DEPARTMENT OF
ANIMAL AND FOOD SCIENCES

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2020 Annual Summary

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Effects of Exercise and Roughage Source on the Health and Performance of Receiving Beef Calves

M. A. Woolsoncroft, M. E. Youngers, L. J. McPhillips, C. G. Lockard, C. L. Haviland, E. S. DeSocio, W. R. Ryan, C. J. Richards and B. K. Wilson

Introduction

Consumers are concerned about animal well-being and the quality of life for animals raised in confinement. Some of these concerns include a lack of exercise and the use of antibiotics. As producers continue to seek alternative methods to improve cattle health and well-being, exercise may be a method to accomplish this and ease consumer concerns. Cottonseed hulls and soybean hulls can effectively be used as roughage sources in diets for receiving calves due to the high fiber content. Feeding hulls as a roughage source can be beneficial for producers not equipped to process or handle long-stem roughages effectively. This experiment used 94 auction market purchased steers in four experimental treatment combinations to determine the effects of exercise (no exercise or 10 minutes of exercise three days per week) and roughage source (cottonseed hulls and soybean hulls or hay) on receiving calf health, performance, and fecal characteristics during a 56-day receiving period.

Findings

There were no differences in BW or ADG regardless of exercise treatment or roughage source. However, calves fed the combination of cottonseed hulls and soybean hulls had reduced DMI compared to calves fed hay. Calves fed hulls also had improved F:G compared to calves fed hay. Exercised calves had improved F:G compared to calves not exercised. On day 56, calves in fed hay and not exercised had a more firm fecal consistency compared to all other treatment combinations. The number of calves that required a second antimicrobial treatment for BRD tended to be reduced for calves fed hay and for calves that were not exercised compared to calves fed hulls and calves that were exercised. This experiment suggests moderate routine exercise conducted in a low-stress manner could potentially improve feed conversion during the receiving period. Further investigation is needed to determine the effects of exercise on fecal characteristics and clinical BRD incidence.

Resources

appliedanimalscience.org/article/S1080-7446(18)30031-7/fulltext

Table 1. Composition of experimental diets[1].

Item	HY	HLS
Ingredient, % DM	10.00	10.00
Dry-rolled corn		
Wet corn gluten feed[2]	54.80	54.80
Dry supplement B-273[3]	5.20	5.20
Prairie hay	30.00	—
Cottonseed hulls	—	15.00
Soybean hulls	—	15.00
Analyzed nutrient composition (DM basis)[4]		
DM, % (as-fed basis)	71.99	70.79
NE_{m1} Mcal/kg	2.01	1.76
NE_{05} Mcal/kg	1.34	1.15
TDN, %	82.10	74.30
CP, %	17.40	18.57
Crude fiber, %	16.57	18.23
NDF, %	42.87	46.33
ADF, %	18.40	25.17
Calcium, %	0.83	0.77
Phosphorus, %	0.72	0.76
Magnesium, %	0.32	0.35
Potassium, %	1.23	1.33

1 HY =30% hay on a DM basis; HLS = 15% cottonseed hulls and 15% soybean hulls on a DM basis.

2 Sweet Bran (Cargill, Dalhart, TX).

3 Dry supplement B-273 was formulated to contain (% DM basis) 38.46% ground corn, 30.36% limestone, 21.04% wheat middlings, 6.92% urea, 1.03% magnesium oxide, 0.618% zinc sulfate, 0.38% salt, 0.119% copper sulfate, 0.116% manganese oxide, 0.05% selenium premix (contained 0.6% SE), 0.311% vitamin A (30,000 IU/g), 0.085% vitamin # (500 IU/g), 0.317% monensin (Rumensin 90; Elanco Animal Health, Greenfield, IN) and 0.195% tylosin (Tylan 40; Elanco Animal Health).

4 Feed samples were analyzed for nutrient composition, and energy values were calculated from the analyzed composition by an independent laboratory (Servi-Tech Laboratories, Dodge City, KS).

Table 2. Effects of roughage source[1] and exercise[2] on BW, ADG, DMI and G:F.

	HY		HLS			P-value	
Item	EX	NEX	EX	NEX	SEM	Roughage source	Exercise
BW[3], kg							
d 0	251	249	249	249	12.1	0.74	0.74
d 14	275	270	273	274	10.9	0.91	0.63
d 28	302	326	324	330	10.9	0.78	0.86
d 56	357	354	356	356	11.4	0.81	0.68
ADG[4], kg							
d 0 to 14	1.73	1.55	1.70	1.77	0.18	0.56	0.74
d 15 to 28	1.89	1.96	1.93	2.06	0.16	0.62	0.53
d 29 to 42	2.03	1.99	1.77	1.94	0.14	0.24	0.62
d 42 to 56	1.95	1.97	2.23	1.91	0.16	0.50	0.35
d 0 to 56	1.90	1.87	1.91	1.92	0.05	0.56	0.83
DMI[5], kg							
d 0 to 14	6.38	6.39	6.42	6.37	0.17	0.92	0.90
d 15 to 28	8.55	9.03	8.44	8.64	0.40	0.32	0.19
d 29 to 42	9.87	10.10	8.27	9.37	0.52	0.04	0.22
d 43 to 56	11.27	11.58	8.76	10.28	0.58	<0.01	0.12
d 0 to 56	9.02	9.27	7.97	8.67	0.34	0.01	0.12
G:F[6]							
d 0 to 14	0.271	0.241	0.266	0.282	0.030	0.44	0.77
d 15 to 28	0.221	0.218	0.231	0.242	0.021	0.38	0.85
d 29 to 42	0.208	0.201	0.215	0.205	0.015	0.68	0.51
d 43 to 56	0.173b	0.169[b]	0.256[a]	0.186[b]	0.011	<0.001	0.02
d 0 to 56	0.212	0.202	0.240	0.223	0.009	<0.001	0.02

a, b Least squares means in the same row with unlike superscripts differ ($P \leq 0.05$).
1 HY = contained 30% hay (DM basis); HLS = contained 15% soybean hulls and 15% cottonseed hulls (DM basis).
2 EX = 529 m (approximately 10 minutes) of exercise three times per week; NEX = no exercise.
3 Treatment BW was the BW in kilograms with a calculated 2% pencil shrink.
4 Treatment ADG was calculated from the shrunk (2%) BW in kilograms and days on feed between the time periods.
5 Treatment DMI was calculated by taking DMI in kilograms for the period divided by the actual head days within each pen.
6 Treatment G:F was calculated by taking pen AD in kilograms divided by the pen average DMI in kilograms for the time period.

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Using a Dried Distillers Grains Cube as a Supplement for Steers Grazing Mixed-grass Prairie in Oklahoma

Zane Grigsby, Paul Beck, Stacey Gunter, Laura Goodman and Charles Worthington

Introduction

Dried distiller's grains have been a widely used supplement for cattle in various feeding operations. Little to no starch, high energy and high bypass protein content are a few of the main upsides to the use of DDGS in a cattle growing operation. However, loose DDGS have not been used extensively in a pasture setting due to the potential loss of product from wind or in the dirt and soil. Research was conducted on the effects of a distiller's cube supplemented to growing steers grazing mixed grass prairie in western Oklahoma. This research was conducted at the Marvin Klemme Range Research Station near Bessie, Oklahoma in Washita County and at the USDA ARS Southern Plains Experimental Range [SPER] near Fort Supply, Oklahoma in Harper County to test the theory that stocking rates can be increased by replacing a fraction of the daily forage intake with supplementation while avoiding negative impacts on animal performance and native range condition. Three treatments were initiated at Fort Supply and two treatments were initiated at Klemme. Treatments at SPER were: 1) Negative Control, no supplementation, 2) Positive Control, supplemented with DDGS cubes 2 pounds per steer on alternate days in late summer, 3) High Supplement, 1/3 increase in stocking rate, 0.75% BW Supplemental DDGS cubes all season. At Klemme only the Positive Control (2.5 pounds per steer on alternate days in late summer) and High Supplement were included in the experiment. Steers at Klemme were assigned to six pastures, three stocked at four acres per head (High Supplement) and three pastures stocked at six acres per head (Positive Control). The SPER site had steers assigned to 12 pastures stocked at 3.5 acres per head (High Supplement) and 5.5 acres per head (Positive and Negative Control).

