Reprinted from the *Journal of Production Agriculture*
Volume 10, no. 2, April–June 1997
677 South Segoe Rd., Madison, WI 53711 USA

Effects of Growth Potential and Protein Supplementation on Steers Grazing Fall Pasture in the Northern Great Plains

E. E. Grings, R. E. Short, and D. C. Adams

Research Question

Regrowth of harvested, irrigated hay fields in the Northern Great Plains can provide a higher quality forage for fall grazing than nonirrigated native rangeland. This high quality regrowth may be suitable for young animals with high nutritional requirements for growth. However, protein needs of 6- to 9-mo-old calves may be greater than what is available from pasture alone, depending upon desired growth rates. Protein requirements of calves are affected by growth rate, and genetic potential for growth may alter responses to different management systems. The objective of this study was to evaluate soybean meal (SBM) supplementation for calves of two growth potentials grazing irrigated pastures in the fall after weaning.

Literature Summary

Efficiency of beef production is affected by rate and efficiency of gain during the postweaning period. Use of cattle with varied growth potentials or the use of different management schemes can alter this efficiency. Research has shown increased weight gains by cattle fed protein supplements along with moderate quality forages compared with cattle fed these forages without supplements. Protein supplementation may affect forage intake and digestion depending upon the forage quality.

Study Description

A 3-yr study (1990 to 1992) was conducted in the fall after weaning to evaluate supplemental SBM for steers (average weight 471 lb) of high- or moderate-genetic potential for growth. Each year 23 or 24 steers grazed regrowth from pastures of a Russian wildrye-wheatgrass complex for about 80 d. Half of the steers were individually fed SBM (1 lb/d) 5 d/wk in 1990 and 7 d/wk in 1991 and 1992. The CP content of the forage consumed averaged 13.2, 12.6, and 10.6% in mid-October and 8.8, 12.3, and 6.0% in mid-December of 1990, 1991, and 1992, respectively.

Applied Questions

What rates of gain can be expected from weaned steer calves grazing fall pasture regrowth in the Northern Great Plains and is supplementary protein valuable?

Using regrowth in Russian wildrye-wheatgrass pastures in the fall for growing cattle can result in weight gains of 0.9 to 1.5 lb/d. Gains may be increased 0.4 lb/d by supplementing with SBM at 1 lb/d.

Do steers of differing genetic growth potential benefit equally from SBM supplementation?

Cattle of both high- and moderate-growth potential benefit equally from added SBM. Forage needs can be determined based upon body weight (BW), with forage intake being an equal percentage of BW for steers of high- or moderate-growth potential.

Full scientific article from which this summary was written begins on page 241 of this issue.

Effects of Growth Potential and Protein Supplementation on Steers Grazing Fall Pasture in the Northern Great Plains

E. E. Grings,* R. E. Short, and D. C. Adams

Cattle of varied genetic growth potential may respond differently to management strategies because of altered nutrient demands for growth. An option for postweaning calf management is use of improved pastures for grazing. A 3-yr study (1990 to 1992) was conducted to evaluate the effects of supplemental soybean [*Glycine max* (L.) Merr.] meal (SBM) on performance of *Bos taurus* steers (average weight 471 lb) of high- (Charolais-sired) or moderate- (Hereford-sired) genetic growth potential. Each year, 23 (Year 1 and 3) or 24 (Year 2) steers grazed pastures of a Russian wildrye [*Psathyrostachys juncea* (Fischer) Nevski]-wheatgrass hybrid [*Elytrigia repens* (L.) Neuski] × [*Pseudoroegneria spicata* (Pursh.) Löve] complex. One-half of the steers were individually fed SBM (1 lb/d, as fed) 5 d/wk in 1990 and 7 d/wk in 1991 and 1992. Crude protein of consumed forage, as determined from esophageal masticate, averaged 15.1, 14.8, and 12.6 in mid-October and 10.5, 14.5, and 7.0% of organic matter (OM) in mid-December of 1990, 1991, and 1992, respectively. Steers of high genetic growth potential gained 1.4 lb/d compared with 1.2 lb/d for moderate growth potential steers ($P < 0.05$) and SBM supplemented steers had greater gains ($P < 0.01$) than nonsupplemented steers (1.5 vs 1.1 lb/d). Forage OM intake was affected by year ($P < 0.01$) and genetic potential for growth ($P < 0.05$). Forage OM intake averaged 8.8, 9.4, and 7.5 lb/d for 1990, 1991, and 1992, respectively, and 9.0 and 8.1 lb/d for high- and moderate-growth potential steers. Supplementation with SBM was cost effective for steers grazing regrowth in irrigated Russian wildrye-wheatgrass hybrid pastures in the fall.

