The Combined Effect of Beef Cattle Frame Score and Forage Grazing Sequence on Yearling Steer Grazing And Feedlot Performance, Carcass Trait Measurements, and Systems Economics

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Project Brief

Over a 2 year period, 192 (96 steers/year) yearling steers originating from two beef cattle herds maintained at the Dickinson Research Extension Center (DREC) were divided into two frame score groups identified as small frame (**SF**: average 3.64) and large frame (**LF**: average 5.44). After weaning each fall (2012 and 2013), the steers were managed as a single group and backgrounded grazing unharvested corn that was supplemented with mixed hay (alfalfa-bromegrass-crested wheatgrass) and 2 lb/steer/day of a 32% CP supplement until the end of April each year. During the backgrounding period, the steers grew at a modest ADG of 1.10 lb/day. The first week of May each year, the steers were randomly assigned to either feedlot (FLOT) or grazing (GRAZ) treatments. Within these two main treatments, two feedlot groups (LF: n=24 and SF n=24) and two grazing groups (LF: n=24 and SF n=24) were established. The FLOT steers were shipped to the University of Wyoming, Sustainable Agriculture Research Extension Center (SAREC), Lingle, Wyoming. The 2-year average number of days on feed (DOF) for the LF and SF feedlot control steers was 222 days. The GRAZ steers grazed native range from the first week of May to mid-August, a period of 109 days before being moved to graze annual forage fields of field pea-barley intercrop (30 days) followed by grazing unharvested corn (75 days). The total grazing period was 219 days. At the end of corn grazing, the GRAZ steers were shipped to the SAREC, Lingle, Wyoming for a delayed feedlot entry finishing period of 70 days. When each of the systems treatment groups were finished, the groups were delivered by commercial truck to the Cargill Meat Solutions packing plant, Ft. Morgan, Colorado. Due to the system's differences, the FLOT control groups were slaughtered in mid-December each year and the delayed feedlot entry GRAZ treatment steers were slaughtered mid-February to the first week of March.

All expenses and returns associated with this alternative growing and finishing systems study were recorded. Native range grazing costs were assessed using the custom grazing rate determination shown in Table 1 and farming expenses for the annual forages in the GRAZ system are shown in Table 2. Steer frame score grazing performance, cost/steer, and cost/lb of gain are shown in Table 3. Feedlot finishing performance, feed intake and efficiency, and finishing economics for the LF and SF treatment groups are shown in Table 4. Carcass traits, tenderness measurements, and total carcass value are shown in table 5. The effect of steer frame score and extended grazing on system net return is shown in Table 6.

Results of this systems investigation show that over the two year period the SF steers tended to grow slower under grazing (P=0.069) and grew significantly slower in the feedlot control treatment (P = <0.0001). Under grazing conditions, the SF steers had a lower cost/steer ($292.90 vs. $303.14); however, due to their slower growth rate, grazing cost/lb of gain was higher ($0.5979 vs. $0.6582). In the feedlot, feed cost/lb of gain was significantly higher for both the LF and SF FLOT treatment steers compared to the GRAZ treatment steers (P = 0.0155). Delaying feedlot entry until after 219 days of grazing reduced the finishing period to 70 DOF and associated finishing costs were also reduced. Comparing the average FLOT and GRAZ systems feed cost/lb of gain, finishing feed cost/lb of gain for the GRAZ system averaged 31.8% less (P = 0.0155).

Carcass trait measurements collected at Cargill Meat Solutions, Ft. Morgan, Colorado, identified economically important differences and similarities. Hot carcass weight (HCW) were numerically different, but did not differ statistically (P = 0.15). Dressing percent was greater for LF and SF FLOT treatment steers compared to GRAZ treatment steers (9 = 0.018). Regardless of system treatment, LF steers had larger ribeye area (P = 0.05). Marbling score among SF steers was numerically greater, but the difference was not statistically significant (P = 0.46). Percent Choice carcass quality grade ranged from 89.6 to 97.9% across treatments. The percent of LF GRAZ systems steers grading Choice or better was lower compared to the other system treatments (P = 0.05). Although there were fewer LF GRAZ system steers that graded Choice or better, LF GRAZ treatment steers returned the highest gross return per carcass of $2223.67 (P = 0.001).

Meat tenderness measured using the Warner-Bratzler shear force test identified numerical differences between FLOT and GRAZ treatments for LF and SF steers; however, there was no statistical difference between treatments (P = 0.483). Meat cooling loss was also measured and there was no difference measured between treatments for LF and SF steers (P = 0.432).

Systems net return has been summarized in Table 6. To determine system net return, expenses (e.g. steer placement cost, grazing and feedlot finishing expenses, transportation and brand expenses) were deducted from the gross carcass value. The 2-year average systems net return was $188.01, $112.98, $526.50, and $344.75 for the FLOT LF and SF, and GRAZ LF and SF, respectively. The combination of lower grazing and feedlot expenses and compensatory growth among GRAZ system steers resulted in greater net return than that received for the FLOT system steers. The data indicates that a much longer grazing season and a significantly abbreviated finishing period favors profitability.

