Transitioning Cattle from RAMP® to a Finishing Diet on Feed Intake and Ruminal pH

Cody J. Schneider
Adam L. Shreck
Terry J. Klopfenstein
Galen E. Erickson[1]

Summary

A metabolism trial was conducted where steers were adapted to high grain diets using a traditional approach or one of two RAMP® adaptation programs. RAMP programs adapted cattle to a finishing diet either gradually over 28 days in four steps or switched to a finishing ration without steps. Feed intake and ruminal pH were monitored continuously throughout the trial. Cattle on the 4-STEP treatment spent more time eating compared to other treatments but total feed consumption was similar among treatments. Ruminal pH was greater for cattle on RAMP adaptation programs when compared to traditional grain adaptation. Cattle fed RAMP for 10 days can be transitioned directly to a finishing diet containing 47.5% Sweet Bran®.

Introduction

RAMP is a complete starter ration that contains a high level of *Sweet Bran* and a minimal amount of forage. Previous research suggests starting cattle on RAMP may eliminate the need for an adaptation period (*2013 Nebraska Beef Cattle Report,* pp.78, 80). However, a metabolism trial reported that a system of transitioning cattle from RAMP to a finishing diet without an adaptation period had decreased ruminal pH and increased time below a pH of 5.6 compared to cattle adapted using a 4-step system (*2013 Nebraska Beef Cattle Report,* pp. 82-83), which suggests that eliminating the adaptation period may have increased acidosis. Therefore, the objective of this experiment was to determine effects of transitioning cattle from RAMP to a finishing diet with or without an adaptation period on ruminal pH, DMI, and eating behavior.

Procedure

A metabolism trial was conducted using 12 ruminally fistulated steers (BW = 877 ± 66 lb) to evaluate the effects of transitioning cattle from RAMP directly to a finishing diet on ruminal pH and DMI characteristics during grain adaptation. The experiment was conducted in two blocks, with each block utilizing six steers for 42 days. Before the trial was initiated, steers in the first block were grazing smooth bromegrass pastures throughout the summer and steers in the second block were used on growing trials to measure digestibility of grass hay.

Treatments consisted of three grain adaptation systems imposed during the first 28 days of the feeding period. Steers on traditional adaptation treatment (TRD; Table 1) were adapted to a finishing diet by feeding 4-step diets for 4, 6, 6, and 6 daus. Alfalfa hay inclusion was gradually decreased from 45 to 7.5% while inclusion of a corn blend (60% high-moisture corn (HMC) and 40% dry-rolled corn) was increased from 25 to 62.5% (DM Basis). The RAMP adaptation treatments (Table 2) involved transitioning cattle from RAMP to a finishing diet containing 47.5% *Sweet Bran* in either four steps or one step. The four-step system (4-STEP) gradually decreased dietary RAMP inclusion (100 to 0%) while increasing finishing ration (0 to 100%) equally over four periods (4, 6, 6, and 6 days) by mixing RAMP with finishing ration 1 (F1, 47.5% Sweet Bran, 40% HMC, 7.5% alfalfa hay and 5% supplement, DM basis) with the blend fed as a single diet. The 1 step adaptation system (1-STEP) involved feeding RAMP for 10 days and switching directly to F1 on day 11. Following the 28-day adaptation period, a second finishing diet (F2) was fed for 14 days (Table 2). All diets contained 25 g/ton Rumensin® and 12 mg/lb thiamine (DM basis).

Steers were individually housed in box stalls and were offered *ad libitum* access to feed and water and fed once daily at 0800 hour. Feed intake was continuously monitored using feed bunks suspended on load cells. Data for feed intake were collected every 10 seconds and six readings were averaged for each minute. Data obtained from continuously monitored DMI included meals consumed per day, time spent eating, and intake rate.

Wireless, submersible pH probes were placed into the rumen of each steer to monitor ruminal pH for the

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Table 1. Traditional (TRD) adaptation diets fed in this trial. Ingredient inclusions and chemical compositions are listed on a DM basis.

