Carcass Gain, Efficiency, and Profitability of Steers at Extended Days on Feed

Robert G. Bondurant, Jim C. MacDonald, Galen E. Erickson,
Kate Brooks, Rick N. Funston, and Kelly Bruns

Summary

Steers were individually fed for 22 and 44 days longer than the industry average marketing point of 0.5" backfat to determine carcass-based gain, efficiency, and deposition changes throughout the feeding period (142, 163, and 184 days on feed). Premiums and discounts for yield grade, quality grade, and overweight carcasses were applied to determine profitability. Feeding steers for 22 and 44 days longer increased carcass weight, quality grade, and yield grade 4 and 5s. Steers fed 44 days longer had increased total revenue and profit per head despite a decrease in live gain and efficiency.

Introduction

Recent increases in base carcass price of fed cattle have increased the incentive to feed cattle longer. Extending the feeding period increases the risk of receiving discounts for overweight carcasses and increased yield grades (YG) while also having increased likelihood of receiving premiums for higher quality grades (QG) due to fat deposition as cattle continue to be fed. Historically, the optimum marketing date of steers has been determined by changes in feed efficiency for live weight gain where cost of gain should not surpass breakeven live price. Since energy deposited as fat on the carcass stays with the animal through harvest, fat is transferred to hot carcass weight (HCW) and adds value to the animal (*2014 Nebraska Beef Report*, pp 92–96). If additional HCW sold, which makes up the largest portion of total revenue, coupled with QG premiums can outweigh YG discounts, profitability may increase when steers are fed longer days on feed (DOF). The objective of this experiment was to evaluate the changes in steer performance on a live-animal and carcass-basis as steers are fed beyond the industry average 0.50 inch backfat and to determine if feeding cattle longer can remain profitable based on market conditions when sold on a grid basis.

Procedure

This study was conducted at the West Central Research and Extension Center (WCREC), North Platte, Neb. Crossbred steers (n = 114, initial BW = 736 ± 65 lb) were individually fed using a GrowSafe® feeding system in an experiment to evaluate the change in carcass characteristics throughout the feeding period and the economic profit/loss realized by feeding cattle 0, 22 and 44 days longer than the industry average fat endpoint. Steers were limit fed a diet containing 55% Sweet Bran® and 45% hay for 5 consecutive d, with a 2 d weight collected. On the second d, steers were implanted with Revalor-200®, stratified by BW and assigned randomly to 1 of 3 pens. Steers were adapted to a concentrate finishing ration for 24 d and moved into GrowSafe® feeding facility to allow for individual DMI calculation.

Steers were weighed for 2 consecutive d with a 4% shrink applied to account for differences in gut fill; a constant gain (81 lb) was applied to the limit fed weight and served as initial BW at the time they entered the GrowSafe® feeding system on d 1. This was necessary because individual DMI could not be calculated until steers were placed in GrowSafe® system. Therefore, adaptation period was not included in DOF calculation. Steers within pen were assigned randomly to 3 serial harvest groups, allowing for 38 steers per harvest (1/3 of each pen). Steers were not blocked by initial BW in an attempt to simulate variation within pen, as might be observed in an industry setting. To maintain *ad libitum* intake, steers were fed twice daily a common finishing ration containing 48% dry-rolled corn, 40% Sweet Bran®, 7% prairie hay, and 5% supplement (DM basis) including Rumensin 90® (28g/ton diet DM), Tylan 40® (10g/ton diet DM), vitamins, and trace minerals. At 80 DOF, steers were re-implanted with Revalor-200® (102 d after initial implant).

Real time carcass ultrasound measurements including LM area, intra-muscular fat percentage, 12th rib fat thickness, and rump fat thickness were collected on 76 steers (2 pens) at 1, 78, and 134 DOF. Ultrasound image interpretation was conducted by The CUP Lab, Ames, IA. Steers were considered to be industry average when the group was estimated to be at 0.5" 12th rib fat thickness. The first set of calves was harvested at 142 DOF, while the second and third groups were harvested at 163 and 185 DOF, respectively. Carcass data were collected by Tyson Fresh Meats utilizing camera data.