Findings

Upon arrival, the steers weighed 529 ± 46 pounds at Klemme and 496 ± 51 pounds at SPER. In Klemme for the early summer (May 22 to July 23), the steers on High Supplement gained 52 ± 16 pounds more ($P \leq 0.03$) than the Positive Control steers. The ADG followed suit with the early season body weight gain per steer with High Supplement steers gaining approximately 0.9 pound more per day than Positive Control steers. Late summer (July 23to September 31), when Positive Control steers were being fed supplement there was no difference ($P = 0.63$) in ADG at Klemme. Early summer ADG at SPERS saw similar results for the early summer (May 17 to July 18) where the High Supplement steers performance was compared to a Negative and Positive Control resulting in a gain of 32 ± 13 pounds ($P \leq 0.03$) and 37 ± 13 pounds ($P \leq 0.01$) more than each, respectively. Early summer ADG of High Supplement at SPERS steers was 0.63 pound ($P \leq 0.01$) more per day than both Positive and Negative Controls. Late summer ADG for High Supplement compared to Negative Control steers was 1.00 ± 0.16 pounds ($P \leq 0.01$) more per day. High Supplementation outperformed Positive Control by 0.36 ± 0.6 pounds more ($P \leq .05$) per day. The main value to pay attention to in this instance would be the gain per acre. At Klemme the gain per acre was 41 ± 4 pounds ($P \leq 0.01$) more for High Supplement steers than Positive Control steers. Fort Supply showed a similar response with 47 ± 3 pounds ($P \leq 0.01$) and 38 ± 3 pounds ($P \leq 0.01$) higher gain per acre for High Supplement than the Negative and Positive Controls, respectively. The enhanced performance of High Supplement was very efficient requiring only 2.8 pounds of feed for each pound of added gain compared with Positive Controls. At the SPERS site, the Positive Controls required only 2.7 pounds of supplement per pound of added gain compared with Negative Control, while the High Supplement treatment required 3.8 pounds of supplement per added pound of gain per acre.

Table 1. Effect of supplemental DDGS cubes for steers grazing mixed grass native prairie at the Marvin Klemme Range Research Station near Bessie, OK.

Item	Positive Control	High Supplement	SE	P-value
Bodyweight, lbs				
Initial (May 17 & 22)	533	526	5.4	0.44
July 23	640	693	10.9	0.03
Ending (Sept 30 & Oct 1)	770	849	14.7	0.02
Average daily gain, lb/day				
Early summer	1.76	2.72	0.115	0.01
Late summer	2.58	2.30	0.400	0.64
Total season	2.06	2.50	0.126	0.09
BW gain/acre, lbs	39.6	80.8	3.08	< 0.01
Supplemental efficiency[a]	-	2.8	-	-

a Pounds of supplement per pound of added gain per acre over Positive Control.

Table 2. Effect of supplemental DDGS cubes for steers grazing mixed grass native prairie at the USDA ARS Southern Plains Experimental Range near Fort Supply, OK.

	Negative Control	Positive Control	High Supplement	SE	P-value
Bodyweight, lbs May 17	500	494	494	8.9	0.85
July 18	589	583	621	8.2	0.03
September 27	667	710	771	9.4	< 0.01
Average daily gain, lb/day					
Early summer	1.45	1.46	2.08	0.075	< 0.01
Late summer	1.18	1.91	2.28	0.108	< 0.01
Total season	1.27	1.64	2.12	0.061	< 0.01
BW gain/acre, lbs	31.6	40.9	79.3	1.88	< 0.01
Supplemental efficiency[a,b]	-	2.7	3.8	-	-

a Pounds of feed per pound of added gain during the late season only for Positive Control vs Negative Control.

b Pounds of feed per pound of added gain per acre for the entire season for High Supplement vs Negative Control.

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Enterprise Budget Analysis of Dried Distiller's Grains Cube Supplementation on Native Range

Paul Beck, Zane Grigsby, Stacey Gunter, Laura Goodman and Charles Worthington

Introduction

Stocking rate is the fundamental management factor under producer control that has a major impact on animal performance and long-term sustainability of native range-based ecosystems. Producers are under significant economic pressures to maximize production per acre, which can prove harmful to the range condition, where desired forage species are overgrazed decline in the stand. Feeding high levels of supplemental feed based on corn co-products of the ethanol production industry can offset forage consumption by grazing cattle and lead to higher stocking rates, without the reductions in forage mass and animal performance. The objective of this project is to investigate the impacts of supplementation and increased stocking rates on performance of growing steers, economics of the stocker cattle enterprise, and range condition in two locations in western Oklahoma (Marvin Klemme Research Range, Besse Oklahoma and USDA ARS-Southern Plains Range Research Station, Ft Supply Oklahoma [SPRRS]). This report summarizes an enterprise budget analysis of two performance trials during the summer of 2019. At the Marvin Klemme Range Research Station there were two treatments, 1) steers stocked at six acres per steer and supplemented with 2.5 pounds of DDGS cubes per day during the late summer only (Positive Control) and 2) increased stocking rate of four acres per growing calf (33% increase in stocking rate) along with supplemental dried distiller's grains cubes fed at a daily rate of 0.75% of bodyweight throughout the grazing season (High Supplement). The study site at SPRRS used the same treatments but included a negative control with no supplemental feeding and were stocked at 5.5 acres per steer for Controls and 3.5 acres per steer for High Supplement. The assumptions used in this analysis were based on actual costs of inputs for supplements offered and the 10-year average Oklahoma auction market prices for 450-pound steers in April and 750 pound steers in October. Other assumptions included: $189.29 per cwt purchase at 450; $152.81 per cwt sales at 750; $6 per cwt slide; $76 per head receiving cost; 79 pounds gain during rec for Bessie and 46 pounds gain during rec at Ft Supply; $750 per ton mineral (4 oz per day); $11 per acre rent; $0.10 per head per day yardage and care; and $548 per ton for DDGS cubes.

Findings

Feeding the DDGS cubes during the late summer only at SPRRS (Table 1) increased profitability per steer by $29.69 and $5.40 per acre. When stocking rates were increased with summer long supplementation, net returns per steer were increased by more than $38.50 per steer and $14 per acre compared with Negative Control at SPRRS even though supplement costs were over $107 per head ($30.50 per acre). Because of the increase in stocking rate, High Supplement increased returns per steer by $8.82 and by $9 per acre at SPRRS because of the increased performance and reduced land rent cost per head. At the Klemme Range site (Table 2) even though total cost per acre increased by $12.88 with the High Supplement treatment, improved animal performance and increased stocking rates resulted in increased profit per steer of $34.15 per steer and $18.08 per acre. Increased performance with higher stocking rate more than offset increased expenses associated with labor and supplement purchase in this analysis.

Table 1. Costs and returns from enterprise budget analysis of DDGS supplementation at the USDA ARS Southern Plains Range Research Station.

	High SR Supplement $/steer	Positive Control $/steer	Negative Control $/steer
Steer			
Purchase	851.80	851.80	851.80
Receiving	76.00	76.00	76.00
Net cost at turnout	927.80	927.80	927.80
Steer Sales	1,170.55	1,103.12	1,046.56
Return before Pasture Costs	242.75	175.32	118.76
Pasture costs			
Mineral	12.19	12.19	12.19
Yardage	13.00	13.00	13.00
Rent	38.50	60.50	60.50
DDGS cubes	107.48	26.87	
Total Pasture Cost	171.17	112.56	85.69
Net Return $/steer	$71.58	$62.76	$33.07
$/acre	$20.45	$11.41	$6.01

Table 2. Costs and returns from enterprise budget analysis of DDGS supplementation at the Klemme Range Research Station, near Bessie, OK.

	High SR Supplement		Positive Control	
	$/steer	$/acre	$/steer	$/acre
Steer				
Purchase	851.80		851.80	
Receiving	76.00		76.00	
Net cost at turnout	927.80		927.80	
Steer Sales	1,248.84		1,163.17	
Return before Pasture Costs	321.04		235.37	
Pasture costs				
Mineral	12.19		12.19	
Yardage	13.00		13.00	
Rent	44.00		66.00	
DDGS cubes	103.10		29.58	
Total Pasture Cost	172.29	43.07	120.77	30.19
Net Return	148.75	$37.18	114.60	19.10

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Weaning Weight Trends in the U.S. Beef Cattle Industry

Claire Andresen, Carla Goad, Lisa Kriese-Anderson, Michael King, Ken Odde and David Lalman

Introduction

Calf weight at weaning is often used as an indicator of productivity in cow-calf operation and represents a large portion of gross income. Improvements in management and genetic selection have resulted in increased weaning weights over the past several decades and genetic trends for pre-weaning growth have been steadily increasing since the 1980's. Large breed association data sets are available representing seedstock operation trends. However, tracking regional or national weaning weight trends in commercial cow/calf operations is more difficult because few widely-used, standardized record systems exist. Therefore, the objective of this study was to characterize trends in commercial cow-calf enterprise calf weaning weight.

