Protein Levels and Decline for Finishing Steers Fed High Moisture Corn

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Story in Brief

One hundred eighty-six steers were grouped and fed four protein levels (9, 11, 13 and declining over time) and two Rumensin levels (0 and 30 g/ton) with high moisture corn for 166 and 194 days. Rumensin improved efficiency of feed use by 3.2 percent, mainly during the first 56 days. Rates of gain and feed efficiency favored the 13 percent ration, especially early in the trial, but economics would favor either a continuous 11 percent protein ration or a system of 13 percent protein for steers to 700 lb, 11 percent to 850 lb and 9 percent protein thereafter.

Introduction

Previous work has suggested that protein level in dry corn rations may be reduced when Rumensin is added (Gill *et al.*, 1977). Decreasing the level of supplemental protein in dry corn rations as steers mature may reduce cost of gain if performance is only slightly reduced. A given amount of protein should be more useful if fed early than late in the finishing period, and declining levels should match protein needs more economically than a constant level. But protein levels, sources and decline with high moisture corn rations have received little attention. This experiment conducted at Panhandle State University, Goodwell, Okla., was designed to examine the effects of protein level or withdrawl and Rumensin presence on performance and carcass characteristics of steers fed a high moisture corn-corn silage ration.

Materials and Methods

One hundred ninety-two steers were divided by weight group (mean shrunk weights of 420, 481 and 539 lb) and allotted to 24 pens. The ration and experimental methods were identical with the trial reported by Gill *et al.*, elsewhere in this publication. These two experiments had six treatments in common. Steers withdrawn from protein were fed the 13 percent protein ration the first 56 days (to a mean weight of 673 lb), the 11 percent protein ration for the next 56 days (to a mean weight of 864 lb) and the 9 percent protein ration containing no added soybean meal to slaughter.

Results and Discussion

Weight grouping had a considerable impact on feed intake throughout the trial, on feed efficiency early in the trial, on carcass weight, on daily gain (heavier initial weights gaining more rapidly), on marbling score and grade and on carcass age. Part of this difference is attributable to slaughter of the two heavier weight groups at 166 days and the lighter group at 194 days on feed. This effect of weight group was removed statistically. As no measurements showed evidence of an interaction of protein level and Rumensin, these two factors will be presented separately.

Rumensin effects

Rumensin effects on performance and carcasses are shown in Tables 1 and 2. Overall feed intake was reduced by 4 percent with Rumensin feeding while gains were decreased by 0.9 percent. This improved feed efficiency by 3.2 percent, most of which was achieved the first 56 days of the experiment.

The first 28 days, Rumensin fed cattle had 10 percent more rapid weight gain, but this weight difference declined over time so that no liveweight difference was apparent at slaughter. Indeed, final weight adjusted to a

Table 1. Rumensin and steer performance

Item	Rumensin Level 0	30
Steers, number	92	94
Initial weight, lb	483	484
Weight, lb/day		
0-56 days	3.09	3.13
56+	3.28	3.22
Total	3.22	3.19
Feed intake, lb/day		
0-56 days	14.2	13.7
56+	19.2[a]	18.4[b]
Total	17.6[a]	16.9[b]
Feed per gain		
0-56 days	4.67[a]	4.45[b]
56+	5.87	5.72
Total	5.48[a]	5.31[b]
Carcass daily gain		
Protein, lb	.244	.239
Fat, lb	1.05	1.05
Energy, mcal	5.11	5.10
Pounds	2.20	2.18
Caloric efficiency		
kcal stored/lb feed	289	302

[a,b]Means in a row which have different superscripts differ statistically.

Table 2. Rumensin and carcass characteristics of finishing steers

Item	Rumensin level 0	30
Carcass weight, lb	649	646
Liver abscesses, %	13	16
KHP fat, %	3.1	3.0
Fat thickness, in	0.65	0.64
Marbling score[a]	14.0	13.8
Ribeye area		
square inches	12.3	12.3
in. ^{2}/cwt carcass	1.90	1.91
Quality grade[b]	13.7	13.5
Color[d]	5.8	5.7
Age[e]	1.9	1.8
Cooler shrink, %	1.18	1.05
Carcass composition,		
Protein, %	14.6	14.6
Fat, %	33.2	33.3
kcal/g	3.92	3.93

[a]Small minus = 13, small = 14, small plus = 15.
[b]Good plus = 13, choice minus = 14.
[c]Cherry red = 6, slightly dark red = 5.

constant dressing percentage gave the control cattle a slight advantage. Since interval weights were taken on a full basis, and steers were not shrunk, greater gut fill with Rumensin feeding may be responsible for these trends over time. Carcass characteristics (Table 2) were unchanged by Rumensin feeding.

Protein level and decline

Protein level and decline effects are presented in Table 3. The 9 percent protein level was obviously deficient for the steers. During the first 84 days on feed, this group continued to fall behind the other groups and thereafter the difference stabilized. The steers fed 11 percent protein lagged behind the 13 percent protein group for the first 56 days but tended to compensate during the rest of the trial. Steers fed declining protein levels paralleled the gain of the 13 percent group during the trial but fell just slightly behind the last 56 days when fed 9 percent protein.

