Growth and Carcass Characteristics of Feed Efficiency Sorted Cattle Fed Corn or Roughage-Based Diets and Finished with Corn or Byproduct-Based Diets

A.S. Leaflet R2864

Jason Russell, Graduate Student;
Erika Lundy, Graduate Student;
Stephanie Hansen, Assistant Professor, Department of Animal Science

Summary and Implications

The current study is part of a five year multidisciplinary grant that aims to identify dietary, genotypic and metabolic factors affecting feed efficiency while also analyzing the effects of feed efficiency differences on feedlot performance and carcass characteristics. The current report serves as a progress update summarizing the first 439 of 1500 total steers that will be fed throughout the duration of the study. Based on the first three groups of steers that have been evaluated, growing phase feed efficiency rank has shown minimal effects on finishing phase growth and carcass traits. Thus far, byproduct-finished cattle have increased hot carcass weight, backfat and yield grade, suggesting distillers grains have a greater energy value than dry rolled corn.

Introduction

After initial animal acquisition cost, cost of gain is the greatest contributor to feedlot profitability, and feed conversion is the greatest contributor to cost of gain. Determining the underlying factors impacting feed conversion differences between animals will help identify animals with superior feed conversion and also help identify nutritional strategies for improving feed conversion. The causes of feed conversion differences between individual animals are poorly understood. Variation in methane production and consequent energy loss has been identified as a significant contributor but only accounts for a fraction of the variation between individuals. Additionally, the relative ranking of animals based on feed conversion during the growing phase versus finishing phase is inconsistent. Previous studies report cattle within a contemporary group maintaining feed efficiency rank as little as 33% of the time whereas other studies report 62% repeatability. Feedlot animals are typically grown on roughage-based diets and finished on corn-based diets, thus differing greatly in energy, fiber and other nutritional aspects. This conventional diet transition further complicates the analysis of feed efficiency within individual animals throughout their lifetime. The objective of the current study is to determine the influence of growing phase feed efficiency ranking and diet type on performance of steers finished on corn or byproduct-based diets.

Materials and Methods

Cross-bred steers were grown and performance tested at the University of Missouri (Columbia, MO) to determine feed efficiency and relative feed efficiency ranking compared to contemporaries fed the same diet during the same time period. Growing phase diets were composed primarily of roughage (G-Rough; alfalfa/grass baleage and soybean hull-based) or whole-shell corn (G-Corn). The steers were housed in dirt lots equipped with Growsafe feed bunks that measure individual steer intake. Two-day start and end weights were measured as well as intermediate weights every 14-28 days. Steers were on the growing phase test for 70 days following a receiving period. Steers were then trucked to Iowa State University for finishing.

Following transport to Iowa State University, steers were blocked by growing phase feed efficiency rank within growing diet into low (worst), mid or high (best) feed efficiency groups, penned in groups of six head and assigned to finishing phase diets. Steers were housed in concrete pens under partial roof. Finishing phase diets (Table 1) were composed largely of corn (F-Corn) or grain byproducts (F-Byp). Steers were fed a receiving diet for 5-7 days, transitioned to finishing diets for 14-21 days and fed finishing diets until an average 0.5 inch backfat depth was reached, after 65-115 days on test. Steers were fed Optaflexx (200mg/steer/day, Elanco, Indianapolis, IN) for the final 30-32 days of the finishing test period prior to harvest. Days on test for the finishing period varied between groups of steers due to finishing phase test start weight and days necessary to reach the designated backfat. Group 1 (167 hd) started the finishing period weighing 1036 pounds, were fed for 85 days, and were harvested at 1331 pounds. Group 2 (82 head) had a 884 pound starting weight and took 115 days to reach 1263 pounds. Group 3 (190 hd) started at 1041 pounds, received finishing diets for 65 days, and weighed 1320 pounds prior to harvest. Two-day start and end-weights were gathered for the finishing period as well as intermediate weights every 28 days.

Data were analyzed using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC). Fixed effects were growing diet, finishing diet, and feed efficiency grouping (Low, Mid, High). Group (1, 2, 3) was applied as a random effect and period start weights were used as a covariate. Pen was the experimental unit and means comparisons were performed with a Tukey test.

Results and Discussion

Finishing phase performance. Lowly feed efficient pens tended to have greater ($P = 0.07$) average daily gain (ADG) during the finishing period but there were no other differences ($P > 0.2$) between feed efficiency groups for finishing phase ADG, dry matter intake (DMI) or gain:feed ratio (G:F; Table 2), based on the first 3 groups of steers tested. Looking at the interaction of finishing phase diet and Optaflexx inclusion, there were differences in ADG, DMI and G:F (Table 3). During the period prior to Optaflexx inclusion, F-Byp steers had greater ($P < 0.05$) ADG and DMI but were not different ($P > 0.05$) in G:F. During the Optaflexx feeding period, the differences in ADG and DMI were recuperated, as F-Corn cattle had greater ($P < 0.05$) ADG and DMI as well as a tendency for greater ($P < 0.07$) G:F.

