Consequence of two grazing systems before feedlot entry on yearling steer grazing and feedlot performance, carcass traits, tenderness and sensory panel response, and net return

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The objective of this research was to examine the consequence of two extensive grazing systems for yearling steers based on perennial grasses or a combination of perennial grasses and annual forages before feedlot entry and to compare system net return to conventional feedlot finishing. Combining perennial grass and annual forage before feedlot entry reduced days on feed, improved feedlot performance, did not affect tenderness or sensory panel response, and resulted in improved system profitability without risk management intervention.

Summary

One hundred forty-one yearling steers, previously wintered for modest gain of less than 1 pound/day, were randomly assigned in early May based on birth date and weight to one of three production systems: 1) control (feedlot direct) (**FLT**), 2) perennial grass pasture (crested wheatgrass (CWG) > native range (NAT) (**PST**) or 3) perennial grass pasture followed by annual forage (CWG > NAT > field pea-barley (PBLY) > unharvested corn (CN)) (**ANN**). During the grazing period, gains were slower for the PST than the ANN system. At feedlot entry, ANN system steers were heavier and needed less days on feed (DOF) to reach final harvest weight. Grazing annual forages after perennial grasses promoted increased growth, rib-eye area (REA), fat depth (FD) and percent of intramuscular fat (%IMF). Compared with the conventional feedlot control days on feed (DOF) of 142 days, grazing system DOF to final harvest were 66 and 91 days for the ANN and PST systems, respectively. In the feedlot, grazing system steers grew faster and were more efficient, and feed cost per unit of gain was lower than for the FLT control steers. Hot carcass weight was heavier for grazing steers than the FLT control; however, no difference was found among systems for marbling score or percent USDA Choice quality grade. Strip loin steaks (approximately 1 inch thick) were removed from each carcass half for tenderness and sensory panel evaluation. For meat samples, no differences were found for shear force (tenderness) or cooking yield, and no systems sensory panel differences were identified for tenderness, juiciness or flavor. Systems net return was determined without accounting for risk management procedures. The ANN system net return was the most profitable system, returning $9.09 per steer; however, a small loss was recorded for the PST (minus $30.10 per steer), and a large loss was recorded for the control FLT system (minus $298). These data suggest that retaining ownership through finishing preceded by a long-term sequence of perennial and annual forages improves economically important muscle and fat traits, and the ANN system has the greatest potential to be profitable.

Introduction

Various factors, but most notably extended periods of drought and high grain prices, have contributed to a shrinking national cow herd, resulting in excess feedlot capacity in the cattle feeding industry. As of July 2013, the cattle feeding industry experienced cash-to-cash losses for 16 continuous months when risk management was not measured (CattleFax, 2013).

High grain prices, supported by corn ethanol production and greater profitability in the stocker cattle business, may lead to fewer calves and a greater number of yearlings being placed on feed in the future. Yearling and long-yearling cattle make up 45 to 55 percent of total feedlot placements (Brink, 2011). Previous research at the Dickinson Research Extension Center has shown that early weaned calves backgrounded on grazing fields of unharvested corn have a competitive economic advantage (Landblom et al., 2010).

The primary objective of this research was to compare two long-term yearling steer grazing systems prior to final feedlot finishing with conventional feedlot growing-finishing to determine the effect of grazing on animal performance, days on feed (DOF), carcass traits, meat tenderness and sensory panel response, and systems net return.

Experimental Procedures

The procedures used in this investigation have been approved by the NDSU Institutional Animal Care and Use Committee.

After weaning in November of each year (2011 and 2012), medium- to large-frame steers (5 to 7 frame score; n = 141) were wintered for modest gain of less than 1 pound per day grazing corn aftermath plus medium-quality hay. In early May, the steers were assigned randomly to one of three treatments based on birth date and weight: 1) control (feedlot direct) (**FLT**), 2) perennial grass pasture (crested wheatgrass (CWG) > native range (NAT) (**PST**) or 3) perennial grass pasture followed by annual forage (CWG > NAT > PBLY > CN) (**ANN**).

The FLT control steers were shipped directly to the University of Wyoming Sustainable Agriculture Research Extension Center in Lingle and fed to final harvest weight. Steers assigned to the PST and ANN forage grazing treatments also were fed to final harvest at the University of Wyoming feedlot at the end of the long-term extended grazing period.

