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Trey Patterson
*University of Nebraska-Lincoln*

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

Don C. Adams
*University of Nebraska-Lincoln*, dadams1@unl.edu

Walter H. Schacht
*University of Nebraska-Lincoln*, wschacht1@unl.edu

Patrick E. Reece
*University of Nebraska-Lincoln*, preece1@unl.edu

*See next page for additional authors*

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## Authors

Trey Patterson, Terry J. Klopfenstein, Don C. Adams, Walter H. Schacht, Patrick E. Reece, Jacqueline A. Musgrave, and Amy Herron

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# Summer Grazing and Fall Grazing Pressure Effects on Protein Content and Digestibility of Fall Range Diets

**Trey Patterson**
**Terry Klopfenstein**
**Don Adams**
**Walter Schacht**
**Patrick Reece**
**Jacki Musgrave**
**Amy Herron**[1]

Protein content and digestibility of fall cow diets may decline with increasing levels of fall grazing pressure. Summer grazing has variable effects on fall diet protein.

**Summary**

*In 1997 and in 1998, four blocks of Sandhills range were used to examine summer grazing time and fall grazing pressure effects on fall diet quality. Three pastures within each block were grazed in June, July, or deferred from summer grazing each year. Multiple grazing pressures were created by grazing cows at various stocking rates in the fall. Diets were collected by esophageally fistulated cows. In 1997, diet protein and digestibility declined with increasing grazing pressure. In 1998, there were no effects of grazing pressure on fall diet protein or digestibility. July grazing reduced fall diet protein compared to June grazing in 1997, and summer grazing reduced fall diet protein compared to no summer grazing in 1998.*

## Introduction

The effects of summer grazing date and fall-winter stocking rate in the Nebraska Sandhills have been evaluated separately (1998 Nebraska Beef Report, pp. 20-21). However, no data have been generated in the Nebraska Sandhills to determine if the effects of fall-winter stocking rate on fall-winter diet quality differ in pastures grazed at different times the previous summer (stocking rate by summer grazing date interaction).

The amount of forage available for grazing per unit of land area varies across years, range sites and management systems. Therefore, it often is more useful to measure the amount of animal demand for forage applied per unit of forage available. Cumulative grazing pressure (CGP), measured in animal unit days (AUD) per metric ton of initial standing forage (t), is a way to express animal demand per unit of available forage. The effects of fall CGP on fall diet quality have not been evaluated in the Nebraska Sandhills.

Defining the protein content and digestibility of fall-winter diets across various grazing systems will allow for the development of accurate supplementation protocols, alleviating inefficiencies associated with over-feeding or under-feeding supplements.

The objective of this study was to examine summer grazing time and fall (October-December) grazing pressure effects on Fall diet CP and in vitro organic matter digestibility (IVOMD).

## Procedure

*Experiment 1.*

Four blocks of rangeland at the University of Nebraska's Gudmundsen Sandhills Laboratory, Whitman, Nebr., each were separated into three .74 acre pastures. The blocks were located on a sands range site in good to excellent condition and dominated by little bluestem, prairie sandreed, sand bluestem and switchgrass. Each of the three pastures in each block were randomly assigned to receive one of three summer grazing treatments in 1997: 1) no summer grazing, 2) grazing in late-June by yearling cattle at .2 AUM/acre, and 3) grazing in late-July by yearling cattle at .2 AUM/acre. Beginning Oct. 9, 1997, six esophageally fistulated cows (two cows/pasture) were stratified by age and weight and randomly assigned to pastures in the first block. Blocks were grazed sequentially throughout the fall for seven days each, with the fourth period ending Nov. 22, 1997.

Cows grazed each .74 acre pasture for the first four days of each 7-day grazing period to create a cumulative stocking rate (SR) of .4 AUM/acre. On day 5, the pastures were split in half by electric fence and .37 acres of each pasture were grazed for two days to create a cumulative SR of .8 AUM/acre. On day 7, each .37 acre paddock was split in half and cows grazed the remaining .19 acres for one day, for a final cumulative SR of 1.2 AUM/acre. Diets were collected by the two fistulated cows grazing each pasture when the cumulative Fall SR was 0, .2, .4, .6, .8, and 1.2 AUM/acre.