Methods

The study included two large data sets from Superior Livestock Auction video sales in the North Central (Colorado, Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wisconsin and Wyoming) and South-central (Arizona, Kansas, Missouri, New Mexico, Oklahoma and Texas) regions. Projected calf delivery weight in lots identified as "non-weaned" was used as a proxy for weaning weight. Also, trend over time of adjusted weaning BW for Angus and Charolais bulls was characterized as reported by the respective breed associations.

Findings

Results from the North Central region of the U.S. indicate projected delivery weight has not increased in either implanted and non-implanted calves (Figure 1) since about 2005. In contrast, data from the SC region shows a steady increase in projected delivery weight for both implanted and non-implanted calves (Figure 2).

Characterization of adjusted weaning weight of Angus and Charolais bull calves over time shows a similar steady increase in projected delivery weight over time (Figure 3). These results indicate that trends for weaning weight in commercial cow/calf operations may vary substantially by region of the country. Therefore, a critical step in decision making for commercial cow/calf operations includes a simple, consistent record keeping system to track progress over time. Assuming a lack of significant progress in calf weaning weight, efforts to enhance profitability should focus on reducing cost of production and/or capturing value of genetic potential for post-weaning performance.

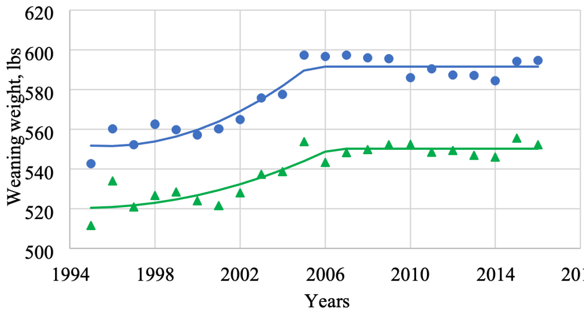

Figure 1. Mean forecasted delivery weight of implanted (●) and non-implanted (▲), nonweaned beef calves originating from the North Central region offered for sale through Superior Livestock video auctions in 1995 through 2016. The breakpoint for NC nonimplanted calves occurred at 2007 with a plateau of 550.2 pounds. The breakpoint for NC implanted calves occurred at 2006 with a plateau of 591.9 lbs.

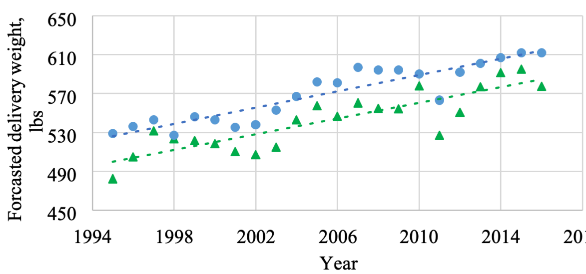

Figure 2. Mean forecasted delivery weight of implanted (●) and non-implanted (▲), nonweaned beef calves originating from the South Central region offered for sale through Superior Livestock Auction's video sales in 1995 through 2016.

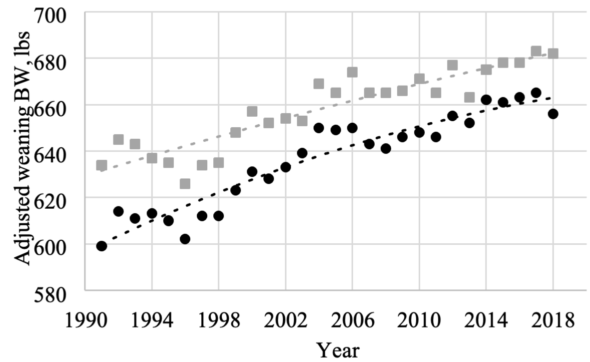

Figure 3. Phenotypic trends for adjusted weaning BW in Charolais (■) and Angus (●) bull calves: 1991 through 2018.

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Predicting Dry Matter Intake of Gestating and Lactating Beef Cows

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H.C. Freetly, P.A. Beck, E.A. DeVuyst and D.L. Lalman

Introduction

An accurate estimate of feed intake is a fundamental component necessary to determine nutrient balance and project animal performance. Most beef cattle nutritionists and computer modelers estimate the amount of feed that cows consume using equations developed and published by the National Academy of Sciences, Engineering and Medicine (NASEM); Nutrient Requirements of Beef Cattle. The NASEM beef cattle committee has published several equations intended to provide general guidance for feed intake of beef cows (1984, 1987, and 1996). In the most recent publication (2016), the NASEM committee recommended continued use of the equation developed in 1996. In addition to these equations, Hibberd and Thrift (1982) published tabular values estimating feed intake in beef cows based on stage of production and forage quality or energy concentration. This table has served as a widely used guideline to estimate feed intake in beef cows over the years. These equations and tabular values were developed using a considerable amount of feed intake data calculated from internal or external marker-based approaches and most of those studies were conducted or published in the '70s, '80s and '90s. The objective of this study was to validate these equations for predicting feed intake in beef cows.

Methods

Criteria for published and unpublished data to be included in the validation data set included conducted or published within the last ten years, direct measurement of forage intake (no marker data), adequate protein, and "normal" housing conditions (defined as no tie stall or metabolism crate data). The validation data set included 53 treatment means for gestating cows and 29 treatment means for lactating cows. Means for the gestating and lactating cow data sets were 28 ± 6.6 pounds DMI, 1,306 ± 172 pounds BW, 0.57 ± 0.06 Mcal NE_m and 31.5 ± 4.4 pounds DMI, 1,112 ± 137 pounds BW, and 0.57 ± 0.11 Mcal NE_m, respectively. A prediction equation was developed for nonlactating and lactating beef cows using the Hibberd and Thrift tabular values to compare those estimates with the 1987 and the 1996 NASEM equations.

Observed feed intake values (y) were regressed over predicted feed intake values (x) for each of the equations. If an equation were to perfectly predict observed values (y = x), the regression of y on x would result in intercept equal to 0 and slope equal to one. Precision was assessed by calculating the coefficient of determination (r^2) to estimate the relative amount of variation in observed values that were explained by the predicted values. Finally, the average distance of observed values from the unity (y = x) line provided an indication of overall accuracy. This calculation is referred to as root mean squared deviation (RMSD).

Findings

Results of the validation statistics are provided in Table 1 and a graphical representation of the relationships are shown in Figure 1 for nonlactating cows and Figure 2 for lactating cows. None of these equations were a good fit for the more recent data from studies with direct measurements of feed intake in nonlactating beef cows. While the precision of the 1987 equation was reasonable (r^2 = 69%), the intercept differed from zero and the slope differed from one with wide average distance from the unity line (RMSD). The RMSD value indicates that on average, the distance between observed feed intake values and predicted feed intake values was 2.8 kg or 6.2 pounds. Similar results were found for the 1996 equation except for lower r^2. While the Hibberd and Thrift equation intercept and slope were not statistically different from zero and one, respectively, the RMSD value was high.

In lactating cows, the slope of the regression for all three equations was statistically different from one and high RMSD values were found for the 1987 and the 1996 equations. Overall, observed values were closer to the unity line (lower RMSD) for the Hibberd and Thrift equation. While this equation provides reasonable estimates for feed intake in lactating beef cows overall, it tends to underestimate at the lower end of the range and underestimate at the higher end of the range (Figure 2).

Summary

The recent validation data sets suggest that there is a need to develop more accurate feed intake prediction models for nonlactating and lactating beef cows.

Table 1. Parameter estimates for regression of observed feed intake on predicted feed intake (kg DM/d) for gestating and lactating beef cows.

	Equation	r^2	RMSD[a]	Intercept[b]	Slope[c]
Gestation					
	Eq A (NRC 1987)	0.69	2.8	-4.0 ± 1.7	1.58 ± 0.15
	Eq B (NRC 1996)	0.58	2.2	-8.1 ± 2.6	1.73 ± 0.22
	Eq C (Hibberd and Thrift 1992)	0.58	2.9	-1.5 ± 1.8	0.96 ± 0.12
Lactation					
	Eq D (NRC 1987)	0.84	4.1	0.91 ±1.1	1.29 ± 0.11
	Eq E (NRC 1996)	0.68	2.8	-2.2 ± 2.2	1.39 ± 0.18
	Eq F (Hibberd and Thrift 1992)	0.73	1.3	3.8 ± 1.2	0.75 ± 0.09

a RMSD = root mean squared deviation and provides an estimate of the average distance of the observed values from the unity (y=x) line, expressed as kg/d.

b Intercept and slope values in bold font indicate significantly different (P < 0.01) from zero and one, respectively.

