J. Range Manage.
52:113–119 March 1999

Economics of maintaining cow condition on fescue prairie in winter

BRIAN S. FREEZE, WALTER D. WILLMS, AND LYLE RODE

Authors are bioeconomist, rangeland ecologist, and animal nutritionist, respectively, Lethbridge Research Centre, Agriculture and Agri-Food Canada, PO Box 3000, Lethbridge, Alberta, Canada, T1J4B1.

Abstract

Lifetime productivity of fescue grasslands (*Festuca scabrella* var. *campestris* Rydb.) is enhanced by fall and winter grazing as opposed to summer grazing. However, forage quality is below the maintenance requirements of cattle and weathering losses will reduce available forage. Cows tend to lose weight and backfat prior to calving if their only feed source through fall and winter is native grassland. Maintaining adequate cow condition for spring calving is important to prevent long term losses associated with reduced calf birth weights, lower cow fertility and reduced cow longevity. Cow condition can be improved by having cows graze annual forage in the fall or by supplementing the cows with grain screenings. Alternatively, cows can be fed in a feedlot prior to calving to restore body condition lost in grazing native grassland in the fall and winter. Results from a 3-year experiment showed that winter wheat pasture grazed in the fall, supplemented with grain screenings was generally the least expensive alternative (ranging from \$70 cow^{-1} at low barley prices approaching \$0.052 kg^{-1}, to \$97 cow^{-1} at high barley prices approaching \$0.175 kg^{-1}) for maintaining cow condition prior to calving. Restoring cow condition in a feedlot prior to calving was less expensive than provision of fall annual pasture when grain prices were low (barley price below \$0.14 kg^{-1}).

Key Words: winter grazing, beef cows, *Festuca scabrella* var. *campetris*

Resumen

La productividad de la vida de las pasturas con festuca (F*estuca scabrella* var. *campestris* Rydb.) se mejora con el pastoreo de otoño y de invierno contrariamente al pastoreo de verano. Sin embargo, la calidad del forraje est· por debajo de los requerimientos de manutención del ganado y las pérdidas debido a la exposición a la intemperie reducirán el forraje disponible. Las vacas tienden a perder peso y grasa del dorso antes de la parición si la única fuente de alimentación durante el otoño y el invierno son los pastos naturales. Es importante mantener a las vacas en adecuado estado para la parición de primavera para prevenir las pérdidas a largo plazo relacionadas con el bajo peso de los terneros al nacer, el bajo índice de fertilidad de las vacas y el acortamiento de la longevidad de las vacas. El estado de las vacas puede ser mejorado haciendo que éstas pasteen en forrajes anuales en el otoño o suplementando a las vacas con granzas ("screenings"). Alternativamente, las vacas pueden ser alimentadas en un feedlot antes de la parición para recuperar el estado perdido durante el pastoreo en pasturas naturales durante el otoño y el invierno. Resultados de un ensayo de tres años de duración demostró que el pastoreo del trigo de invierno durante el otoño y suplementado con granzas de granos, fue generalmente la alternativa más económica (yendo desde \$70 vaca^{-1}, cuando el precio de la cebada era alto y llegaba a 0.051 \$ kg^{-1}, hasta \$97 vaca^{-1}, cuando el precio de la cebada era alto y llegaba a 0.175 \$ kg^{-1}) para mantener la condición de las vacas antes de la parición. El costo para recuperar el estado de la vaca antes de la parición en un feedlot fue más económico que la alimentación en pasturas anuales en el otoño, cuando el precio del grano era bajo (si el precio de la cebada es menor de \$0.14 kg^{-1}).

The fescue grassland prairie extends from the southern mixed prairie of the North American Great Plains to the northern forests. The grassland prairie likely developed from winter grazing of buffalo and occasional fires that kept trees from invading and is dominated by rough fescue (*Festuca scabrella* var. *campestris* Rydb) a deep-rooted tufted species with high production potential and relatively good forage quality when dormant. Despite the evolution of fescue grasslands under a winter grazing system, they are largely managed for cattle using a system of continuous summer grazing (Willms et al. 1986). Fescue plants are more easily damaged during the summer growing season and at higher stocking rates are replaced by less productive species such as Parry oat grass (*Danthonia parryi* Scribn.) (Willms et al. 1985). If alternative summer pasture is available, such as crested wheatgrass [*Agropyron cristatum* (L.) Gaertn. and *A. desertorum* (Fisch.) Schult.], winter grazing of the native fescue grasslands helps protect the fescue prairie and may reduce the cost of feeding preserved forages.