E.E. Grings and R.E. Short, USDA-ARS Ft. Keogh Livestock and Range Res. Lab, Rt. 1, Box 2021, Miles City, MT 59301; D.C. Adams, Univ. of Nebraska West Cent. Res. and Ext. Cent., Rt. 4, Box 46A, North Platte, NE 69101. Contribution from the USDA-ARS and the Montana Agric. Exp. Stn. as MAES J. Ser. J-3074. *Corresponding author (elaine@larrl.ars.usda.gov).

Published in J. Prod. Agric. 10:241–245 (1997).

RATE AND EFFICIENCY of growth from weaning to slaughter are important considerations for determining efficiency of beef production. Postweaning growth can be altered by choice of breed, genetic selection, and nutritional management. Cattle of varying genetic growth potential produce carcasses of differing fat content depending upon rates of growth throughout the postweaning period. Coleman et al. (1993) recommended that early maturing types of cattle be raised at moderate growth rates until reaching 75% of slaughter weight to minimize carcass fat, while later maturing types should be fed to gain more rapidly. It is important to determine how cattle of differing growth potentials respond to different management strategies to evaluate the effectiveness of those strategies in the production of desirable carcasses.

Options for fall postweaning management of calves in the Northern Great Plains include feeding harvested feeds,

Abbreviations: ADF, acid detergent fiber; ADIN, acid detergent insoluble N; ADL, acid detergent lignin; BW, body weight; CP, crude protein; DM, dry matter; INDF, indigestible neutral detergent fiber; NDF, neutral detergent fiber; OM, organic matter; SBM, soybean meal.

grazing native rangeland, or grazing improved pastures. Regrowth of harvested, irrigated hay fields may provide forage of a higher quality for fall grazing than nonirrigated native rangeland. The quality of forages produced on irrigated pastures make them suitable for young animals with high nutritional requirements for growth. Additionally, supplemental protein might aid in maintaining calf growth rates. Increased weight gain in cattle fed protein supplements along with moderate quality forages has been documented (Donaldson et al., 1991; Anderson et al., 1988; Worrell et al., 1990). The objective of this study was to evaluate the response of steers of two genetic growth potentials to protein supplementation when grazing irrigated pastures in the fall after weaning.

MATERIALS AND METHODS

A 3-yr study was conducted from October through December at the Ft. Keogh Livestock and Range Research Lab near Miles City, MT (46° 22′ N, 105° 5′ W). Each year, steers sired by Charolais bulls selected for high yearling weight-expected progeny differences were designated as high growth potential steers (initial weight 497 lb). Steers sired by Hereford bulls with average yearling weight ratios were designated as moderate growth potential steers (initial weight 451 lb). Two sires of each growth potential group were used each year, but different sires were used each year. Dams were crossbred multiparous *B. taurus* cows of a wide range in size and milk production potential. Frame scores were not assigned to calves, and because of the large variation in size of dam, steers of a given growth potential were not of a consistent frame size. Average birth date of steers was 8 April and average weaning date was 18 September.

