Effects of Roughage and Protein Levels on Performance of Finishing Steers and Heifers

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Summary

A 142-day trial used 36 Angus steers and 63 mixed-breed heifers to study the effects of roughage and protein levels in beef cattle finishing rations.

Results from a 13% crude protein ration the first 70 days or a ration with supplemental protein removed the final 30 days did not differ significantly from results with an 11% crude protein ration.

Rations containing 10.0, 17.5 or 25.0% roughage (dry matter basis) made no significant difference in performances by steers or heifers.

Introduction

Costs of supplemental protein prompt research on its more efficient use by feedlot cattle. Additional information is needed on protein requirements at various stages of growth. This trial is a part of the research at Kansas State to determine effects of feeding higher levels of protein (13% C.P.) early in the finishing phase and withdrawing supplemental protein late in the feeding period.

Three roughage levels during finishing also were studied to determine if level of roughage affects rate or efficiency of gain and whether protein and roughage level are interrelated.

Experimental Procedure

Thirty-six Angus steers and 63 mixed-breed heifers were used. These compact, early maturing animals were not uniform in size or conformation. Average beginning weights were 621 pounds for steers; 547 pounds for heifers. Steers and heifers were randomly allotted to each of three treatments. Each group contained 12 steers and 21 heifers. Group 1 was fed a control ration of 11% crude protein for 142 days; group 2 an 11% crude protein ration for 112 days with the protein supplement withdrawn the final 30 days. Group 3 was fed a 13% crude protein ration for the first 70 days and 11% crude protein ration for final 72 days. Equal numbers of animals in each group were fed rations containing 10.0, 17.5, or 25.0% roughage on a dry basis. Composition of supplements is shown in table 2.1 and complete rations in table 2.2.

Additional soybean oil meal was used to formulate the 13% crude protein rations. To remove the protein supplement the final 30 days, we replaced soybean oil meal and urea with rolled milo, with no adjustment for mineral differences between soybean oil meal and milo. Each ration ingredient was

sampled periodically and analyzed. Average crude protein was calculated as shown in table 2.2.

Results

Results of the 142-day trial (August 14, 1972-January 3, 1973) are shown in table 2.3 and 2.4. Final gains were lower than expected, but cold, wet weather, the second half of the feeding period and type of cattle may have been factors. Protein (table 2.3) or roughage levels used (table 2.4) did not significantly affect gains, efficiency or carcass grades of either steers or heifers, perhaps because of individual differences among animals and too few animals, especially steers.

Steers and heifers in group 3, fed a 13% crude protein ration 70 days, gained the fastest and most efficiently during the first 70 days: 3.43 lb. per day by steers and 2.97 lb. for heifers (table 2.3). That agrees with previous trials here showing improved performance from 13% crude protein the first half of the feeding program.

Steers with no supplemental protein the final 30 days gained 0.16 lb. per day less than the two groups on 11% rations. The slow gainers had been gaining consistently slower before supplement withdrawal, so the reduced performance likely was not related to protein level. Removing supplemental protein from heifer rations did not significantly affect gain. Extreme variations in efficiency within groups appeared to be unrelated to protein level.

Steers and heifers fed 10% roughage (dry matter basis) gained faster, more efficiently, and graded higher than those fed 17.5% or 25% roughage. However, the differences were small in most instances and not significant. This study was during fall and early winter. Additional trials are needed to determine optimum roughage levels for different seasons of the year.

Table 2.1. Composition of Protein Supplements

Ingredient	Steers %	Heifers %
Soybean oil meal[a]	53.50	45.35
Rolled milo	15.75	23.50
Limestone	15.65	15.65
Salt	10.00	10.00
Urea[a]	3.20	3.20
Trace mineral (Z-5)[b]	1.00	1.00
Aureomycin (10 gms/lb.)	0.75	0.75
Vitamin A (30,000 I.U./gm)	0.15	0.15
MGA	---	0.40

[a]Replaced by rolled milo the last 30 days of treatment 2.

[b]Calcium Carbonate Company.

