Effects of Forage Level in Finishing Diets on Beef Feedlot Performance and Carcass Characteristics

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Introduction

Increased costs of grain and consumer trends desiring cattle finished on all or higher forage diets has peaked producer interest in alternative finishing rations and methods to reduce production costs. The objective of this study was to evaluate three different finishing diets that contained 20, 30, or 40 percent forage to assess effects on growth performance and meat-quality traits.

Procedures

One hundred-twenty steers were randomly allotted by weight to one of twelve pens (n = 10 head/pen). Dietary treatments were forage levels in finishing rations (Table 1). All steers were fed a 40 percent forage diet for the first 28-day period and then assigned to one of three treatments: 1) 40% forage (40FOR), 2) 30% forage (30FOR) or 3) 30% forage for 28 days and then 20% (20FOR) forage for the remainder of the finishing period. Steers were weighed approximately every 28 days. Performance data collected included average daily gain, dry matter intake, and gain efficiency (gain:feed). Steers were harvested at Tyson Fresh Meats in Dakota City, Nebraska. Carcass attributes were measured after a 24-hour chill. Beef strip loins were obtained from the carcasses, vacuum packaged and transported to North Dakota State University Meats Laboratory and aged for 10 days at 39° F. At 10 days, three steaks (~1 in) were cut from the strip loins. Steaks were vacuum-packaged individually and then either frozen until further evaluation of tenderness or prepared immediately for retail display.

Table 1. Finishing rations for steers fed different levels of forages

	Diet Treatments		
Feeds	40FOR	30FOR	20FOR
	Percent, Dry matter basis		
CRP- Prairie hay	8	8	8
Corn silage	32	22	12
Corn #2	18.5	23.5	28.5
Barley	18.5	23.5	28.5
Modified distillers grains	20	20	20
Calcium carbonate	1	1	1
Supplement (Rumensin™, vitamin and minerals)	2	2	2
Total, Percent	100	100	100
Nutrients			
Dry Matter, %	53.67	59.09	65.72
Net Energy Gain, Mcal/lb	56.90	59.00	61.10
Crude Protein, %	13.15	13.44	13.72
Calcium, %	0.71	0.69	0.67
Phosphorous, %	0.31	0.32	0.34
Potassium, %	0.72	0.67	0.61

Retail display shelf-life steaks were placed on metal trays, covered with polyvinyl chloride film, and placed under continuous fluorescent lighting at 39° F. Steaks were evaluated for objective color scores with a Minolta chromameter (model CR-410, Konica Minolta, Osaka, Japan) every 24 hours and rotated randomly. Lean L* (muscle lightness), a* (muscle redness), and b* (muscle yellowness) color scores were recorded for 10 days. Strip loin steaks used for tenderness evaluation were thawed for 24 hours

at 39° F. Warner-Bratzler shear force analysis was conducted according to American Meat Science Association guidelines (AMSA, 1995). Steaks were weighed and cooked on clamshell-style grills to an internal temperature of 160˚F. Steaks were cooled to room temperature and weighed to determine cooking loss. Six 0.5 inch cores from each steak were removed parallel to the muscle fibers and were sheared using a Warner-Bratzler shear force machine. The mean of the six cores per steak was used for analysis. The protocol for this study was approved by the North Dakota State University Institutional Animal Care and Use Committee.

Results

Feedlot Performance and Carcass Traits

Measures of growth performance (Table 2) were not significantly different between treatments (P > 0.05). The cost per pound of gain was very similar across all treatments. This indicated the cost between the diets would have very little impact on overall profit. Hot carcass weights, ribeye area, 12th rib fat thickness, kidney-pelvic-heart fat, marbling score, and USDA yield grade were all similar between treatments (P > 0.05). Warner-Bratzler shear force and cook loss were also not significantly different among treatments (Table 3).

Table 2. Performance of yearling steers fed different levels of forages as part of finishing rations.