Diets were immediately frozen following collection. They were subsequently freeze dried, ground, and analyzed for DM, OM, CP, IVOMD and undegradable intake protein (UIP; 1998 Nebraska Beef Report, pp. 90-92). Forge UIP was calculated using the rate (Kd) of neutral detergent insoluble CP (NDICP) between 2 and 12 hours and a passage rate (Kp) of 2.0% ((Kp/(Kd +Kp)) + undegradable NDICP).

To determine the amount of standing forage per unit area, clipped samples were taken at a rate of 10 per .19 acres with .25 meter squared rectangular frames prior to application of fall grazing treatments. Samples were dried at 140° Fahrenheit for 48 hours prior to weighing. Cumulative grazing pressure was calculated as the cumulative AUD applied to a given paddock (or sub-paddock) at the time of diet collection

(Continued on next page)

divided by the metric tons of forage initially available (0 AUM/acre) in that paddock.

The effects of summer treatment, SR and summer treatment × SR were analyzed in a split-plot design. Whole plot error was calculated as block × summer treatment with SR as the sub-plot. Summer treatment effects were detected with contrasts (grazed versus deferred; June grazed versus July grazed). Simple regressions across CGP were calculated for CP, IVOMD, and UIP.

*Experiment 2.*

In 1998, summer grazing treatments were randomly applied to three .74 acre pastures in four blocks of upland range as described for Exp. 1. The blocks were located on a different site with less little bluestem than the site used in the first experiment. Diets were collected by two esophageally fistulated cows per pasture on Oct. 17. Each pasture was then split into one .37 acre and two .19 acre paddocks. The three paddocks in each pasture were grazed simultaneously by intact cows at either .4, .8, or 1.2 AUM/acre for three consecutive days (two blocks at a time) between Oct. 19 and 24. Due to animal and labor constraints, diets were collected with esophageally fistulated cows (two cows/paddock) seven weeks following the application of fall grazing treatments. When post-graze diets were being collected, diets were taken in an adjacent ungrazed pasture to adjust for any effect of advancing season on diet quality. Undegradable intake protein was not measured in this experiment. Clipped samples were taken immediately before application of Fall grazing treatments. Other procedures and analyses were as described for Exp. 1.

**Table 1. Crude protein, undegradable intake protein (UIP), and in vitro organic matter digestibility (IVOMD) of fall diets following various summer grazing dates in the Nebraska Sandhills (Exp. 1).**

| | Summer Treatment | | | |
|---|---|---|---|---|
| Item | Deferred | June | July | SEM[a] |
| CP, % OM[b] | 7.2 | 7.5 | 7.1 | 0.1 |
| UIP, % DM[c] | 1.41 | 1.62 | 1.49 | 0.08 |
| IVOMD, % | 51.5 | 50.6 | 51.9 | 0.7 |

[a]Standard error of the mean; n = 72.
[b]Significant contrast: June versus July (P = .11).
[c]Significant contrasts: Grazed versus Deferred (P = .10); June versus July (P = .14); calculated using rate of NDIN digestion (2 and 12 hours) and a 2.0% rate of passage.

**Table 2.Crude protein and in vitro organic matter digestibility (IVOMD) of fall diets following various summer grazing dates in the Nebraska Sandhills (Exp. 2).**

| | Summer Treatment | | | |
|---|---|---|---|---|
| Item | Deferred | June | July | SEM[a] |
| CP, % OM[b] | 9.0 | 8.5 | 7.9 | 0.3 |
| IVOMD, % | 54.0 | 54.5 | 52.9 | 0.6 |

[a]Standard error of the mean; n = 45.
[b]Significant contrast: Grazed versus Deferred (P = .09).

## Results

In Exp. 1, there were no SR× summer treatment interactions for fall diet CP, IVOMD, or UIP (P > .50). The main effect of SR was significant for all variables (P < .01). Fall diet CP was higher (P = .11) in pastures grazed in June (Table 1) than those grazed in July. Undegradable intake protein (DM basis) in the fall was higher (P = .10) in summer grazed pastures than deferred pastures, and UIP tended to be higher (P = .14) in June versus July grazed pastures. Summer treatment had no effect on IVOMD.