Dressing percent for each harvest group was calculated using the total HCW sold divided by the gross live weight (no shrink). Carcass adjusted live animal performance was calculated using the calculated dressing percent of each harvest group rather than a common dressing percent. Incremental carcass-based gain and feed efficiency was calculated in an attempt to quantify performance over extended DOF on a carcass-basis using different sets of steers. Carcass-based gain and feed efficiency was calculated using the following calculations:

Carcass ADG for 163 DOF: (163 DOF average HCW − 142 DOF average HCW)/22 DOF

Carcass ADG for 185 DOF: (185 DOF average HCW − 163 DOF average HCW)/23 DOF

Carcass F:G for 163 DOF: 163 DOF carcass ADG/21.8 (average DMI from 142–163)

Carcass F:G for 185 DOF: 185 DOF carcass ADG/23.1 (average DMI from 163–185)

Economic factors were applied to the animal performance and carcass characteristics to determine total profit/loss when marketing steers at each harvest point under current market conditions (February 2015 averages). Economic prices of importance included Nebraska feeder, feed-

stuffs, 5-Area market average dressed steer, and 5-Area market average premiums and discounts applied to the carcass including HCW, QG, and YG. Yardage, vet./chute/misc, death loss, trucking and interest on cattle and feed were also included in the analysis (Table 1). Market prices were obtained from the Livestock Marketing Information Center, Lakewood, CO.

All data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.). To develop 12th rib fat thickness, marbling score, and LM area data for the 2 pens of steers ultrasounded, data were analyzed separate from non-ultrasounded steers using covariate regression. Pen was included as random effect. Orthogonal contrasts were used to test linear and quadratic effects of DOF for steers.

Results

Average dressing percent at harvest was 63.54, 64.59, and 64.82% for 142, 163, and 185 DOF, respectively. Carcass adjusted final live weight increased linearly ($P < 0.01$) from 1295 to 1392 lb as steers were fed additional DOF (Table 2). Steer DMI was not different ($P = 0.59$) among DOF. Live ADG decreased linearly ($P < 0.01$) while F:G increased linearly ($P < 0.01$) as steers were fed longer. As steers were fed from 142 to 185 DOF, HCW increased linearly ($P < 0.01$) from 823 to 903 pounds, respectively. Incremental carcass ADG was 1.41 lb between days 142 and 163, and 2.13 lb between days 163 and 185. Carcass F:G was 15.38 between 142 and 163 days, and 10.87 between 163 and 185 days. Steer LM area quadratically increased ($P = 0.04$) from 13.8 to 14.5 in^2 (142 and 163 DOF, respectively) and did not change for 185 DOF at 14.3 in^2. Actual marbling score numerically increased from 475 to 506 (142 and 185 DOF, respectively) but was not significantly different ($P = 0.14$). Calculated YG and actual 12th rib fat thickness increased linearly ($P < 0.01$) as DOF increased for steers.

On d 1 when initial ultrasound was conducted, 12th rib fat thickness, marbling score, and LM area were not different ($P \geq 0.42$) among harvest groups. Steer 12th rib fat thickness increased quadratically ($P < 0.01$) from 0.19" on d 1 to 0.65" on d 185 (Figure 1). Steers ultrasounded on 134 DOF had 0.47" backfat, while those harvested at 142 DOF had an actual

Table 1. Prices used for economic analysis of steers fed increasing days on feed

Yard Information,	
Yardage, $/hd/d	0.45
Vet./Chute/Misc., per hd	15.00
Death Loss	2.0%
Trucking, $/hd	5.00
Interest on Feedlot Charges	5.0%
Interest on Calf	5.0%
Feedstuffs[a],	$/ton DM
Corn ($3.81/bu)	161.03
Ration cost	164.69
Dressed Steer, Base Choice[b]	253.00
Nebraska Feeder Calves[c],	$/cwt
500–599	279.99
600–699	245.15
700–799	219.30
800–899	199.88
900–999	186.12
1000–1099	176.60
Carcass Premiums and Discounts[d],	$/cwt
HCW,	
400–499	(25.43)
500–549	(22.82)
550–599	(2.73)
600–899	—
900–999	—
1000–1049	—
≥ 1050	(23.47)
Quality Grade,	
Prime	15.88
Choice, Upper 1/3	1.54
Choice, Middle 1/3	1.99
Choice, Bottom 1/3	—
Select	(6.08)
Standard	(17.09)
Yield Grade,	
1.00–1.99	4.59
2.00–2.49	2.25
2.50–2.99	2.13
3.00–3.49	—
3.50–3.99	—
4.00–4.99	(8.27)
≥ 5.00	(13.02)

[a]Values from the 5-Area Monthly Feedstuffs averaged for February 2015.
[b]Values from the 5-Area Weekly Dressed Steer averaged for February 2015.
[c]Values from the Nebraska Weekly Feeder Market Sales averaged for February 2015.
[d]Values from 5-Area Market Premiums and Discounts received for dressed steers averaged for February 2015.

