiotics to heifer supplements for 300 days was relatively inexpensive and increased feed costs by $10.50 per heifer. Year 1 data suggest that probiotics seems to be a promising strategy for cow-calf producers in FL. However, **large number of animals per treatment (>50 per treatment) is required to properly evaluate reproductive performance of beef cattle and make recommendations to producers with confidence**. Year 1 had only 32 heifers per treatment. Therefore, we will seek additional funds to repeat the study for a second year to obtain greater statistical power and confirm the results obtained in year 1.

Table 1 - Performance of developing replacement Brangus heifers offered daily concentrate supplementation (2% of their body weight) added or not with a *Bacillus*-based probiotic (3 grams per day) from August 2023 to May 2024.

	Supplement treatment			P-value
Item	**NOBAC**	**BAC**	**SEM**	**SUPP**
% of mature body weight at breeding	70.3	70.0	0.7	0.77
ADG, lb/day				
Weaning to start of breeding season	1.81	1.78	0.07	0.76
Weaning to end of breeding season	1.63	1.62	0.04	0.92
Pubertal, % of total	6.7	24.1	6.6	0.06
Repro tract score, 1 to 5 scale	3.72	4.00	0.12	0.12
Pregnant, % of total				
AI	37.5	52.5	9.1	0.24
AI + Bull	73.3	72.4	8.4	0.94

Data not included in this report = Microbiome analyses of vaginal and fecal samples, and plasma concentrations of metabolites. Data obtained from blood, fecal and vaginal samples were already analyzed in our laboratory. The statistical analyses and data interpretation are currently undergoing. Combined, the microbiome and blood data collected in our study will help us understand how probiotic supplementation altered the intrauterine environment and physiology, leading to improved reproductive success of heifers in year 1.

Results obtained in year 1 are promising. This supplementation program could be a groundbreaking strategy to improve heifer reproductive success in FL for many producers.

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Invoice Date:	08/09/2024
Invoice Period:	03/01/2024 - 07/31/2024
Principal Investigator:	Moriel,Philipe
Award Begin Date:	10/30/2023
Award End Date:	07/31/2024
UF FEIN:	59-6002052

Sponsor Award ID:	55
Award Title:	A new supplementation strategy for beef heifers in Florida
Award Amount:	$72,531.00

Invoice #	I000130164
UF Award #	AWD15802
Primary Project #	P0324616
Primary Department:	60780000
Current Invoice Amount:	$72,449.61

Description	Current	Cumulative
Materials and Supplies	$39,386.36	$39,427.05
Contractual Services	$25,200.00	$25,200.00
Other Expenses	$100.79	$100.79
Direct Cost	$64,687.15	$64,727.84
Facilities and Administrative Costs	$7,762.46	$7,767.34
Total	$72,449.61	$72,495.18

For billing questions, please call 352.392.1235
Brown,Katrina Adel brownk3@ufl.edu
Please reference the UF Award Number and Invoice Number in all correspondence

By signing this report, I certify to the best of my knowledge and belief that the report is true, complete, and accurate, and the expenditures, disbursements and cash receipts are for the purposes and objectives set forth in the terms and conditions of the federal award. I am aware that any false, fictitious, or fraudulent information, or the omission of any material fact, may subject me to criminal, civil, or administrative penalties for fraud, false statements, false claims or otherwise. (U.S Code Title 18, Section 1001 and Title 31, Sections 3729-3730 and 3801-3812).

Katrina Brown

Certifying Official

Payment History	
Cumulative Invoices:	$72,495.18
Payments Received:	$45.57
Outstanding Balance:	$72,449.61
Note: Outstanding balance includes current invoice amount	

FOR UF USE ONLY Additional Projects: N

Project ID	Deptid	Department Name	Current	Cumulative
P0324616	60780000	AG-RCREC-ONA	$72,449.61	$72,495.18