Also in Exp 1., CP responded cubically (P < .01) to increasing CGP (Figure 1), declining from 8.6% pre-grazing (0 AUD/t) to 6.5% at 50 AUD/t. There were no effects of CGP on diet UIP content. Diet IVOMD also responded cubically (P = .05) to increasing CGP (Figure 2), declining from 54% at 0 AUD/t to 50% at 50 AUD/t.

In Exp. 2, no SR× summer treatment interactions existed for CP or IVOMD (P > .15), and SR was not significant for either variable (P > .20). However, CP in fall diets from pastures deferred from summer grazing was greater (P = .09) than in diets grazed in the summer (Table 2). There were no effects of CGP on CP or IVOMD.

Downs (1998 Nebraska Beef Report, pp. 20-21) found no response of summer grazing date (deferred, June, or July) on the CP content of fall-winter diets in the Nebraska Sandhills. In these two experiments, however, summer grazing date did affect CP in fall diets. Conditions such as precipitation, temperature, and date of first freeze may affect how plants respond to late season herbivory, thus affecting diet protein content in the fall. The response of increased UIP in June grazed pastures is similar to that measured by Downs (1997 Nebraska M.S. Thesis). However, with values at 1.5% of DM, biological implications to foraging cattle do not likely exist. Indeed, degradable intake protein (DIP), not UIP, has been shown to be first limiting to cows grazing winter Nebraska Sandhills range (1996 Nebraska Beef Report, pp. 14-16).

Crude protein (7.3 and 8.5%) and digestibility (52 and 54%) values were lower in Exp. 1 than in Exp. 2, respectively. Other data have indicated year to year variation in fall-winter diet CP values. Data from Gudmundsen Sandhills Laboratory showed not only different diet CP values collected in two consecutive years, but CP content of diets changed from December to February in the opposite direction each year (1993 Nebraska Beef Report, pp. 8-10). The fall conditions during Exp. 2 (1998) included warmer than normal temperatures and above average precipitation. Data are not available as to the effects of environment on the response of diet quality to increasing fall grazing pressure. Nevertheless, the CP and IVOMD response was different in Experiments 1 and 2.

Another explanation for the lack of response of CP and IVOMD to fall CGP

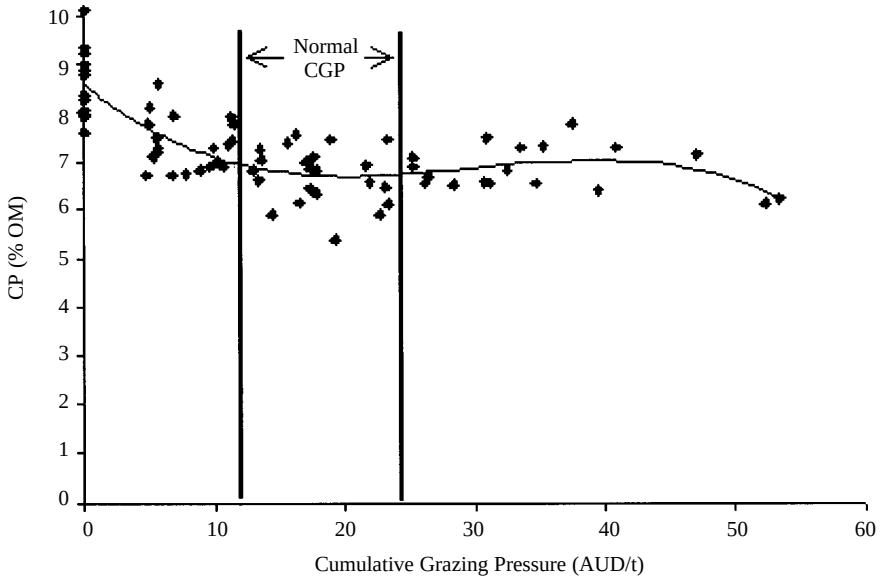


**Figure 1. Change in CP of cow diets from upland Sandhills range collected across multiple cumulative fall grazing pressures. Cubic response, P < .01.**