Although dormant fescue better tolerates winter grazing, the senesced forage is unable to meet cow maintenance requirements (NRC 1984). Johnston and Bezeau (1962) reported a decline in the crude protein concentration in rough fescue from 17% at the leaf stage in summer to

The assistance of economics technician Mr. Jose Barbieri in compiling and summarizing the experimental data is acknowledged with thanks.

Manuscipt accepted 4 July 1998.

about 5% at the cured stage in autumn, with a corresponding moderate increase of crude fiber from about 30 to 33%. Cows may lose weight and backfat especially during severe winter conditions (Kartchner 1981).

Research at the Lethbridge Research Centre suggests that 5 to 6 mm of backfat is optimum for wintering cows. Cows below that level by calving time may wean lighter calves (due to decreased milk production), may have re-breeding problems and may experience a lower lifetime productivity. The assumption is that the net present value of such productivity losses may be greater than the cost of maintaining the cows at an optimum body condition of at least 5 mm of backfat, which is comparable to a U.S. body condition score of about 5 to 6 out of 9. Support for this assumption comes from several studies. Wikse et al. (1995) estimated an improvement in net revenue ranging from $64 to $91 cow^{-1} from re-conditioning of thin cows with body condition scores of 3 to 4, to a body condition score of 5.5 by the time of parturition, and determined that a reduced pregnancy rate was responsible for the largest proportion of the production losses of thin cows. Spitzer et al. (1995) reported that greater body condition score at calving resulted in significantly more cows in estrus and more cows pregnant at 40 to 60 days into a breeding season. Marston et al. (1994) concluded that feeding greater amounts of supplemental energy before calving increased cow body weight gains, body conditions scores, and pregnancy rates. Given these recent studies, it is generally recognized that severe restrictions in feed requirements prior to calving will affect long term performance and productivity.

Thus, although the need exists for more definitive longer term studies on the economics of winter feed requirements of cows, the assumption is made in this study that the economics favor maintenance of good cow condition (as measured by achievement of 5 mm of backfat) prior to calving. The question then becomes how to most economically achieve that goal. Alternatives include providing protein and/or energy supplements during fall and winter grazing of fescue grasslands, or feeding of grain in a feedlot for about a month prior to calving to restore body condition to the optimum 5 mm of backfat.

The provision of annual forages for fall grazing, in addition to fall and winter grazing of fescue grasslands, may help maintain cows in optimum condition prior to calving. Annual standing forages have the potential for providing high losses and reduced forage palatability. Snow cover will further reduce availability. Tall annuals, such as corn (*Zea mays* L.), may overcome the problems associated with snow and weathering because of their high stem-to-leaf ratio. Although the leaves weather rapidly, the stems are resistant and provide the bulk of dry matter for late season grazing (Gutierrez-Ornelas and Klopfenstein l991). Corn stems in winter tend to be more digestible and have a higher crude protein (CP) than leaves, but dry matter digestibility may be only 40% and CP only 5% (Gutierrez-Ornelas and Klopfenstein 1991). In a preliminary 3-week trial made in late fall at Stavely, Alberta, cows on corn with immature cob development averaged 3.5 mm back-fat and gained 1.18 kg animal-unit day^{-1} (AUD^{-1}) while cows on native range averaged 2.8 mm back-fat and lost 0.07 kg AUD^{-1} (Willms et al. 1993). This evidence suggested that providing supplemental annual forage to cattle prior to winter grazing may be a feasible approach to keeping cattle on fescue prairie while ensuring adequate condition for calving and re-breeding in spring. While extending the grazing season with annual forages may be less costly than feeding preserved forages (hay or silage), the efficiency and economics of this approach is not clear.