Table 2. Feedlot and carcass performance of steers fed increasing days on feed

Live Animal Performance[a],	Days on feed				Contrasts	
	142	163	185	SE	Linear	Quadratic
Initial BW	732	739	736	11	0.79	0.75
Final BW, lb	1295	1322	1392	19	< 0.01	0.35
Live DMI, lb/d	23.8	23.5	24.1	0.5	0.59	0.31
Live ADG, lb	3.92	3.58	3.55	0.08	< 0.01	0.10
Live F:G, lb/lb	6.10	6.54	6.80	—	< 0.01	0.30
Carcass Performance,						
HCW	823	854	903	12	< 0.01	0.56
LM area, in^2	13.8	14.5	14.3	0.2	0.06	0.04
Marbling score[b]	475	476	506	15	0.14	0.42
12th rib fat thickness, in	0.49	0.58	0.69	0.04	< 0.01	0.79
Calculated YG[c]	2.89	3.05	3.56	0.16	< 0.01	0.20

[a]Live animal performance calculated using carcass adjusted final live weight: HCW divided by actual dressing percent from each serial harvest time point (64.83, 65.91. and 66.14%, respectively)
[b]200=Traces^{00}, 300 = Slight^{00}, 400 = Small^{00}, 500 = modest^{00}, 600 = moderate^{00}, 700 = Slightly Abundant^{00}, 800 = Moderately Abundant^{00}
[c]Calculated as: YG = 2.50 + (2.5 * rib fat thickness, in) − (0.35 * REA, in^2) + (0.2 * 2.5 KPH) + (0.0038 * HCW, lb)

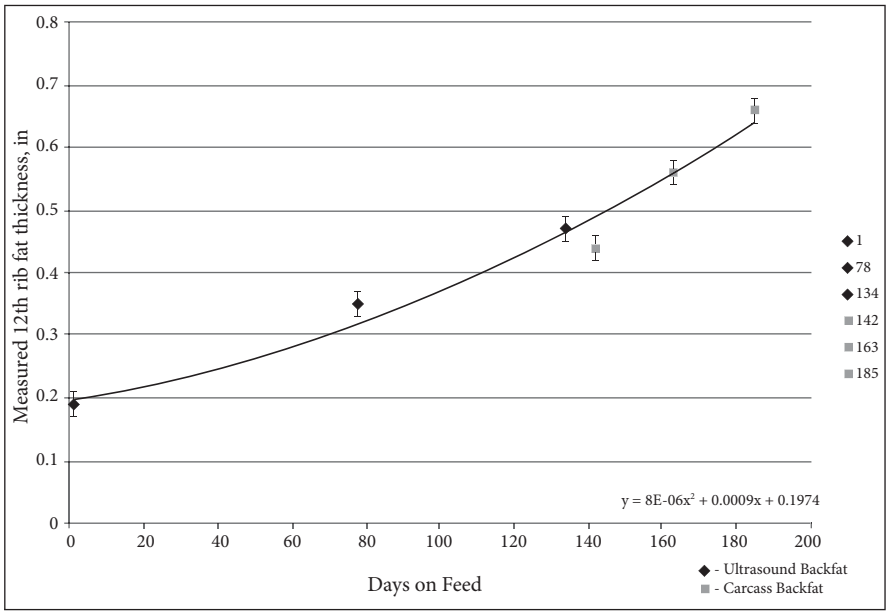

Figure 1. Measured 12th rib backfat thickness in inches throughout days on feed. Days 1, 78, and 134 were measured using real-time carcass ultrasound on 2 pens of cattle (n = 76) and averaged. Days 142, 163, and 185 were measured at time of harvest for each serial slaughter group (38 head) and averaged. Steer 12th rib backfat thickness increased quadratically ($P < 0.01$) from 0.19" at d 1 to 0.69" at 185 days on feed.

12th rib fat thickness of 0.44". This small discrepancy in fat thickness may be due to hide pulling and carcass trim at the harvest facility or the inherent differences in ultrasound and camera measurements. Marbling score increased quadratically ($P < 0.01$) from 346 at d 1 (initial ultrasound) to 526 at 185 DOF (Figure 2). Measured LM area increased quadratically ($P < 0.01$) from 10.3 in^2 (initial ultrasound) on d 1 to 14.4 in^2 as steers were fed to 185 DOF (Figure 3). The percentage of steers with final YG 5 was not different among DOF (Figure 4). The percentage steers within harvest group with final YG 4 increased linearly ($P < 0.01$) with DOF (2.63, 10.53, and 31.58%, respectively). Steers harvested at 185 DOF had 10.5% more YG 3 than 142 and 163 DOF which were not different. The percentage of steers grading choice or better was not different across DOF; however, the 185 d cattle had an increased percentage of steers grading upper 2/3 choice (Figure 5).