Item	Step 1	Step 2	Step 3	Step 4	Finisher
Ingredient, %					
Alfalfa hay	45.0	35.0	25.0	15.0	7.5
High-moisture corn	25.0	35.0	45.0	55.0	62.5
Sweet Bran[1]	25.0	25.0	25.0	25.0	25.0
Dry supplement[2]	5.0	5.0	5.0	5.0	5.0
Chemical composition, %					
DM	75.9	74.3	72.7	71.2	70.1
CP	14.7	14.1	13.5	12.8	12.4
NDF	35.4	30.9	26.5	22.0	18.6

[1]Sweet Bran, Cargill Corn Milling, Blair, Neb.
[2]Supplement formulated to contain 25 g/ton Rumensin and 12 mg/lb thiamine (DM basis).

duration of the trial. Each probe was attached to a weighted enclosure designed to ensure the electrode remained in the ventral sac of the rumen. On day 14 and 28, each probe was removed for approximately 2 hours in order to download pH data and recalibrate probes. Ruminal pH measurements from each period were adjusted using beginning and ending calibration values to ensure accurate pH measurements.

Because treatment was an adaptation system, data from two time periods were analyzed to compare the three adaptation systems. Time periods included the entire adaptation system (day 1 to 28) and all days cattle were fed a common finishing diet (day 29 to 42). Ruminal pH and DMI characteristics for each of the two time periods were analyzed as separate variables using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.). All data were analyzed using a repeated measures analysis. The model included d and treatment as a fixed effects and steer nested within treatment was considered a random effect.

Table 2. Adaptation diets for the 4-STEP treatment[1] where RAMP[2] was blended with a finishing diet 1 (F1) to adapt cattle to high grain diets. Following the adaptation system a common finishing ration (F2) was fed.

	Ratio of RAMP:F1					
Item	100:0	75:0	50:50	25:75	0:100	F2
Ingredient, %						
RAMP	100.0	75.0	50.0	25.0	—	—
High-moisture corn	—	10.0	20.0	30.0	40.0	42.5
Sweet Bran	—	11.9	23.8	35.6	47.5	25.0
MDGS	—	—	—	—	—	22.5
Alfalfa hay	—	1.9	3.7	5.6	7.5	—
Wheat straw	—	—	—	—	—	5.0
Dry supplement[3]	—	1.2	2.5	3.8	5.0	5.0
Nutrient composition, %						
DM	65.7	66.1	66.6	67.0	67.5	66.0
CP	24.5	22.3	20.2	18.0	15.8	16.6
NDF	35.8	33.0	20.1	27.3	24.4	24.4

[1]Treatment were as follows: 4-STEP blends 100:0, 75:0, 50:50, 25:75, and 0:100 were fed for 4, 6, 6, 6, and 6 days, respectively; 1-STEP fed 100:0 for 10 days and 0:100 day 11 to 28.
[2]RAMP is a complete starter feed (Cargill Corn Milling, Blair, Neb.) consisting of wet corn gluten feed, alfalfa hay, minerals, and vitamins.
[3]Supplement formulated to contain 25 g/ton Rumensin and 12 mg/lb thiamine (DM basis).

Table 3. Dry matter intake and ruminal pH characteristics during the 28 day adaptation system.

	Adaptation treatment[1]				
Item	TRD	4-STEP	1-STEP	SEM	*P*-value
DMI, lb/day	25.1	24.7	22.4	1.74	0.53
Intake rate, %/hour	17.8	19.9	21.5	1.18	0.17
Eating time, minute	246[a]	336[b]	276[a]	14.8	0.01
Meals/d, n	8.93	9.44	9.71	0.74	0.76
Ruminal pH					
Average	5.81[a]	5.94[b]	5.98[b]	0.06	0.09
Minimum	5.26[a]	5.36[a]	5.52[b]	0.06	< 0.01
pH variance	0.099	0.084	0.092	0.010	0.44
Time < 5.6, minute	316[a]	252[ab]	219[b]	39.7	0.08
Area < 5.6[2]	100	31	49	29.1	0.27

[a,b]Within a row, means with different superscripts are different ($P \leq 0.10$).
[1]Treatments were a traditional adaptation system (TRD), or two RAMP treatments where cattle were adapted in 4-step diets (4-STEP) or transitioned directly to a finishing diet (1-STEP).
[2]Area < 5.6 = area under the curve (magnitude of pH < 5.6 by minute).