The objective of this study was to compare the economics of alternatives designed to overcome the limitation associated with winter grazing of native fescue grasslands; that is, the depletion of cow condition (as measured by backfat) prior to spring calving. The alternatives included provision of annual forages in the fall, supplemental feeding of grain screenings in the fall, and grain feeding in a feedlot one month prior to calving. Results of a 4-year grazing experiment conducted near Stavely, Alberta from 1988 to 1992 are analyzed.

Materials and Methods

Grazing Experiments

Details of the grazing experiment are given in Willms et al. (1993). The

Table 1. Treatment-time period combinations from Experiment 1

Combination[a]	Description
N1-N2-N3-N4-N5	Cows pastured on native fescue from mid-June to end of March
N1-N2-N3-F4-N5	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March
N1-W2-C3-N4-N5	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on corn until the end of November, then pastured on native fescue pasture until the end of March
N1-W2-S3-N4-N5	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screen ings until the end of November, then pastured on native fescue pas ture until the end of March

a/ N- native fescue prairie,
F- dry lot feeding,
W- winter wheat pasture,
C- corn pasture,
S- supplementation with grain screenings while grazing native fescue pasture
1- mid June to beginning of October,
2- beginning of October to the end of October,
3- end of October to the end of November,
4- end of November to the end of February,
5- end of February to end of March.

experiment, conducted from 1988 to 1992, utilized a 2 × 2 factorial design representing alternative fall grazing treatments of grazing native fescue prairie only, or grazing native fescue prairie with supplemental annual forage grazing using winter wheat pasture and corn. Alternative treatments from December to the end of February included grazing of native fescue prairie or dry lot feeding of cows to restore body condition. In 1989 another treatment was added of supplementing the cows with grain screenings in addition to grazing of native fescue prairie. Cattle weights and backfats were recorded at the beginning and end of the following periods (which varied slightly in timing from year-to-year):

1. mid June to beginning of October,
2. beginning of October to the end of October,
3. end of October to the end of November,
4. end of November to the end of February,
5. end of February to end of March.

The 4 resultant treatment and time period combinations are described in Table 1.

Economic Analysis

The economic analysis involved a determination of the cost of supplementing grazing of native fescue prairie with either annual forage (winter wheat or standing corn), or grain screenings versus the alternative of grazing native rough fescue grasslands followed by feedlot feeding of cows prior to calving to restore body condition. Either strategy brought the cows to an optimum body condition of near 5 mm of backfat by the end of February, just prior to calving. Sensitivity analysis was conducted for 3 levels of feedlot diet cost (low, medium, and high barley price) and for 2 levels of winter pasture rental rate ($ AUM^{-1}) (Table 2). Winter pasture rental rates are typically set at 1/2 the summer rates (Alberta Agriculture, Food and Rural Development 1995a). Grain screenings were priced at a discount of $0.015 kg^{-1} to the price of barley grain. Other cost variables, that change relatively less over time, were based on 1995 prices and production coefficients as listed in Table 3.

Pasture and feed intakes (per cow per grazing period or feeding period) were estimated using an equation developed at the Lethbridge Research Centre that uses cow weight and backfat to predict the amount of digestible energy intake required to maintain or restore weight and body condition of pregnant cows as defined as a minimum of 5 mm of backfat. The equation data were developed from 2 experiments conducted from 1981 to 1983 to compare barley grain and alfalfa cubes with regard to the digestible energy (DE) intake required to maintain animal weight and body condition of pregnant beef cows. Forty pregnant Hereford cows were housed individually and fed either alfalfa cubes or an all-concentrate diet. Level of feed provided was based on body weight according to NRC (1976) and adjusted biweekly according to body condition (measured by ultrasonic backfat). Feed intake was increased by 50% if backfat was 1 m or less, 30% if backfat was 1.1 to 3 mm, 20% if backfat was 3.1 to 4.9 mm and reduced by 10% if backfat was greater than 10 mm. From regression analysis on the 2 years of data, the following equation was developed to calculate the digestible energy requirement for pregnant beef cows based on body weight and condition:

$$DE = (0.1375\ BW^{0.75} + 7.5\ ADG) \times (-0.5624 \log FAT + 1.4307) \quad \textbf{(1)}$$

where,

DE = digestible energy required (mcal/day)
BW = body weight of the cow (kg)
ADG = desired average daily gain (kg / day)
FAT = ultrasonic backfat level (mm)

Table 3. Prices (1995) and production coefficients used to budget conditioning alternatives.

