Performance of Beef Calves Provided Molasses-Based Creep Supplements

John Arthington[1]

Molasses-based liquid creep supplements have the advantage of self-limiting intake in suckling beef calves. Performance and economic responses are highly variable among years.

Summary

These results support the earlier findings by Dr. Bill Kunkle and his research involving limit-creep supplements based on cottonseed meal and salt mixtures. Calf performance responses, as measured by the added gain realized by creep supplementation, are highly variable and cannot always be described by amounts of creep feed consumed. This variability has large and direct impacts on the cost effectiveness of the management system. In our studies, using liquid molasses-based creep supplements, we realized a 4-year average cost of gain of $0.53 / lb of added gain – not including the costs associated with feeding equipment and labor. Although this value may appear cost-effective, in 2 of the 4 study years, the cost of added gain exceeded the per lb value of the calves we sold. These studies evaluated an array of molasses-based supplement formulas including those with urea, urea & Alimet®, and cottonseed meal. We did not evaluate sugarcane molasses (blackstrap) alone, which may be a consideration within future study designs. Further, it is important to note that pasture forage conditions likely have a significant impact on the effectiveness of limit-fed creep supplements, particularly when these supplements are offered to older calves in the last months prior to weaning. In our experiments, we realized significant variation in the crude protein content of the bahiagrass pastures between experiments. In Experiment 2, pasture crude protein concentrations were greater and calf response to creep supplementation was poorer than in Experiment 1. There is a likely potential that these two factors are related and may influence the results achieved. Our future studies will attempt to incorporate different pasture forage types (i.e. limpograss vs. bahiagrass) and nutritional quality among our treatment factors. Efforts to better understand the variability in calf responses to limit-creep supplements will assist producers in making decisions on when the management system may add value to their beef production enterprise.

Introduction

Creep feeding is a management tool used to provide supplemental nutrients to pre-weaned calves. The word "creep" refers to the process by which the calf is allowed to creep into (or access) a space that is designed to exclude the cow. There are multiple designs of systems that will achieve this goal ranging from complex to very simple. In general, fencing structures or electrified wire that is positioned 36 to 42 inches above the ground are adequate to allow calf access but exclude cow access. The rationale for creep feeding is centered on the concept that the cow's milk will only provide about half of the nutrition required by a 4 month-old calf. Without supplemental feed, the calf must obtain the remainder of its nutrition from forage. Often the forage base may be of limited quality for the calf to fulfill this deficit. This is further complicated by an inability to consume large amounts of forage due to an underdeveloped rumen. If milk and forage together cannot supply the calf with adequate nutrition, then sub-optimal body weight gain can be expected.

[1]Range Cattle Research and Education Center, University of Florida, Ona, FL.

There are three types or categories of creep feeding. Two types involve the provision of feed or feed byproducts, within a cow-exclusion area, that are offered either 1) free-choice (unlimited creep), or 2) limited (limited-intake creep). The third type involves the management of a high-quality pasture forage that is only allowed to be grazed by pre-weaned calves (i.e. creep grazing).

Decisions regarding creep feeding beef calves must weigh the cost of implementing this management tool against the value of unrealized body weight due to inadequate nutrition. Most studies involving unlimited creep feeding have found that the value of this "added" gain, due to creep feeding, is poorly efficient, meaning that the pounds of creep feed needed to produce 1 lb of added gain is typically more costly than the value of that added gain. During the early weeks of creep feeding it is not uncommon for this ratio to be as great at 12 to 15:1. As days of creep feeding advance, this conversion ratio typically improves, thus producers can realize the greatest economic benefits of creep feeding when the management system can be applied to the herd for over 90 d. Despite the number of days creep feeding is offered, the economics of the practice continue to be debatable. Calves will experience some level of daily gain, even if creep feed is not provided, so it is important that beef producers understand the calculation used to estimate "added" gain. Added gain is the difference between the daily gain of calves consuming creep feed compared to those not consuming creep feed. This added gain is attributed to the creep feed consumed and is often of less value than the cost of feed required to produce it. In general, unlimited creep feeding becomes more economical as feed prices decrease and calf prices increase.