Results

Intakes were similar for treatments during the 28-day adaptation period ($P = 0.53$; Table 3) and during the 14-day period when cattle were fed a common finishing diet. ($P = 0.77$; Table 4; Figure 1). Time spent eating during the adaptation period was affected by treatment ($P = 0.01$) with 4-STEP cattle spending more time eating compared to 1-STEP ($P = 0.02$) or TRD ($P < 0.01$). While cattle were on a common finishing diet, treatment tended to effect eating time ($P = 0.12$; Table 4) with 4-STEP cattle spending more time eating compared with TRD ($P = 0.04$). No differences among treatments were observed for meals per day during the adaptation period ($P = 0.76$; Table 3) or while cattle were fed a common diet ($P = 0.82$; Table 4). Intake rate was similar for all treatments during adaptation ($P = 0.17$; Table 3) and while on a common diet ($P = 0.38$; Table 4). The percentage of feed consumed after 2100 hour was not different as a result of adaptation treatment ($P = 0.49$; Table 4) once cattle were on a common finishing diet.

During the 28-day adaptation system, average ruminal pH was affected by treatment ($P = 0.09$) and was higher for 1-STEP ($P = 0.04$) and 4-STEP ($P = 0.10$) compared to TRD (Table 3). Minimum pH was different among treatments ($P < 0.01$) during the adaptation period. Surprisingly, minimum ruminal pH was higher for 1-STEP when compared to 4-STEP ($P = 0.04$) or TRD ($P < 0.01$) and time below pH of 5.6 was lower for 1-STEP compared to TRD ($P = 0.03$) during the adaptation period. Treatment had no effect on area below pH of 5.6 ($P = 0.27$) or pH variance ($P = 0.44$) during the first 28 days of the experiment. These findings are contrary to previous research where adapting cattle with *Sweet Bran* increased pH variance and decreased average, and minimum pH values (*2009 Nebraska Beef Cattle Report*, pp. 56-57). The previous trial also reported time and area below pH 5.6 was approximately three times greater for cattle adapted to

Table 4. Dry matter intake and ruminal pH characteristics during the 14-day period when cattle were on a common diet

	Adaptation treatment[1]				
Item	TRD	4-STEP	1-STEP	SEM	*P*-value
DMI, lb/day	28.6	27.1	26.5	2.1	0.77
Intake Rate, %/hour	18.6	16.9	21.0	1.99	0.38
Eating time, minute	259[a]	299[b]	276[ab]	11.9	0.12
Meals/day, n	9.50	8.95	9.52	0.74	0.82
Night intake,[2]%	24.3	28.9	23.1	3.45	0.49
Ruminal pH					
Average	5.65	5.87	5.96	0.12	0.21
Minimum	5.10	5.28	5.44	0.11	0.17
pH variance	0.083	0.086	0.068	0.014	0.65
Time < 5.6, min	611	323	236	138.2	0.19
Area < 5.6[3]	196	60	39	56.0	0.16

[a,b]Within a row, means with different superscripts are different ($P < 0.05$).
[1]Treatments were a traditional adaptation system (TRD), or two RAMP treatments where cattle were adapted in 4-step diets (4-STEP) or transitioned directly to a finishing diet (1-STEP).
[2]Night intake = percentage of total DMI consumed after 2100 hour.
[3]Area < 5.6 = area under the curve (magnitude of pH < 5.6 by minute).

