

Evaluation of digestible fiber based creep feed diets and subsequent 28-Day complete pelleted starting feed performance

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Abstract

Two experiments were conducted to evaluate the effects of digestible fiber creep feeds and delivery method on cow/calf performance and subsequent carry-over effect on 28-day weaning transition performance of steer calves. Grazing, nursing calves received either no creep (CTL), an unrestricted, all-natural 19.1% CP creep diet (ANT), an unrestricted 19.5% CP creep diet with NPN from urea (NPN), or a 39.6% CP salt restricted, all-natural, creep diet (SLT). Crude protein and digestible organic matter estimates computed from fecal samples were similar across treatments for both July and October sampling periods. Uniformity of these measurements suggests pasture variation across treatments was minimal. Calves receiving the NPN and SLT creep diets grew faster ($P < .05$) than the CTL and ANT treatments. Salt restriction controlled intake to 2.77 lbs/hd/da in the SLT treatment. Total creep consumption was greatest ($P < .05$) in the unrestricted NPN treatment in which calves received a creep feed with 2.4% crude protein equivalents from urea. This level of urea in calves initially weighing less than 400 pounds was not problematic and was an effective way to deliver degradable intake protein. Utilization of salt as a method to control consumption was very successful. Nutrient flow provided by the SLT diet was sufficient to meet supplemental nutrient requirements without over consumption. Cow weight increased from the trial start to the end, but did not differ between treatments. Associated condition score was also unaffected by creep feed treatment, but cows increased condition score by one score value to "6" across all treatments. After weaning, steer calves from each pasture creep feeding treatment were moved directly to feedlot pens and started on a mixed hay and a complete pelleted 28-day starting feed program. Post-weaning performance analysis was unable to detect differences in performance between the control calves and those that were previously creep fed. Overall calf gain after weaning on the complete pelleted starting feed program was consistently uniform across treatments demonstrating this program to be an efficient and effective program for transitioning calves from grazing to the feed yard with minimal weaning stress.

Introduction

Delivery of energy and protein supplements to grazing cattle during drought, as preconditioning procedures for nursing calves, and as winter supplements is commonly practiced. And, it is not uncommon to observe considerable year-to-year variation in response to supplementation on pasture.

Supplemental feeding programs for calves nursing cows grazing native ranges can utilize co-products from the soybean milling industry (soybean hulls), the brewing industry (barley malt sprouts), and the wheat milling industry (wheat middlings) as digestible fiber sources. Several studies have been conducted showing supplements prepared with digestible fiber sources containing low levels of starch present less negative associative effects relative to fiber digestibility, when used in grazing situations, than has been observed with starch or molasses supplements (Anderson et al., 1988; Martin and Hibberd, 1990; Galloway et al., 1991; Ovenell et al., 1991; Grigsby et al., 1992). Recent work comparing high starch and high digestible fiber supplements demonstrated that performance differences in growing steers did not differ when supplementation from starch did not exceed .5% of body weight (Garces-Yepez et al., 1997).

Limiting intake of self-fed supplements with salt (sodium chloride) to avoid over consumption, reduce cost, and lower labor requirements is a time-tested practice that has been widely used. Schauer et. al (2000) used yearling steers grazing south central North Dakota native range (initial BW 768 lbs.) to evaluate 16% salt, 5.25% anionic salts (ammonium chloride and ammonium sulfate), 7% calcium hydroxide, and daily hand feeding as methods for limiting intake of supplements based on wheat middlings, soybean hulls, and barley malt sprouts. All supplemented groups grew faster than an unsupplemented control group. Feed efficiencies (supplement/lb. of gain) for the limiting agents evaluated were 1.27, 1.77, 1.35, and .97 for the salt, anionic salt, calcium hydroxide, and hand-fed groups, respectively. Based on supplement intake, ADG, F:G, and variability between years, the data suggested salt to be the most consistent limiting agent for self-fed pasture supplementation.

