SHORT COMMUNICATION

Growth response of pastured Simmental calves to a high by-pass protein creep supplement

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Jensen, D. O., Okine, E., Goonewardene, L. A., Erichsen-Arychuk, C. and Milligan, D. 1999. **Growth response of pastured Simmental calves to a high by-pass protein creep supplement.** Can. J. Anim. Sci. **79**: 557–560. One hundred and thirty-seven cow-calf pairs on pasture in southeastern Alberta, were randomly allocated to one of two treatments no supplement (NOS) or a high by-pass protein (70% of CP) creep supplement (HPS) at an intake of 1.5 kg head^{-1} d^{-1}. Calf weaning weights and pre-weaning ADG were higher (P < 0.01) in calves fed HPS (306.0 kg and 1.49 kg d^{-1}) compared with NOS (298.2 kg and 1.41 kg d^{-1}), respectively. However, it was uneconomical to feed this high by-pass creep as the feed cost of a kg of additional gain at weaning was $9.60.

Key words: Creep supplement, pasture, growth, beef cattle

Jensen, D. O., Okine, E., Goonewardene, L. A., Erichsen-Arychuk, C. et Milligan, D. 1999. **Efficacité d'un complément alimentaire à haute teneur en protéines non dégradables dans le rumen pour la croissance des veaux Simmental au pâturage**. Can. J. Anim. Sci. **79**: 557–560. Cent trente-sept veaux sous la mère élevés au pâturage (sud-est de l'Alberta) ont été affectés au hasard à l'un ou l'autre des traitements suivants : sans complément protéique (scp) ou avec complément à haute teneur en protéine non dégradable dans le rumen (chp 70 % de la PB) à raison de 1,5 kg par jour chacun. Le GMQ jusqu'au sevrage et le poids au sevrage étaient plus importants (P < 0,01) chez les veaux recevant le complément, soit respectivement 1,49 et 306 kg j^{-1} que chez les veaux témoins : 1,41 et 298,2 kg j^{-1}. La complémentation n'était cependant pas rentable puisqu'il en coûtait 9,60 $ en aliment par kilo de gain supplémentaire.

Mots clés: Complément alimentaire, pâturage, croissance, bovin à viande

Weaning weight and pre-weaning average daily gain of suckled beef calves depend on calves' genetic potential and on milk production of the cows (Butson et al. 1980). Thus, there have been numerous data on the modification of nutritional management to increase milk production of the cow (Marston et al. 1992). On the other hand, feeding energy and/or protein supplements in the form of creep has been shown to improve preweaning weight gains of calves (Lusby 1986; ZoBell and Goonewardene 1989). At adequate energy intake, a response in calf performance to by-pass protein may be expected considering increased demand for undegradable protein (by-pass) with high rates of growth (National Research Council [NRC] 1996). Indeed, there is a positive relationship between level of by-pass protein and weight gain (Dhuyvetter et al. 1993). Feeding creep may be justified when the quality of pasture is poor or inadequate and does not supply the necessary nutrition for the cow and calf. However, decisions to creep feed rest not only on the weight gains to be made by calves but also on the economics of the gains. For creep feeding to be cost effective, the cost of the supplemental feed should be recovered by the price paid for weaned calves. As such, the cost of a kilogram of additional gain becomes an important consideration in the decision to use a supplement. The present study evaluated the pre-weaning growth and the feed cost in gain of Simmental calves fed a high by-pass protein supplement on pasture in the southeastern part of Alberta.

All animals used in the study were cared for according to the Canadian Council on Animal Care guidelines. The study was conducted in southeastern Alberta, which experiences low rainfall (<400 mm yr^{-1}), which in turn can adversely affect pasture production. A group of 137 Simmental calves (147.3 ± 30.4 (SD) kg and 84 ± 23 (SD) d) were randomly allocated by sex and weight to one of two supplement creep feeding treatments, no creep supplement (NOS, n = 68) and a high bypass protein creep supplement (HPS, n = 69). The supplement was fed free-choice in a creep feeder on pasture. The supplement contained on a DM basis 23.0% CP (by-

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Abbreviations: **ADF,** acid detergent fibre; **ADG,** average daily gain; **CP**, crude protein; **CWG**, crested wheat grass; **DE**, digestible energy; **DM**, dry matter; **HPS**, high protein supplement; **NAT**, native pasture; **NDF,** neutral detergent fibre; **NOS**, no supplement

Table 1. Nutrient analysis, dry matter basis, of Crested wheat grass and native grass during the period of study