Total feedlot costs increased linearly ($P < 0.01$) with increasing DOF for 142, 163, and 185 ($431.36, $482.57 and $549.58, respectively). There was no difference ($P \geq 0.17$) in HCW and QG premiums and discounts however; there was a linear increase ($P < 0.01$) in YG discounts as steers were fed increasing DOF. Steers fed for 142 DOF had no HCW discount, a $1.40 and $6.23/head premium for QG and YG, respectively. However, the 163 DOF steers had no HCW discount, but $6.40 and $0.07/head discounts for QG and YG. Discounts of $6.72/head for HCW and $19.25 per head for YG were observed with a $5.12/head QG premium received for those steers fed to 185 DOF. Revenue generated from HCW linearly increased ($P < 0.01$) with increasing DOF from 142 to 185 ($2081.68 to $2283.37 per head, respectively). Similarly, total revenue including premiums and discounts linearly increased ($P < 0.01$) from $2089.41 to $2262.43 per head as DOF increased. Total profit per head increased from $18.20 to $85.74 as steers were fed from 142 to 185 DOF; however, due to variation among individuals within harvest groups, total profit per head only tended to increase ($P = 0.06$). Steers fed for 163 and 185 DOF sold 31 and 80 lb of additional HCW compared to the 142 DOF which equated to an additional $79.16 and $201.69 per head, respectively (Table 4). The incremental cost of HCW gain de-

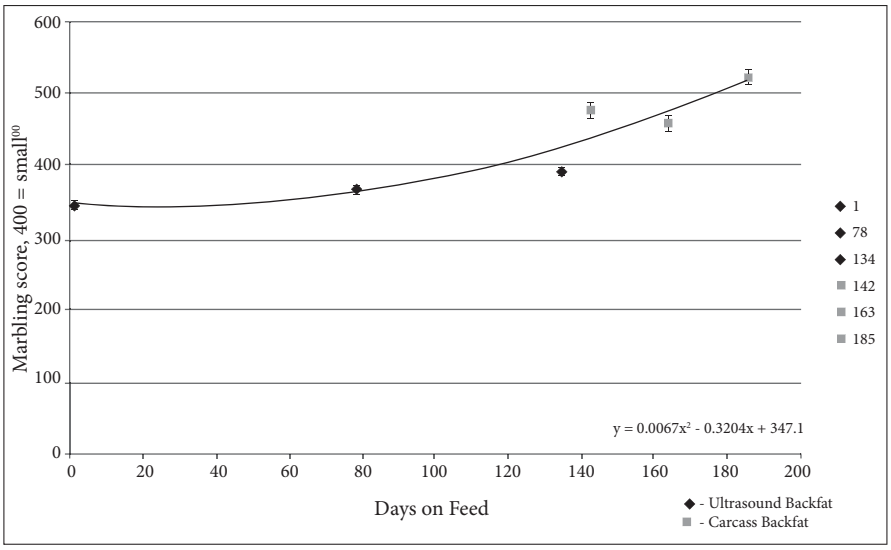

Figure 2. Marbling score of steers throughout days on feed. Days 1, 78, and 134 were measured using real-time carcass ultrasound on 2 pens of cattle (n = 76). Ultrasound measurement was evaluated as % IMF and converted to marbling score which was averaged for total group. Marbling score for days 142, 163, and 185 was calculated at time of harvest for each serial slaughter group (38 head) and averaged. Marbling score quadratically increased ($P < 0.01$) from d 1 at 346 to 526 at 185 days on feed.

