Florida Cattle Enhancement Grant Application

Title: ***Evaluating cost-effective supplementation programs for cows during late-gestation***
FCEB No: 15 **UF Project No: AGR7485**
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Project Overview

Recent studies have shown that the supplementation of energy and protein during the entire-late gestation can also modify offspring growth and health after birth. For instance, cow supplementation of 1 lb of a high-protein supplement during the entire late-gestation increased weaning weights and carcass quality of steers, and accelerated puberty achievement of heifers. It is important to highlight that all studies mentioned above were conducted with *bos taurus* cows grazing cool-season forages, and not with cows having *bos indicus* genetic influence and consuming low-quality, warm-season forages that represent the majority of pastures in FL. It is unknown if cows and calves will experience similar positive results under our environment conditions.

Our proposal will address FCA Priorities **#3 (Calf loss)**, **#7 (Animal herd nutrition winter supplementation)**, and **#8 (Animal health).** We will evaluate if pregnant cows supplemented with energy and protein during the entire late-gestation will have greater reproductive success and long-term growth and health of their calves compared to non-supplemented cows. We also want to investigate if providing the same total amount of supplement, but for a shorter period (6 weeks versus 12 weeks), will achieve similar results, reduce labor, and be more cost-effective than a longer period of supplementation. More specifically, our objectives include using pre-calving supplementation of beef cows to: **(1)** increase their body condition score at calving and pregnancy rates; **(2)** improve calf development during late-gestation and impact their subsequent health and growth, and consequently, further increase cowherd profitability; **(3)** improve our understanding of the differences on the metabolism of mature cows (and their calves) under different pre-calving supplementation strategies, which will assist on designing future studies and harvest greater performance levels; and **(4)** generate novel information to further assist producers and county.

Significance

Figure 1. Total daily energy requirements (NEm), Mcal/day

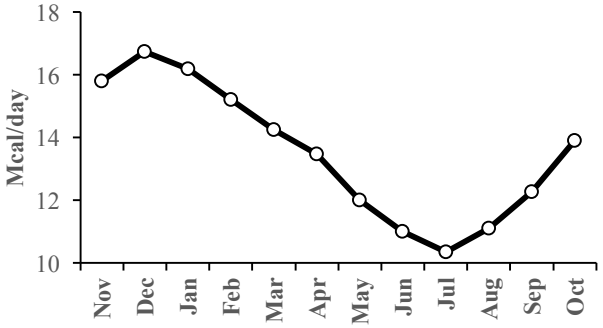

Figure 1 represents the daily energy requirement of a mature Brangus cows calving in November and weaning its calf in July. Within a production cycle, nutrient demand of cows achieves the lowest levels during the first 30 days after calf weaning, then exponentially grows during late-gestation. This occurs because approximately 2 thirds of calf fetus growth occur during the last 12 weeks of gestation. However, late-gestation also corresponds with the beginning of Fall/Winter seasons when forage nutritional value and availability are low. Unfortunately, reproduction has the lowest nutrient priority, and consequently,

it will be impaired by this mismatch between nutrient demand and availability. Increased reproductive success can be achieved by increasing body condition score at calving (5 or 6, according to a 1 to 9 scale). In fact, body condition score at calving is the most important factor that influences the interval from parturition to first ovulation, overall pregnancy rate, and calving distribution of beef cows. Several cow-calf operations do not provide any kind of supplementation before calving, and inadequate dietary energy/protein during late pregnancy lowers reproduction even if the amount of energy and protein consumed after calving are sufficient. So, we are missing an opportunity to increase cow reproductive success.

In addition, recent studies have shown that the supplementation of energy and protein during the entire-late gestation can also modify placental development, fetal organ formation, and improve offspring growth and health (a process called ***fetal-programming***). For instance, calves born to cows that experienced energy deficiency during the last 40 days of gestation experienced poor vaccine response and antibody production, which might compromise calf health and increase calf loss. Also, cow supplementation of 1 lb of a high-protein supplement during the entire late-gestation increased weaning weights and carcass quality of steers, and accelerated puberty achievement of heifers. Thus, the decisions about cowherd supplementation should also include the impact on future offspring performance. Identifying nutritional strategies that can improve cow reproductive performance, decrease calf loss, and optimize future calf growth and health is crucial and the primary goal of this proposal.