Prior to weaning, steers and their dams were grazed together during the summer. Summer management and growth rates of calves are described in Grings et al. (1996). Approximately 1 wk after weaning, 12 steers from each sire breed were placed on a 94 acre pasture that had been harvested for hay once during the summer. In Years 1 and 3, one steer was removed from the study for health reasons unrelated to the experiment. The pasture consisted of a mixture of Russian wildrye, RS-2 (a quackgrass × bluebunch wheatgrass hybrid), and creeping foxtail (*Alopecurus arundinaceus* Poiret). Forbs (weeds) comprised less than 20% of the pasture dry matter (DM) as estimated during the fecal sampling periods in Years 2 and 3. Management of the pasture prior to grazing included a harvest (1900 to 2600 lb/acre) during mid-summer (20 July 1990, 8 Aug. 1991, and 20 July 1992) followed by flood irrigation, which started approximately 1 wk after harvest. Pastures were not fertilized at any time. The pasture was divided into four paddocks with electric fencing and cattle were allowed access to one or two paddocks at a time based upon visual estimation of forage mass and subjective evaluation of rates of removal. The study lasted approximately 80 d (October through December). Half of each sire group received SBM by individual feeding. Steers were fed 1 lb/feeding (as fed basis) for 5 d/wk in Year 1 and 7 d/wk in Year 2 and 3. Soybean meal averaged 42.3% crude protein (CP), 22.3% neutral detergent fiber (NDF), 11.9% acid detergent fiber (ADF), and 1.3% acid detergent lignin (ADL). Each morning all steers were gathered at 0700 h and placed in a corral. Supplemented steers were sorted into individual pens and fed SBM in plastic tubs. Steers consumed their supplement within approximately 30 min. All animals were then returned to paddocks for grazing. Calves were weighed initially and again at the end of the study on a nonshrunk basis.

One week after grazing was initiated and again 6 wk later, all calves were given a sustained-release chromic oxide bolus (Captec, Nufarm, Auckland, New Zealand) as an indigestible marker to estimate fecal output. Six days after each bolus administration, fecal bags were placed on three (Year 2) or four (Years 1 and 3) steers for total fecal collection to provide a correction factor for chromic oxide release rate related to differences in dietary factors (Adams et al., 1991). Bags were weighed and emptied each morning for 5 d, and a sample of feces was collected. After drying, fecal samples from each bagged steer were composited across days at a rate of 0.1% of DM. Grab samples of feces were collected at 0800 h from all other calves from Day 7 to Day 11 after each marker bolus dosing. Grab samples were dried at 131° F, composited on an equal dry weight basis by animal across days, and ground. Analysis on fecal samples included DM, ash (AOAC, 1990), Cr (Williams et al., 1962), and indigestible NDF (INDF, Cochran et al., 1986). Data from the two fecal output collections were averaged to give a single value per animal per year.

Diet quality was determined using three esophageally cannulated crossbred calves of the same age as the other experimental calves. Calves grazed with the herd throughout the study. Diet samples were collected during two 40 min grazing bouts 3 to 4 d before fecal sample collection. Esophageal masticate was frozen, lyophilized, ground to pass a 0.04 in. screen on a Wiley mill and analyzed for DM, ash, ADF (AOAC, 1990), CP (Hach, 1987), NDF, ADL, acid detergent insoluble N (ADIN) (Goering and Van Soest, 1970), and INDF.

Diet digestibility was calculated on an individual animal basis by the ratio of fecal INDF to esophageal masticate INDF. Forage intake was estimated from fecal output and diet digestibility. The contribution of SBM to fecal output was calculated by subtracting SBM INDF from fecal INDF.

In Year 2 and 3, forage mass was determined by clipping herbage within 15 randomly located 2.7-sq-ft quadrants. Sampling of forage mass was conducted during the same week as fecal collections. Herbage was clipped at ground level and sorted into grass and forbs. After drying for 48 h at 140°F, herbage was weighed, composited, ground, and analyzed for DM, ash, CP, NDF, ADF, and ADL as previously described.

Weight gain and intake data were analyzed with a model containing supplementation, genetic growth potential, and year as main effects and all appropriate interactions. Interactions were all nonsignificant. Initial weight was used as a covariate for weight data. Analyses were conducted using the general linear models procedure of SAS Institute (1989). Significance was assumed at $P < 0.05$. Trends toward significance were considered for $0.10 > P > 0.05$. Diet quality was evaluated in a model containing year, month, and the year × month interaction with the residual used as the error term. Because samples were composited for chemical analyses, herbage quality data was not statistically analyzed.