	Treatments				
Item	40FOR	30FOR	20FOR	StErr	P-Value
Number of pens	4	4	4		
Number of animals	40	40	40		
Days on Feed	122	122	122		
Body Weight, lbs					
Initial wt., Oct 8	861.2	865.6	862.4	20.6	0.98
Final wt., Feb 22	1383.4	1399.1	1393.1	27.9	0.92
Avg. Daily Gain, lbs	4.08	4.25	4.26	0.10	0.39
Dry Matter Intake, lbs/hd/d	27.5	27.7	28.1	0.57	0.71
Gain:Feed, (DM)	0.14	0.14	0.13	0.003	0.14
Cost/lb gain	$0.70	$0.69	$0.71		

Table 3. Carcass traits of steers fed different levels of forages as part of finishing rations.

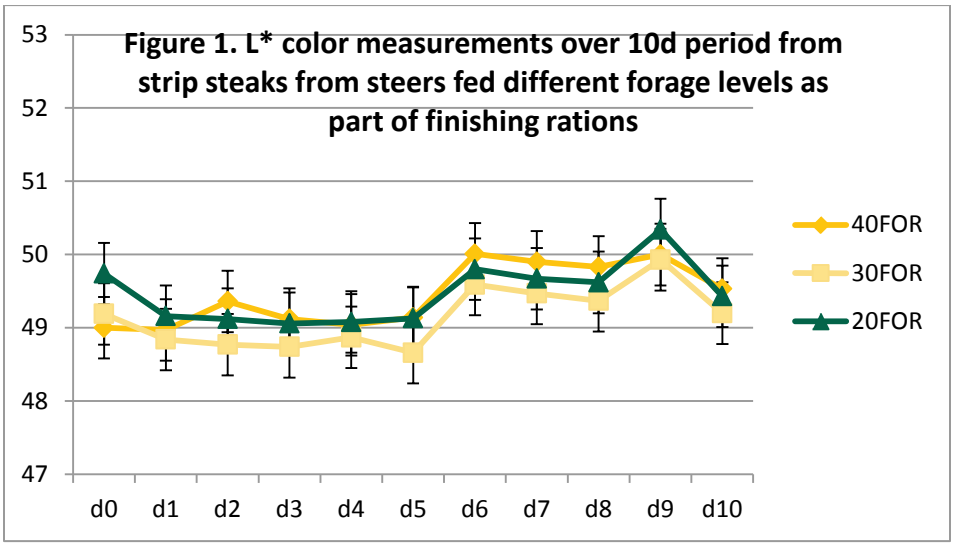
	Treatments				
	40FOR	30FOR	20FOR	St Err	*P*-Value
Hot carcass wt., lbs	817.41	831.75	825.20	37.8	0.87
Ribeye area, sq in	13.44	13.69	13.71	0.67	0.82
Back fat thickness, in	0.45	0.45	0.43	0.05	0.90
KPH, %	2.42	2.44	2.52	0.20	0.74
Marbling score[a]	350	340	354	19.5	0.61
Yield grade[b]	2.91	2.89	2.84	0.18	0.86
Warner Bratzler Shear Force, lbs	6.50	5.82	6.48	0.29	0.26
Cook loss, %	19.47	18.30	17.94	3.43	0.89