It is important to highlight that all of those studies mentioned above were conducted with *bos taurus* cows grazing cool-season forages, and not with cows having *bos indicus* genetic influence and consuming low-quality, warm-season forages that represent the majority of pastures in FL. It is unknown if cows and calves will experience similar positive results under our environment conditions. Hence, our proposal will: **(1)** evaluate if supplementation of Brangus cows during the entire late-gestation **(2.25 lb/day for 12 weeks = 189 lb per cow)** will increase reproductive success of cows, calf development during gestation and performance after birth to levels higher than the cost of this supplementation strategy, and **(2)** investigate if concentrating cow supplementation during their period of lowest nutrient demand (first 6 weeks after weaning) will be more cost-effective than cows supplemented during the entire late-gestation. First, we believe that cows supplemented during late-gestation, regardless of length of supplementation, will have greater profitability than non-supplemented cows due to improvements on cow reproduction and calf performance. Second, we believe that supplementing **4.50 lb/day for 6 weeks after weaning** will reduce feeding costs, have the greatest improvement on cow weight gain and reproduction success, but not cause fetal-programming effects (due to the shorter supplementation period), whereas the supplementation of **2.25 lb/day for 12 weeks** will have greater feeding costs, have a lower improvement on reproduction, but enhance calf development during gestation and performance after birth.

Approach

The 3-year experiment is being conducted at the Range Cattle Research and Education Center (RCREC; Ona). The study began at weaning (August 2017) and will be repeated twice (**Cow group 1** = March 2017 to March 2019; **Cow group 2** = March 2018 to March 2020) in order to have stronger data and powerful statistical analyses. Pastures were prepared in March 2017. In

mid-August (day 0 of the study), mature Brangus cows were allocated into 1 of 6 bahiagrass pastures (14 cows/pasture; 84 cows/year). Treatments consist of cows receiving:

(1) no concentrate supplementation until calving (**CON**);
(2) 2.25 lb/day of dry distiller grains (DDG) from mid-August to mid-November (**SUP12**; all 12 weeks of late-gestation; total of 189 lb of supplement/cow);
(3) 4.50 lb/day of DDG from mid-August to early-October (**SUP6**; first 6 weeks after weaning; total of 189 lb of supplement/cow).

Supplement will be offered twice weekly (Mondays and Thursdays). Trace mineral/vitamin mix will be provided separately in a loose meal form during entire late-gestation. After calving, cows and calves will be managed similarly until the end of the study.

Cow evaluation: Cow body weight and body condition score will be collected every 60 days from August until weaning of first calf crop. Blood samples from jugular vein will be collected from 6 cows/pasture before and after calving (days 0, 45, 90, 150, 180, and 210) to determine the plasma concentrations of hormones and metabolites correlated with reproductive performance and energy metabolism (glucose, insulin growth factor-1, and non-esterified fatty acids). Pregnancy rates will be determined in May 2018 and 2019 and confirmed at calving.

Offspring evaluation: Calving season will occur from October to December of 2017 (Cow group 1) and 2018 (Cow group 2). Calf blood samples will be collected within 24 hours of birth to determine the concentrations of IgG (indicator of immunity). Calf body weight will be collected at birth and every 60 days until weaning at 8-9 months of age. Calves will be vaccinated against bovine respiratory disease pathogens in March and July. After weaning, 30 steers will be assigned to a post-weaning evaluation of growth and immune response, whereas 48 heifers will be selected for a 150-day development program (July to November) and a 60-day breeding season (December to February). Steers will be fed ground hay and concentrate for 45 days in drylot. Blood samples of steers will be collected from jugular vein on days 0, 1, 3, 7, 14, and 45, relative to weaning, to determine the plasma concentrations of haptoglobin and cortisol (indicators of immunity and stress), and serum antibody titers against bovine viral diarrhea virus 1a and infectious bovine rhinotracheitis virus (indicators of vaccine response). Heifers will graze on bahiagrass pastures and receive concentrate supplementation to achieve 1.25 lb/day of weight gain until the end of breeding season. Blood samples of heifers will be collected from jugular vein every 7 days from September to February to determine the plasma progesterone concentrations (indicator of puberty assessment).