Table 1. Native range pasture custom grazing rate calculation[1]

GRAZ SF[2]	**Grazing Cost/lb**	**Weight**	**Cost/Day**	**Days**	**Period Total**	**Grazing Cost/ Steer/Day**
Date In		**In Weight**				
May 1	0.001125	652	$0.73	54	$39.61	
Date Out		**Out Weight**				
Aug 17	0.001125	890	$1.00	55	$55.07	
Pasture Cost/Steer				109	$94.68	$0.87
GRAZ LF[2]						
Date In		**In Weight**				
May 1	0.001125	757	$0.85	54	$45.99	
Date Out		**Out Weight**				
Aug 17	0.001125	1033	$01.16	55	$63.92	
Pasture Cost/Steer				109	$109.90	$1.01

[1] 2-Year Average

[2] **SF;** Small Frame, **LF;** Large Frame

Table 2. Farming input cost for annual forages pea-barley and unharvested corn that were grazed[1]

CROP EXPENSES	**Pea Barley**	**Unharvested Corn**
Custom Drilling or Planting/Ac, $	12.00	15.00
Custom Chemical Application/Ac, $	5.00	5.00
Custom Fertilizer Broadcast Application/Ac, $	-	5.00
Windrowing/Ac, $	10.00	-
Fertilizer/Ac, $	-	40.25
Seed (Perfection pea, Haybet Barley; Pioneer P9690R Corn)/Ac, $	47.00	62.50
Innoculant/Ac, $	4.33	-
Chemical – Pea-Barley (Glyphosate, AMS, Helfire, Rifle D)	12.62	
Chemical – Corn (Glyphosate, AMS, Helfire)		7.92
Crop Insurance/Ac, $	15.00	15.00
Land Rent/Ac, $	35.00	35.00
Subtotal	140.95	185.67
Interest, 5.0%	7.05	9.28
Total Crop Input Cost/Ac, $	148.00	194.95
Cost/Steer, $	83.25	104.79

[1]2-Year average

Table 3. Effect of frame score on extended grazing performance and cost[1]

	GRAZ[2] LF[3]	GRAZ[2] SF[3]	SEM[4]	P Value[5]
Number of Steers	24	24		
Frame Score	5.44[a]	3.60[b]	0.18	0.021
Days Grazed	219	219		
Grazing Performance				
Start Weight, lb	757	652	39.17	0.059
End Weight, lb	1264	1097	49.48	0.093
Gain, lb	507	445	15.07	0.13
ADG, lb	2.32	2.03	0.069	0.13
Grazing Cost				
Perennial Pasture (109 Days), $	108.74	93.68		
Field Pea-Barley (30 Days), $	78.99	83.25		
Unharvested Corn (75 Days), $	104.23	104.79		
32% Crude Protein Suppl. (0.81 lb/d), $	11.18	11.18		
Grazing Cost/Head, $	303.14	292.90		
Grazing Cost/lb of Gain, $	0.5979	0.6582		

[1]2-Year average
[2]FLOT steers moved directly to the feedlot for growing and finishing; and GRAZ steers grazed a sequence of native range, field pea-barley intercrop, and unharvested corn before transfer to the feedlot at the University of Wyoming
[3] **SF;** Small Frame, **LF;** Large Frame
[4] **SEM;** Pooled standard error of the mean
[5] **P-Values: Trt**; (Treatment), **Yr**; (Year), and **Tr x Yr**; (Treatment x Year interaction)
[a-b] Means with unlike superscripts differ significantly ($P \leq 0.05$)

Table 4. Effect of steer frame score and extended grazing on feedlot finishing performance, efficiency, and conomics[1]

	FLOT[2] LF[3]	FLOT[2] SF[3]	GRAZ[2] LF[3]	GRAZ[2] SF[3]	SEM[4]	P-Value[5]		
						Trt	Yr	Trt x Yr
Number of Steers	24	24	24	24				
Frame Score	5.54	3.67	5.44	3.60	0.231	0.0012	0.014	0.62
Finishing Performance								
Grazing Days	-	-	219	219				
Feedlot Days Fed	222	222	70	70				
Start Weight, lb	750[c]	660[d]	1228[a]	1105[b]	39.94	0.0004	<0.0001	0.53
End Weight, lb	1501	1290	1566	1407	53.88	0.140	0.0002	0.69
4% Shrunk Slaughter Weight, lb	1441[b]	1238[d]	1503[a]	1351[c]	54.80	0.022	<0.0001	0.743
Gain, lb	751[a]	630[b]	338[c]	302[c]	18.17	<0.0001	0.316	0.98
ADG, lb	3.38	2.84	4.83	4.31	0.123	0.094	0.82	0.22
Feed Intake and Efficiency								
DM Feed/Steer/Day, lb	26.08[a]	21.94[b]	26.04[a]	24.00[c]	0.656	<0.0001	<0.0001	<0.0001
DM Feed/lb of Gain, lb	7.72[a]	7.73[a]	5.39[b]	5.57[b]	0.231	0.007	<0.0001	<0.0001
Finishing Economics								
Feed Cost/Steer, $	632.12[a]	541.01[b]	193.88[cd]	177.92[d]	11.87	<0.0001	<0.0001	0.057
Feed Cost/Steer/Day, $	2.85	2.45	2.55	2.34	0.069	0.149	<0.0001	0.128
Feed Cost/Lb of Gain, $	0.84[a]	0.86[a]	0.57[b]	0.59[b]	0.0248	0.0155	0.0021	0.397