	Crested wheat grass[z]					Native grass[y]				
Variable	CP (%)	ADF (%)	DE (Mcal kg^{-1})	Ca (%)	P (%)	CP (%)	ADF (%)	DE (Mcal kg^{-1})	Ca (%)	P (%)
No-supplement	13.1	33.2	2.88	0.52	0.13	8.1	38.0	2.54	0.42	0.12
Supplement	13.9	32.6	2.89	0.69	0.16	6.7	41.9	2.28	0.40	0.11
SEM[x]	0.95	0.81	0.05	0.10	0.01	0.56	1.63	0.07	0.02	0.01
P	NS	NS	NS	NS	<0.05	NS	<0.05	<0.05	NS	NS
	May					July				
	15.8*a*	32.1*a*	2.92*a*	0.55	0.16*a*	7.5	38.6	2.50	0.41	0.11
	June					August				
	15.7*a*	30.8*a*	3.02*a*	0.77	0.18*a*	7.2	40.3	2.39	0.40	0.11
	July					September				
	8.9*b*	35.8*b*	2.71*b*	0.49	0.11*b*	7.5	40.9	2.34	0.41	0.11
SEM	1.32	0.93	0.06	0.12	0.01	0.70	1.26	0.08	0.03	0.01
P	<0.01	<0.01	<0.01	NS	<0.01	NS	NS	NS	NS	NS

[z]Cattle grazed CWG in May, June and July.
[y]Cattle grazed NAT in July, August and September.
[x]Standard error of the mean.
*a,b*Means in the same column with different letters are significant ($P < 0.05$).

pass protein as a percentage of CP = 70%), 6.6% fat, 38.9% NDF, 23.5% ADF, 3.14 Mcal kg^{-1} DE, 1.84% Ca, 0.81% P, 1.34% K, 0.43% Mg, 0.21% Na and trace minerals. The cow calf pairs of each treatment group were grazed on the same crested wheat grass (CWG) pasture but were separated by fences for the first 65 d of the study (May, June and July). They were then reweighed and moved to the same native (NAT) pastures but also separated by fences for the months of July, August and September where they remained till they were weaned. Calf weaning weights were recorded on day 106 of the study. Days on pasture for the cow-calf pairs were based on availability of pasture DM. Thus, cattle were removed from the pastures when pasture availability was less than 700 kg pasture DM ha^{-1}. Average daily gains were calculated according to total weight gain and days on each pasture and over the total period of grazing.

The pastures on which the HPS and NOS cattle grazed were sampled every 2 wk from 24 May to 30 September. Three 0.25 m^2 sites were randomly selected in each pasture at each sampling time. The CWG was sampled once in May, twice in June and July whereas, NAT was sampled once in July and twice in August and September. The pasture samples were oven-dried at 50°C for 48 h and corrected for DM by drying at 105°C. Samples were the ground in a Wiley mill to pass a 1.0-mm screen. Crude protein, Ca and P were measured colorimetrically with a Technicon Auto Analyzer II method, in which samples had been prepared using the Kjeldahl digestion method (Association of Official Analytical Chemists 1990; methods 7.022) and ADF was determined by the method of Van Soest et al. (1991). Digestible energy was estimated according to equations by Mathison et al. (1982).

The weaning weight and pre-weaning ADG data were analyzed by the General Linear Model (GLM) of the SAS Institute, Inc. (1985) with supplement treatment, sex and interaction of supplement treatment and sex as main effects, and start weight, calf age and age of the cow included as covariates. The two grasses, CWG and NAT were analyzed separately by the GLM procedure of SAS. The dependent variables were CP, ADF, DE, Ca and P and the main effects included were treatment, month and treatment times month as interaction.

The CP, ADF, DE and Ca levels in the CWG grazed by NOS and HPS calves were similar ($P > 0.05$) during the first 65 d of the study (Table 1). However, the ADF level was lower and DE was higher ($P < 0.05$) in the NAT pastures grazed by NOS cows and calves compared with the NAT pasture grazed by the HPS cows and calves. Furthermore, there was a trend ($P = 0.07$) to suggest that the CP% was higher in NAT pastures grazed by the NOS cattle. Okine et al. (1996) showed that cattle can selectively graze and that there are in situ differences in degradabilities of forages selected and not selected by grazing cattle. Indeed, the quality of CWG as determined by CP content decreased during the month of July (8.9% CP, DM basis) compared with that in May and June (15.7 to 15.8% CP, DM basis), while the quality of the NAT grass remained low and constant from July to September (7.2 to 7.5% CP, DM basis). The ADF and DE values of the NAT pasture remained uniform from July to September.