Table 1. Chemical composition of esophageal masticate collected by calves grazing irrigated Russian wildrye-wheatgrass pastures in the fall and forage mass and quality at time of diet quality sampling.

Constituent	1990 Oct	1990 Dec	1991 Oct	1991 Dec	1992 Oct	1992 Dec	SE
	% of OM						
Masticate composition							
CP†‡§	15.1	10.5	14.8	14.5	12.6	7.0	0.24
NDF†‡	52.2	67.0	62.0	65.1	61.7	74.4	1.18
ADF†‡§	34.2	43.2	38.3	38.7	40.7	47.3	0.65
ADL	6.2	5.6	6.4	6.4	7.6	6.2	0.30
ADIN†‡§	7.8	12.8	8.8	8.0	9.5	15.5	0.18
Herbage quality							
CP	NA¶	NA	13.0	10.8	12.4	7.8	
NDF	NA	NA	71.2	78.8	74.9	79.7	
ADF	NA	NA	49.0	55.2	50.2	51.4	
ADL	NA	NA	8.1	7.7	8.0	6.6	
Forage mass	lb DM/acre						
	NA	NA	1068	1580	1229	1180	

† Chemical constituent affected by month of sampling ($P < 0.01$).
‡ Chemical constituent affected by year of sampling ($P < 0.05$).
§ Significant month × year interaction ($P < 0.05$).
¶ NA = Not available.

RESULTS AND DISCUSSION

The CP concentrations of available forage collected by hand clipping during fecal collection periods varied numerically from 13.0 to 7.8% (Table 1). The forage CP range agrees with research of Haferkamp et al. (1995), who reported that RS-2 hybrid maintained a CP concentration greater than 10% throughout the fall after late summer harvesting.

Quality of consumed forage (Table 1), as determined from esophageal masticate, declined in Year 1 and 3 between October and December, as evidenced by decreased CP and increased NDF and ADF concentrations. In Year 2, December dietary CP and ADF concentrations remained at levels similar to those observed in October, while NDF increased between October and December as it did in other years. Acid detergent lignin did not vary among years or months. Acid detergent insoluble N increased between October and December in 1990 and 1992, but not in 1991. Diet quality differences in 1991 could be related to significant September precipitation or the higher average monthly temperatures from October through December of that year (Fig. 1).

Supplementation with SBM, genetic growth potential, and year affected rate of gain in steers (Table 2). In our study, steers fed SBM gained 1.5 lb/d compared with 1.1 lb/d for control steers. These results agree with those of Worrell et al. (1990), who observed an increase in average daily gain with protein supplementation of steers consuming ryegrass pasture of 13 to 17% CP in the fall. Weight gain in these calves was similar to gains observed in contemporary steers grazing native range and allowed to suckle their dams throughout this period (1.4 lb/d; Short et al., 1996).

High-growth potential steers gained 1.4 lb/d compared with 1.2 lb/d for moderate-growth potential steers. Lack of an interaction between supplementation and genetic potential for growth indicated that the effect of SBM supplementation did not differ among steers of either high- or moderate-growth potential.

