2018

Supplementing Rumen Undegradable Protein to Grazing Cattle

Braden C. Troyer
University of Nebraska - Lincoln

Bradley M. Boyd
University of Nebraska-Lincoln, bboyd4@unl.edu

Andrea K. Watson Watson
University of Nebraska-Lincoln, awatson3@unl.edu

Terry J. Klopfenstein
University of Nebraska - Lincoln, tklopfenstein1@unl.edu

Supplementing Rumen Undegradable Protein to Grazing Cattle

Braden C. Troyer
Brad M. Boyd
Andrea K. Watson
Terry J. Klopfenstein

Summary with Implications

A pooled-analysis of previous Nebraska Beef Report Articles examined the impact of rumen undegradable protein (RUP) supplementation for cattle grazing different types of forage. Each lb of RUP supplement increased ADG by 0.63 lb/d when cattle were grazing smooth brome and 0.43 lb/d when grazing warm season grasses. Cattle did not respond to RUP when grazing summer annuals which were high (18.2%) in CP.

Introduction

Forages have been widely used to background cattle before entering the feedlot. The energy content of the grass determines the potential cattle gains but protein content of the grass may also limit performance. Although grass can be relatively high in protein, the protein is almost all rumen undegradable protein (RDP) which means that it provides very little rumen degradable protein (RUP). The low level of RUP supplied from grass leads to less metabolizable protein (MP) for the animal to use and MP requirements are high for growing cattle.

There is a cost to supplementation of RUP and understanding how to maximize gains with minimal RUP supplementation on different types of forage is important. There can be confusion on how much supplement is needed across the growing season because CP content of the forage changes as the forage matures and cattle are selective grazers which can influence the total amount of CP consumed. This pooled analysis was done to determine the gain response to RUP supplementation while cattle are grazing a variety of different grasses.

Procedure

Data were collected from 10 previous studies that were published in the Nebraska Beef Cattle Reports ranging from 1987–1991. These 10 studies included 458 steers and 210 heifers grazing a variety of grasses. Crude protein of the forages varied from 10.4–21.7% and was measured in diet samples collected over the grazing period from cannulated steers. This method of forage analysis helps mitigate the risk of using an incorrect figure due to selective grazing. Two studies with bromegrass pastures did not measure CP content using diet samples. The RUP supplement came from a variety of sources (blood meal, corn gluten meal, SoyPass, feather meal) and ranged from 0–0.562 lb RUP per head daily. All studies included a control that provided an energy supplement with no RUP. Also each supplemental RUP treatment was formulated to have equivalent energy as the control to ensure that any response in ADG was due to RUP and not energy. In order to compare the response across trials, ADG was regressed above the ADG of the control treatment. This allowed the trials to be compared based on the additional ADG the cattle gained from the RUP supplementation.

Studies were divided into three types of forage being grazed. Within this analysis five studies evaluated cattle grazing brome grass, three studies evaluated cattle grazing warm season grass, and two studies evaluated cattle grazing summer annuals. The goal was to determine if type of forage affected ADG response to increasing RUP supplementation. Another goal was to determine if CP content of the grass affected the response to RUP supplementation. The hypothesis was that grass with lower CP would have a greater response to RUP supplementation. Considerable research has been conducted to determine the RUP content of common forages grazed in Nebraska. However, those procedures assume that soluble protein in the forage is rapidly and completely degraded in the rumen. It has been hypothesized that when cattle graze lush grass some RDP passes through the rumen with the liquid fraction into the small intestine before being degraded. Our objective was to determine if grasses with greater CP content require less RUP supplementation due to an increase in undegraded RDP reaching the small intestine and being utilized as RUP.