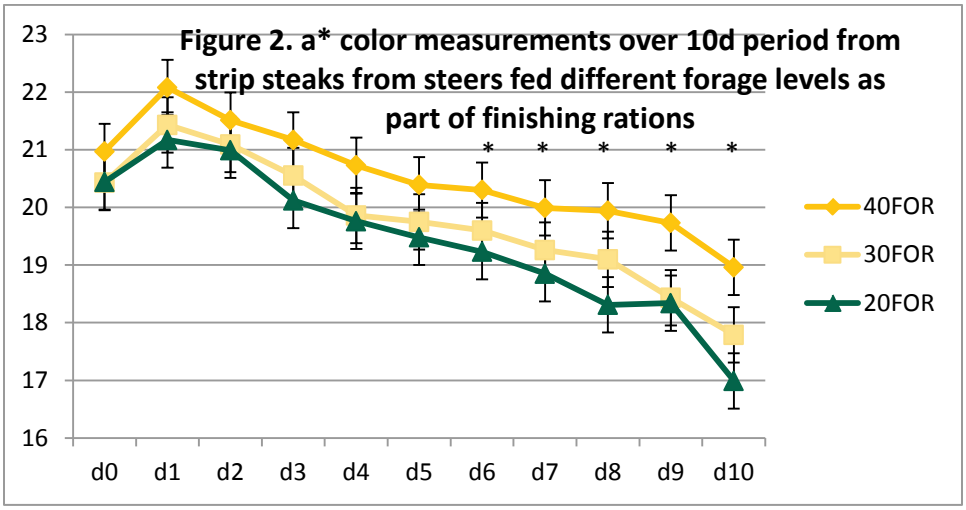
[a] Based on scores 300-300 = small and USDA Choice Quality Grade

[b] Yield Grade is a composite calculation of fat to lean yield in a carcass based on a relationship of hot carcass wt., ribeye area, fat thickness, and KPH, low values = lean carcasses

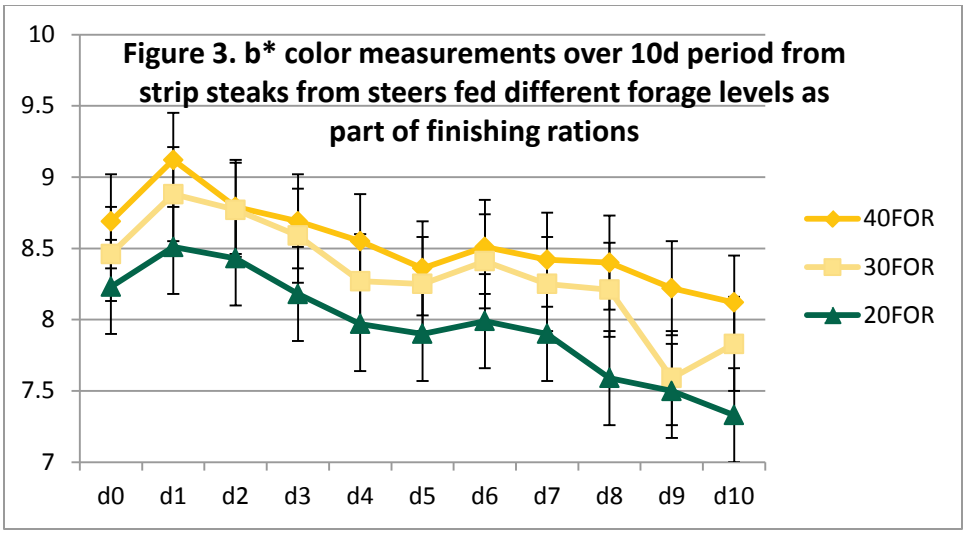
Shelf Life Display

During shelf life display, steak lightness (L*) scores were similar among treatments for the 10-day study (Figure 1). Steak redness (a*) scores were significantly higher for the 40 percent forage diet after day 6 (Figure 2). This indicates the higher forage diet resulted in meat that stayed redder longer. Steak yellowness (b*) had a tendency to be higher for the 40 percent forage diet when compared to the other treatments (Figure 3).





* Means between 40FOR and 30FOR or 20FOR are different (P< 0. 05)



These results could be due to forages being rich in antioxidants, which can contribute to the delay of oxymyoglobin and lipid oxidation in meat resulting in extended color stability for beef (Liu et. al., 1995). This study indicates that finishing diets with greater amounts of forage does not influence body weights, carcass composition, meat quality, or tenderness and did not decrease cost of gains. However, meat color attributes were improved.