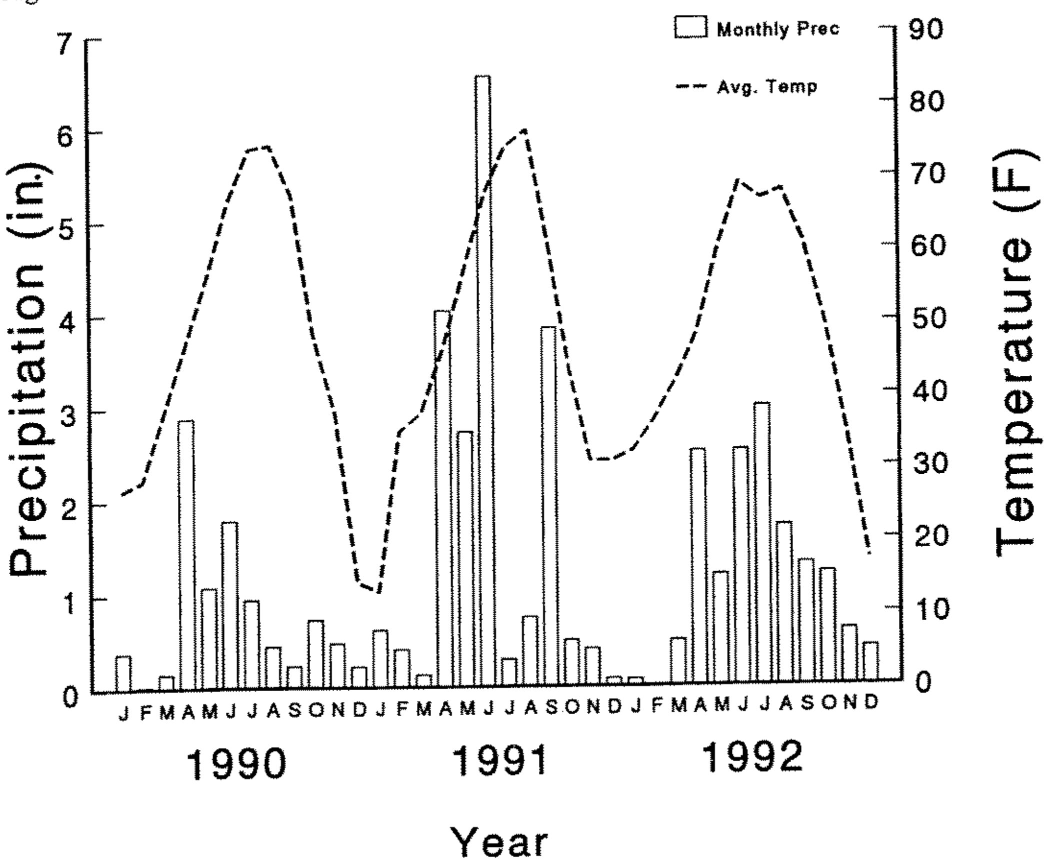

Fig. 1. Monthly precipitation and average monthly temperature from January 1990 through December 1992 at Miles City, MT.

Table 2. Least squares means of forage and total OM intakes and BW change of steers of two genetic growth potentials grazing irrigated pastures in the fall with or without soybean meal supplementation.

Item	Year			Protein		Growth potential		P values†			Pooled SEM
	1990	1991	1992	No	Yes	High	Moderate	Year	Protein	Growth	
Forage intake											
lb/d	8.8	9.4	7.5	8.9	8.3	9.0	8.1	0.002	0.216	0.041	0.21
% of BW	1.9	1.7	1.4	1.7	1.6	1.6	1.6	0.001	0.065	0.997	0.03
Total intake,											
lb/d	9.2	9.9	7.9	8.9	9.1	9.4	8.5	0.002	0.575	0.041	0.21
% of BW	1.9	1.8	1.4	1.7	1.7	1.7	1.7	0.001	0.744	0.910	0.03
Forage OM digestibility, %	61.8	63.1	45.6	57.7	55.8	56.6	57.1	0.001	0.013	0.492	0.36
Total digestible OM intake, lb/d	5.7	6.4	3.8	5.2	5.4	5.6	5.1	0.001	0.485	0.088	0.15
Weight											
Final‡, lb	564	601	575	564	597	588	570	0.001	0.001	0.016	3.3
Average daily gain‡, lb/d	1.1	1.5	1.4	1.1	1.5	1.4	1.2	0.004	0.001	0.018	0.04
Lb. digestible OM intake/lb. gain	5.8	4.5	3.0	5.1	3.8	4.3	4.6	0.001	0.002	0.438	0.19

† All interactions were nonsignificant ($P > 0.10$).
‡ Means adjusted for initial BW.

Steers gained less in Year 1 than in Years 2 and 3. This might have resulted from providing SBM only 5 d/wk (5 lb/wk) in Year 1 as opposed to 7 d/wk (7 lb/wk) in Years 2 and 3.

