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RANGE VS FEEDLOT FINISHING. II. PERFORMANCE AND CARCASS QUALITY COMPARISON OF FEEDLOT AND LIMITED GRAIN FINISHING OF FALL-BORN STEERS

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Summary

Feedlot trials with five steers per treatment were conducted in conjunction with range finishing trials to compare annual ryegrass straw (ARS), perennial ryegrass straw (PRS), wheat straw (WS) and grass hay (GH) in trial 1 and ARS, WS and GH in trial 2 as roughage sources for finishing rations. No differences ($P<.10$) were found for days on feed, slaughter weight, ADG or carcass grades between treatments for trial 1. Steers on the WS treatment tended to have lower daily feed intakes and improved feed efficiency. Steers on the WS treatment also tended to have lower daily intakes in trial 2 which resulted in lower ($P<.01$) ADG compared to the other treatments.

Results of range finishing treatments reported in a companion paper were compared to the feedlot results. Feedlot finishing increased ($P<.01$) ADG by .63 and .61 kg and produced slaughter animals 6 and 5 months younger than range finishing for trials 1 and 2, respectively. However, range finishing required only 21 to 37% as much grain as feedlot finishing. Carcass characteristics were similar for range and feedlot finishing in trial 2. Feedlot finishing resulted in higher ($P<.01$) taste panel ratings for aroma, tenderness, juiciness, flavor and overall desirability than range finished beef with or without electrical stimulation.

Introduction

An abundance of low-quality roughages exist throughout the world that in many instances creates disposal and environmental problems. These are an estimated 75 million tons of cereal crop residue produced annually in the United States and the grass seed industry of Oregon has an estimated annual production of 500 thousand tons of ryegrass straw. Traditionally, these waste products have been ploughed

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back into the soil (cereal straws) or disposed of by open-field burning. Alternative methods of disposal have been researched for several years including their potential for use in ruminant rations.

By-product straws are characterized by high lignin and crude fiber and low digestible energy and protein. The low digestibility results in a slower passage rate and reduced voluntary intakes when fed as a high percentage of ruminant diets. Several processing methods have been used to increase the digestibility and speed passage, however, economics have generally been a limiting factor.

The use of straws in growing and finishing rations has been limited, as increasing amounts result in decreased average daily gains and feed efficiency and longer feeding periods (Anderson, 1978). However, uncertainty in future availability and cost of concentrate sources for livestock production has renewed interest in producing slaughter beef with a maximum of forage and a minimum of grain.

The objectives of the current studies were to evaluate low-quality roughage sources that are available in Oregon, as the major roughage source for growing and finishing feedlot rations. These results were then compared to the results of range finishing trials reported in a companion paper to determine differences in live animal performance and acceptability of beef from the two production systems.

Experimental Procedure

Feedlot trials were conducted in conjunction with range finishing trials reported in a companion paper (Daugherty *et al.*, 1980). Twenty steer calves in trial 1 and 15 steer calves in trial 2 of Hereford-Angus breeding and approximately 230 kg in weight were placed in a feedlot following weaning in late summer. Steers were fed good quality grass hay for a 25 and 68 day postweaning adjustment and growth period for trials 1 and 2, respectively. Steers were then allotted by weight to treatments to compare perennial ryegrass straw (IRN 1-04-076), annual ryegrass straw (IRN 1-04-059), wheat straw (IRN 1-05-175) and grass hay (IRN 1-02-250) in trial 1 and annual ryegrass straw, wheat straw, and grass hay in trial 2 as roughage sources for finishing rations. Rations were formulated to 15 to 11 percent crude protein and 70 and 80 percent TDN for the starter and finishing rations, respectively. Nutrient analyses for the feedlot rations are shown in table 1. Steers were fed *ad libitum* and had access to trace mineralized salt and water at all times.

Steers were given an initial implant of 36 mg zeranol and fed the 35% roughage ration to a mean weight of 360 kg. Steers were then given a second implant of 36 mg zeranol and switched to the 17.5% roughage ration. Steers were weighed at 14-day intervals and slaughtered upon reaching a minimum of 7.6 mm backfat as determined by measurement with an ultrasound instrument.