Cost of Production Coefficient	Value
Summer pasture rental rate ($ AUM^{-1})	$13.60[a]
Yardage charge ($ day^{-1} cow^{-1})	$0.15[b]
Cost of winter wheat establishment ($ ha^{-1})	$270.91
Cost of corn pasture establishment ($ ha^{-1})	$340.51
Dry matter of native pasture in fall and winter	1.00
Dry matter of feedlot diet	0.90
Dry matter of winter wheat pasture	0.66
Dry matter of corn pasture	0.44
Dry matter of grain screenings	0.90
Dry matter of canola meal supplement	0.94
Digestible energy of native fescue June to Oct (Mcal kgDM^{-1})	2.11
Digestible energy of native fescue Nov (Mcal kgDM^{-1})	2.02
Digestible energy of native fescue Dec to March (Mcal kgDM^{-1})	1.98
Digestible energy of winter wheat pasture (Mcal kgDM^{-1})	3.00
Digestible energy of feedlot diet (Mcal kgDM^{-1})	3.40
Digestible energy of corn pasture (Mcal kgDM^{-1})	3.26
Digestible energy of grain screenings (Mcal kgDM^{-1})	1.84
Digestible energy of canola meal supplement (Mcal kgDM^{-1})	2.49
Native fescue pasture yield (tonnes ha^{-1})	1.06
Corn pasture yield (tonnes ha^{-1})	2.60
Winter wheat pasture yield (tonnes ha^{-1})	1.83

[a]Alberta Agriculture, Food & Rural Development. 1995a. Custom Rate Survey-Crop and Pasture Land, Lease and Rental Interim Report, p. 16.
[b]Alberta Agriculture, Food & Rural Development. 1995b.Custom Rate Survey-Livestock Operations Report.

Table 2. Sensitivity Analysis Variables and Levels

Price Variables	Low Value	Medium Value	High Value
Feedlot diet cost ($ kg^{-1})[a]	$0.051	$0.113	$0.175
Winter pasture rental rate ($ AUM^{-1})[b]	$6.80	none	$13.60

[a]Agriculture and Agri-Food Canada. Feed Grain Facts, various years 1986-1996, Livestock Feed Bureau, Policy Branch, Montreal, Quebec.
[b]Alberta Agriculture, Food & Rural Development. 1995a. Custom Rate Survey-Crop and Pasture Land, Lease and Rental Interim Report, p. 16.

Table 4. Costs per period per cow and average backfat (mm) for treatments in Experiment for Winter Pasture Rental Rate of $6.80 AUM^{-1}.

Treatments[a]	I - All Native		II - Feedlot		III - Annual Forage		IV - Grain Supplement	
Period	Stage	Cost	Stage	Cost	Stage	Cost	Stage	Cost
Mid Jun–Beg Oct	N1	$41.75	N1	$41.75	N1	$41.75	N1	$32.83
Beg Oct–End Oct	N2	$3.94	N2	$3.94	W2	$36.88	W2	$14.66
End Oct–End Nov	N3	$2.52	N3	$2.52	C3	$52.25	S3	$7.52[b]
								$9.57[c]
								$11.61[d]
End Nov–End Feb	N4	$12.80	F4	$44.47[b]	N4	$13.57	N4	$10.95
				$80.68[c]				
				$116.89[d]				
End Feb–End Mar	N5	$5.05	N5	$5.39	N5	$5.00	N5	$4.69
Total Costs at End Mar		$66.07		$98.07[b]		$149.45		$70.65[b]
				$134.29[c]				$72.70[c]
				$170.50[d]				$74.74[d]
Backfat (mm) at end Feb		3.60		4.65		4.62		6.40

[a]N-native fescue prairie,
F-dry lot feeding,
W-winter wheat pasture,
C-corn pasture,
S-supplementation with grain screenings while grazing native fescue pasture
1-mid June to beginning of October,
2-beginning of October to the end of October,
3-end of October to the end of November,
4-end of November to the end of February,
5-end of February to end of March.
[b]Feedlot diet cost at $0.051 kg^{-1}
[c]Feedlot diet cost at $0.113 kg^{-1}
[d]Feedlot diet cost at $0.175 kg^{-1}

The equation has been used at the Lethbridge Research Centre to calculate feed requirements for group-fed cows such that body condition is maintained at the 5 mm of backfat level, and predicts DE requirements at about 75% of NRC (1984).