Supplementation with SBM did not affect forage or total OM intake of steers, expressed as pounds per day, but forage OM intake as a percentage of BW tended ($P < 0.10$) to decrease with SBM supplementation (Table 2). This indicates that supplemented steers were substituting SBM for forage. This is a common response for ruminants consuming forage of the quality found in this study (Matejovsky and Sanson, 1995). Due to a decrease ($P < 0.05$) in forage OM digestibility associated with SBM feeding, total digestible OM intake was not altered by SBM supplementation (Table 2).

Steers with high genetic growth potential had greater forage and total OM intake than did their contemporaries with moderate- growth potential when expressed as pounds per day but not when expressed as a percentage of body weight (BW) (Table 2). This indicates the use of increased feed to support increased gains. Coleman and Evans (1986) reported that Charolais steers consumed more total feed during the growing phase than Angus (*B. taurus*) steers, but differences were not apparent if feed intake was expressed on a metabolic BW basis.

Intakes were lower in Year 3 than in other years (Table 2). This could be related to decreased dietary CP and digestibility during Year 3 (Table 1).

The pounds of digestible OM intake required to produce a pound of gain was decreased ($P < 0.01$) with the feeding of SBM (Table 2). The effect of SBM as both an energy and protein source cannot be completely differentiated. The SBM supplied about 0.64 Mcal NE_g (National Research Council, 1984), which could supply energy toward the difference in observed average daily gain. However, with the substitution of SBM for forage and decreased OM digestibility, steers receiving SBM consumed only 0.12 Mcal/d more digestible energy (Rittenhouse et al., 1971) than those not receiving SBM (10.21 vs. 10.33 Mcal DE/d for control and SBM supplemented steers, respectively). This indicates that some of the additional gain was due to improved efficiency related to protein supplementation. Although CP in SBM has a relatively high ruminal degradability, approximately 30% of the CP in SBM would be expected to pass to the small intestine (National Research Council, 1989). This would supply some additional amino acids for intestinal absorption, which might account for the response in weight gain and feed efficiency to SBM supplementation in growing steers consuming a moderate quality forage. In a study conducted on warm-season pastures in Nebraska, Hafley et al. (1993) found that heifers receiving an energy supplement did not exhibit increased gains, while those fed a combination of ruminally degradable and undegradable protein sources increased gains by 0.29 lb/d. Extent of response could differ in warm- and cool-season grasses, however. Other researchers have found that the response to protein supplementation on moderate to high protein forages is related to the solubility of the N in the forage (Worrell et al., 1990) and to forage DM content (Phillips et al., 1995). Acid detergent insoluble N in esophageal masticate ranged from 7.8 to 15.5% of the total N, indicating that the majority of dietary N was available for release in the rumen. Positive response to escape protein supplementation was observed in calves grazing smooth bromegrass pastures in the fall that contained 13.4% CP with ADIN being 12.1% of the total N (Anderson et al., 1988).

The pounds of digestible OM per pound BW gain was 4.3 for high- and 4.6 for moderate-growth potential steers ($P > 0.10$; Table 2). Coleman and Evans (1986) found no differences in efficiency of gain between Angus and Charolais steers, and a study evaluating the efficiency of gain for steers selected for fast or slow growth rate within a single breed showed no differences in efficiency due to growth rate (Herd et al., 1991).

The cost of 82 lb of SBM ($195/ton) was $8. Steers receiving SBM gained an additional 33 lb during the grazing period. Feed cost of this gain was 24.2¢/lb, which is below current market prices for calves. Therefore, SBM supplementation at 1 lb/d to calves grazing fall pasture was cost effective, however, labor costs were not included in this estimate.

CONCLUSIONS

Using regrowth of Russian wildrye-wheatgrass pastures in the fall for growing cattle can result in weight gains over 1 lb/d, which can be increased by 0.4 lb/d through the addition of SBM. Cattle of both high and moderate genetic potential for growth benefit equally from added SBM. Forage intake estimates can be determined based upon BW, being of an equal percentage of BW for steers of high- or moderate-growth potential.

REFERENCES

Adams, D.C., R.E. Short, M.M. Borman, and M.D. MacNeil. 1991. Estimation of fecal output with an intra-ruminal continuous release marker device. J. Range Manage. 44:204–207.