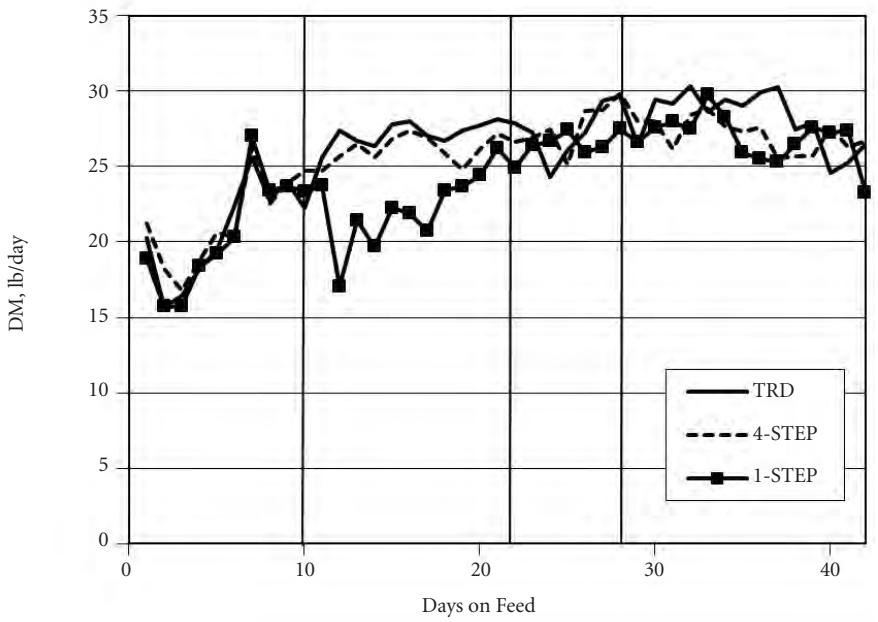

Figure 1. Daily DMI for steers adapted to a finishing diet using a traditional program (TRD), transitioned from RAMP to a finishing diet using four steps (4-STEP), or transitioned directly (1-STEP). Solid vertical bars indicate from left to right: 1-STEP starting on a finishing ration on d 10, 4-STEP and TRD starting on a finishing ration on day 21, and all cattle starting on a common finishing ration on day 28.

finishing diets with *Sweet Bran* than for cattle adapted with a traditional grain adaptation program using alfalfa hay. The authors attributed low pH to differences in DMI. It is unclear why there are differences among trials in the effects of grain adaptation on ruminal pH but they may be due differences in DMI among trials. Transitioning cattle directly from RAMP to a finishing diet did not reduce average ruminal pH and actually resulted in a higher minimum pH when compared to the 4-STEP program suggesting less acidosis. These findings are contrary to the observations of previous work which observed transitioning cattle from RAMP directly to a high-grain finishing diet decreased average ruminal pH while increasing time below pH 5.3 and pH variation when compared to a 4-STEP system suggesting more acidosis (*2013 Nebraska Beef Cattle Report*, pp. 82-83). It is unclear why acidosis was more apparent in the previous trial, other than susceptibility to acidosis among animals is highly variable.

While cattle were fed a common finishing diet (Table 4), no differences in average ruminal pH ($P = 0.21$) or minimum pH ($P = 0.17$) were observed as a result of previous adaptation treatment but numerical differences were still apparent. Ruminal pH variance was similar for all treatments once cattle were fed a common diet ($P > 0.43$). Adaptation treatment did not affect time or area below pH 5.6 when cattle were fed a common finishing diet ($P > 0.16$). These findings are contrary to the results of previous trial where greater ruminal pH variance was observed once cattle that had been transitioned directly from RAMP to a finishing diet were fed a common diet when compared to cattle adapted using a 4-step system (*2013 Nebraska Beef Cattle Report,* pp. 82-83).

The findings of this research suggest that feeding RAMP to adapt cattle to high grain diets may allow feedlots to eliminate the adaptation period. Regardless of adaptation period length, RAMP treatments increased eating time and average ruminal pH during the adaptation period, suggesting less risk of acidosis when using RAMP to start cattle on feed. Cattle fed RAMP for 10 days can be transitioned directly to a finishing diet containing 47.5% Sweet Bran and may actually have higher ruminal pH and less intake variation over the first 28 days of the feeding period.

[1]Cody J. Schneider, former graduate student; Adam L. Shreck, research technician; Galen E. Erickson, professor; Terry J. Klopfenstein, professor; University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.