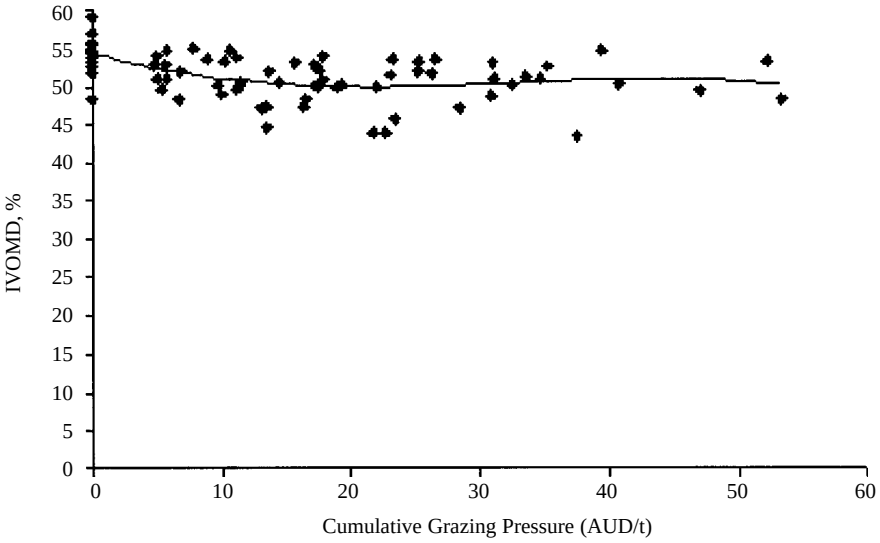


**Figure 2. Change in in vitro organic matter digestibility (IVOMD) of cow diets from upland Sandhills range collected across multiple cumulative fall grazing pressures. Cubic response, P < .05.**

in Exp. 2 could lie in the fact that post-graze diets were collected seven weeks after application of fall treatments. Observations indicated that sedges regrew following the October grazing period; therefore the cows could have collected some regrowth in December in addition to residue remaining after the October grazing.

As shown in Figures 1 and 2, the decline in CP and IVOMD across CGP in Exp. 1 occurred with the first imposed grazing pressures. This is consistent with that reported by Downs (1997 Nebraska M.S. Thesis). It appeared that when low stocking rates (.2 AUM/acre), or imposed grazing pressures (5-10 AUD/t) were reached, diet protein and digestibility were relatively consistent irrespective of further increases in grazing pressure. After this initial decline, supplemental requirements of grazing cattle may remain constant with increasing grazing pressures until the point when grazed forage intake is reduced by the amount of available forage.

The range of normal grazing pressures in the Nebraska Sandhills also is shown in Figure 1. In a 90-day continuous grazing program with similar initial standing forage as reported here, it would take between 45 and 90 days of grazing before a CP deficiency occurred in a mature beef cow (180 days pregnant). Therefore, defining the decline in cow diet CP is important in determining both the timing and amount of supplementation required. The effect of year on diet quality may be larger than the effect of grazing pressure. Combining the two years of diet quality data collected by Downs (1997 Nebraska M. S. Thesis) and the data from the two experiments reported here, generalizations on winter supplement requirements to spring calving cows can be made. Across the four years of data, fall/winter diet CP ranged from 5% to 8.5% of OM (4.5 to 7.7% of DM). Likewise, fall/winter diet digestibility (TDN) ranged from 51% to 55%. With this range of diet CP, cow requirements for supplemental DIP are between 0 and 230 grams/day. If DIP requirements are met, supplemental UIP is not necessary until just prior to calving. Between 50 and 120 grams/day of supplemental UIP may be required in last month of gestation. With adequate forage availability, energy is not deficient to the mature cow until the last six weeks before calving. If winter diets are 51% TDN, cows grazing range will be 1.6 Mcal/day deficient in NEm at 45 days pre-calving.

The lack of an interaction between fall stocking rate and summer grazing date was consistent between experiments. Increased fall grazing pressure caused a reduction in CP and IVOMD in one of two experiments. The decline in quality occurred with the first levels of imposed grazing pressure. July grazed pastures had lower CP values than June pastures in Exp. 1, and summer grazed pastures were lower in CP than deferred pastures in Exp.2.

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[1]Trey Patterson, research technician; Terry Klopfenstein, Professor, Animal Science, Lincoln; Don Adams, Professor, Animal Science, West Central Research and Extension Center, North Platte; Walter Schacht, Associate Professor, Agronomy, Lincoln; Patrick Reece, Associate Professor, Agronomy, Panhandle Research and Extension Center, Scottsbluff; Jacki Musgrave, research technician, West Central Research and Extension Center, North Platte; Amy Johnson, former graduate student.