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Undegradable Intake Protein Supplementation of Compensating, Grazing Steers

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Yearlings wintered at a faster rate of winter gain responded better to undegradable intake protein supplementation during the summer, however increased gains were not maintained during the finishing phase.

Summary

A trial was conducted to evaluate the effect of previous winter gain on response to undegradable intake protein (UIP) supplementation during the summer grazing period. Steers wintered at the FAST rate of gain had a greater response to UIP supplementation than steers with SLOW rate of gain. Maximum response for FAST cattle occurred at 150 g/d of supplemental UIP, while SLOW cattle showed no response through 150 g/d. Forage DM intake was similar for FAST and SLOW cattle, therefore SLOW cattle consumed more as a percentage of body weight. Increased gains from UIP supplementation were not maintained during the finishing phase.

Introduction

Because of the high degradability of protein in actively growing forages, undegradable intake protein (UIP) may be first limiting before energy (1991 Nebraska Beef Report, pp. 27-28). Therefore, supplementation of UIP should increase gains during the summer grazing phase.

Compensatory gain typically occurs in animals that have been previously restricted or maintained on a low plane of nutrition, and enhanced intake is often cited as a mechanism for which compensatory gain occurs. Previous research at the University of Nebraska has shown that the rate of winter gain and subsequent compensatory gain affects the response of grazing steers to UIP supplementation but not dry matter intake (DMI) during the summer phase (2000 Nebraska Beef Report, pp. 30-32). Steers with higher daily gains during the winter phase respond more to UIP supplementation, even though cattle with slower rates of winter gain experience compensatory growth during the summer. Therefore, it appears that cattle with different degrees of compensatory gain have different requirements for UIP. Additionally, cattle wintered at different rates of daily gain still consume the same amount of DM. Therefore, the objectives of our study were to evaluate the effects of previous winter gain on response to UIP supplementation and forage DMI during the summer grazing period.

Procedure

Forty-nine steers (503 lb; 11/24/98) were used in a 2x7 factorial treatment design. Steers were allotted randomly to one of two rates of winter gain, 1.5 (FAST, n=25) and .5 lb/day (SLOW, n=24). Steers then were randomly assigned to one of six UIP supplements (n=3) or an energy control (n=7). Protein supplements were formulated to deliver 75, 112.5, 150, 187.5, 225, or 262.2 g/day of supplemental UIP. The

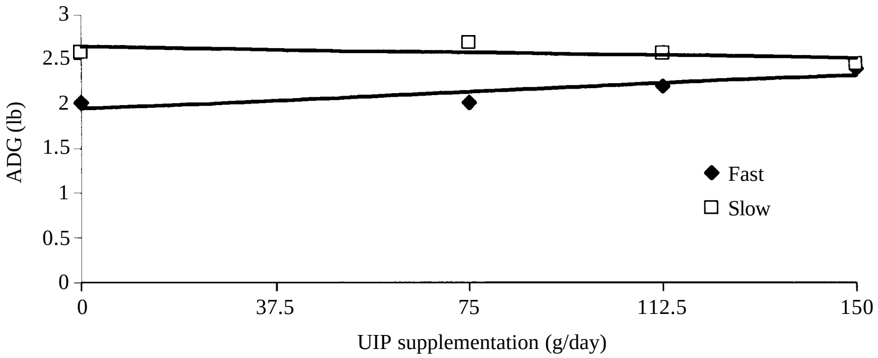

Figure 1. Average daily gain (lb) of steers during the summer grazing period excluding UIP supp. levels >150 g/day. Summer x winter interaction (P<.10).