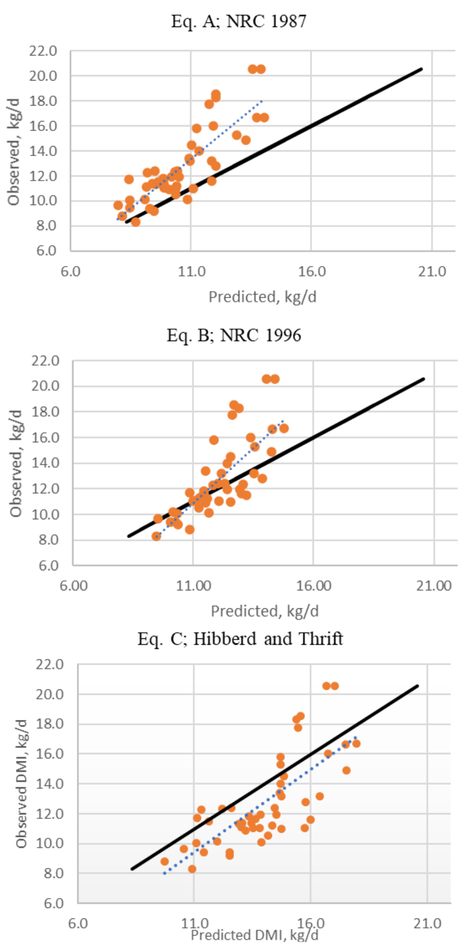

Figure 1. Relationship of observed to predicted feed intake in nonlactating beef cows using equations A, B and C.

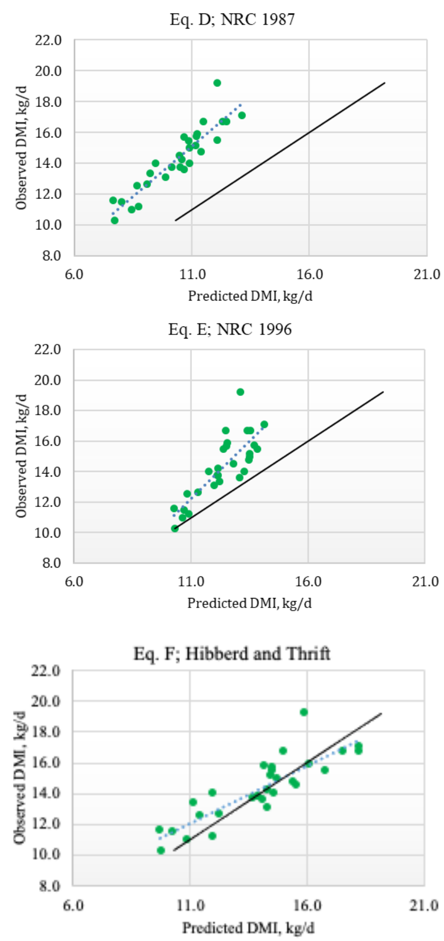

Figure 2. Relationship of observed to predicted feed intake in lactating beef cows using equations D, E and F.

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Review of Literature Reporting Phenotypic and Genetic Correlations for Feed Intake in Growing Cattle and Beef Cows

Amanda Holder, Megan Rolf and David Lalman

Introduction

The beef cattle industry has recently adopted expected progeny differences (EPDs) to estimate genetic merit for feed intake (FI), residual feed intake (RFI) and residual average daily gain (RADG). These selection tools are calculated using phenotypic data from growing animals fed a total mixed ration in confinement. Feed intake and efficiency traits are considered to be moderately heritable. For example, Berry and Crowley (2013) reviewed 45 experiments where heritability of average daily gain (ADG), body weight (BW), FI, and RFI were determined in growing animals. The pooled heritabilities across all studies were 0.31, 0.39, 0.40 and 0.33 for ADG, BW, FI and RFI, respectively, suggesting that substantial genetic improvement can be made in feeder calves for these traits. However, a primary consideration is whether selecting for growing and finishing period efficiency results in improved forage utilization in the cow herd. After all, approximately 70% of feed energy used in the process of beef production is consumed by the cow herd (Gregory, 1972), and increasing efficiency of feed utilization in cows should be a primary economic selection criterion. Considerable research has been published during the last 20 years related to feed efficiency traits in growing cattle consuming high-quality diets, however, relatively little is known about the genetics of low-quality forage utilization efficiency in beef cows.

Beef Improvement Federation guidelines require a minimum diet energy concentration of 2.4 Mcal ME/kg feed (DM basis). This is approximately equivalent to 67% total digestible nutrients or 0.43 Mcal of net energy for gain (NEg) per pound of feed. Since this is a minimum requirement, many test diets contain around 70% to 74% TDN or 0.47 to 0.53 Mcal of NEg per pound of feed DM. This degree of diet energy concentration (or digestibility) is equivalent or beyond the absolute peak of forage digestibility in almost any environment. In most grazing systems beef cows spend more than half of the year consuming moderate to low-quality forage ranging from 48% to 60% digestibility. Differences in diet quality combined with differences in physiological maturity represent the potential for a genotype by environment interaction (GxE) regarding genetic potential for feed intake or feed efficiency. In other words, mature animals consuming moderate to low-quality forage diets may re-rank compared to their ranking established during a test period that was conducted while they were 8 months to 14 months of age, growing rapidly and consuming a high-quality diet. Thus, the factors that must be considered before selecting on existing feed intake and efficiency metrics in the industry (derived from high-quality diets and growing animals) to improve cow feed intake and efficiency are a) evidence of high genetic correlations over time (age and stage of production) and b) high genetic correlations between measures collected using a wide range in diet characteristics.

Stage of Production, Age

In studies where growing animals and cows were provided similar high-quality forage or mixed forage and concentrate rations during both stages, phenotypic correlations for FI are generally positive [Freetly, 2016 (0.65); Cassady, 2016 (0.57); Hardie, 2016 (0.78)]. Similarly, phenotypic correlations for RFI measured during the post-weaning period and again at three to five years of age are generally positive when high-quality diets are fed during both stages of maturity [Archer et al., 2002 (0.4); Herd et al., 2006 (0.39); Lawrence, 2012 (0.59); Hafla et al., 2013 (0.42)]. Genetic correlations for FI were moderate to high [Nieuwhof et al., 1992, (0.74); Freetly, 2016 (0.65); Archer et al., 2002 (0.69)] when high-quality diets were provided to heifers during the post-weaning period and again during lactation. Under the same circumstances, genetic correlations for RFI were moderate to high in two experiments [Nieuwhof et al., 1992 (0.58); Archer et al., 2002 (0.98)]. Taken together, these studies indicate FI and RFI are moderately repeatable across time (age) and stage of production when high-quality diets are provided during each stage of maturity or production. It would seem that repeatability should be reasonable in situations where cows are not frequently subjected to restricted nutrient quality or quantity.

Diet Quality and Age

Studies investigating the relationship of FI or RFI determined during the postweaning phase and FI or RFI determined in mature cows consuming a moderate or lowquality diet are sparse. Using a 1.5 Mcal NEm/kg diet for heifers and 1.0 Mcal NEm/kg diet for cows, Black et al. (2013) reported a phenotypic correlation of 0.63 for FI. There was no significant correlation for RFI, however. Cassaday (2016) reported lower DMI for mature cows previously classified as medium and low RFI and FI during the postweaning period. The diet used in this experiment contained 80% (DM basis) processed switchgrass hay and 20% (DM basis) corn condensed distillers solubles. In a recent study, De La Torre et al. (2019) found no difference in hay intake of cows previously classified as high or low RFI as heifers. In contrast, in a large experiment involving 584 purebred dry, open Charolais cows, phenotypic and genetic correlations of 0.36 and 0.83 were reported for residual energy intake. In this study, feed intake was measured during two consecutive periods, beginning with hay and followed by a corn silage diet supplemented with soybean meal. Due to the conflicting nature of these studies, more research is needed to establish a consensus.