Urea has long been utilized by feed manufacturers as a rapidly available, low-cost source of non-protein-nitrogen (NPN) for beef cattle. Furthermore, the 1996 Beef NRC states that cattle have needs for both degradable intake protein (DIP) and undegradable intake protein (UIP). Urea serves as an excellent source of DIP and may be needed by beef cattle consuming native range. Additionally, there is a perceived safety concern when urea is being fed to cattle, especially, lightweight calves. However, this concern is often not an issue when appropriate levels of urea are used.

Methods by which supplements are delivered to nursing calves in extensive grazing situations commonly practiced in much of the western US include unrestricted and restricted delivery systems. Given the outcome of delivery systems as described by Schauer (2000), the purpose of this project was to evaluate the effect of digestible fiber-based creep diets (formulated with blends of soybean hulls, barley malt sprouts, and wheat middlings) and the delivery method on performance of cows and calves grazing western North Dakota native range. Specifically, performance of an unsupplemented control group of cows and calves has been compared to three fiber-based diets: 1) a standard all-natural 19.1% CP creep diet in which consumption was unrestricted, 2) a 19.5% CP creep diet containing an inclusion level of urea equivalent to 2.4% crude protein, 3) a 39.6% CP diet in which consumption was restricted with 16% salt to limit intake to approximately 3 lbs/he/da, and 4) to evaluate higher levels of DIP from urea.

In a second study, the effects of pre-weaning creep feed on 28-day weaning transition performance was evaluated when fed through a

mixed hay and complete pelleted starting feed program.

Materials and Methods

One hundred eight crossbred cows from approximately a 3/4 Angus x 1/4 Hereford base with spring born calves sired by Hereford, Angus, Red Angus or Charolais bulls were blocked by sex of calf, sire breed and cow age and placed into two replicates of four treatment groups. The treatments were; no creep feed, an all natural protein creep feed, creep with NPN as part of the protein source, and a salt limited high protein creep. Table 1 shows the analysis of the creep feeds. The first replicate of sixty pairs were placed in four approximately 160 acre native pastures on Section 12 T138N R102W, referred to as Pyramid Park about thirty miles southwest of Dickinson, ND for the duration of the study. The second replicate of 48 pairs were placed in 160 acre pastures on Section 16 T143N, R96W, at the Manning Ranch Headquarters 25 miles northwest of Dickinson. A herbage clipping at the beginning and end of the trial was obtained from a silty site at the Pyramid and the Manning locations. Three 1/4 square meter frames were clipped at each site and separated into cool or warm season grasses, forbs, sedges, woody plants, standing dead, and liter. These values are shown in [Appendix I](#).

All cows and calves were weighed on June 15, 1999 at which time the pairs were placed in their respective pastures. Calf weights, cow weights, and cow condition scores were again obtained at the start of the trial on July 20, on August 31 (interim), and October 19 (weaning) on the Pyramid groups for a 98 day trial period. The Manning groups were weighed, condition scored, and weaned on the day following the Pyramid groups. A fecal sample was obtained from each cow at the onset and at the end of the trial. Samples were forwarded to the Texas A & M Grazingland Animal Nutrition Lab for estimated percent crude protein and dietary digestible organic matter. Results of these analysis and dietary estimate are shown in [Appendix II and III](#).

The creep feeders were placed near the water and mineral feeders in all pastures with the creep feed started on July 23 at Pyramid and July 24 at Manning. The salt limited group was started on the all natural creep, switched to a 8% salt creep on Aug. 17 and to a 16% salt creep on Sept 13.

Post-weaning, a commercially available complete pelleted starting feed program was initiated to document consumption and performance over a 28-day feeding period. Steer calves from each pasture creep treatment were weaned and moved directly to replicated feedlot pens at the DREC Headquarters, Manning, ND.