The economic considerations described above occur when unlimited creep feed is provided. Another option for consideration is limited creep feeding, which is designed to provide a small amount of supplemental nutrition targeted to fill gaps in protein and/or energy deficiency and compliment the value of the milk and forage consumed by the calf. In Florida, Dr. Bill Kunkle previously investigated the effects of providing cottonseed meal to pre-weaned calves. Intake was limited by the inclusion of salt, which was gradually increased in the formula (up to 8%) to limit intake to approximately 0.50 to 0.75 lb/d. A summary of 6 experiments revealed that calves experienced 0.30 lb/d of added gain while consuming an average of 0.65 lb of cottonseed meal daily. Each pound of added gain required 2.2 lb of cottonseed meal. Although these experiments revealed significant variation among studies, they collectively suggest that pre-weaned beef calves can experience efficient, cost-effective added gains when provided limit-fed creep supplements.

In Florida, as well as much of the Gulf coast region, the use of molasses-based liquid feeds for the supplementation of beef cows is common. These supplements can be fortified to increase the protein, energy, and/or vitamin and mineral profile of the product. Some of ingredients commonly added to molasses supplements include urea, vegetable meals (i.e. cottonseed meal), byproducts (dried distillers grains), fats and oil, and minerals and vitamins. Molasses-based supplements are also readily consumed by pre-weaned calves and have an added benefit of self-limiting intake.

The objective of these studies was to examine the influence of free-choice, molasses-based creep supplements on the efficiency and cost-effectiveness of added gain in pre-weaned beef calves.

Materials and Methods

Two experiments were conducted at the Range Cattle Research and Education Center in Ona. Each experiment was repeated in consecutive years resulting in 4 years of data. The experiments were conducted using fall-calving (October – December) beef herds and were initiated in April of each year and concluded at weaning (122, 117, 104, and 102 d, respectively). Liquid creep supplements were based on a sugarcane molasses carrier with ingredients added as described below. Supplements were offered to calves in cow-exclusion areas within open 90-gallon tubs.

Experiment 1

The first experiment used Braford cow/calf pairs grazing established summer bahiagrass pastures (20 ac each). Cow/calf pairs were initially stratified by cow age and randomly assigned to pastures (approximately 17 cow/calf pairs per pasture). Treatments consisted of 1) no creep, 2) molasses + urea creep, and 3) molasses + urea + Alimet® creep. Alimet® (Novus International, St. Louis, MO), a commercial source of rumen bypass sulfur-containing amino acids (TSAA), was blended into the molasses + urea formulation (0.63% as-fed basis) and provided 0.22% TSAA. The rationale for including Alimet® was to investigate the potential influence of supplemental TSAA on pre-weaned calf growth. The nutrient profile of the supplements and bahiagrass pasture are shown in Table 1.

Experiment 2

The second experiment used Brangus-crossbred cow/calf pairs grazing established bahiagrass pastures. Treatments were applied to 12 pastures (5 ac) containing 4 and 3 cow/calf pairs in yr 1 and 2, respectively. Treatments consisted of 1) no creep, 2) molasses + urea creep, and 3) molasses + cottonseed meal creep. The nutrient profile of the supplements and bahiagrass pasture are shown in Table 1.

Data Collection

In each of the 4 study years, calf body weight, cow body condition, and cow body weight (following 12-h feed withdrawal) was recorded at the start and end of the creep supplementation period. Calf body weight was adjusted for sex of calf. Creep intake was determined by weighing each tub in 14-d intervals and disappearance calculated. Pasture forage quality was assessed by hand-plucked samples collected in June of each year.

Statistical Analyses

All responses were analyzed by fitting mixed models using the PROC MIXED procedure of SAS (SAS Institute Inc., 1996). The model statement included the treatment and time (when appropriate). Data were analyzed using pasture (treatment*year) as the random variable. Pasture was the experimental unit. Means were considered different when F test *P* values were < 0.10.

Results

Supplement Intake

There was annual variation in the consumption of liquid creep supplement in Experiment 1 with almost twice as much supplement consumed in Year 2 vs. Year 1 (Table 2). Further, in Year 2, calves provided creep supplements with Alimet® consumed almost 1/3 less supplement than calves provided supplements without Alimet®. This difference is likely due to an offensive odor, which is characteristic of this ingredient. There was no treatment or treatment x year interactions for supplement intake in Experiment 2, with calves consuming an average of 1.03 lb of supplement daily (Table 2).