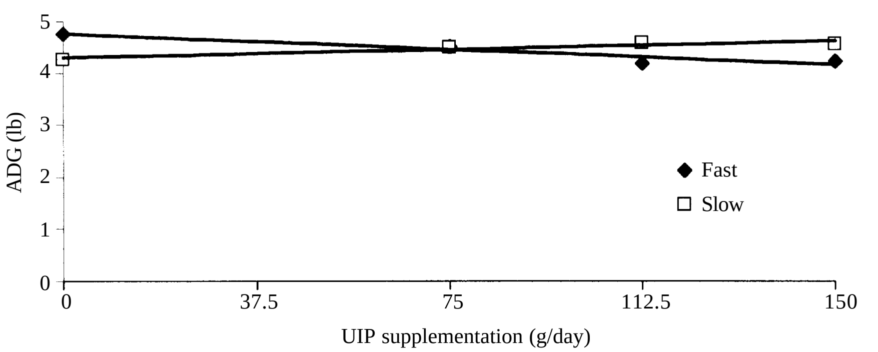

Figure 2. Average daily gain (lb) of steers during the finishing phase excluding UIP supp. levels >150 g/day. Summer x winter interaction (P<.10).

protein supplement was composed of 74% Soypass (treated soybean meal), 19% feather meal, 3% molasses, and 4% salt. The energy supplement consisted of 56% soyhulls, 9% tallow, 6% Carolac (a rumen protected fat), 24% molasses, and 5% salt. Combinations of the protein and energy supplements provided the graded levels of UIP and all supplements were formulated to be isocaloric. Steers were individually fed supplements four days per week.

Steers grazed four 8-acre fertilized brome pastures in a rotational grazing system from May 5 to June 11. Steers were then moved to pastures containing a mixture of warm season grasses and were maintained there in a four-pasture rotational system until the end of the trial Aug. 19. A fifth pasture was used in late July because of slow regrowth of the warm season grasses due to drier than normal conditions. Biweekly diet samples were collected via ruminally fistulated animals and samples were analyzed for CP, UIP, and IVDMD. An intake determination period, consisting of two one-week periods, was conducted while cattle grazed brome (early June) and warm season (mid-July) pastures. All steers receiving the energy control supplement (n=7) and the highest levels of UIP (n=7) within each winter treatment received a Captec continuous release chromium bolus to estimate fecal output. Fecal grab samples were taken for five consecutive days during each week of each intake period. Samples were composited within week for analysis and determination of fecal output. Total chromium payout from the bolus was verified using total fecal collection with six bag steers. Forage intake was calculated by dividing fecal output by forage indigestibility.

At the end of the summer grazing phase, steers were assigned within winter treatment to feedlot pens for finishing. Steers were stepped-up to the finishing ration which consisted of 47% high moisture corn, 44% wet corn gluten feed, 5% alfalfa and 4% supplement. All steers were fed for 106 days, at which point animals were slaughtered and carcass characteristics were recorded.

Results

A significant winter gain by UIP supplementation interaction (P=.09) was observed for summer grazing ADG; therefore, effects within winter treatment are reported (Figures 1 and 2). A significant quadratic effect (P=.09) on ADG across all UIP levels was detected for FAST cattle, with the maximum response occurring at the 150 g/day level. SLOW cattle responded linearly (P=.02) to increasing UIP levels; however, the response was negative. Supplemental levels above 150 g/day caused a reduction in gains of FAST cattle. Therefore, in order to determine a response to UIP supplementation within the range of positive effects, the data were reanalyzed excluding UIP levels greater than 150 g/day. These new analyses showed FAST cattle responded linearly (P=.08; .44 lb/day) to increasing UIP, while the SLOW cattle had no response to UIP. Additionally, SLOW cattle experienced compensatory growth and had higher gains overall (2.0 v. 2.7 lb/day for FAST vs. SLOW cattle receiving the energy control, respectively). Therefore, cattle with slower ADG during the winter phase were able to partially compensate for weight differences that were created by the winter treatment. Because of the length and severity of restriction in the SLOW cattle during the winter, they were only able to compensate 25% of the difference created by the winter treatments (177 v. 143 lb for initial and final grazing weight differences, respectively).

Crude protein, UIP (%DM), and IVDMD averaged 16.8%, 1.09%, and 70.3%, respectively, for the brome pastures and 15.5%, 1.40%, and 60.6%, respectively, for the warm season pastures. Dietary UIP content was measured using an in situ neutral detergent insoluble nitrogen (NDIN) technique, and calculated using rate of passage and rate of digestion.