Least square means for pre-weaning weights and pre-weaning ADG by supplement treatment and sex are shown in Table 2. Calves on the HPS were 3.8% heavier at 65 d ($P < 0.01$) and 2.6% heavier ($P < 0.05$) at weaning compared with NOS. Overall, the ADG was only 5.7% higher ($P < 0.01$) in the HPS calves compared with NOS calves. However, the ADG between the start and 65 d was 9.5% higher ($P < 0.01$) in HPS compared with NOS calves. The improved pre-weaning ADG, and higher weaning weight in supplement-fed calves in our study are similar to other results in the literature (ZoBell and Goonewardene 1989; Bailey et al. 1991; Faulkner et al. 1993). However, there was no difference ($P > 0.05$) in ADG between HPS and NOS calves when they grazed the native pasture probably due to inadequate energy intake. At adequate energy intake a response in calf performance to by-pass protein may be

Table 2. Changes in body weight and average daily gain of male and female Simmental calves fed high bypass protein supplement

	Body weight (kg)			Average daily gain (kg d^{-1})		
Effect	Day 0 start	Day 65	Day 106 weaning	Day 0–day 65d	Day 66–day 106	Overall
No supplement[z]	148.4	244.0	298.2	1.47	1.31	1.41
Supplement[y]	148.6	253.3	306.0	1.61	1.30	1.49
SEM	2.1	1.5	1.8	0.02	0.03	0.02
P	NS	<0.01	<0.05	<0.01	NS	<0.01
Male[x]	153.9	252.9	307.9	1.60	1.34	1.51
Female[w]	143.1	244.6	296.3	1.47	1.27	1.40
SEM[v]	2.0	1.4	1.7	0.02	0.03	0.02
P	<0.01	<0.01	<0.01	<0.01	NS	<0.01

[z] $n = 67$.
[y] $n = 69$.
[x] $n = 62$.
[w] $n = 74$.
[v] Standard error of the mean.

expected considering increased demand for undegradable protein with high rates of growth (NRC 1996). Thus, it is important to ensure that energy intakes are adequate to justify feeding high bypass protein supplements. Male calves had heavier ($P < 0.01$) weaning weights and overall higher ADG ($P < 0.01$) compared with female calves (Martin et al. 1981; ZoBell and Goonewardene 1989). The interaction between supplement and sex was not significant ($P > 0.05$) for any trait.

The actual total intake of creep feed for all calves during the 106-d period was 11 260 kg or 163.2 kg head^{-1}. The cost of creep feed was \$0.46 kg^{-1} (\$ 460.00 t^{-1}). Thus, the cost of creep feed per calf was \$75.07. The supplement fed calves were 7.8 kg heavier than calves receiving no creep at weaning (Table 2). Thus, the cost of additional gain at weaning was 75.07/7.8 = \$9.60 kg^{-1}. The weaned Simmental calves were sold at \$2.60 kg^{-1}; the 7.8 kg advantage at weaning being equivalent to \$20.28. However, it cost \$75.07 to achieve this weight gain. In a study in which a canola–soybean creep was fed to Charolais calves (ZoBell and Goonewardene 1989) the feed cost during the feeding period of 121 d was \$9.29 head^{-1}, at an intake of 0.25 kg head^{-1} d^{-1}. The creep-fed calves gained 20.6 kg more than the calves not fed creep and at a market value of \$2.20 kg^{-1} the advantage was \$45.32, reflecting a net gain of \$36.03 per head. Differences in weaning weights of calves in the present study compared to results of ZoBell and Goonewardene (1989) could be due to breed type, milking ability of the cows, type of protein supplement, length of the feeding period, level of intake among other factors. In another study in which the price of protein supplement was \$0.40 kg^{-1} and the creep fed calves gained an extra 8.7 kg at the end of the test, the cost of the supplement was \$18.560 and the revenue by the sale of calves was \$19.14 head^{-1}, there was no economic advantage in feeding supplement (ZoBell and Goonewardene 1989). In studies conducted in Oklahoma (Lusby et al. 1985; Lusby 1986) there was a need to limit the intake of creep to a maximum of 485 g d^{-1} in order to derive any potential economic advantage.

The profitability of supplement feeding appears to depend on matching the nutrient content of the creep to overcome the nutrient limitation of the pasture. It also is influenced by the cost of creep, level of intake, weight differential of creep fed calves, price paid for calves, milk production of the cows and pasture conditions. As the price paid for calves and the dams' milk production are difficult to control, the profitability of feeding creep becomes a function of the cost of supplement, intake and the weight advantage of creep fed calves. Our results and data by ZoBell and Goonewardene (1989) indicate that in the south and southeastern parts of Alberta economic benefit of feeding a nutritionally balanced creep feed is feasible when the cost of supplement is below \$0.20 kg^{-1}, the intake is limited to about 0.25 kg head^{-1} d^{-1} and the weight gain advantage at weaning is \$20 kg.

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