During the grazing season, PST steers were moved from spring crested wheatgrass to native range pastures in mid-June and, for the ANN treatment, the steers were moved from crested wheatgrass to native range in mid-June and from native range to PBLY the third week of August each year. After PBLY grazing was completed, the steers were moved to standing unharvested corn. Forage crude protein change was determined with bi-monthly sampling from three locations in the PST and ANN treatments.

The design was to graze each forage type until forage crude protein (CP) content declined to a range of 8 to 10 percent CP or the pasture or field was sufficiently grazed. Grazing season cost/steer for the perennial (CWG and NAT) pastures was determined using a constant cost/pound of body weight of $0.0009 multiplied by the start weigh and end weight to arrive at a daily grazing cost. Then, using one-half the total number of days grazed, the first half and second half grazing charges were summed to arrive at the total grazing charge/steer. For the ANN treatment, the grazing cost was based on the sum of the custom grazing charge for the CWG and

NAT pastures, plus the actual farming input costs for crop establishment and $30/acre cash rent for western North Dakota.

The length of time on feed was determined using ultrasound measurements for rib-eye muscle area (longissimus dorsi), external fat depth and percent of intramuscular fat. At the packing plant and after a 48-hour chill, strip loin steaks were taken from each carcass half between the 12th and 13th ribs and frozen for shear force and sensory panel evaluation at the NDSU Meats Laboratory.

The animal data was analyzed using MIXED procedures of SAS, and the GLM procedure of SAS was used for analysis of tenderness and sensory panel data. Pen (pasture) served as the experimental unit.

Results and Discussion

The results of this yearling steer alternative production systems evaluation have been summarized in Table 1.

Steer growth rate for the PST and ANN steers was 1.71 and 2.21 pounds/day, respectively, for the average 182-day grazing season, resulting in a total grazing season gain of 309 and 405 pounds per steer for the PST and ANN extended grazing system treatments, respectively. The total grazing cost for the ANN treatment was higher; however, the grazing cost per pound of gain for the PST and ANN systems was similar ($0.5571 vs. $0.5924 for PST and ANN, respectively).

Grazing annual forages (PBLY > CN) after native range improved economically important muscle and fat measurements prior to feedlot entry. When measured with ultrasound at the end of the grazing season, rib-eye area, fat depth and the percent of intramuscular fat were significantly greater for the ANN than the PST systems, which may have contributed to a numerically greater number of ANN steers having carcasses grading Choice or better after the finishing period.

Feedlot performance for either of the extended grazing systems (PST and ANN) was superior to the FLT control steers. The FLT control steers averaged 3.81 pounds per day and reached slaughter weight earlier than steers in the PST and ANN forage grazing systems; however, once the grazing system steers entered the feedlot, their average daily gains (ADGs) were significantly greater than those in the FLT control.

FLT control steers were 18.1 months of age at slaughter, compared with 21.4 and 22.1 months of age for the ANN and PST systems, respectively. Although grazing increased the number of days from birth to slaughter, grazing (PST and ANN) dramatically reduced the number of DOF in the feedlot. Compared with the FLT control that averaged 142 DOF, the ANN steers reached final slaughter weight after a short 66 DOF and the PST steers required 91 DOF. This difference in the number of DOF to reach final slaughter weight is a direct result of combining perennial and annual forages in a sequence in which the ANN steers grazed higher-quality forage throughout the extended grazing season.

Thus, compared with the ANN treatment, declining late summer and fall native range forage quality resulted in lesser rib-eye area, fat depth and percent of intramuscular fat among the PST system steers. Declining late-season forage quality resulted in the PST steers to be on feed for an additional 25 days to reach the final harvest end point.

Despite reaching the slaughter end point sooner, feedlot performance for the conventional FLT control system was inferior in most of the economically important criteria measured. In total and compared with the FLT control, extended grazing systems that delay feedlot entry resulted in better feedlot ADG, feed efficiency, feed cost per steer and feed cost per pound of gain.