Anderson, S.J., T.J. Klopfenstein, and V.A. Wilkerson. 1988. Escape protein supplementation of yearling steers grazing smooth brome pastures. J. Anim. Sci. 66:237–242.

Association of Official Analytical Chemists. 1990. Official methods of analysis. 15th ed. AOAC, Arlington, VA.

Cochran, R.C., D.C. Adams, J.D. Wallace, and M.L. Galyean. 1986. Predicting digestibility of different diets with internal markers: Evaluation of four potential markers. J. Anim. Sci. 63:1476–1483.

Coleman, S.W., and B.C. Evans. 1986. Effect of nutrition, age and size on compensatory growth in two breeds of steers. J. Anim. Sci. 63:1968–1982.

Coleman, S.W., B.C. Evans, and J.J. Guenther. 1993. Body and carcass composition of Angus and Charolais steers as affected by age and nutrition. J. Anim. Sci. 71:86–95.

Donaldson, R.S., M.A. McCann, H.E. Amos, and C.S. Hoveland. 1991. Protein and fiber digestion by steers grazing winter annuals and supplemented with ruminal escape protein. J. Anim. Sci. 69:3067–3071.

Goering, H.K., and P.J. Van Soest. 1970. Forage fiber analysis (apparatus, reagents, procedures, and some applications). USDA-ARS Agric. Handb. no. 379. Washington, DC.

Grings, E.E., R.E. Short, M.D. MacNeil, M.R. Haferkamp, and D.C. Adams. 1996. Efficiency of production in cattle of two growth potentials on Northern Great Plains rangelands during spring-summer grazing. J. Anim. Sci. 74:2317–2326.

Hach Co. 1987. Feed analysis manual. Hach Co., Ames, IA.

Haferkamp, M.R., D.C. Adams, M.M. Borman, E.E. Grings, and P.O. Currie. 1995. Yield and quality of RS-2, a quackgrass × bluebunch wheatgrass hybrid. J. Range Manage. 48:362–369.

Hafley, J.L., B.E. Anderson, and T.J. Klopfenstein. 1993. Supplementation of growing cattle grazing warm-season grass with proteins of various ruminal degradabilities. J. Anim. Sci. 71:522–529.

Herd, R.M., P.A. Speck, and P.C. Wynn. 1991. Feed requirements for maintenance and growth of one-year-old Angus steers—selected for either fast or slow yearling growth rate. Aust. J. Exp. Agric. 31:591–595.

Matejovsky, K.M., and D.W. Sanson. 1995. Intake and digestion of low-, medium-, and high-quality grass hays by lambs receiving increasing levels of corn supplementation. J. Anim. Sci. 73:2156–2163.

National Research Council. 1984. Nutrient requirements of beef cattle. 6th rev. ed. National Academy Press, Washington, DC.

National Research Council. 1989. Nutrient requirements of dairy cattle. 6th rev. ed. National Academy Press, Washington, DC.

Phillips, W.A., G.W. Horn, and M.E. Smith. 1995. Effect of protein supplementation on forage intake and nitrogen balance of lambs fed freshly harvested wheat forage. J. Anim. Sci. 73:2687–2693.

Rittenhouse, L.R., C.L. Streeter, and D.C. Clanton. 1971. Estimating digestible energy from digestible dry and organic matter in diets of grazing cattle. J. Range Manage. 24:73–75.

SAS Institute. 1989. SAS users guide: Basics. SAS Inst., Cary, NC.

Short, R.E., E.E. Grings, M.D. MacNeil, R.K. Heitschmidt, M.R. Haferkamp, and D.C. Adams. 1996. Effects of time of weaning, supplement, and sire breed of calf during the fall grazing period on cow and calf performance. J. Anim. Sci. 74:1701–1710.

Williams, C.H., D.J. David, and O. Iismaa. 1962. The determination of chromic oxide in faeces samples by atomic absorption spectrophotometry. J. Agric. Sci. 59:381–385.

Worrell, M.A., D.J. Undersander, C.E. Thompson, and W.C. Bridges, Jr. 1990. Effects of time of season and cottonseed meal and lasalocid supplementation on steers grazing rye pastures. J. Anim. Sci. 68:1151–1157.