Results and Discussion



Pasture Creep Feeding Phase

Based on pasture clippings taken during the third week of July and October ([Appendix I](#)), there was adequate forage available throughout the creep feeding period with the composition characterized as being predominantly cool-season varieties. There was a larger representation of warm-season grass varieties, sedges and forbs in the Manning site pastures. Estimates of crude protein ([Appendix II](#)) and digestible organic matter ([Appendix III](#)) were obtained from cows grazing the sampled pasture forages. Crude protein estimates were similar across treatment pastures at both sampling periods, however, as expected, crude protein values dropped approximately 2 percentage points compared to the values obtained at the start of the creep feeding period. Measurements of digestible organic matter

were similar at both the July and October sampling periods. Uniformity of these measurements suggests that crude protein and digestible organic matter consumed by cows nursing calves was similar across treatments.

The control group (CTL) of cows and calves received no supplemental creep feed on pasture. Supplemented calves received diets identified as a basal fiber-based, all natural diet (ANT), a second digestible fiber-based diet containing a portion of the crude protein as equivalent protein from non-protein nitrogen (NPN), and a third digestible fiber-based diet containing twice the crude protein (39.6%) in which intake was salt limited (SLT). Growth and feed consumption are shown in [Table 2](#). During the first 6 weeks of creep feeding, calf ADG did not differ between treatments, however, as the season advanced, calf growth in the last 6 weeks, was slower overall for all treatment groups, but during the last period growth was greatest ($P < .05$) for calves receiving the fiber-based NPN and SLT creep diets and progressively slower for the ANT and CTL groups.

Creep feed consumption was a significant source of variation. Calves receiving unrestricted NPN and ANT treatments readily consumed the fiber-based diets offered suggesting the formulations were very palatable and digestively acceptable. Intake restriction met by the addition of 16% salt in the SLT diet resulted in a 54.9% ($P < .05$) reduction in supplement intake when compared to the NPN group. This reduction occurred without affecting growth due to creep between the NPN and SLT groups suggesting that nutrient shortages not supplied through either pasture or milk were met with an average creep intake of 2.77 lb/hd/day supplied by the SLT diet. These data indicate that, when creep feeds are offered ad libitum, intakes can become greater than desired, and that a cost saving intake limiter like salt can be used very effectively. Moreover, application of an intake limiting protocol, such as the one evaluated in this study, suggests feed efficiency can be improved by limiting intake of a high crude protein/fiber-based creep feed diet to approximately 3.0 lbs/hd/da.

The plant production on pastures during the summer of 1999 was considerably greater than average because the precipitation from August through November of 1998 was 5.73 inches above normal. The precipitation during the critical months of August and September, 1999 was 2.17 inches above normal although January through September of 1999 revealed only .31 inches above normal precipitation. ([Appendix IV- Precipitation at Dickinson](#)). Llewellyn Manske, Phd. Range Scientist, Dickinson Research Extension Center, (Pers. Com.) attributed much of the above normal grass growth in 1999 to the additional moisture in the fall of 1998 which allowed the fall growth of the cool season grasses to reach the 4  leaf stage compared to 1  leaf stage in the fall of 1999. Some of this fall growth overwintered and nonruptured cells regreen providing photosynthetic leaf material (Manske, 1999), which contributed to the above average growth observed during the summer of 1999. The resultant favorable pasture conditions allowed control calves to gain consistently well during the summer diluting creep feed efficiency. Under hotter, drier conditions normally experienced in the Northern Great Plains, gain and efficiency of gain due to supplemental creep feed would have been expected to be greater.

As previously noted, pasture conditions during the summer of this study were very good, and those conditions were reflected in cow gain and condition score change ([Table 3](#)) from pasture turnout to the end of the creep feeding period. Cow weights did not differ between treatments, but all cow groups ended the grazing season heavier than when they started, and increased condition score by one (1) condition score value to a score of "6". During the 91 day creep feeding period cow condition scores did not change between treatments. Cow gain and condition score improvement of this nature is typical of cows nursing calves on western North Dakota pastures that have received above average Summer/Fall precipitation.