Summary

Development of tools that can accurately rank mature cattle for low-quality forage intake is a critical step in improving beef production efficiency, carbon footprint, and cow/calf enterprise profitability. Therefore, we encourage continued research comparing intake across different diets, especially those that reflect prevailing conditions in most commercial cattle herds.

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Effects of Weaning Timing on Performance and Energy Utilization in Beef Cows

Aksel Wiseman, Miles Redden, Adam McGee, Courtney Spencer, Megan Gross, Gerald Horn, Ryan Reuter and David Lalman

Introduction

Compared to mature cows, two-year-old first-calf heifers give less milk, wean lighter calves, take longer to reinitiate estrous cycles after calving, and generally have lower pregnancy rates. In addition, previous research indicates that lactation increases maintenance energy requirements of the beef cow by approximately 20% (NASEM, 2016). Early weaning should eliminate the nutrients required to produce milk and at the same time, reduce the cow's maintenance energy requirements. This feed energy savings could be redirected to calf growth by feeding the calf directly. Therefore, the objective of this study was to determine the effects of timing of weaning on energy utilization and production efficiency in first-calf beef heifers and their calves.

Methods

This experiment used 90 Angus and Angus x Hereford first-calf heifers and their calves over a two-year period. Cow/calf pairs were randomly assigned to six different dry lot pens each year. Three pens each year were assigned to early weaning (130 days) and three pens assigned to traditional weaning (226 days) treatments. Cows were limit-fed to achieve modest weight gain, while calves were offered free-choice access to the same diet as their dams in a creep feeding area. The diet included (dry matter basis) 33% chopped Bermudagrass hay, 33% dried distillers' grains with solubles, 24% rolled corn, 5% supplement,and 5% liquid supplement. Measurements included cow feed intake required to achieve targeted weight gain, body condition score, body weight, milk yield and composition, as well as calf body weight gain and creep feed intake.

Findings

As designed, there were no differences in body weight and body condition score throughout the experiment. Maintenance energy requirements were slightly greater (5%) in lactating than in non-lactating cows. Early weaned calves consumed more feed than traditional weaned calves. However, feed and milk energy intake for traditional weaned calves was greater than feed energy intake alone in early weaned calves. This resulted in greater daily gain and total body weight gain in calves weaned at an older age. The increased traditional weaned calf performance offset the additional maintenance costs of their lactating dams. This resulted in an improved gain to feed ratio when all feed consumed by the cow/calf pair was considered. During the post-weaning growing period, traditional weaned calves gained faster, although were still lighter than traditional weaned calves at the time of feedlot entry. Results from this study suggest that early weaning soon after the breeding season does not improve overall efficiency of nutrient utilization. Improved efficiency in the traditional system under these circumstances appear to be due primarily to two factors: a) only slight increase (5%) in maintenance energy requirement of the dam due to lactation compared to previously reported estimates (20%) and b) suppressed performance of early-weaned calves through 226 days of age.

Resources

beef.okstate.edu

Table 1. Effects of lactation status on feed required, cow weight, and condition change in first calf heifers.

	Trt[1]	
Item	TW	EW
Feed dry matter intake, lbs. per day		
Cow weight, lbs.	16.7	11.0
January	919.0	912.0
April		
Cow BCS[2]	981.0	981.0
January	4.7	4.7
April	5.1	5.2

1 TW = traditional weaning, EW = early weaning

2 Body Condition Score on a 1(emaciated) to 9 (obese) scale.

Table 2. Effects of weaning age on energy intake, performance and feed efficiency.

	Trt[1]	
	TW	EW
Cow energy intake, cumulative Mcal ME[2]*	1993	1314
Calf energy intake, cumulative Mcal ME		
TMR*	1031	1231
Milk	649	---
Total*	1680	1231
Pair cumulative Mcal TMR ME*	3063	2521
Calf ADG, lbs*	2.91	2.23
Calf BW gain, lbs*	271.2	209.4
Gain:Feed		
Calf TMR Gain:Feed[3]*	0.12	0.08
Pair Gain:Feed[4]*	0.04	0.038
Gain:Energy Intake		
Calf total Gain:Energy intake[5]	0.16	0.17
Pair Gain:Energy Intake[6]*	0.09	0.083

1 TW = traditional weaning, EW = early weaning
2 MCal ME = Mega calorie of metabolizable energy intake
3 Calf weight gain in pounds per pounds of calf TMR intake-1
4 Calf weight gain in pounds per pounds of TMR intake of the pair-1
5 Calf weight gain in lbs per Mega calorie of calf TMR intake and milk intake-1
6 Calf BW gain in lbs per Mega calorie of pair TMR intake-1
* Indicates a statistical significance

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Maintenance Energy Requirements and Forage Intake of Purebred vs Crossbred Beef Cows

Claire Andresen, Aksel Wiseman, Adam McGee, Amanda Holder,
Carla Goad, Andrew Foote, Ryan Reuter and David Lalman

Introduction

While crossbreeding has historically been used to increase growth, milk yield, weaning rate and longevity, there may also be opportunities to capitalize on breed complementarity to reduce feed intake and input costs. One method to better match beef cows to lower input production systems is to use a crossbreeding system that balances breeds with high output with a breed of lower feed intake. For example, in MARC data, Hereford cattle average about 42 pounds less yearling weight and 21 pounds less WW due to milk, compared to Angus. Recent MARC data also documented 2.1 pounds per day less feed intake in heifers fed a forage-based diet. Therefore, the objective of this study was to determine maintenance energy requirements, voluntary feed intake, and efficiency of preweaning calf growth for Angus and Hereford X Angus cows.

Methods

Fifty-nine Angus (n=32) and Hereford×Angus (n=27) cow/calf pairs were assigned to four pen replicates per breed. Cows were limit-fed to achieve BW and BCS stasis. The diet included (dry matter basis) 33% chopped Bermudagrass hay, 33% DDG with solubles, 24% rolled corn, 5% dry supplement and 5% liquid supplement. Following weaning, a 45-day experiment was conducted to determine voluntary low-quality forage intake.

Findings

There were no differences in cow hip height, BW, milk yield or cow maintenance energy requirement. Hereford-sired cows had greater BCS and ultrasound rib fat and rump fat throughout the experiment. There was no difference in gain-to-feed ratio when feed consumed by the calf or all feed consumed by the cow-calf pair was considered. During the voluntary feed intake study, Hereford-sired cows consumed 2 pounds per day less forage than Angus cows. Calves from Angus dams were heavier at the start of the experiment, although there were no differences in ADG, final BW or adjusted weaning BW.

Table 1. Effects of breed type on feed intake, body weight, body condition, and pregnancy rates and calf performance in limit-fed beef cows.

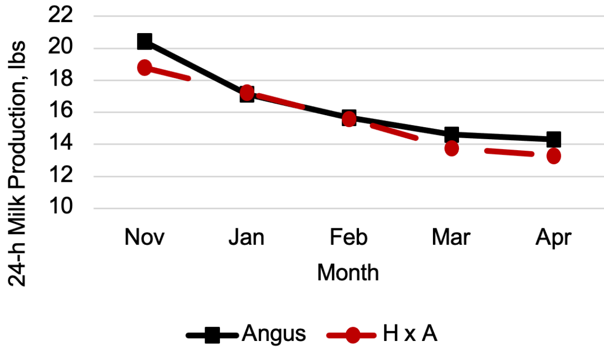
Item	Breed: Angus	Breed: Hereford x Angus
Average body weight, lbs	1124	1139
Average BCS*	5.07	5.38
Carcass ultrasound		
12th rib fat, cm	0.14	0.21
Rump fat*, cm	0.16	0.24
Pregnancy rate, %5	94.4	89.3
Calf performance		
Total calf gain, lbs	198	194
ADG, lbs	2.38	2.29
205-d Adjusted WW, lbs	529	513

Table 2. Effect of breed type on cow body condition, voluntary forage intake and average daily gain, lb / d.

Item	Breed[1]: ANG	Breed[1]: HA
Average BCS*	5.69	6.25
DM Intake*, lb/d	34.6	32.6
Cow ADG, lb/d	1.46	1.45

Summary

For commercial producers, the largest economic benefit (66%) of crossbreeding comes from having crossbred cows (maternal heterosis). Results from the current experiment suggest that Hereford genetics were complementary in a crossbreeding system with Angus cows to reduce cow/calf enterprise input costs. This advantage manifested as improved body condition and less ad libitum forage intake. The potential for reduced input costs need to be weighed with potential differences in productivity at the time of weaning and during the post-weaning phases.