The results of the feedlot trials were compared to the range finishing results to determine differences in live animal performance, carcass characteristics and acceptability of beef. The range finishing treatments, taste panel sampling and procedure and electrical stimulation procedure are described in Daugherty *et al.* (1980). The range and feedlot treatment groups were comibined within trials to increase the number of observations and strengthen the comparisons. Data were subjected to one-way analysis of variance and differences between treatments means tested by Least Significance Differences as described by Steel and Torrie (1960).

Results and Discussions

The results of the feedlot trials are shown in table 2. No differences ($P>.10$) in average daily gains (ADG), final weight or days of feed were found between treatments in trial 1. The wheat straw treatment group had a reduced intake compared to the other treatments but they were also more efficient resulting in similar ADG. This trend was reversed for the perennial ryegrass straw treatment group with a higher intake and reduced efficiency.

A reduced intake for the wheat straw treatment group was also found in trial 2. However, the feed efficiency was not different which resluted in a lower ($P<.01$) ADG and a trend towards lighter ($P>.10$) final weights.

No significant differences in carcass characteristics were found between feedlot treatments for trial 1 excepting a trend for lower marbling scores and quality grades for the grass hay treatment group. This trend was not repeated in trial 2 where quality grades were similar. The wheat straw treatment group in trial 2 reached the pre-determined backfat thickness for slaughter at lighter weight resulting in lighter ($P<.05$) chilled carcass weights than the grass hay treatment group. No other differences in carcass characteristics were found between treatment groups in trial 2.

Because of the limited number of animals in the feedlot trials and the large variations within treatments, it is difficult to draw conclusions regarding the individual roughage sources. However, all straws tested resulted in satisfactory animal performance, indicating that these low-quality straws can be used as the major roughage source in feedlot finishing rations without adversely affecting ADG or carcass characteristics.

A comparison between range and feedlot finishing treatments for trials 1 and 2 is shown in table 4. Feedlot finishing increased ($P<.01$) ADG by .63 and .61 kg and produced slaughter animals 6 and 5 months sooner than range finishing. However, range finishing required only 21 to 37% as much grain as feedlot finishing although range cattle carried less finish. Average daily gains from weaning to slaughter were .81 and .48 kg higher for the feedlot finishing regime and ownership of the steers was reduced by 185 and 155 days for trial 1 and 2, respectively.

Slaughter weights were similar between trials for the feedlot finished steers. However, the range finished steers were wintered at higher rates of gain in trial 2 resulting in 79 kg heavier slaughter weights.

The increased slaughter weights for range finished steers in trial 2 resulted in improved carcass characteristics when compared to feedlot finished steers (table 5). The range finished steers in trial 2 had heavier ($P<.01$) chilled carcass weights than feedlot finished steers and were equal for all other carcass characteristics with the exception of less ($P<.01$) backfat. The lighter range finished steers in trial 1 had less finish than feedlot finished steers resulting in lower ($P<.01$) dressing percents, less ($P<.01$) backfat, lower ($P<.10$) marbling scores and decreased ($P<.10$) quality grades. The carcasses of range finished steers in trial 1 had significantly yellower fat than feedlot finished steers. The reason for differences in fat color between the feedlot trials is not known. However, for the range finishing trials it may be due to the higher degree of finish on the steers in trial 2 before they were turned onto spring range. The difference in range forage between trials may also be involved.

Taste panel comparisons between range and feedlot finished beef are shown in table 6. A statistical comparison was made only during trial 2 because taste panel evaluations were not available for feedlot finished steers in trial 1. However, the taste panel evaluations for range finished steers in trial 1 are included in table 6 to show the variations between trials. The range finished steers in trial 2 had a higher degree of finish than in trial 1 and would have been expected to receive higher taste panel ratings. However, the results were not as expected. This high ratings for the range finished beef in trial 1 may be the result of a lack of comparison to feedlot finished beef. The range finished beef from trial 1 that had been subjected to electrical stimulation was very comparable to feedlot finished beef in trial 2 for aroma, tenderness, flavor and overall desirability. The range finished beef in trial 2 had lower ($P<.01$) taste panel ratings for all categories regardless of control or electrical stimulation treatments. Tenderness, juiciness and overall desirability ratings for the range finished beef were below the favorable zone of 5 on the hedonic scale.