Calf Performance

In Experiment 1, creep supplementation resulted in 0.14 lb/d of added gain compared to calves receiving no creep supplement. The average daily gain (ADG) of calves consuming supplements containing Alimet® was 5.1% less than calves consuming supplements without Alimet® (Table 3). This response is likely the result of reduced supplement intake rather than a direct adverse effect on calf growth. Although supplement intake was greater in Experiment 1 than in Experiment 2, there was no effect of treatment on calf ADG in Experiment 2 (Table 4). Overall, calf ADG was less in both years of Experiment 2 compared to those in Experiment 1 (Figure 1).

The cost of the base molasses + urea supplement was $137/ton (delivered, Ona, FL). Calculated cost of gain was highly variable ($0.10 to $4.45 / lb of added gain) and due primarily to annual differences in added gain among creep-fed calves. An overall assessment of added gain and creep intake revealed a 4-yr average cost of gain of $0.57/lb of added gain (Table 5).

Cow Performance

There was no impact of creep supplement on change in cow body weight or body condition score (Tables 6 and 7); however, cows in

Experiment 2 had less body weight and body condition at both the start and end of the supplementation period compared to cows in the first experiment.

Table 1. Nutrient profile of molasses supplements and pastures from Exp. 1 and 2.

Item	Exp. 1 Molasses + Urea [1]	Exp. 2 Molasses + Urea	Exp. 2 Molasses + Cottonseed meal [2]	Exp. 1 Pasture	Exp. 2 Pasture (Yr. 1)	Exp. 2 Pasture (Yr. 2)
	---------- % (DM basis) ----------					
Crude protein	21.0	19.0	16.4	8.6	11.8	19.3
Acid detergent fiber	-----	-----	4.6	40.7	-----	34.0
Neutral detergent fiber	-----	-----	5.7	69.5	-----	64.0
Total digestible nutrients	75.0	72.0	71.1	56.3	-----	61.0
Ca	0.95	0.85	0.75	0.30	-----	0.30
P	0.06	0.07	0.29	0.19	-----	0.39
Mg	0.42	0.39	0.45	0.24	-----	0.22
K	5.20	4.90	4.19	1.02	-----	2.12
Na	0.122	0.078	0.185	0.010	-----	0.021

[1]A third treatment in Exp. 1, was created by blending Alimet® (Novus International, St. Louis, MO) into the molasses + urea formulation (0.63% as-fed basis) to provide 0.22% TSAA.
[2]Blackstrap molasses + cottonseed meal blend (80:20; as-fed basis).

Table 2. Voluntary intake of creep feed over 100 days prior to weaning (lb/d) [1]

Item	Molasses + Urea	Molasses + Urea + Alimet	Pooled SEM	P - value
Exp. 1 (Yr. 1)	0.19	0.19	0.023	1.00
Exp. 1 (Yr. 2)	0.59	0.41	0.023	0.004
	Molasses + Urea	Molasses + Cottonseed Meal	Pooled SEM	P - value
Exp. 2 (Yr. 1 & 2)	0.91	1.14	0.18	0.39

[1] Creep intake was determined by weighing individual 90-gallon tubs on 14-day intervals and disappearance calculated

Table 3. Effects of creep-feed formulations containing molasses and urea with or without Alimet on performance of beef calves over 100 days prior to weaning (Exp. 1).

	Treatment				Contrasts	
Item	No Creep	Molasses + Urea	Molasses + Urea + Alimet	SEM	Alimet vs. No Alimet	Creep vs. No Creep
April body weight, lb	358	364	363	5.9	0.84	0.40
Weaning body weight, lb	575	602	589	6.9	0.10	0.01
ADG, lb/d	1.95	2.14	2.03	0.034	0.03	0.007

[1]Pooled results of a total of 265 calves (2 years; 8 pastures/year; n = 3 pastures each for creep supplements and 2 pastures for no creep control.

Table 4. Effects of creep-feed formulations containing molasses and urea or cottonseed meal on performance of beef calves over 100 days prior to weaning (Exp. 2).[1]

	Treatment				Contrasts	
Item	No Creep	Molasses + Urea	Molasses + Cottonseed meal	SEM	Urea vs. Cottonseed meal	Creep vs. No Creep
April body weight, lb	302	287	287	7.4	0.99	0.15
Weaning body weight, lb	468	453	461	9.8	0.58	0.39
ADG, lb/d	1.37	1.35	1.46	0.053	0.15	0.55

[1]Pooled results of a total of 84 calves (2 years; 12 pastures/year; n = 4 pastures/treatment.