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Validating Genomicaly Enhanced EPDs for Intake in Mature Cows Consuming a Hay Diet

Amanda Holder, Claire Andresen, Megan Gross, Alexi Moehlenpah, Megan Rolf, David Lalman*

Introduction

Genotyping platforms currently available to rank animals for dry matter intake were developed using growing animals fed a high-quality diet. High-energy, high-protein diets are used to develop these markers because the objective is to facilitate expression of genetic differences in growth and feed intake under typical post-weaning management (growing and finishing) conditions. It is unknown whether genomic markers or genomically-enhanced expected progeny differences (GE-EPD) can be used to reliably rank mature cows consuming a lower quality forage diet. For that reason, we initiated a project to determine the relationship between currently available GE-EPD for dry matter intake (DMI) and actual feed intake of beef cows consuming a grass hay diet.

In the first year of this study, 40 Angus cow/calf pairs were used (first calf heifers n=21, mature cows ≥ 3 years old n = 19), each assigned to one of five dry-lot pens according to the DMI GE-EPD of the dam. During late lactation (January through April), the pairs were provided abundant bermudagrass hay, mineral and 5 pounds of dried distiller's grains with solubles daily. Milk yield and composition were determined monthly using a milking machine. After weaning, cows were returned to the pens and hay (CP = 5.7%, NDF = 66.4, TDN = 54%) intake was determined using SmartFeed individual intake units. To ensure adequate protein supply and positive energy balance, 2 pounds of corn and 2 pounds of cotton seed meal were provided daily. Following a 14-day adaptation period, individual cow forage intake was measured for 45 days.

Preliminary Findings

Cows that spent more time/day in the feeder consumed more hay and gained more weight compared to cows spending less time in the feeders. Time in the SmartFeed® units consuming hay averaged 4.6 ± 0.8 hours per day. Mean daily hay consumption was 27.3 ± 5.1 pounds per day. The minimum and maximum daily hay consumption was 20.3 pounds and 41.8 pounds, respectively. Similarly, when calculated as a percent of average trial body weight, minimum and maximum hay consumption was 1.6% and 3.1% of body weight, respectively. Genomically-enhanced EPD for DMI was not related to phenotypic hay intake expressed as a percentage of body weight in this first experiment (Figure 1). There was also no relationship observed between genomic score for DMI and time spent in the feeders, average study body weight, or ADG on trial. Mature cows consumed 4.5 more pounds per day than first calf heifers, though there was no difference when expressed as a percent of body weight (both consumed 2.2% of body weight during the dry period). There was also no difference in the amount of time spent in feeders nor body condition score between heifers and cows with an average BCS of 5 (scale of 1 to 9) for both groups. Mature cows produced more milk per unit of body weight and had greater residual feed intake and calf weaning weight compared to heifers. However, during the post-weaning period, heifers consumed similar amount of forage per unit of BW, spent the same amount of time in feeders and were more efficient in converting hay and supplement to weight gain compared to cows.

A system was developed using SmartFeed® units and specialized hay baskets to measure hay consumption on an individual basis for beef cows housed together in pens. Intake studies will be conducted to determine the repeatability of ranking for hay intake across stage of production.

Table 1. Effects of treatment group on cow and calf performance and intake variables.

Variable	TRT[1] HMATURE	HTWO	LMATURE	LTWO
Weight (lbs)[2]	1291[a]	1151[a, b]	1280[a]	1073[b]
BCS[3]	5.4	5.2	4.9	5.0
Hay Intake (lbs/day)	29.5	25.9	28.3	26.1
Time Feeding (hrs/day)	4.4	4.5	4.7	4.6

1 HMATURE= GE-EPD > breed average, ≥ 3 years of age; HTWO = GE-EPD > breed average, two-year old; LMATURE = GE-EPD < breed average, ≥ 3 years of age; LTWO = GE-EPD < breed average, two-year old

2 Average weight during post-weaning feed intake period

3 Body Condition Score on a 1 (emaciated) to 9 (obese) scale during post-weaning feed intake period

a,b Means followed by the same letter are not significantly different, if no letters are shown, means for each treatment within that variable did not differ significantly

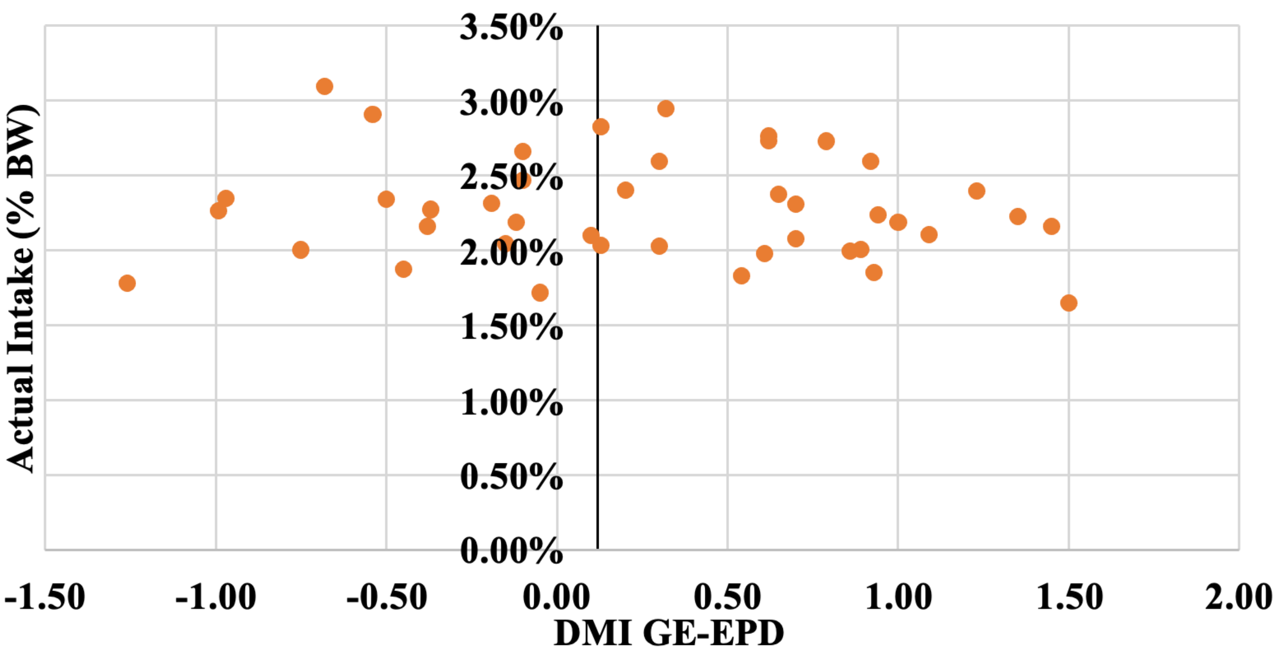

Figure 1. Relationship of dry matter intake GE-EPD and gestation period dry matter intake expressed as a percentage of body weight.

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Ionophores and Implants Affect Performance and Carcass Characteristics in Hair Sheep

Brittany Lippy, Jerry Fitch, Gretchen Mafi, Justin Crosswhite, Leon Spicer, Adel Pezeshki and Blake Wilson*

Background

The use of growth promoting technologies can result in improved feed efficiency and increased lean deposition in ruminant animals. However, unlike in the beef industry, the sheep industry has had varying success when using growth promoting technologies. Historically, wool breeds have demonstrated some improvement in lean deposition and feed conversion when implanted with zeranol, but also have demonstrated increased incidence of rectal prolapses in some cases. Lambs also may be fed ionophores, such as lasalocid, in order to prevent coccidiosis. In some cases, lambs fed ionophores have demonstrated improvements in average daily gain and feed efficiency. A recent trend in the U.S. sheep industry has been the increased production of hair sheep. Hair sheep are better adapted for higher ambient temperatures, have improved parasite tolerance, and do not require tail docking or shearing. In addition to these benefits, it is possible that hair sheep may respond differently to growth promoting technologies than wool sheep. This experiment utilized 30 crossbred hair whether lambs to determine the effects of dietary inclusion of lasalocid in combination with zeranol implants on performance, carcass characteristics, and economic returns.

Figure 1. Carcasses from lambs receiving either no growth promoting implant or ionophore or lambs receiving both an implant (zeranol) and ionophore (lasalocid).

Table 1. Effects of feeding lasalocid in combination with zeranol (LZ) on lamb performance and carcass characteristics.