The range finishing treatments produced average carcass grades of good minus which agrees with the work of Raleigh *et al.* (1967). However, Turner and Raleigh (1977) concluded that carcasses from range finished beef were lighter, graded lower and had lower dressing percents than feedlot finished beef.

The taste panel work in these trials are inconclusive. However, Schupp *et al.* (1979) reported that although taste panels detected differences between forage, forage plus limited grain and feedlot finished beef, differences were small and all beef was rated in the favorable zone of the hedonic scale. They also conclude that it was important to feed forage and limited grain finished beef to slaughter weights of 454 to 476 kg which would produce beef scoring in the favorable zone of the hedonic scale.

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TABLE 1. NUTRIENT ANALYSIS OF FEEDLOT RATIONS FOR TRIALS 1 AND 2 (% DRY)

Item	Starter	Finishing
Dry matter, %	90.28	89.93
Crude protein, %	14.85	10.50
Estimated TDN, %	70.00	80.00
Ether extract, %	1.30	2.60
Acid detergent, %	21.60	13.70
Ash, %	5.50	4.30

TABLE 2. THE EFFECTS OF VARIOUS ROUGHAGE SOURCES IN FINISHING RATIONS ON LIVE ANIMAL PERFORMANCE

	Treatments[c]				
Item	PRS	ARS	WS	GH	(SEM)
Trial 1					
Days on feed	142	139	141	139	(4.8)
Init. wt, kg	251	268	253	254	
Final wt, kg	441	466	451	449	(11.2)
ADG, kg	1.34	1.44	1.42	1.41	(.07)
Intake, kg/day	10.57	9.40	8.42	9.59	
Feed/gain, kg	7.88	6.57	5.96	6.86	
Trial 2					
Days on feed		113	122	126	(6.0)
Init. wt, kg		285	286	279	
Final wt, kg		448	436	463	(9.5)
ADG, kg		1.45[a]	1.23[b]	1.46[a]	(.04)
Intake, kg/day		11.57	9.44	10.60	
Feed/gain, kg		7.97	7.69	7.29	

[a,b]Means in the same row with different superscripts differ significantly ($P<.01$).

[c]Perennial ryegrass straw (PRS), annual ryegrass straw (ARS), wheat straw (WS) and grass hay (GH).

TABLE 3. THE EFFECTS OF VARIOUS ROUGHAGE SOURCES IN FINISHING RATIONS ON CARCASS CHARACTERISTICS

Item	Treatments[f] PRS	ARS	WS	GH	(SEM)
Trial 1					
Maturity	A-	A-	A-	A-	
Chilled wt, kg	253	259	255	261	(6.2)
Dressing, %	57.3	55.7	56.4	58.2	(.72)
Marbling score[c]	4.5	4.3	4.2	4.0	(.24)
Backfat, cm	1.62	1.17	1.37	1.52	(.13)
Fat color[d]	4.0	4.0	4.0	3.8	(.20)
Ribeye area, cm^2	66.4	69.8	66.7	65.7	(2.42)
Grade[e]	11.5	10.6	10.6	9.4	(.60)
Trial 2					
Maturity	A-	A-	A-	A-	
Chilled wt, kg		259^{ab}	248^{a}	274^{b}	(6.6)
Dressing, %		57.7	56.8	59.1	(.76)
Marbling score[c]		4.0	4.0	4.2	(.22)
Backfat, cm		1.09	1.17	1.17	(.10)
Fat color[d]		5.0	5.0	5.0	(.00)
Ribeye area, cm^2		69.0	70.2	68.6	(2.11)
Grade[e]		10.4	10.6	10.6	(.57)

[a,b]Means in the same row with different superscripts differ significantly ($P<.05$).
[c]3=traces, 4=slight, 5=small.
[d]3=slight yellow, 4=slightly yellow tinge, 5=white.
[e]13=average choice, 10=average good, 7=average standard.
[f]Perennial ryegrass straw (PRS), annual ryegrass straw (ARS), wheat straw (WS) and grass hay (GH).