Results

Looking into the correlation between ADG and amount of RUP supplement relative to type of forage, warm season grasses had the strongest correlation (r^2=0.79) and showed an increase of 0.43 lb in ADG for each 1 lb increase in RUP supplementation. Cattle grazing brome grass showed a similar trend (P = 0.93) with 0.63 lb ADG increase with each additional lb of RUP supplementation, however, the correlation was slightly lower (r^2=0.65). Summer annuals had no correlation (r^2=0.00) and did not show a response to the RUP supplement (slope of the line was not different from 0; P = 0.84). The differences observed due to type of forage may be due to forage quality, specifically CP content.

The idea to evaluate the relationship between CP of the forage and ADG related to increasing RUP supplement stemmed from the trends observed in the types of grass. The average CP for brome grass was 16.0%, the average CP for warm season grass was 10.4%, and the average CP for summer annuals was 18.2%. Based on CP content and the results observed from the forage type groupings the advantage of RUP supplementation has a break point in forages that contain between 16.0% and 18.2% CP.

Responses shown here could be due to high intakes and rapid passage of forage through the rumen. This allows undegraded RDP to pass from the rumen in the liquid contents and enter the omasum and eventually the small intestine. The undegraded

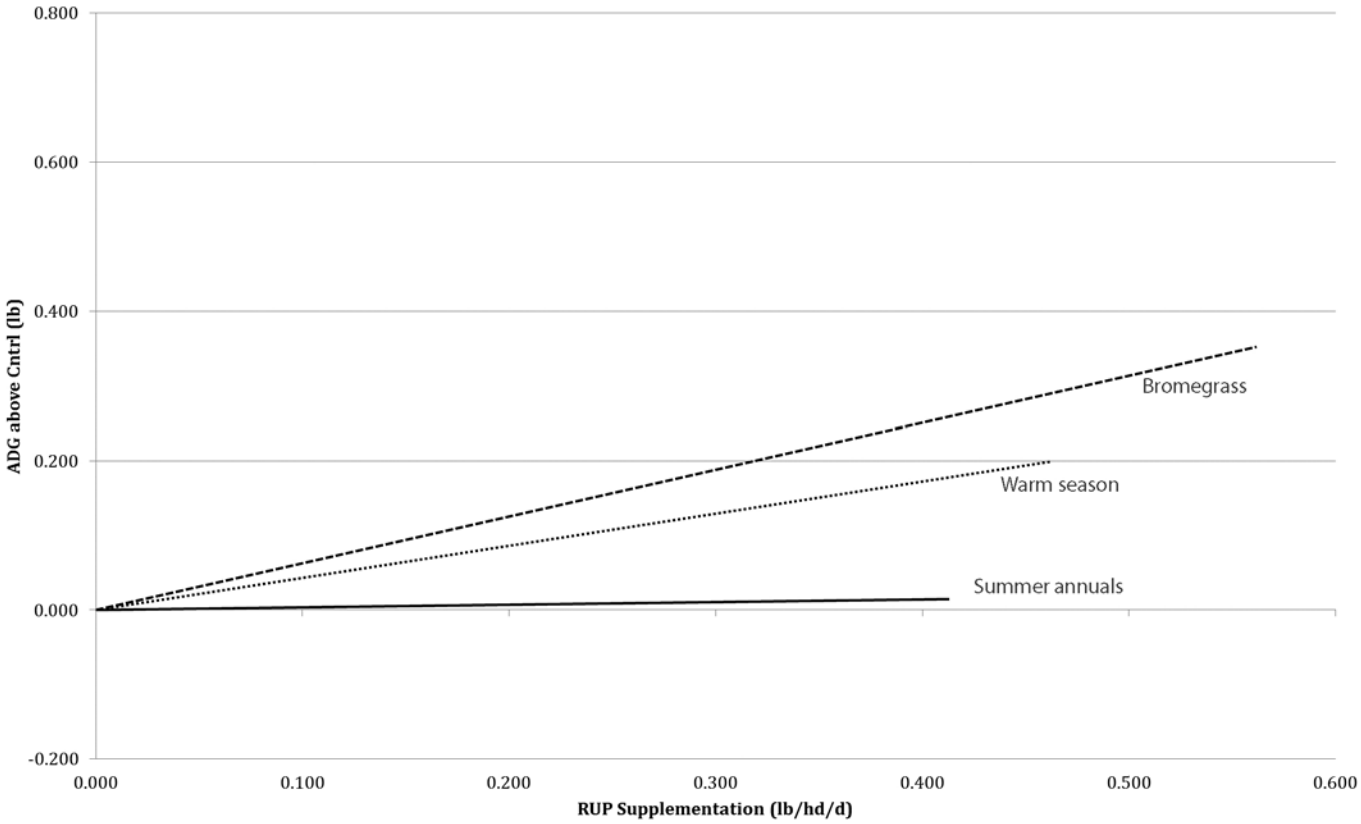

Figure 1. Pooled response of calves to RUP supplement in 10 studies. The additional ADG above cattle receiving a control supplement is graphed relative to amount of RUP supplement calves received. Data are divided by grass type and adjusted to have a 0 intercept. Warm season (Dotted line): y = 0.43 (0.07) x, r^2 = 0.79, n = 11. Bromegrass (Dashed line): y = 0.63 (0.08) x, r^2 = 0.65, n = 30. Summer annuals (Solid line), y = 0.03 (0.17) x, r^2 = 0.00, n = 11.

RDP is utilized in the small intestine as RUP and increases the total MP available for the animal. This extra "RUP" may be why the supplemental RUP did not improve ADG in steers grazing summer annuals that had greater than 17% CP. A study in 2011 with steers grazing smooth bromegrass pastures demonstrated a greater response to supplementation later in the grazing season. Supplementing dried distillers grains plus solubles (DDGS) resulted in 0.33 lb/d increase in ADG early in the grazing season (first 60 days) and jumped to 0.75 lb increase in ADG for the remaining 96 days of the study (2011 Nebraska Beef Cattle Report, MP 94:24). The lower response early in the study may be due to greater RUP content of the early growth of smooth bromegrass.