Feed efficiencies were good on all treatments. Steers fed 13 percent protein had the most favorable feed efficiency, about 10 percent superior to steers fed the 9 percent protein ration. Feed efficiency differences paralleled weight gains, with differences being noted primarily during the first 56 days on

Table 3. Performance of finishing steers across protein levels

Item	Protein Concentration, percentage			
	9	11	13	13-11-9
Steers, number	47	48	45	46
In weight, lb	483	483	484	483
Weight gain, lb/day				
0-56 days	2.48[a]	3.11[b]	3.44[b]	3.40[b]
56+	3.25	3.34	3.25	3.15
Total	3.01[a]	3.27[b]	3.31[b]	3.24[b]
Feed intake, lb/day				
0-56 days	13.7	14.1	13.9	14.1
56+	19.0	19.0	18.5	18.7
Total	17.3	17.4	17.1	17.2
Feed per gain				
0-56 days	5.54[c]	4.54[b]	4.05[a]	4.14[a]
56+	5.85	5.69	5.71	5.92
Total	5.76[c]	5.34[b]	5.15[c]	5.31[bc]
Feed/gain improvement with rumensin, %	0.7	5.4	4.2	2.4
Carcass daily gain				
Protein, lb	0.240	0.233	0.246	0.247
Fat, lb	0.99	1.14	1.07	1.01
Energy, mcal	4.84	5.46	5.17	4.96
Pounds	2.07[a]	2.23[b]	2.25[b]	2.21[b]
Caloric efficiency kcal stored/ lb feed	279[a]	312[b]	303[ab]	288[a]

[a,b,c]Means in a row which have different superscripts differ statistically.

trial with mean weights under 680 lb. This suggests that with high moisture corn based rations, protein levels above 11 percent are needed to maximize gain and efficiency for steers of English breeding under 700 lb. A decline to 11 percent protein at 700 lb appears feasible and a drop to 9 percent at 850 lb may not have a deleterious effect on gain and feed efficiency. Since the cattle fed 11 percent protein made greater compensatory gain from 56 days to slaughter than those fed 9 percent protein, this suggests that previous protein status also may influence need for protein during the later phases of finishing. Moderate protein levels should permit compensatory performance whereas marginal levels may not.

Carcass characteristics of steers fed various protein levels are shown in Table 4. Carcass weight and fat thickness over the rib were lower for steers fed the 9 percent protein ration. Fat thickness and kidney-heart and pelvic fat also appeared slightly reduced with the declining protein treatment. This would suggest that lower levels of protein during later stages of finishing may decrease fat cover and possibly marbling as well.

Economic analysis of the value of soybean meal supplementation to increase protein content of the ration is shown in Table 5. The value of added soybean meal increases with overhead cost, and corn price. The value of adding soybean meal should generally justify its addition to a level of 11 percent protein or to the declining protein levels. But adding soybean meal to

Table 4. Carcass characteristics of finishing steers across protein levels

Item	Protein Concentration			
	9	11	13	13-11-9
Carcass weight, lb	626[a]	654[b]	659[b]	652[b]
Liver abcess, %	12	4	23	19
KHP fat, %	3.0	3.1	3.1	2.9
Fat thickness, inc.	.58[a]	.69[b]	.68[b]	.62[ab]
Marbling score[c]	13.7	14.6	14.0	13.3
Ribeye area				
square in	12.0	12.3	12.6	12.2
square in/100 lb carcass	1.92	1.89	1.92	1.88
Quality grade[d]	13.5[a]	13.9[b]	13.6[a]	13.4[b]
Color[e]	5.7	5.8	6.0	5.5
Age[f]	1.8	1.8	1.9	1.9
Cooler shrink, %	1.15	1.11	1.04	1.18
Carcass composition				
Protein, %	14.9	14.2	14.6	14.8
Fat, %	32.3	35.0	33.4	32.4
kcal/g	3.84	4.07	3.94	3.85

[a,b]Means in a row which have different superscripts differ statistically.
[c]Small minus = 13, small = 14, small plus = 15.
[d]Good plus = 13, choice minus = 14.
[e]Cherry red = 6, slightly dark red = 5.
[f]A minus = 1, A = 2.

Table 5. Economic analysis of protein levels for finishing steers

Item	Protein level, percentage of dry matter			
	9	11	13	13-11-9
Daily gain	3.01	3.27	3.31	3.24
Days/cwt gain	33.27	30.60	30.21	30.87
Overhead/cwt gain				
@ 30¢/day	9.98	9.18	9.06	9.26
Feed/cwt gain				
Total lb	576.4	534.3	515.4	531.2
Non-soybean meal	576.4	514.9	470.6	512.6
Soybean meal lb	0	19.4	44.8	18.6
Basal ration costs/cwt gain				
5¢/lb	28.82	25.74	23.53	25.63
6¢/lb	34.58	30.89	28.24	30.76
Total cost/cwt gain excluding soybean meal				
Overhead *Feed*				
0 5¢/lb	28.82	25.74	23.53	25.63
0 6¢/lb	34.58	30.89	28.24	30.76
30¢/day 5¢/lb	38.80	34.92	32.59	34.89
30¢/day 6¢/lb	44.56	40.07	37.30	40.02
Value of added soybean meal $ per ton @ 90% dry matter	Protein level changes			
Overhead *Feed*	9→ 11%	11→ 13%	9→ Variable protein	
0 5¢/lb	$286	$157	$309	
0 6¢/lb	$342	$188	$370	
30¢/day 5¢/lb	$360	$165	$378	
30¢/day 6¢/lb	$417	$196	$439	

increase protein from 11 to 13 percent often would prove non-economic despite a potential improvement in feed efficiency. The protein level which maximizes steer gain or efficiency may not be the most economical to feed. The declining protein levels proved most economical as less total protein was used. Feed intake was lower early in the finishing period when protein content was highest. Declining protein levels with dry corn rations worked well last year as well (Martin *et al.*, 1977). Adjusting the protein level to maximize economic return should prove rewarding. More steer performance trials with various protein levels, sources and corn processing methods are needed to refine these economic models.

Literature Cited

Gill, D. R., F. N. Owens, J. J. Martin, D. E. Williams and J. H. Thornton. 1977. Protein levels and Rumensin for feedlot cattle. Agric. Exp. Sta., Okla. State Univ., Misc. Pub. MP-101:42.

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