28-Day Post-weaning Steer Performance

Steer calves were moved directly from pasture to replicated feedlot pens at the DREC Headquarters, Manning, ND. Each corresponding pasture treatment was replicated twice in the drylot phase. Results of these data are shown in [Table 4](#). Mean starting weight for steer calves from the NPN creep treatment were significantly heavier than steers from the other treatments when the complete pelleted starting feed phase was initiated. The NPN treatment yielded the fastest growth on the digestible fiber creep diets, and tended to grow at a faster pace after weaning, but post-weaning growth measured was not significantly greater than the other treatment groups.

While there was a trend toward faster post-weaning gain among the NPN group, overall calf gain after weaning on the complete pelleted starting feed program was consistently uniform across treatments demonstrating that this program is efficient and effective for transitioning calves from grazing to the feedlot environment with minimal stress. Stress is always a part of weaning, and pre-weaning access to creep feed has been shown to improve the transition for a nursing/grazing calf to that of a weaned/drylot calf by minimizing weaning lag. Data analysis of post-weaning performance for these steer calves, however, was unable to measure detectable differences in performance between calves that had previously been creep fed and the control calves that received no creep.

Acknowledgment

Appreciation is expressed to Land O' Lakes/Harvest States Feed Company for their financial support, and for providing creep feed supplements and Headstart complete weaning feed for this project.

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Table 1. Analysis of Creep Feeds (Dry Matter Basis)

	Non-Prot Nitrogen (NPN)	Salt Limited (SLT)	All Natural (ANT)
Dry Matter %	88.71%	89.23%	90.24%
Crude Protein	19.52%	39.6%	19.11%
ADF	24.17%	12.49%	23.99%
NDF	43.56%	20.25%	42.89%
Calcium	1.17%	1.37%	.94%
Phosphorous	.57%	1.07%	.60%

Table 2. Calf Performance on Digestible Fiber Creep Diets

	Treatments					
	Control	Non-Prot	Salt	All		

	Control (CTL)	Nitrogen (NPN)	Limited (SLT)	Natural (ANT)	SE	P-Value ^a
Calf weights, lb						
On Creep Pasture	261	269	271	269	8	.69
Start of Creep	361	369	366	368	7	.49
Interim	482	502	499	485	9	.52
Weaning	583	627	618	596	9	.16
Calf Avg. daily gain, lb						
Creep Start to Interim	2.89	3.16	3.18	2.82	.09	.07
Interim to Weaning	2.04 ^c	2.56 ^a	2.42 ^{a,b}	2.27 ^b	.04	.01
Creep Start to Weaning	2.43 ^b	2.84 ^a	2.77 ^a	2.52 ^b	.04	.01
Creep Performance (per calf)						
Creep Fed, lbs	0	541 ^a	244 ^b	384 ^{a,b}	50	.02
Creep/Hd/Day, lbs	0	6.41	2.77	4.36		
Creep Gain, lbs	0	37 ^a	31 ^a	7 ^b	4	.02
Creep:Gain, lbs	0	15.4	7.9	86.0	27.3	.32
^a Values with unlike superscripts are different (P<.05)						

Table 3. Cow Performance with Calves that Received Digestible Fiber Creep Diets.