The recommendation for supplementing RUP to cattle grazing forages varies. Understanding the type, quality, and CP content of the forage is essential to deciding how much RUP to supplement. For cattle grazing warm season or brome grasses, these studies show that when energy is held constant RUP is limiting performance, so adding an RUP source will increase ADG. The RUP sources in these trials cost approximately \$0.70 per lb of RUP. This means that the extra gain cost \$1.32/lb. Determining if supplemental RUP is economical all depends on the RUP sources available to producers. Distillers grains plus solubles are a good source of RUP and are readily available in Nebraska. Assuming DGS are 30–32% CP and 63% RUP (as a % of CP), if purchased for \$150/ton the DGS would price into an operation between \$0.35 to \$0.40 per lb of RUP. This calculates to paying between \$0.66 to \$0.75 per lb of additional gain. The delivered price of DDGS is quite variable and is dependent on distance from ethanol plants and the ability to store and feed distillers grains. The DDGS would also supply extra energy to the cattle that the RUP sources in these studies did not provide. This energy could boost ADG even more. A 10-yr summary of calves grazing smooth bromegrass and supplemented with DDGS had an ADG response of 0.67 lb per lb of RUP from DDGS (2016 Nebraska Beef Cattle Report, MP 103:61). It is important to take into consideration the cost of the RUP supplement and the type of forage being grazed to determine if RUP supplementation is profitable.

Conclusion

In conclusion, supplementing calves grazing brome or warm season pastures with RUP will increase ADG, roughly an increase of 0.5 lb/d for each lb of RUP supplement. However, identifying an inexpensive source of RUP is key for supplementation to be profitable.

Braden Troyer, graduate student

Brad Boyd, research technician

Andrea Watson, research assistant professor

Terry Klopfenstein, professor, University of Nebraska–Lincoln, Department of Animal Science