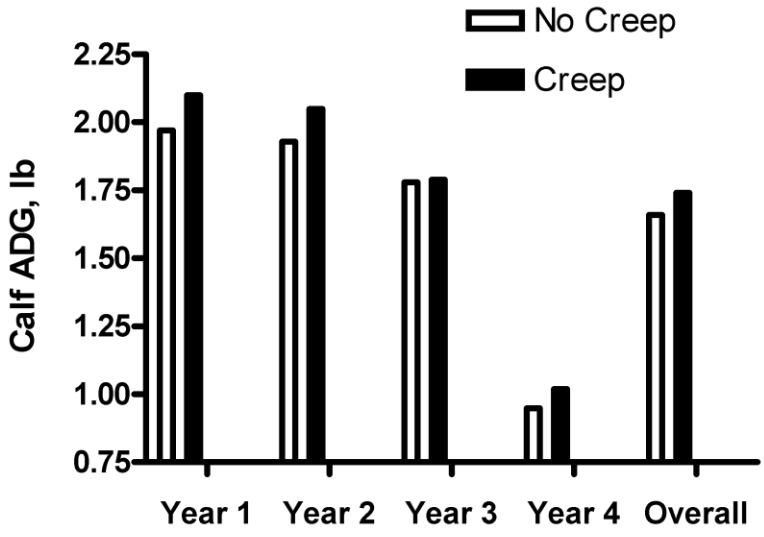

Figure 1. Effect of liquid, molasses-based creep (treatments pooled within year) over 4 years. Experiment 1 = Years 1 and 2 and Experiment 2 = Years 3 and 4.

Table 5. Cost of added gain for creep-fed calves

Item	Added Gain, lb/d	Creep Intake, lb/d	Cost of Gain, $ [1]
Exp. 1; Year 1	0.13	0.19	0.10
Exp. 1; Year 2	0.12	0.50	0.29
Exp. 2; Year 1	0.01	0.65	4.45
Exp. 2; Year 2	0.07	1.42	1.39
Overall Total [2]	38	294	0.53

[1]Cost of gain based on $137/ton sugarcane molasses delivered (Ona, FL) without consideration to costs of feeding equipment or labor.
[2]Overall total cost of gain calculated from the total gain and creep intake within the individual creep feeding periods of each study year (122, 117, 104, and 102 days, respectively).

Table 6. Effects of calf creep-feed formulations containing molasses and urea with or without Alimet on body weight (BW) and body condition score (BCS) of beef cows over 100 days prior to weaning (Exp. 1).

	Treatment				Contrasts	
Item	No Creep	Molasses + Urea	Molasses + Urea + Alimet	SEM	Alimet vs. No Alimet	Creep vs. No Creep
	---------- lb ----------					
April BW [1]	1072	1070	1081	14.4	0.56	0.83
Weaning BW [1]	1139	1166	1169	14.4	0.88	0.19
BW Change	71	90	93	10.7	0.75	0.17
	----------1 to 5 scale ----------					
April BCS	5.2	5.0	4.9	0.16	0.57	0.23
Weaning BCS	5.9	5.9	5.8	0.19	0.55	0.94
BCS Change	0.7	1.0	0.9	0.07	0.58	0.05

[1]Shrunk BW following a 12-hour feed withdrawal.

Table 7. Effects of calf creep-feed formulations containing molasses and urea or cottonseed meal on body weight (BW) and body condition score (BCS) of beef cows over 100 days prior to weaning (Exp. 2).

	Treatment				Contrasts	
Item	No Creep	Molasses + Urea	Molasses + Cottonseed Meal	SEM	Urea vs. Cottonseed Meal	Creep vs. No Creep
	---------- lb ----------					
April BW [1]	961	919	928	20.1	0.75	0.16
Weaning BW [1]	1025	981	982	19.2	0.98	0.11
BW Change	66	59	50	10.7	0.53	0.32
	----------1 to 9 scale ----------					
April BCS	4.3	4.0	4.1	0.18	0.74	0.36
Weaning BCS	4.7	4.3	4.6	0.16	0.18	0.25
BCS Change	0.46	0.22	0.50	0.157	0.18	0.53

[1]Shrunk BW following a 12-hour feed withdrawal.