(Continued on next page)

Results from intake determination are summarized in Table 1. There was a significant effect (P<.005) of forage type on forage intake. Therefore, means within forage type are reported. Winter treatments did not affect pounds of DMI during the brome or warm season grazing period. However, there was a winter treatment effect (P<.0001) when DMI was expressed as a percentage of body weight. For both forage types, FAST and SLOW cattle consumed similar amounts of DM; however, due to weight differences created by the winter treatments, the SLOW cattle consumed more DM as a percentage of BW. The increase in consumption, when expressed as a percentage of BW, has been previously reported and may partially explain the compensatory gain that occurred with the SLOW cattle.

A summer by winter treatment interaction (P=.09) occurred for feedlot performance. Therefore, data were analyzed within winter treatment. Additionally, performance data were analyzed excluding the same treatment groups as described for ADG in the grazing phase (UIP levels >150 g/day). Analysis with these levels showed that there was no effect of summer supplementation level on feedlot performance in the SLOW cattle. A negative linear effect (P=.09) of UIP supplementation during summer grazing occurred on feedlot ADG in FAST cattle. Cattle that responded to UIP supplementation during the summer had significantly lower ADG than those cattle that received the energy control and lower levels of UIP during the grazing period. This decrease in gains allowed for cattle to compensate for weight differences created by summer treatments. There were no differences (P>.3) in carcass characteristics due to summer treatments in either FAST or SLOW cattle. There was an effect (P=.0002) of winter treatment on hot carcass weight since SLOW cattle were able to only compensate 25% of the weight difference created by winter treatments during the grazing phase. There were no other effects of winter treatment on carcass characteristics.

Table 1. Forage intake of steers within forage type.

	Winter treatment			
	FAST	SLOW	SEM	P-value
Brome				
DMI, lb/day	15.4	15.7	.67	.76
DMI, % BW	1.92	2.52	.09	.0001
Warm Season				
DMI, lb/day	20.9	21.2	.71	.81
DMI, % BW	2.29	2.80	.09	.0006

Table 2. Metabolizable protein balances for steers during the summer grazing period.

	FAST		SLOW	
	Energy	Protein	Energy	Protein
Brome				
Actual gain, lb/day	1.94	2.36	2.54	2.56
ME allowable gain	2.33	2.33	2.54	2.54
MP balance, g/day	-93	+122	-65	+150
Warm season				
Actual gain, lb/day	2.05	2.31	2.69	2.78
ME allowable gain	2.31	2.31	2.76	2.76
MP balance, g/day	+22	+237	+18	+234

Performance, intake and diet composition data were used to evaluate the 1996 NRC computer model at the end of the trial. Actual DMI and forage digestibilities were used for each forage type, as well as ADG during each grazing phase. Adjustments for NEm and NEg were calculated using metabolizable energy intake (NE adjuster = $(-.0360 \pm 0.0047) \times \text{MEI} + (1.6869 \pm 0.0785)$). Using the NE adjusters, the metabolizable energy allowable ADG for the highest responding protein level was calculated using the model. The metabolizable protein (MP) balance was then determined for the energy control and highest responding protein level treatments. The model predicted that the SLOW gaining cattle were deficient in MP during the brome grazing period; therefore, the SLOW cattle should have responded to UIP supplementation (Table 2). Additionally, the model predicted the FAST cattle were deficient in MP while grazing brome, but that this deficiency was overly compensated for with UIP supplementation. The model also predicted neither group to be deficient during the warm season period. The NRC model inaccurately estimated MP balance for cattle at different physiological states and adjustments need to be made to the model to account for differences in efficiency created by compensatory gain.

Previous winter treatment and subsequent compensatory gain do affect the response to UIP during the summer grazing period. Cattle maintained at a slower rate of gain during the winter and experience a greater degree of compensatory gain during the summer respond less to UIP than those yearlings that were wintered at a FAST rate of gain. Additionally, forage intake (in pounds) was not affected by winter treatment, however, slower cattle eat more as a percentage of body weight due to weight differences created by the winter treatment. Body weight advantages gained by supplementation during the summer are completely compensated for during the finishing phase. We concluded that supplementation during the summer grazing period was not economical.

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