For the grazing alternatives, the estimated feed intakes per period were divided by the digestible energy content of the pasture to determine the amount of land required to supply that period intake, assuming a stocking rate of 2.4 AUMs ha^{-1} on native range. For annual forages, the land require-

Table 5. Costs per period per cow and average backfat (mm) for treatments in Experiment for Winter Pasture Rental Rate of $13.60 AUM^{-1}.

Treatments[a]	I - All Native		II - Feedlot		III - Annual Forage		IV - Grain Supplement	
Period	Stage	Cost	Stage	Cost	Stage	Cost	Stage	Cost
Mid Jun - Beg Oct	N1	$41.75	N1	$41.75	N1	$41.75	N1	$32.83
Beg Oct - End Oct	N2	$7.87	N2	$7.87	W2	$36.88	W2	$14.66
End Oct - End Nov	N3	$5.05	N3	$5.05	C3	$52.25	S3	$13.85[b]
								$15.90[c]
								$17.94[d]
End Nov - End Feb	N4	$25.61	F4	$44.47[b]	N4	$27.15	N4	$21.90
				$80.68[c]				
				$116.89[d]				
End Feb - End Mar	N5	$10.10	N5	$10.79	N5	$10.01	N5	$9.38
Total Costs at End Mar		$90.38		$109.93[b]		$168.03		$92.62[b]
				$146.14[c]				$94.67[c]
				$182.35[d]				$96.71[d]
Backfat (mm) at end Feb		3.60		4.65		4.62		6.40

[a] N- native fescue prairie,
F- dry lot feeding,
W- winter wheat pasture,
C- corn pasture,
S- supplementation with grain screenings while grazing native fescue pasture
1- mid June to beginning of October,
2- beginning of October to the end of October,
3- end of October to the end of November,
4- end of November to the end of February,
5- end of February to end of March.
[b] Feedlot diet cost at $0.051 kg^{-1}
[c]Feedlot diet cost at $0.113 kg^{-1}
[d]Feedlot diet cost at $0.175 kg^{-1}

Table 6. Costs differences of conditioning alternatives from all native grazing for the Low Winter Pasture Rental Rate of $6.80 AUM^{-1}.

Combination	Description	Total Mean Cost	Cost Differential from all Native Fescue Grazing
N1-N2-N3-N4-N5	Cows pastured on native fescue from mid-June to end of March for years 1988–1992	$66.07	
N1-W2-C3-N4-N5	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on corn until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$149.45	$83.38
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.051 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$98.07	$32.00
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.113 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$134.29	$68.22
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.175 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$170.50	$104.43
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.051 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$70.65	$4.58
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.113 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$72.70	$6.63
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.175 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$74.74	$8.67

ment was multiplied by the establishment costs to determine the period costs per cow. For native fescue range, the land requirement in AUM's was multiplied by the pasture charge to determine the period cost per cow. Native range was assumed to deteriorate in quality into the winter, having an energy content of 2.112 mcal kg^{-1} DM from mid-June to the end of October; 2.024 mcal kg^{-1} DM during November and 1.98 mcal kg^{-1} DM to the end of February.

Results

Costs per period per cow and average backfat (mm) at the end of February for each of the conditioning alternatives and levels of the sensitivity variables are presented in Tables 4 and 5. Regardless of the pasture rental rate, the results show that as feedlot diet cost ranges from $0.051 kg^{-1} to $0.175 kg^{-1} that total costs for the feedlot and grain screenings supplement treatments increase, respectively, $72.43 cow^{-1} and $4.09 cow^{-1} (Tables 4 and 5). The grain screening supplement treatment increases because grain screenings are priced at a discount of $0.015 kg^{-1} to the price of barley. The increase is much less than that of the feedlot treatment since grain screenings are relatively only a minor proportion of the treatment nutrition.