TABLE 4. INTAKE AND PERFORMANCE COMPARISON OF RANGE VS FEEDLT FINISHING

Item	Trial 1 Range	Feedlot	(SEM)	Trial 2 Range	Feedlot	(SEM)
No. of steers	18	18		20	15	
Slaughter age, mo.	21	15		21	16	
Postweaning days	350	165		341	186	
Days on feed	62	140		62	120	
Weaning wt, kg	239.7	236.6	(7.07)	237.3	220.0	(9.04)
Initial wt, kg	365.3^{a}	256.0^{b}	(8.77)	443.5^{a}	283.5^{b}	(7.88)
Final wt, kg	412.8^{a}	451.6^{b}	(7.84)	491.2^{a}	449.0^{b}	(9.28)
ADG finishing, kg	$.77^{a}$	1.40^{b}	(.05)	$.77^{a}$	1.38^{b}	(.04)
ADG postweaning, kg	$.49^{a}$	1.31^{b}	(.02)	$.75^{a}$	1.23^{b}	(.02)
Grain intake, kg[c]	208	979		346	935	

[a,b]Means within trials, in the same row with different superscripts differ significantly ($P<.01$).
[c]Includes total barley consumption from weaning to slaughter.

TABLE 5. CARCASS COMPARISON OF RANGE VS FEEDLOT FINISHING

Item	Trial 1			Trial 2		
	Range	Feedlot	(SEM)	Range	Feedlot	(SEM)
Maturity	A-	A-		A-	A-	
Chilled wt, kg	225.0	256.9[b]	(4.62)	289.3[a]	260.0[b]	(5.26)
Dressing, %	54.5[a]	56.9[b]	(.42)	57.7	57.9	(.48)
Marbling score[g]	3.7[e]	4.2[f]	(.23)	3.9	4.1	(.15)
Backfat, cm	.55[a]	1.43[b]	(.07)	.72[a]	1.14[b]	(.05)
Fat color[h]	3.0[a]	3.9[b]	(.04)	4.9	5.0	(.06)
Ribeye area, cm^2	62.5[c]	67.1[d]	(1.51)	72.3	69.3	(1.40)
Grade[i]	9.4	10.4[f]	(.42)	9.7	10.5	(.38)

[a,b]Means within trials, in the same row with different superscripts differ significantly ($P<.01$).
[c,d]Means within trials, in the same row with different superscripts differ significantly ($P<.05$).
[e,f]Means within trials, in the same row with different superscripts differ significantly ($P<.10$).
[g]3=traces, 4=slight, 5=small.
[h]3=slight yellow, 4=slightly yellow tinge, 5=white.
[i]13=average choice, 10=average good, 7=average standard.

TABLE 6. TASTE PANEL COMPARISON OF RANGE VS FEEDLOT FINISHING

Item	Trial 1		Trial 2			
	Range		Range			
	Control	Electric	Control	Electric	Feedlot	(SEM)
Aroma	6.0	6.0	5.2[b]	5.3[b]	6.2[a]	(.08)
Tenderness	5.6	5.8	4.2[b]	4.6[b]	5.8[a]	(.17)
Juiciness	5.0	5.4	4.7[b]	4.9[b]	5.7[a]	(.10)
Flavor	5.7	5.9	4.9[b]	5.0[b]	6.0[a]	(.11)
Overall	5.4	5.6	4.5[b]	4.7[c]	5.8[a]	(.14)

[a,b,c]Means within trial 2, in the same row with different superscripts differ significantly ($P<.01$).