Carcass characteristics. The G-Rough/F-Byp and G-Corn/F-Byp pens had greater ($P < 0.05$) hot carcass weight (HCW) compared to G-Rough/F-Corn (Table 4). The G-Rough/F-Byp pens also had greater ($P < 0.05$) HCW than G-Corn/F-Corn. The F-Byp pens tended to have greater ($P < 0.06$) kidney, pelvic and heart fat (KPH) than F-Corn pens. Interestingly, within G-Rough pens the low feed efficiency groups had greater ($P < 0.05$) ending bodyweight (BW) and HCW versus mid feed efficiency groups (Table 5). The G-Rough/F-Byp pens had greater ($P < 0.05$) backfat (BF) and yield grade (YG) versus G-Rough/F-Corn. There were no differences ($P > 0.3$) in ribeye area or marbling.

Conclusions are limited as the current study is less than half completed. Thus far, growing phase feed efficiency rank had minimal effects on finishing phase growth and carcass traits though roughage-grown pens in the low efficiency group did outperform roughage-grown pens in the mid efficiency group. Regardless of growing phase diet, byproduct-finished cattle have increased HCW, BF and YG, supporting the conclusion that distillers grains have a greater energy value than dry rolled corn. At the time of printing, Group 4 is nearing completion of the finishing period and Group 5 (of 8) should arrive at Iowa State in Spring 2014.

Acknowledgements

The current study is funded by the USDA NIFA Grant 10653331. The authors wish to thank the farm staff at the University of Missouri and Iowa State University. Additional thanks to Drs. Monty Kerley and Justin Sexten at the University of Missouri as well as contributing students at both universities.

Table 1. Finishing phase diets.

	Ingredients, % DM	
	F-Corn	F-Byp
Cracked corn	75	30
DDGS	14.99	39.99
Hay	8	8
Soybean hulls	-	20
Limestone	1.54	1.54
Sodium chloride	0.31	0.31
Vitamin A premix[a]	0.11	0.11
Trace mineral premix[b]	0.035	0.035
Rumensin 90[c]	0.013	0.013

[a] = Vitamin A premix contained 2,000,000 IU/lb
[b] = 30ppm Zn, 20ppm Mn, 0.5ppm I, 0.1 ppm Se, 10 mg Cu, 0.1 mg Co
[c] = 200 mg/steer/d Monensin; donated by Elanco Animal Health, Indianapolis, IN

Table 2. Finishing phase performance as affected by growing phase feed efficiency grouping.

	Low FE	Mid FE	High FE	Error	P-value
ADG, lb/d	3.564	3.344	3.388	0.099	0.07
DMI, lb/d	22.55	22.11	22.308	0.407	0.6
G:F	0.156	0.15	0.151	0.004	0.2

Table 3. Finishing phase performance as affected by finishing phase diet and Optaflexx inclusion.

	Pre-Optaflexx		Optaflexx			
	F-Corn	F-Byp	F-Corn	F-Byp	Error	P-value
ADG, lb/d	3.39[b,c]	3.81[a]	3.54[a,b]	3.04[c]	0.135	<0.01
DMI, lb/d	21.74[b]	23.5[a,c]	22.7[a,b]	21.38[c]	0.748	<0.01
G:F	0.155	0.16	0.154	0.14	0.008	0.04

[a, b, c] = Least squares means without common superscript differ ($P < 0.05$) using a Tukey comparison

Table 4. Carcass traits as affected by growing phase diet and feed efficiency grouping.

	G-Corn			G-Rough				
	Low FE	Mid FE	High FE	Low FE	Mid FE	High FE	Error	P-value
HCW, lb	851[a,b]	854[a,b]	851[a,b]	865[a]	845[b]	849[a,b]	5.9	0.05
BF[x], in	0.55	0.56	0.56	0.55	0.55	0.56	0.0248	1
YG[y]	3.21	3.19	3.2	3.29	3.2	3.27	0.134	0.9
KPH, %	2.28	2.38	2.29	2.4	2.35	2.29	0.068	0.3
REA, in^2	13.58	13.69	13.64	13.55	13.5	13.41	0.254	0.8
MS[z]	432	433	413	413	434	426	12.4	0.2

[a, b] = Least squares means without common superscript differ ($P < 0.05$) using a Tukey comparison
[x] = Backfat
[y] = Yield grade (1-5)
[z] = Marbling score (300=slight, 400=small, 500=modest)

Table 5. Carcass traits as affected by growing phase diet and finishing phase diet.

	G-Corn		G-Rough			
	F-Corn	F-Byp	F-Corn	F-Byp	Error	P-value
HCW, lb	849[b,c]	854[a,b]	840[c]	862[a]	4.8	0.01
BF[x], in	0.55[a,b]	0.56[a,b]	0.51[b]	0.6[a]	0.205	0.02
YG[y]	3.19[a,b]	3.21[a,b]	3.09[b]	3.41[a]	0.111	0.05
KPH, %	2.29	2.35	2.31	2.39	0.056	0.8
REA, in^2	13.55	13.73	13.49	13.5	0.216	0.5
MS[z]	433	420	424	424	10.2	0.4

[a, b, c] = Least squares means without common superscript differ ($P < 0.05$) using a Tukey comparison
[x] = Backfat
[y] = Yield grade (1-5)
[z] = Marbling score (300=slight, 400=small, 500=modest)