	Treatment[1]	
Item	CON	LZ
Body condition score[2]		
d 0	2.4	2.5
Final	3.2	3.4
Body weight, lbs[3]		
d 0	54	54
Final*	92	105
Average daily gain, lbs/d[4]*	0.36	0.49
Dry matter intake, lbs/hd/d[5]	2.1	2.3
Feed:Gain[6]*	6.21	4.80
Hot carcass weight, lbs*	53	60
Loin eye area, in2*	2.3	2.7
Dressing %	57.7	57.7
USDA Yield grade[7]**	2.3	2.8
USDA Quality grade[8]	11.7	11.8
Flank streakings[8]	11.6	12
Leg conformation[8]	11.7	12

1 Treatments: Control (CON) = Fed a pelleted basal diet of primarily corn and alfalfa, received no implant or lasalocid, Implant and ionophore (LZ) = fed a pelleted basal diet of primarily corn and alfalfa, implanted with 12 mg of zeranol (Ralgro®; MSD Animal Health, Spartan, RSA) and fed 35 mg/head/day of lasalocid (Bovatec® 91; Zoetis, Kalamazoo, MI)
2 Body condition score scale ranged from 1 to 5
3 Body weights are reported with a 4% calculated shrink to account for rumen fill and water intake
4 Average daily gain was calculated from shrunk body weight divided by days on feed
5 Dry matter intake was reported with a 10% shrink to account for spilled/wasted feed not accounted for via weigh backs
6 Feed:Gain was calculated dry matter intake/average daily gain
7 USDA Yield Grade = 0.4 + (10 × adjusted fat thickness)
8 USDA Quality Grade, flank streakings, and leg conformation: 1 = cull to 15 = high prime
* Indicates statistical significance;
** Indicates a statistical tendency

Findings

There were no differences in body condition score, dry mater intake, dressing percentage, leg conformation or USDA Quality Grades between treatments. However whether lambs fed lasalocid and implanted with zeranol had heavier final body weights, greater average daily gains, and improved feed efficiency compared to lambs on the control treatment. Lambs fed lasalocid and implanted with zeranol also had heavier hot carcass weights and larger loin eye areas than lambs on the control treatment. Lambs fed lasalocid and implanted with zeranol also had greater net returns on both a live and carcass basis. While lambs fed lasalocid and implanted with zeranol had a greater total input costs, they also had improved cost of gain compared to lambs on the control treatment. This experiment suggests that the dietary inclusion of lasalocid used in combination with zeranol implants can effectively improve performance, carcass characteristics, and economical returns of hair whether lambs fed a concentrate diet.

Table 2. Effects of feeding lasalocid in combination with zeranol (LZ) implants on economic returns in hair sheep.

	Treatment[1]	
Item[2]	CON	LZ
Purchase price[3]	120.32	119.27
Yardage cost[4]	27.10	27.25
Feed cost[5]*	38.54	44.79
Lasalocid cost[6]*	0.00	0.09
Zeranol implant cost[7]*	0.00	3.18
Total cost[8]**	186.20	194.59
Cost of gain[9]**	4.28	3.27
Gross return, live basis[10]*	172.55	196.64
Gross return, carcass basis[11]*	200.64	228.19
Net return, live basis[12]*	-13.46	2.49
Net return, carcass basis[13]*	14.44	33.58

1 Treatments: Control (CON) = Fed a pelleted basal diet of primarily corn and alfalfa, received no implant or lasalocid, Implant and ionophore (LZ) = fed a pelleted basal diet of primarily corn and alfalfa, implanted with 12 mg of zeranol (Ralgro®; MSD Animal Health, Spartan, RSA) and fed 35 mg/hd/d of lasalocid (Bovatec® 91; Zoetis, Kalamazoo, MI)

2 All items are reported in U.S. dollars, $

3 Purchase price = d 0 BW × $2.20/lb (Average slaughter lamb price, 40-80 lb, from November 13, 2018, Producers Livestock Auction Company, San Angelo, TX)

4 Yardage cost = Days on feed × $0.25

5 Feed cost = Total feed intake × $0.1550/lb

6 Lasalocid cost = Days on feed × 0.035g of lasalocid × $0.02/g

7 Zeranol cost = Number of implants × $1.27

8 Total cost = Yardage cost + purchase price + feed cost + lasalocid cost + zeranol cost

9 Cost of gain= (Total cost –purchase price) / gain

10 Gross return, live basis = Final BW × $1.88/lb (Average slaughter lamb price, 90-110 lb, from the weeks of February 8, March 1, 8, and 29, 2019, National Sheep Summary, San Angelo, TX)

11 Gross return, carcass basis = HCW × $3.78/lb (Average of gross carcass value from February 8, 27, March 1, and April 1, 2019, USDA Estimated National Lamb Carcass Cutout, St. Joseph, MO)

12 Net return, live basis = Gross return, live basis – total cost

13 Net return, carcass basis = Gross return, carcass basis – total cost

* Indicates statistical significance; ** Indicates a statistical tendency

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Utilizing Cotton Byproducts in a Beef Cattle Finishing Diet

Andrea Warner, Paul Beck, Andrew Foote, Kaitlyn Pierce, Colton Robison, Don Hubbell and Blake Wilson*

Background

Many feedlot finishing diets utilize a low to medium quality hay as the primary roughage source; however, hay can be expensive when compared to other available low to medium quality plant byproducts. In the southwestern U.S., a recent increase in cotton production has resulted in greater availability of byproducts such as cotton gin trash and whole cottonseed for use in beef cattle diets. Cotton gin trash is a low-quality byproduct that is high in effective fiber and consists of stems, burrs, lint, leaves, immature cottonseed and dirt. Whole cottonseed provides additional fiber and can also be used as a source of fat and protein in the diet. This experiment was conducted using 64 crossbred beef steers to determine the effects of including cotton byproducts in a finishing ration on steer performance and carcass characteristics. The treatment diet (CTN) provided the fat, protein and fiber components of the diet using whole cottonseed and cotton gin trash. This was compared to a control diet (CON) which provided the fat, protein, and fiber components using Sweet Bran, prairie hay, and a molasses based liquid fat supplement.

Findings

The CTN fed steers tended to have heavier final body weights compared to CON steers. For the entire feeding period, steers fed the CTN diet had increased dry matter intake and average daily gain when compared to CON steers. There was no difference in feed conversion between diets. As expected with the increase in final body weights, the CTN steers also had heavier hot carcass weights compared to CON steers. The CTN carcasses also had increased fat, as demonstrated by increased 12th rib fat thickness, increased dressing percentage, and increased USDA Yield Grade compared to CON steers. Although the CTN steers in this experiment had an increased USDA Yield Grade, this did not cause carcasses to be discounted and therefore is likely of minimal concern when considering the addition of cotton byproducts at these levels to finishing diets. Interestingly, there were no differences in marbling score or rib eye area between treatments. Overall, this experiment suggests that whole cottonseed and cotton gin trash can be effectively used as the fat, protein and fiber sources in a finishing feedlot diet without compromising performance or carcass characteristics.

Figure 1. Cattle at the Willard Sparks Beef Research Center consuming a dry-rolled corn based diet containing 15% whole cottonseed and 7% cotton gin trash.

Table 1. Effect of including cotton byproducts (CTN) in a finishing ration on the performance of crossbred feedlot steers.

	Treatment[1]	
Item	CON	CTN
Body weight,[2] lbs		
d 0	686	689
d 28	840	836
Final[3] **	1351	1390
Average daily gain, lbs		
d 0 to 28	5.57	5.28
d 28 to final**	4.05	4.47
d 0 to final**	4.29	4.60
Dry matter intake, lbs/d		
d 0 to 28	20.0	19.6
d 28 to final**	27.1	29.0
d 0 to final *	25.7	27.3
Gain:feed		
d 0 to 28	0.279	0.272
d 28 to final	0.150	0.153
d 0 to final	0.167	0.167

1 Treatments included: (CON) = 7% hay, 15% Sweet Bran, 67.25% rolled corn, 5% liquid supplement, or (CTN) = 7% cotton gin trash, 15% whole cottonseed, 72.75% rolled corn. Both rations contained 5% dry supplement and 0.75% urea
2 Body weight adjusted by a 4% calculated pencil shrink
3 Cattle were harvested in 2 groups on d 140 (n = 4 pens per treatment) and d 168 (n = 4 pens per treatment)
*Indicates statistical significance;
**Indicates a statistical tendency

Table 2. Effect of including cotton byproducts (CTN) in a finishing ration on the carcass characteristics of crossbred feedlot steers.