[1]2-Year average
[2]FLOT steers moved directly to the feedlot for growing and finishing; and GRAZ steers grazed a sequence of native range, field pea-barley intercrop, and unharvested corn before transfer to the feedlot at the University of Wyoming
[3] **SF;** Small Frame, **LF;** Large Frame
[4] **SEM;** Pooled standard error of the mean
[5] **P-Values: Trt**; (Treatment), **Yr**; (Year), and **Tr x Yr**; (Treatment x Year interaction)
[a-d] Means with unlike superscripts differ significantly ($P \leq 0.05$)

Table 5. Effect of steer frame score and extended grazing on carcass trait measurements and value[1]

	FLOT[2] LF[3]	FLOT[2] SF[3]	GRAZ[2] LF[3]	GRAZ[2] SF[3]	SEM[4]	P-Value[5]		
						Trt	Yr	Trt x Yr
Number of Carcasses								
Hot Carcass Weight, lb	867	752	882	774	32.66	0.154	<0.0001	0.948
Dressing Percent, %	60.23[a]	60.7[a]	58.7[b]	57.3[b]	0.319	0.018	0.0002	0.148
Fat Depth, in	0.45	0.48	0.33	0.42	0.018	0.469	<0.0001	0.915
Ribeye Area, sq. in	13.2[a]	12.0[b]	13.2[a]	12.3[b]	0.277	0.050	0.0002	0.282
USDA Yield Grade	2.41	2.61	2.07	2.24	0.089	0.139	<0.0001	0.019
Marbling Score	595	646	573	635	10.82	0.459	0.0019	0.990
Percent Choice, %	91.7[a]	95.8[a]	89.6[b]	97.9[a]	2.811	0.050	0.0004	0.163
Carcass Value/Steer, $	2073.33[b]	1820.33[d]	2223.67[a]	1974.17[c]	77.78	0.001	<0.0001	0.017
Warner-Bratzler Shear Force, lb	5.36	5.32	5.81	5.81	0.135	0.483	<0.001	0.291
Cooking Loss, %	17.85	17.61	17.50	15.40	1.17	0.432	<0.001	0.115

[1]2-Year average
[2]FLOT steers moved directly to the feedlot for growing and finishing; and GRAZ steers grazed a sequence of native range, field pea-barley intercrop, and unharvested corn before transfer to the feedlot at the University of Wyoming
[3] **SF;** Small Frame, **LF;** Large Frame
[4] **SEM;** Pooled standard error of the mean
[5] **P-Values: Trt**; (Treatment), **Yr**; (Year), and **Tr x Yr**; (Treatment x Year interaction)
[a-d] Means with unlike superscripts differ significantly (P≤0.05)

Table 6. Effect of steer frame score and extended grazing on system net return[1]

	FLOT[2] LF[3]	FLOT[2] SF[3]	GRAZ[2] LF[3]	GRAZ[2] SF[3]	SEM[4]	P-Value[5]		
						Trt	Yr	Trt x Yr
Number of Steers	24	24	24	24				
Income:								
Carcass Value/Steer, $	2073.33[b]	1820.33[d]	2223.67[a]	1974.17[c]	77.78	0.001	<0.0001	0.017
Expenses:								
Cost/Steer, $	1229.80	1142.94	1173.06	1131.51				
Grazing Cost/Steer, $	-	-	303.14	292.90				
Feedlot Cost/Steer, $	632.12[a]	541.01[b]	193.88[cd]	177.92[d]	11.87	<0.0001	<0.0001	0.057
Transportation&Brand,$	23.40	23.40	27.09	27.09				
Total System Expense/Steer, $	1885.32	1707.35	1697.17	1629.42				
System Net Return/Steer, $	188.01	112.98	526.50	344.75				

[1]2-Year average
[2]FLOT steers moved directly to the feedlot for growing and finishing; and GRAZ steers grazed a sequence of native range, field pea-barley intercrop, and unharvested corn before transfer to the feedlot at the University of Wyoming
[3] **SF;** Small Frame, **LF;** Large Frame
[4] **SEM;** Pooled standard error of the mean
[5] **P-Values: Trt**; (Treatment), **Yr**; (Year), and **Tr x Yr**; (Treatment x Year interaction)
[a-d] Means with unlike superscripts differ significantly (P≤0.05)