Costs of maintaining or restoring cows to optimum backfat and body condition prior to calving were calculated as the difference in the cost per cow of a conditioning alternative (supplementation with annual forage, or with grain screenings), and the cost per cow of grazing solely on native fescue grassland. For example, the differential cost of feedlot conditioning from the end of November to the end of February was calculated as the total cost of feedlot feeding and grazing of native fescue prairie ($98.07) minus the total cost of grazing only native fescue prairie ($66.07) equals $32 (Table 6). Differential conditioning costs are displayed in Tables 6 and 7. At the low pasture rental rate of $6.80 AUM^{-1}, the fall annual pasture conditioning alternative had a differential cost over native range grazing of $83.38 cow^{-1}, while the feedlot conditioning alternative differential cost ranged from $32.00 to $104.43 cow^{-1}, as feedlot diet cost was increased from $0.051 kg^{-1} to $0.175 kg^{-1} (Table 6). At a feedlot diet cost of $0.14 kg^{-1}, the differential costs for the feedlot and fall pasture conditioning alternatives, for the low pasture rental rate, were equal at $83.38 cow^{-1}. Differential costs for the grain screenings conditioning alternative ranged from $4.58 cow^{-1} to $8.67 cow^{-1} for the low winter pasture rate (Table 6). At the high pasture rental rate of $13.60 AUM^{-1}, the fall annual pasture conditioning alternative had a differential cost over native range grazing of $77.65 cow^{-1}, while the feedlot conditioning alternative differential cost ranged from

Table 7. Costs differences of conditioning alternatives from all native grazing for the Low Winter Pasture Rental Rate of $13.60 AUM^{-1}.

Combination	Description	Total Mean Cost	Cost Differential from all Native Fescue Grazing
N1-N2-N3-N4-N5	Cows pastured on native fescue from mid-June to end of March for years 1988–1992	$90.38	
N1-W2-C3-N4-N5	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on corn until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$168.03	$77.65
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.051 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$109.93	$19.55
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.113 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$146.14	$55.76
N1-N2-N3-F4-N5 Feedlot Diet cost of $0.175 kg^{-1}	Cows pastured on native fescue from mid-June to end of November, then fed in a feedlot to end of February and then pastured on native fescue to end of March for years 1988–1992	$182.35	$91.97
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.051 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$92.62	$2.24
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.113 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$94.67	$4.29
N1-W2-S3-N4-N5 Feedlot Diet cost of $0.175 kg^{-1}	Cows pastured on native fescue from mid-June to the beginning of October, then pastured on winter wheat until the end of October, then pastured on native fescue and supplemented with grain screenings until the end of November, then pastured on native fescue pasture until the end of March for years 1988–1992	$96.71	$6.33

$19.55 to $91.97 cow^{-1}, as feedlot diet cost was increased from $0.051 kg^{-1} to $0.175 kg^{-1} (Table 7). At a feedlot diet cost of $0.151 kg^{-1}, the differential costs for the feedlot and fall pasture conditioning alternatives, for the low pasture rental rate, were equal at $77.65 cow^{-1}. Differential costs for the grain screenings conditioning alternative ranged from $2.24 cow^{-1} to $6.33 cow^{-1} for the low winter pasture rate (Table 7).

Discussion

Across all feed cost and pasture rental scenarios, grazing cows on native fescue grassland throughout the mid-June to end of March period is the least expensive short run production strategy for a rancher at a cost of $66 cow^{-1}, at a pasture rental rate of $6.80 kg^{-1} (Table 4) and $90 at a pasture rental rate of $13.60 kg^{-1} (Table 5). However, this strategy leaves cows in less than ideal body condition with backfat below 5 mm, i.e., 3.6 mm (Tables 4 and 5) and thus susceptible to long run economic losses due to lower calf weaning weights, re-breeding losses, and reduced cow longevity. All of the other conditioning alternatives appeared to leave cows at the end of February with backfat scores close to or exceeding 5 mm (Tables 4 and 5). Maintaining cow condition by supplementation with grain screenings was generally the least expensive conditioning alternative with a differential cost ranging from $4.58 cow^{-1} to $8.67 cow^{-1} for the low winter pasture rate (Table 6) and ranging from $2.24 cow^{-1} to $6.33 cow^{-1} for the high winter pasture rate (Table 7). Maintaining cow condition using fall winter wheat pasture followed by fall corn pasture to supplement native fescue range grazing was the next least expensive alternative when feedlot diet costs were above $0.14 kg^{-1} for the low winter pasture rental rate (Table 6) and above $0.151 kg^{-1} for the high winter pasture rental rate (Table 7). When feedlot diet costs are low and below these same levels, restoring cow condition in a feedlot prior to calving is less expensive than provision of fall annual pasture (Tables 6 and 7).