	Treatment	
Item	CON	CTN
Hot carcass weight, lbs *	840	871
Rib eye area, in^2	14.9	14.7
Fat thickness, in*	0.49	0.54
Kidney, pelvic, heart fat, %**	1.81	1.91
Dressing percentage**	62.2	62.7
Calculated yield grade**	2.51	2.83
Marbling score[1]	508	499

1 Small00 = 400; Modest00 = 500; Moderate00 = 600

* Indicates statistical significance

** Indicates a statistical tendency

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Heifer Development: A Grazing Systems Approach to Sexed vs Conventional Semen

Brian Freking, JJ Jones, Chris Rice, Chris Stansberry and Barry Whitworth

Introduction

Limited research exists identifying performance and economic advantages for implementing a grazing management system to reduce feed cost by utilizing options like rotational grazing and cool season forages components. Oklahoma producers rarely utilize grazing management techniques to improve their bottom line completely with grazing systems and artificial insemination.

Findings

Heifer development can be accomplished in a multitude of management systems. This demonstration project compared a continuous grazing system to a rotational grazing system. It also compared technology between conventional semen and sexed semen. The fertility associated with the use of sexed bull semen is typically 20% to 25% lower than that with conventional unsexed semen. The goal of any heifer development program is to get heifers pregnant as efficiently as possible. These results in Table 1 show an advantage to the traditional management system (TMS) of feeding heifers to reach a target point versus what we are calling for more Advanced Management system (AMS) using forages with AI technology (TMS 77.5% AI, AMS 60% AI). The old saying "If you are going to breed them you need to feed them" still holds true. Overall Cost in an enterprise budget shows an advantage to AMS because we can spread the cost over more animals and improved grazing efficiencies when you consider both AI and a clean-up bull. This data suggests heifers had some individual performance reductions in growth however, reproduction was better overall in the AMS. Sexed semen still has some challenges (14% disadvantage using sexed semen), however this system was a little better than industry average. Individual year variation will always exist but an overall AI rate of 67% is still quite efficient considering time and forage resources allocated in this demonstration project. In this demonstration we calculated a stocking rate increase $63 per head advantage for AMS (Table 2).

Table 1. AI Combined 5 Years 67/100=67%

	TMS (8)	AMS (12)	
ABS SEXATION	13/19 = 68.4%	15/28 = 53.6%	28/47= 59.6%
Conventional	18/21 = 85.7%	21/32 = 65.6%	39/53= 73.6%
Total AI	31/40 = 77.5%	36/60= 60.0%	
Total AI + Bull	35/40 = 87.5%	54/60= 90.0%	
	*TMS	*AMS	
	$398	$396	
	AI Cost / Pregnancy		
	$513	$660	
	Cost / Overall Pregnancy		
	$455	$440	

Table 2. Pregnancy Efficiency (Cost/pregnancy)

Year	TMS	AMS
2014-15	485	369
2015-16	543	457
2016-17	458	452
2017-18	521	469
2018-19	565	511
Average 5 YR	$514.40	$451.60
Advantage		$62.80

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Novel Packaging Improves Dark-cutting Beef Color

Kendra Wills, Gretchen Mafi, Deb VanOverbeke and Ranjith Ramanathan*

Background

The characteristic bright cherry red lean muscle color of beef carcasses at the 12th/13th rib interface is a desirable trait during grading. Dark-cutting carcasses are an example of a color deviation which results in discounted carcass value. In 2000, the U.S. beef industry lost approximately $165 to $170 million due to the occurrence of dark-cutting beef. Later in 2011, the National Beef Quality Audit reported 3.2% of carcasses graded were assessed as darkcutting. Although in 2016 National Beef Quality Audit, the level of dark-cutting beef has decreased to 1.9%, dark-cutters remain a quality defect worldwide. Lowering the muscle pH by lactic acid enhancement increased redness of darkcutting steaks. Similarly, high-oxygen modified atmospheric packaging enhanced the color of darkcutting beef by providing additional oxygen for myoglobin. Hence, the overall objective of this study was to determine the combined effects of aging, antioxidant enhancement, and MAP on the lean muscle color of dark-cutting beef during simulated retail display.

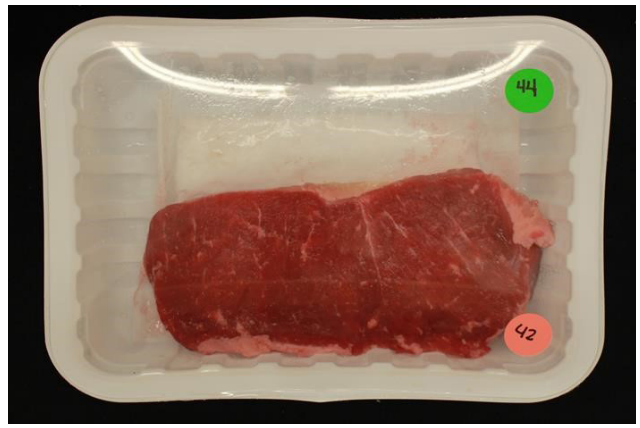

Figure 1. Improved color of dark-cutting steak. ncbi.nlm.nih.gov/pmc/articles/PMC6292250/

Findings

Packaging steaks in modified atmospheric packaging can improve redness of dark-cutting beef. However, a combination of rosemary enhancement and high-oxygen modified atmospheric packaged dark-cutting steaks had similar color as normal-pH steaks. Rosemary is a natural source of antioxidant utilized in food and the level of rosemary used in enhancement will not impart any off-flavor characteristics.

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Competition for an Automated Supplement Feeder Affects Behavior of Stocker Steers

Taylor Husz, Carla Goad and Ryan Reuter*

Background

Automated feeding equipment has recently been developed for supplementing grazing cattle, and researchers and ranchers are interested in evaluating the potential cost-effectiveness of these units. The feeder (Super SmartFeed, C-Lock, Inc.) consists of a large feed bin that dispenses feed into four feeding stations. Each feeding station is accessible to one animal at a time and each station is controlled by the feeder electronics. Feed dispense is triggered by an animal's RFID tag.

If the animal is eligible for feed, supplement is dispensed, until the limit is met. Mixed breed beef steers were used in this trial and were sourced from sale barns. The experiment was conducted in the summers of 2018 and 2019 at the OSU Bluestem Research Range with steers grazing bermudagrass and supplemented with cottonseed meal through the automated feeder.

The experimental treatment was stocking density of the feeder. Therefore, each week, different numbers of steers were commingled and given access to the feeder to vary the stocking density at the feeder. The location of tester steers was recorded for both years with a GPS unit. In 2019, pedometers were also employed to count the steps taken by the tester steers.

Findings

Approximately 31% of the steers did not voluntarily use the feeder; therefore, effective competition was less than the study design. Tester steers consumed an average of 0.64 pound supplement/day. Competition for a feeding station reduced supplement intake by about 0.15 ounces per day per steer of additional competition. Overall, tester steers consumed less feed in 2019, than in year 1 (0.46 pound vs. 0.82 pound, respectively). Steers spent an average of 4.4% of the time within 50 feet of the feeder regardless of competition, indicating that the feeder didn't alter grazing behavior much. As stocking density increased, steers took approximately 144 more steps per steer of additional competition. Previous week stocking density did not have an effect on the number of steps taken, suggesting that walking more was not a learned behavior from the week before. Overall, it was found that an automated feeding station could support up to 20 cattle (80 total for this unit) with minimal effects on key animal behavior traits.

doi.org/10.1093/jas/skz053.143

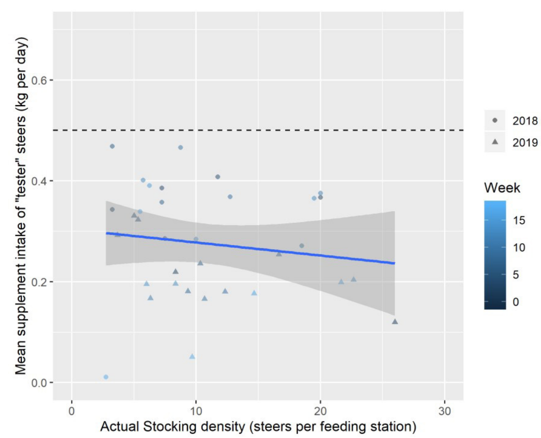

Figure 1. Competition for a feeding space at the automated feeder caused steers to reduce their supplement intake slightly. The dashed line represents the maximum potential intake (1.1 lb per day).

Figure 2. Super SmartFeed automated supplement feeder.

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