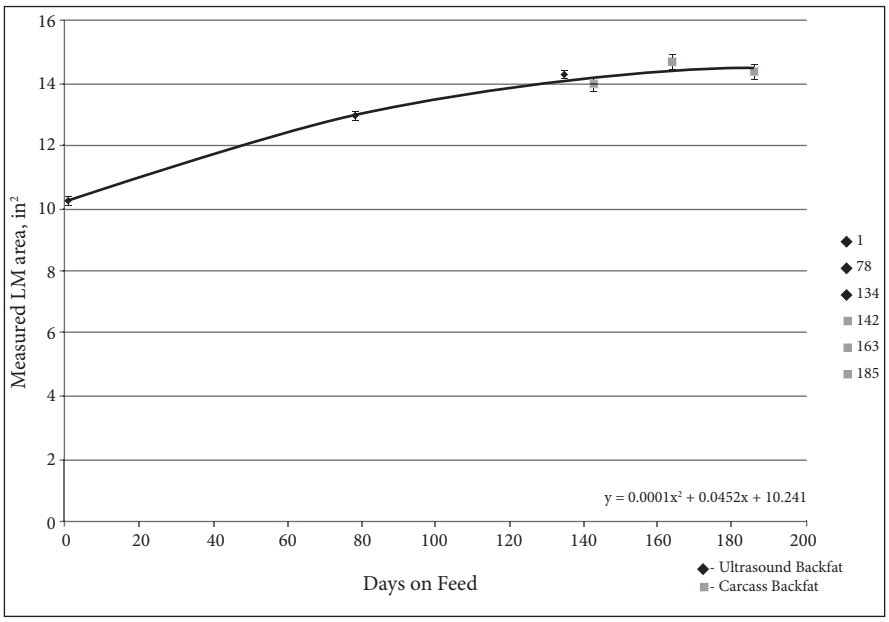

Figure 3. Measured LM area (in^2) throughout days on feed. Days 1, 78, and 134 were measured using real-time carcass ultrasound on 2 pens of cattle (n = 76) and averaged. Days 142, 163, and 185 were measured at time of harvest for each serial slaughter group (38 head) and averaged. Steer LM area increased quadratically ($P < 0.01$) from 10.3 in^2 at d 1 to 14.3 in^2 at 185 days on feed.

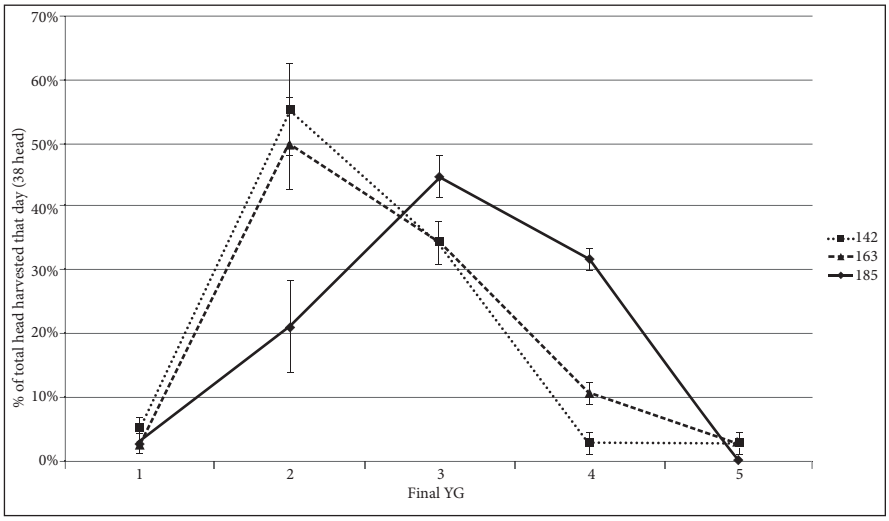

Figure 4. Percent of total steers harvested (38/day) on days 142, 163, and 185 having final yield grade (YG) 1–5. Final YG linearly increased ($P < 0.01$) with increasing days on feed from 142 to 185.

creased from $1.65 to $1.37 per lb as steers were fed an additional 22 or 23 d (142 to 163 and 163 to 185 DOF, respectively).

Although carcass adjusted live ADG decreased and live F:G became poorer with increasing DOF, steer HCW increased significantly. For steers fed longer DOF, the increase in profit despite the added total feedlot costs can be attributed to more HCW sold. Even though an increase in YG was observed, the premium received for QG coupled with the value of additional HCW in the current market equates to an increase in total revenue. When comparing economics at current market conditions, steers can be fed for 44 days longer than industry average of 0.5" backfat and increase profit per head because the cost of HCW gain is decreasing.

Robert G. Bondurant, research technician

Jim MacDonald, associate professor

Galen Erickson, professor, University of Nebraska–Lincoln (UNL) Department of Animal Science, Lincoln, Nebr.

Kate Brooks, assistant professor, UNL Department of Agricultural Economics, Lincoln, Nebr.