Table 2.2. Composition of Rations (%, dry matter basis)

Ingredient	Crude Protein, %								
	11.0			13.0[a]			Basal[b]		
	Steers								
Sorghum silage	10.0	17.5	25.0	10.0	17.5	25.0	10.0	17.5	25.0
Rolled milo	84.4	78.4	70.6	81.0	72.8	64.4	86.1	78.9	71.5
Supplement	4.0	3.7	3.6	3.8	3.8	3.8	3.9	3.6	3.5
Soybean oil meal	---	0.4	0.8	5.2	5.9	6.8	---	---	---
Crude protein, %	11.2	11.2	11.2	13.0	13.0	13.0	9.7	9.7	9.7
	Heifers								
Sorghum silage	10.0	17.5	25.0	10.0	17.5	25.0	10.0	17.5	25.0
Rolled milo	86.0	77.9	70.0	80.4	72.2	64.0	85.7	78.4	70.9
Supplement	4.0	4.1	4.2	4.5	4.5	4.1	4.3	4.1	4.1
Soybean oil meal	---	0.5	0.8	5.1	5.8	6.9	---	---	---
Crude protein, %	11.0	11.0	11.0	13.0	13.0	13.0	9.9	9.9	9.9

[a]Ration contained approximately 13% C.P. for first 70 days and 11% C.P. for final 72 days.

[b]Ration contained approximately 11% C.P. for 112 days and no protein supplement for final 30 days.

Table 2.3. Feedlot Performances by Steers and Heifers fed Indicated Levels of Protein

Days	% Crude Protein (dry matter basis)					
0-70	11.2	11.0	11.2	11.0	13.0	13.0
71-112	11.2	11.0	11.2	11.0	11.2	11.0
113-142	11.2	11.0	9.7	9.9	11.2	11.0
Item	Steers	Heifers	Steers	Heifers	Steers	Heifers
Group No.	1	1	2	2	3	3
Number of animals	10[a]	19[b]	11[c]	20[d]	12	20[e]
Initial wt., lb.	609.	547.	621.	547.	633.	548.
Final wt., lb.	981.	858.	958.	871.	992.	883.
Avg. total gain, lb.	372.	311.	337.	324.	359.	335.
Avg. daily gain, lb.						
0-70 days	3.18	2.86	3.10	2.77	3.43	2.97
0-112 days	2.68	2.30	2.52	2.41	2.79	2.45
0-142 days	1.98	1.78	1.82	1.82	1.98	2.05
Feed D.M./lb. gain, lb.						
0-70 days	6.80	6.81	6.90	6.90	6.22	6.46
0-112 days	8.18	8.47	8.62	8.24	7.69	7.94
0-142 days	9.88	11.60	10.67	13.74	10.39	9.20
Dressing percentage[f]	59.99	59.63	58.56	59.74	60.38	60.63
USDA grade[g]	10.44	9.97	10.22	9.52	9.50	9.21

[a]One steer removed because of urinary calculi; another because of sickness.
[b]Two heifers removed.
[c]One steer died.
[d]One pregnant heifer removed.
[e]One heifer removed.
[f]Calculated from hot carcass wt.
[g]High good = 9; low choice = 10.

Table 2.4. Feedlot Performance of Steers and Heifers fed Rations Containing Indicated Roughage Levels (142 days)

	Roughage (%, dry matter basis)					
	10.0		17.5		25.0	
Item	Steers	Heifers	Steers	Heifers	Steers	Heifers
Number of animals	11[a]	19[c]	12	19[d]	10[b]	21
Initial wt., lb.	621.	547.	621.	546.	621.	547.
Final wt., lb.	991.	876.	960.	870.	979.	866.
Avg. total gain, lb.	370.	329.	339.	324.	358.	319.
Avg. daily gain, lb.	2.61	2.32	2.39	2.28	2.52	2.25
Feed D.M./lb. gain, lb.	8.15	8.30	8.98	8.54	8.35	8.56
Dressing percentage[e]	60.10	60.28	59.96	60.15	58.91	59.57
USDA grade[f]	10.5	9.7	9.5	9.7	10.2	9.3

[a]One steer removed because of urinary calculi.

[b]One steer died and one removed because of sickness.

[c]Two heifers removed.

[d]One pregnant heifer taken off test; another removed.

[e]Calculated from hot carcass weight.

[f]High good = 9, low choice = 10.