Anticipated outcomes and timeline for the project

***Breakeven scenario*:** The total amount of supplement will be the same (189 lb of DDG/cow), so the only difference among treatments is the additional hours of labor needed to provide supplements for 6 or 12 weeks. Assuming a herd of 100 cows, we expect that 2 hours of additional labor will be needed for every feeding event (2 hours × $12.05/hour cost with minimum wage and fuel ÷ 100 cows = $0.241/cow/feeding event). Thus, labor cost for cows supplemented

for 6 weeks will be $2.89/cow (6 weeks × 2 feeding events/week × $0.241/cow/feeding event), whereas labor cost for cows supplemented for 12 weeks will be $5.78 (12 weeks × 2 feeding events/week × $0.241/cow/feeding event). Therefore, a herd of 100 cows will require 1,820 and 2,040 lb of additional pounds of weaned calves to cover the extra labor costs with pre-calving supplementation for 6 weeks or 12 weeks, respectively (See Table 1). In other words, pregnancy rate needs to increase by 3 to 4 percentage units or calf loss needs to decrease by 3 to 4 percentage units to cover the additional costs.

Table 1. Production level required to breakeven	**Supplementation for 6 weeks**	**Supplementation for 12 weeks**
Supplement cost (189 lb of DDG/cow @ $220/ton)	$20.79	$20.79
Feeding cost (labor + fuel)	$2.89	$5.78
Total cost, $/cow	**$23.68**	**$26.57**
Additional weaning weight (@$1.30/lb of calf weight)	18.2	20.4
Additional weaning weight for 100 cows	1,820	2,040
Additional 550-lb calves for 100 cows to breakeven	**3.31**	**3.70**

General comments to sponsors

By design, cow supplementation began at the start of the last trimester of gestation, and thus, animal feeding phase had to begin in min-August and will end in November 2017 (Cow group 1). However, all reagents for laboratory analyses of year 1 were successfully purchased from before August (the late purchase date of these reagents was intentionally used due to the short life of commercial laboratory kits). Blood samples collection began in mid-August and will be completed by mid-November. All laboratory analyses described in the proposal will be performed before early-December once all blood samples are available. An article summarizing the available data will be prepared and submitted to The Florida Cattlemen and Livestock journal in January 2018. Due to conflict of dates, the educational program for producers was postponed to October 2017. This program will be delivered in a 3-day format training in collaboration with livestock agents. The program will cover multiple topics related to body condition score and nutritional management of beef females. At the end of the program, producers will be exposed to an interactive body condition score training to improve the accuracy of body condition scoring. Due to the educational program being postponed, the **project completion percentage by September 1st, 2017 was 83%, but will reach 100% by November 2017.**

Data Summary (data collected from mid-August to September 2017).

The study began in mid-August. So currently, we only have the baseline performance data at the start of the study (Table 2). No complications have been observed, and cows are consuming the DDG supplement within a few minutes after morning supplementation. Cow blood samples, body weight and BCS will be collected in October and November, whereas calf birth body weight and blood samples will be collected immediately after calving (November). All reagents were purchased, so we are ready to run all laboratory analyses as soon as blood samples are available.

Table 2. Growth performance of cows receiving no supplementation from mid-August until calving (CON), or dry distillers grains supplementation from mid-August to October (4.50 lb of DDG daily for 6 weeks; SUP6) or from mid-August until calving (2.25 lb of DDG daily for 12 weeks; SUP12).

	Treatments				*P*-value
Item	**CON**	**SUP6**	**SUP12**	**SEM**	**Treatment**
Cow Body Condition Score					
August (Start of study; day 0)	5.04	4.96	5.22	0.097	-
October (day 45)					
November (calving day 90)					
Cow Body Condition Score change					
August to October					
October to November					
Cow Body Weight, lb					
August (Start of study; day 0)	908	939	935	10.2	-
October (day 45)					
November (calving day 90)					
Cow Average Daily Gain, lb/day					
August to October					
October to November					

BUDGET FOR FLORIDA CATTLE ENHANCEMENT FUND- BUDGET JUSTIFICATION					
PROJECT TITLE: Evaluating cost-effective supplementation programs for cows during late-gestation					
DETAILED LINE ITEM DESCRIPTION	QTY	% Complete	TOTAL	EXPLANATION/JUSTIFICATION OF DELIVERABLE	COMPLETION DATE
Materials and Supplies	Various	100%	$ 3,603.05	Laboratory consumables for upcoming collections of blood and feed samples, fencing supplies, and pasture shade structures.	8/15/2017
Laboratory analyses - Blood hormones and metabolites, and gene expression	Various	100%	$ 5,549.91	Cost to purchase commercial kits to analyze the plasma concentrations of IGF-1 and glucose (480 samples) and gene expression of liver tissue samples (100 samples)	8/1/2017
Data and sample collection	N/A	100%	$ 7,930.78	Cost for sample and data collection	7/31/2017
IDC	N/A		$ 2,646.26		N/A
GRAND TOTAL: (equal to percentage of completion)			**$ 19,730.00**		