In the future, multiple year, long term grazing experiments need to be designed to test the assumption that maintaining cows in optimum body condition before calving will reduce weaning weight losses, reduce rebreeding and fertility losses and enhance cow longevity. If the net present value of the costs associated with weight losses, re-breeding losses and fertility losses are less than the additional costs associated with maintaining cows at, or restoring cows to, optimum body condition prior to calving, it may be more economical for the rancher to winter pregnant cows strictly on native fescue range.

The examination of winter versus summer grazing regimes for use of fescue grasslands is not explored in

this study and needs further economic analysis. Winter grazing promises less damage to the fescue community, greater long term sustainability of that community, and a reduction in the need for winter hay supplies. However, these benefits would have to be weighed against the cost of supplying alternative summer pasture.

Literature Cited

Agriculture and Agri-Food Canada. Feed Grain Facts, various issues 1987 to 1996, Livestock Feed Bureau, Policy Branch, Agr. and Agri-Food Canada, Montreal, Quebec.

Alberta Agriculture, Food and Rural Development. 1995a. Custom Rates Survey - Crop and Pasture Land Lease and Rental Interim Report 1995. Market Analysis and Statistic Branch, Edmonton, Alberta.

Alberta Agriculture, Food and Rural Development. 1995b. Custom Rates Survey-Livestock Operations Report 1995. Market Analysis and Statistic Branch, Edmonton, Alberta.

Gutierrez-Ornelas, E. and T.J. Klopfenstein. l991. Changes in availability and nutritive value of different corn residue parts as affected by early and late grazing seasons. J. Anim. Sci. 69:1741–1750.

Johnston, A. and L.M. Bezeau. 1962. Chemical composition of range forage plants of the *Festuca scabrella* association. Can. J. Plant Sci. 42:105–115.

Kartchner, R.J. 1981. Effects of protein and energy supplementation of cows grazing native winter range forage on intake and digestibility. J. Anim. Sci. 51:432–438.

Marston, T.T., K.S. Lusby, R.P. Wettemann, and H.T. Purvis. 1994. Effects of feeding energy or protein supplements before or after calving on performance of spring-calving cows grazing native range. J. Anim. Sci. 73:657–664.

National Research Council. 1976. Nutrient requirements of domestic animals. Nutrient requirements of beef cattle. 5th ed. Nat. Acad. of Sci., Nat. Res. Council, Washington, D.C.

National Research Council. 1984. Nutrient requirements of domestic animals. Nutrient requirements of beef cattle. 6th ed. Nat. Acad. of Sci., Nat. Res. Council, Washington, D.C.

Spitzer, J.C., D.G. Morrison, R.P. Wettemann, and L.C. Faulkner. 1995. Reproductive responses and calf birth and weaning weights as affected by body condition at parturition and postpartum weight gain in primiparous beef cows. J. Anim. Sci. 73: 1251–1257.

Willms, W.D., S. Smoliak, and J.F. Dormaar. 1985. Effects of stocking rate on a rough fescue grassland vegetation. J. Range Manage. 38:220–225.

Willms, W.D., S. Smoliak, and G.B. Schaalje. 1986. Cattle weight gains in relation to stocking rate on rough fescue grassland. J. Range Manage. 39:182–187.

Willms, W.D., L.M. Rode, and B.S. Freeze. 1993. The performance of Hereford cows on fescue prairie in winter. Can. J. Anim. Sci. 73:881–889.

Wikse, S.E., D.B. Herd, R.W. Field, P.S. Holland, J.M. McGrann, J.A. Thompson, C. White, and R. Angerstein. 1995. Use of performance ratios to calculate the economic impact of thin cows in a beef cattle herd. J. Amer. Vet. Med. Assoc. 207:1292–1297.