STEER GROWTH WITH ROUND-BALED RED CLOVER SILAGE PRESERVED WITH ENZYME BASED ADDITIVE

P. Narasimhalu
Charlottetown Research Centre, Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island, Canada, C1A 7M8

ABSTRACT
A 12-wk growth trial was conducted on 32 Holstein steers to study the effects of preserving round-baled red clover (*Trifolium pratense* L.) without or with enzyme additive on silage composition and steer performance. Enzyme additive did not affect silage composition except for increasing lactic acid content. Intake was higher for treated silage but live weight or carcass gain was not different between untreated and treated silage. Supplementing treated silage with barley did not affect silage intake but roasted-steeped soybeans or potato plus roasted-steeped soybeans lowered silage intake. Supplementation of treated silage, particularly with barley, improved live or carcass weight.

KEYWORDS
Cattle performance, red clover, round-baled silage, enzyme additive

INTRODUCTION
Red clover (*Trifolium prastense* L.) has a key role in crop-rotation systems in Atlantic Canada, and with the introduction of the labour- and time-saving round balers, this legume crop is harvested more often as round-baled silage. However, red clover grown in this region contains insufficient fermentable substrate and ensiles poorly (Narasimhalu and Sanderson, 1994). Cell wall polysaccharidases can improve ensiling process in chopped herbage (Weinberg et al., 1993), and is a safer alternative to the classical method of preserving poorly ensilable crops with acid (Virtanen, 1933). This study was conducted to determine the effects of ensiling round-baled red clover with enzyme additive on silage composition, and utilization by beef cattle.

MATERIALS AND METHODS
A mainly red clover crop, in its first year of production and at about 50% in flower, was harvested on July 5-7, 1993, from a 12-ha field located in Charlottetown, Prince Edward Island. The cut crop was field-wilted, and was picked by a round-baler (model 435, John Deere Co., Ill) when it reached 40-50% dry matter content, as 0.5-t round-bales. An enzyme additive (Alfazyme; Finnfeeds International Ltd., UK) was sprayed on herbage as it was picked but every sixth bale was formed without enzyme application. The bales were plastic-wrapped with a tube-wrapper (Graysof Setterangus Ltd, Aberdeenshire, UK), and a tube containing 150 treated bales and another of 25 untreated bales were stored outdoors.

A 12-wk growth trial was conducted using a completely randomized design with unequal treatment sizes. The trial used 36 Holstein yearling steers formed into two groups of four, and a further four groups of seven animals. Of the two groups of four, one group was sacrificed for establishing hot-carcass yield at start of the trial to estimate initial carcass weights of steers. The second group of four steers received ad libitum of untreated silage. The treated silage was offered to the remaining four groups of seven animals, and of these, one group received only silage, and the remaining three were randomly allotted to receive a daily supplement of about 300 g crude protein through barley, roasted-steeped whole soybeans (Mosimanyana and Mowat 1994) or potato plus roasted-steeped whole soybeans. Steers were randomly allotted to individual, electronically gated, mangers (American Calan Co., NH). All steers received a daily allowance of mineral supplement and had free access to water. Steers were given humane care as per the guidelines described by the Canadian Council of Animal care (Olfert et al. 1993). Daily feed offered, refused and consumed were recorded for individual steers. Body weights were obtained on two consecutive days at the start and conclusion of the trial. All steers were sacrificed at the end of the trial for determining hot-carcass yield.

Silage were sampled weekly during the 12-wk trial, and analyzed as described by Narasimhalu et al. (1992). Supplements were sampled monthly and were analyzed for total-N by the Kjeldahl procedure.

Compositions of treated and untreated silage were compared by t-test. Data on steer performance were subjected to ANOVA using initial body weight as the covariate, and treatment means were separated for significant ($P<0.05$) differences (Genstat 5 Committee 1987).

RESULTS AND DISCUSSION
Silage composition. The untreated silage contained more dry matter than the treated silage (Table 1). Each untreated bale was formed after six of treated bales, and consequently, the untreated material was field-dried for longer intervals between baling. Enzyme application did not affect silage pH. Silage volatile fatty acid levels were generally low (about 1% of dry matter, calculated from Table 1) and were indicative of low fermentation activity in round-baled silage. The treated silage contained significantly more lactic acid than the untreated silage which agreed with the report by Selmer-Olsen et al. (1993).

Steer performance. Initial weights of steers were not significantly different among treatment groups (Table 2). Enzyme application increased silage intake significantly. Harrison et al. (1994) while reviewing the effects of enzyme additives on silage utilization, stated that NDF reduction was small in enzyme treated silage. However, they also concluded that a reduction in lag phase and a shift from slowly degradable to rapidly degradable fibre fraction contribute to increase in intake of enzyme treated silage. However, live weight was not different between untreated and treated silage but carcass weight gain was slightly higher for treated silage ($P<0.1$).

Intake of treated silage was not changed with barley supplement whereas, soybeans or potato plus soybeans significantly lowered intake of this silage. Supplementation of treated silage improved live weight and carcass weight gains. Among the supplements, energy sources such as barley or potato plus soybeans produced significantly higher live weight gain than soybeans.

It was concluded that enzyme treatment improved intake of round-baled red clover silage, and supplementation of treated silage, particularly with barley, improved live weight gain in Holstein steers.

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Table 1
Mean (SEM)^{z} pH, and dry matter content and composition of round-baled red clover silage conserved untreated or treated with enzymes

	Untreated silage	Treated silage
pH	4.2 (0.07)	4.1 (0.03)
Dry matter, g kg	450 ^{x}(24.8)	368^{y} (28.4)
Dry matter composition		
NDF, g kg	560 (18.2)	592 (19.6)
ADF, g kg	255 (11.8)	251 (7.9)
Ammonium-N, g kg	1.48 (0.144)	1.88 (0.128)
Acetic acid, g kg	8.5 (1.53)	9.5 (1.06)
Propionic acid	Trace^{w}	Trace^{w}
Butyric acid, g kg	1.2 (1.03)	0.8 (0.94)
Lactic acid, g kg	37.3^{x} (2.36)	53.3^{y} (2.04)

^{z}Standard error of the mean (12 observations per mean).
^{x,y}Values on the same line with different superscripts are different, $P<0.05$, according to t-test.
^{w}Trace amount <0.1 g kg^{-1} dry matter.

Table 2
Means of initial body weight, estimated initial carcass weight, intakes of silage and supplement dry matter, gain in live and carcass weights for steers fed untreated or enzyme treated round-baled red clover silage.

	Initial body weight	Initial carcass weight	Silage dry matter intake	Supplement dry matter intake	Live weight gain	Carcass weight gain
	(kg)	(kg)	(kg d^{-1})	(kg d^{-1})	(kg d^{-1})	(kg d^{-1})
Untreated silage(UT)	412	230	4.0	-	0.44	0.09
Treated silage (T)	423	239	8.1	-	0.48	0.23
T + barley (TB)	425	266	8.8	2.9	0.74	0.52
T + soybeans (TS)	438	258	6.3	0.7	0.54	0.43
T + potato + soybeans (TPS)	419	253	5.2	2.8 0.2	0.75	0.36
SEM^{z}	14.9	-	1.19	-	0.103	0.104
Significant contrasts ($P<0.05$)	-	-	UT vs. T T,TB vs. TS,TPS	-	T vs. TB,TS,TPS TS vs TB,TPS	T vs. TB,TS,TPS

^{z}Standard error of mean (12 observations per mean)