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South Dakota Beef Report, 1987 | Animal Science Reports

1987

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BEEF REPORT

OPTIMUM LEVELS OF DIETARY CRUDE PROTEIN AND MONENSIN FOR STEER CALVES ON LIMIT-FED, HIGH CONCENTRATE DIETS

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Summary

One hundred ninety-two Angus and Angus x Limousin calves (611 lb) were randomly allotted to one of four levels of crude protein intake and three dosages of monensin in an 80% concentrate diet. Intake of the complete diet was restricted to allow 2.2 lb average daily gain over an 84-day period. Crude protein was fed at 90, 100, 110 or 120% of the gram daily requirement described by NRC. Monensin was fed at 120, 180 or 240 mg/head/day. Each 10% increase in dietary crude protein caused a .13 lb increase in ADG, a .34 unit improvement in feed efficiency and .90 mg/dl increase in plasma urea nitrogen (P<.001). Increasing monensin from 120 to 180 mg/head/day improved ADG .19 lb per day and feed/gain .56 units (P<.01). There was no additional response to feeding monensin at 240 mg/head/day.

(Key Words: Limit Feeding, Crude Protein, Monensin, ADG, Feed Efficiency, Steer Calves.)

Introduction

Present growing programs for cattle utilize forages as the main dietary ingredient. Drawbacks associated with this type of program include a complication of feed handling, high relative cost per unit of energy contained in the forages and seasonal availability. By feeding restricted levels of high concentrate diets, some of these management problems may be eliminated, reducing production costs and allowing for more accurate performance predictability.

Limited feeding may cause decreased microbial growth rate and possibly increased ruminal proteolysis. These changes may cause actual protein requirements to differ from those established by the NRC. It is unclear what level of monensin maximizes performance under conditions of restricted feeding. The levels (g/ton) established for monensin are based on ad libitum intake. Limit feeding would lead to discrepancies between g/ton and mg/head/day dosages currently relied upon.

The objectives of this study were to determine optimum levels of dietary crude protein and monensin in a high concentrate diet fed to steer calves when intake was restricted to control growth rate.

Materials and Methods

The steers were vaccinated for IBR, BVD, PI_3, RSV, Haemophilus somnus, 7-way clostridia and treated for parasites upon feedlot arrival 5 weeks before the trial was initiated. The steers were maintained during this receiving period on a corn silage diet.

The steers were stratified by initial weight ($\bar{x}$ 611 lb) and allotted to 24 pens of eight head each. The diets were 80% concentrate (tables 1 to 3) and were fed to allow for 2.2 lb/day ADG, based on the estimated mean period weight of the cattle and NE equations for maintenance and gain. The trial consisted of three 28-day periods.

Treatments represented 90 (90-CPR), 100 (100-CPR), 110 (110-CPR) and 120% (120-CPR) of the daily crude protein requirement in grams derived from the NRC factorial equation for predicting crude protein requirements. Dry matter and crude protein intakes were adjusted every 28 days for the projected mean weight of the steers for

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the following 4-week period. This resulted in more feed being offered to the faster gaining steers. However, feed delivery was not increased until after gain responses were measured. To make these projections, individual steer weights were taken at 14-day intervals during the 84-day feeding period.

TABLE 1. PERIOD I DIETS[a,b]

Item	90[c]-CPR	100-CPR	110-CPR	120-CPR
Hay	20.00	20.00	20.00	20.00
Rolled corn	75.38	72.62	69.80	66.97
Soybean meal	1.98	4.88	7.88	10.88
Dicalcium phosphate	1.06	.99	.93	.85
Limestone	.59	.61	.62	.64
Trace mineralized salt	.50	.50	.50	.50
Potassium chloride	.49	.40	.27	.16
Crude protein, %[d]	11.12	12.30	13.51	14.73
NEm[e]	.89	.89	.89	.89
NEg[e]	.59	.57	.57	.57

[a] All diets provided >17,000 IU of vitamin A per head per day.
[b] Percentage, dry matter basis.
[c] Percentage of daily protein requirement (g) established by the NRC.
[d] Calculated values.
[e] Mcal/lb.