Rick Funston, professor

Kelly Bruns, professor, UNL West Central Research

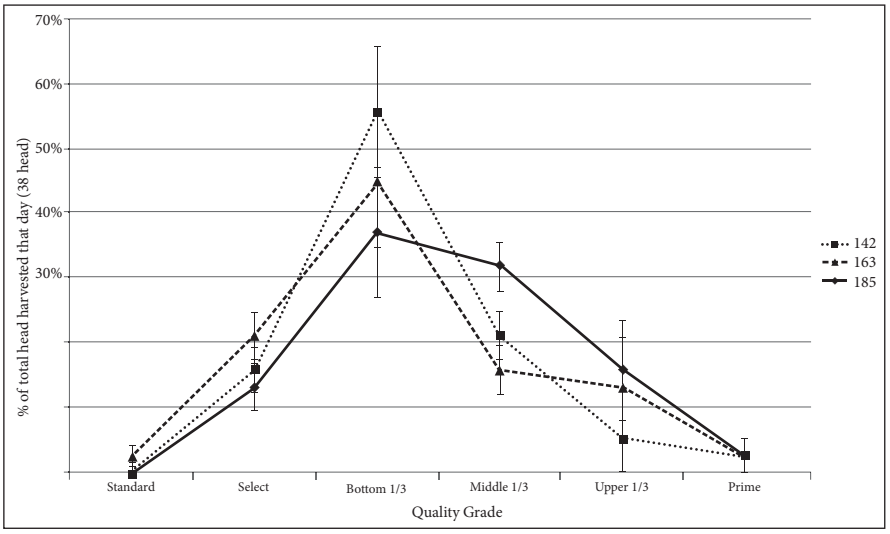

Figure 5. Percent of total steers harvested (38/day) on days 142, 163, and 185 having quality grade (QG) of standard, select, bottom 1/3, middle 1/3, upper 1/3, and prime.

Table 3. Feedlot economics for steers fed increasing days on feed

	Days on feed				Contrasts	
Inputs,	142	163	185	SE	Linear	Quadratic
Purchase Cost, $/hd[a]	1639.71	1635.83	1626.92	9.91	0.36	0.83
Feed Cost, $/hd[b]	279.27	315.48	366.66	6.54	< 0.01	0.20
Total Feedlot Costs, $/hd[c]	431.36	482.57	549.58	6.60	< 0.01	0.19
Premiums/Discounts[d],						
HCW, Average $/hd	0	0	(6.72)	3.95	0.23	0.48
Quality Grade, Average $/hd	1.40	(6.20)	5.12	5.67	0.64	0.17
Yield Grade, Average $/hd	6.23	(0.07)	(19.25)	7.10	< 0.01	0.33
Outputs,						
HCW Sold, $/hd[e]	2081.68	2160.84	2283.37	30.53	< 0.01	0.56
Total Revenue, $/hd[f]	2089.41	2154.47	2262.43	31.10	< 0.01	0.57
Total Profit, $/hd[g]	18.20	36.22	85.74	24.98	0.06	0.60

[a]Calculated using Nebraska Market sales with 100 lb weight groups multiplied by initial BW/100
[b]Calculated by: total DM feed usage multiplied by ration cost/ton DM.
[c]Total feedlot costs including feed, vet. and misc, yardage, trucking, death loss, and interest.
[d]Values from 5-Area Market premiums and discounts received for dressed steers.
[e]Calculated by: (HCW/100) * February 2015, 5-Area Market Dressed Steer Price.
[f]Calculated by: HCW sold + Premiums and Discounts received.
[g]Calculated by: Total Sold – (Purchase Cost + Total Feedlot Cost).

Table 4. Comparative feedlot economics of feeding an additional 22 or 44 days

	Days on Feed[a]	
Item,	142–163	163–185
Added Feed Cost, $/hd	36.31	51.18
Added Total Feedlot Cost, $/hd[b]	51.21	67.01
Additional HCW Sold, lbs/hd	31	49
Additional Revenue from HCW, $/hd	79.16	122.53
Total Additional Revenue, $/hd[c]	65.06	107.96
Cost of HCW Gain, $/lb[d]	1.65	1.37

[a]Values calculated per head for 22 or 44 additional days on feed, respectively.
[b]Including additional feed, vet. and misc, yardage, trucking, death loss, and interest for added days on feed.
[c]Additional $/hd received including discounts and premiums.
[d]Calculated as: Added Total Feedlot Cost / Additional HCW sold.