For carcass traits, average hot carcass weight for the FLT control system was 78 pounds lighter than the average of the two pasture systems, which is likely due to the fact that steers in the grazing systems' treatments were an average 3.7 months older. Although a numerically smaller number of carcasses graded Choice or better, no statistical difference was found among the systems' treatments for quality grade. Steer carcasses from the PST and ANN forage systems tended to have larger rib-eye area, as well as more fat depth. The FLT control steers had less fat depth, resulting in lower USDA yield grade values, compared with the PST and ANN system carcasses; however, marbling score and quality grade did not differ between FLT, PST, and ANN treatments.

Meat tenderness and sensory panel evaluations of strip loin steaks did not differ among treatments for Warner-Bratzler shear force and cooking meat yield. Sensory panel evaluation of the steaks showed no difference for perceived tenderness, juiciness and flavor.

When the system's two-year average income, expense and net return were summarized, the ANN extended grazing system was the only system with a positive net return of $9.09, whereas, the PST system lost $30.10 per steer, which is attributed to slower growth due to declining forage quality. The conventional feedlot control system lost $298.05.

The results of this study indicate that extended grazing systems can reduce the cost of production among steers held for retained ownership. The ANN extended grazing system that included grazing annual forages during the late summer and early fall seasons prior to feedlot entry was a profitable system without using risk management tools, which was an underlying objective in the study.

The decision for cattlemen with access to pasture and cropland will be determined by several factors such as the implications of crop insurance, adequate fencing and reliable water sources. Water can be hauled to locations where permanent water is not developed, but the logistics may be prohibitive. A decision for whether to graze cropland also will depend on crop insurance rules and estimated value of competing crops.

Literature Cited

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Table 1. Effect of extended grazing system on yearling steer pasture performance.

	PST	ANN	FLT	SE	*P*-Value
No. Steers	48	47	46		
Grazing Performance:					
Days grazed	181	183			
Start wt., lb.	814	826		5.59	0.058
End wt., lb.	1122[a]	1231[b]		8.39	<0.0001
Gain, lb.	309[a]	405[b]		5.54	<0.0001
ADG, lb.	1.71[a]	2.21[b]		0.03	<0.0001
Cost/head, $	157.19[a]	238.36[b]		0.81	<0.0001
Cost/lb. gain, $	0.5571	0.5924		0.015	0.14
Ultrasound Measurements:					
End rib-eye area, sq. in.	8.66[a]	10.86[b]		0.11	<0.0001
End fat depth, in.	0.23[a]	0.33[b]		0.007	<0.0001
Pct. intramuscular fat, %	3.22[a]	4.13[b]		0.11	0.0003
Feedlot Performance:					
Feedlot days on feed	91	66	142		
Slaughter age (birth to harvest), mths	22.1[a]	21.4[b]	18.1[c]	0.043	<0.0001
Feedlot start wt., lb.	1073[a]	1189[b]	808[c]	15.1	<0.0001
Feedlot end wt., lb.	1488[a]	1479[a]	1350[b]	18.1	0.0002
Feedlot gain, lb.	416[a]	290[b]	538[c]	12.1	<0.0001
Feedlot ADG, lb.	4.59[a]	4.41[a]	3.81[b]	0.15	0.006
Feed:gain, lb.	6.23[a]	6.15[a]	6.91[b]	0.24	0.018
Feed cost/head, $	381.18[a]	276.12[b]	578.30[c]	7.62	<0.0001
Feed cost/lb. gain, $	0.9283[a]	0.9550[a]	1.08[b]	0.035	0.005
Carcass:					
Hot carcass weight	855[a]	851[a]	775[b]	9.30	<0.0001
Marbling score	516.0	530.0	501.0		0.58
Yield grade	2.93[a]	2.82[a]	2.41[b]		0.042
Percent choice or greater, %	82.1	86.5	65.6		0.312
Meat Evaluation:					
Shear force, lbs.	7.78	6.93	7.30	0.27	0.109
Cooking yield, %	81.0	84.2	82.5	1.04	0.062
Tenderness	5.10	5.02	5.54	0.11	0.399
Juiciness	5.63	5.53	5.78	0.10	0.26
Flavor	5.78	5.87	5.91	0.09	0.245
Systems Economics:					
Gross income, $	1,718.41	1,738.93	1,497.41		
Expenses, $	1,748.51	1,729.84	1,795.46		
Net return, $	**-30.10**	**9.09**	**-298.05**		

[a-c]Means within a row with different superscripts differ (P < 0.05).