	Treatments					
	Control (CTL)	Non-Prot Nitrogen (NPN)	Salt Limited (SLT)	All Natural (ANT)	SE	P-Value ^a
Body weights, lb						
On Creep Pasture	1187	1191	1174	1135	17	.28
Start of Creep	1265	1270	1206	1194	13	.07
Interim	1302 ^a	1292 ^{a,b}	1251 ^{b,c}	1233 ^c	10	.02
Weaning	1277	1276	1259	1217	14	.17
Cow Condition Score						
On Creep Pasture	5	5	5	5	.2	.98
Start of Creep	6	6	6	6	.2	.68
Interim	6	6	6	6	.1	.2
Weaning	6	6	6	6	.2	.74
^a Values with unlike superscripts are different (P<.05)						

Table 4. Performance of Steer Calves Fed a Complete Pelleted Starting Feed for 28-Days Post-weaning

	Treatments					
	Control (CTL)	Non-Prot Nitrogen (NPN)	Salt Limited (SLT)	All Natural (ANT)	SE	P-Value ^a
Steer weights, lb						
Weaning Weight, lbs (10/19,20/99)	615 ^b	651 ^a	622 ^b	606 ^b	3.9	.01
Ship Weight, lbs (11/17/99)	697	749	703	699	11.8	.12
Gain, lbs	82	98	81	93	13.2	.75
ADG, lbs	2.87	3.46	2.85	3.25	.46	.75
Headstart Efficiency						
Feed:Gain (lbs)	6.89	6.26	7.06	6.51	.70	.85
^a Values with unlike superscripts are different (P<.05)						

Appendix I: Pasture Clippings Dry Matter Weights - Silty Site(Average weight from three 1/4 m² frames converted to lb/ac)					
	Manning		Pyramid		
Herbage Type	July20	Oct. 20	July 23*	July 30*	Oct. 19
Cool Season	2270	842	1709	1584	1270

Warm Season	503	407	0	161	146
Sedges	168	0	4	18	4
Forbs	375	54	182	54	39
Total Grass, Sedges, & Forbs	3316	1303	1895	1817	1459
Standing Dead	171	50	21	75	54
Woodys	0	25	186	11	4
Liter	924	610	443	646	492
TOTAL ALL	4411	1988	2545	2549	2009

*** A second initial clip was taken on July 30 due to lack of warm season collected on the July 23 clip**

Appendix II: NIRS Fecal Sample Analysis - Percent Crude Protein Estimates				
	Pyramid		Manning	
Treatment Group	July 20, 99	Oct. 19, 99	July 21, 99	Oct. 20, 99
All Natural	8.55%	7.51%	9.43%	8.37%
None	9.17%	8.96%	10.66%	8.37%
NPN	10.00%	8.08%	10.48%	8.47%
Salt	10.54%	6.78%	11.08%	7.89%

Appendix III: NIRS Fecal Sample Analysis - Percent Digestible Organic Matter Estimates				
	Pyramid		Manning	
Treatment Group	July 20, 99	Oct. 19, 99	July 21, 99	Oct. 20, 99
All Natural	60.59%	59.23%	60.86%	59.23%
None	60.81%	59.41%	60.82%	59.49%
NPN	60.41%	59.49%	60.47%	61.68%
Salt	60.58%	59.75%	61.40%	61.27%

Appendix IV: 1998-1999 Weather Data for Dickinson Experiment Station, Dickinson, ND*				
Month	Monthly Precipitation	Departure From Normal	Ave. Temperature	Departure From Normal
August 1998	2.90	1.22	70.4	3.3
September 1998	2.03	.40	63.0	7.8
October 1998	4.50	3.50	44.4	.20
November 1998	1.06	.61	31.1	3.1
December 1998	.25	-.16	20.7	5.7
January 1999	.71	.37	11.8	.70
February 1999	.52	.22	28.5	11.6
March 1999	.01	-.65	35.8	8.4
April 1999	1.48	-.36	41.4	.5

May 1999	3.94	1.32	53.3	.5
June 1999	1.99	-1.64	60.9	-1.6
July 1999	.99	-1.12	69.2	.5
August 1999	3.23	1.55	67.4	.3
September 1999	2.25	.62	52.3	-2.9
October 1999	.32	-.68	42.6	-1.6
November 1999	.11	-.34	38.7	10.7
*National Oceanic and Atmospheric Administration				