TABLE 2. PERIOD II DIETS[a,b]

Item	90[c]-CPR	100-CPR	110-CPR	120-CPR
Hay	10.00	10.00	10.00	10.00
Cobs	10.00	10.00	10.00	10.00
Molasses	1.50	1.50	1.50	1.50
Rolled corn	73.80	70.95	68.30	65.77
Soybean meal	1.70	4.45	7.20	9.90
Dicalcium phosphate	1.18	1.14	1.09	1.03
Limestone	.68	.91	.96	.95
Trace mineralized salt	.50	.50	.50	.50
Potassium chloride	.64	.55	.45	.35
Crude protein, %[d]	9.91	11.00	12.11	13.21
NEm[e]	.87	.87	.87	.87
NEg[e]	.56	.55	.55	.55

[a] All diets provided >17,000 IU of vitamin A per head per day.
[b] Percentage, dry matter basis.
[c] Percentage of daily protein requirement (g) established by the NRC.
[d] Calculated values.
[e] Mcal/lb.

TABLE 4. EFFECT OF PROTEIN INTAKE ON FEEDLOT PERFORMANCE

Item	Percentage NRC requirement[a]				
	90-CPR	100-CPR	110-CPR	120-CPR	SEM
Initial wt, lb	612	609	613	611	2.47
Final wt, lb	775	781	795	807	4.29
ADG, lb[b,c,f]	1.94	2.05	2.17	2.33	.28
Dry matter intake, lb/day	12.86	12.80	12.92	13.02	0
Feed conversion[b,e]	6.63	6.25	5.96	5.58	.14
PUN, mg/dl (day 56)[b,c,f]	5.13	5.62	6.62	7.82	.31
PUN, mg/dl (day 84)[b,d,f]	4.61	5.27	6.93	8.06	.38

[a] Percentage of daily crude protein requirement, g.
[b] Linear effect (P<.001).
[c] 100-CPR vs 110-CPR (P<.05).
[d] 100-CPR vs 110-CPR (P<.01).
[e] 100-CPR vs 120-CPR (P<.01).
[f] 100-CPR vs 120-CPR (P<.001).

Average daily gain increased (P<.01) as the monensin dosage was increased from 120 to 180 mg/head/day with no further advantage seen at the 240-mg treatment (table 5). There was a tendency for delayed feed consumption when monensin was fed at the 240 mg/head level. This may be useful in larger pens to allow for more uniform feed consumption, especially when bunk space is limited. The 120, 180 and 240 mg/head/day monensin levels used in the study correspond with levels of 18.6, 27.9 and 37.2 g/ton, respectively.

TABLE 5. EFFECT OF MONENSIN DOSAGE ON FEEDLOT PERFORMANCE

Item	Dosage[a]			
	120	180	240	SEM
Initial wt, lb	613	609	611	2.14
Final wt, lb[c]	781	793	795	3.72
ADG, lb[b,d]	2.00	2.19	2.19	.25
Dry matter intake, lb/day	12.89	12.89	12.89	0
Feed conversion[b,c]	6.45	5.89	5.89	.13
PUN, mg/dl (day 56)	6.19	6.09	6.61	.27
PUN, mg/dl (day 84)	5.98	6.06	6.61	.33

[a] Mg/head/day.
[b] Linear effect (P<.01).
[c] 120 vs 180 mg/head/day (P<.05).
[d] 120 vs 180 mg/head/day (P<.01).

The concentration of PUN did not increase when crude protein increased from 90 to 100% of NRC crude protein requirement. From 100 to 110% of NRC and 110 to 120% of the crude protein requirement, PUN increased (P<.05). These diets contained 12.51 (110-CPR) and 13.61% (120-CPR) crude protein. The increase in PUN may indicate that ruminal N requirements had been meet and excess NH_3 was being absorbed from the rumen. Average daily gains increased through 120% of the estimated crude protein requirement. This gain response to 120-CPR suggests that protein requirements for maximum growth were not exceeded in this study. Since ruminal N requirements were probably met with the 100-CPR or 110-CPR diets, the gain response associated with the 120-CPR diet may be due to an increased amount of bypass of feed protein which may occur simply because more protein was fed and ruminal degradation rate remained constant.