COW-CALF PRODUCTION RESPONSE TO PASTURE FORAGE SPECIES

J.C. Kopp[1], W.P. McCaughey[2] and K.M. Wittenberg[1]
[1]Department of Animal Science, University of Manitoba, Winnipeg, Manitoba
[2]Agriculture and Agri-Food Canada Research Centre, Brandon, Manitoba

ABSTRACT
To study cow-calf production on fragile soils, 32 'tester' cow-calf pairs were grazed on fertilized and unfertilized meadow brome (*Bromus biebersteinii* Roem & Schult.) and alfalfa (*Medicago sativa* L.)/meadow brome pastures, to determine the effects of forage type and fertility on pasture yield and botanical composition; and on animal productivity including cow milk production, cow and calf average daily gain and total gain (per head and per hectare). Cow fertility may be depressed on alfalfa-based pastures, therefore, blood urea nitrogen (BUN) levels were also examined. Cow average daily gain (0.15 kg d^{-1}) and milk production (4.82 kg d^{-1}) were not affected by pasture type or fertility level. However, calf average daily gain was 11% higher when calves were grazed on legume- vs.grass-based pastures (1.20 vs. 1.08 kg d^{-1}; P=0.01). Blood urea nitrogen levels were at the top of the normal range for cows grazing alfalfa-based pastures (7.79-8.09 mmol L^{-1}), but were within the normal range (3.53-5.01 mmol L^{-1}) for cows grazing grass-based pastures.

KEYWORDS
Beef, production, cow-calf, rotational grazing

INTRODUCTION
From an agronomic viewpoint, alfalfa is the best adapted legume for use in western Canadian pastures. It is higher yielding than other legumes and suitable grazing tolerant cultivars are available. Unfortunately, very little research has been conducted to examine the benefits of including legumes such as alfalfa in pasture mixtures for cow-calf pairs. The main limitation of alfalfa is that it can cause frothy bloat in ruminants (Kudo et al., 1985). However, pastures containing a high percentage of alfalfa have been successfully grazed at the Brandon Research Centre for a number of years, with very few cases of bloat. Meadow bromegrass is a well adapted forage that is suitable for pasture use. It has strong regrowth potential and is quite palatable (Smoliak et al., 1992). This study evaluates the benefits of pasture fertilization and compares cow-calf productivity on meadow bromegrass and alfalfa/meadow bromegrass pastures, in terms of milk production, cow and calf weight gains and carrying capacity. Blood urea nitrogen levels were also examined to determine if cow fertility might be depressed on legume-based pastures.

MATERIALS AND METHODS
Description. The experimental site was located 2.4 km east of Brandon. Four-4 ha pastures were seeded in the spring of 1994 to meadow bromegrass (cv. 'Paddock'; 10 kg ha^{-1}) and four-4 ha pastures were seeded to a mixture of alfalfa (cv. 'Spredor II'; 3 kg ha^{-1}), meadow brome (cv. 'Paddock'; 6 kg ha^{-1}) to produce alfalfa dominant pastures. Two pastures each of the grass and grass-legume pastures were fertilized at soil test recommended levels and the remaining two were left unfertilized. Pastures were fenced with electric fences and polywire grazing strings were used to sub-divide each pasture into 5 paddocks. Portable water tanks were used to provide drinking water in every paddock. The alfalfa-grass pastures were supplemented with 1:1 (Ca:P) mineral and the grass pastures were supplemented with 2:1 mineral.

Experimental Design. Eight pastures were randomly assigned to a 2 x 2 factorial combination of fertilization (no fertilizer and soil-test recommended rates) and pasture type (meadow bromegrass and alfalfa/meadow bromegrass). Each pasture treatment combination was replicated twice but main effects were evaluated with four replications of each treatment due to the factorial design of the experiment. The experimental data was analyzed using SAS (1989).

On each pasture, 4 'tester' cow-calf pairs (first-calf heifers) were used for data collection and an additional 'put and take' cow-calf pairs were added to maintain equal herbage availability on all pasture treatments. This ensured a similar length of grazing season on all pasture treatments and equal herbage availability for all animals. Cow-calf pairs were weighed on day zero, stratified by sex of calf, and randomly allotted to treatments which were balanced for sex of calf.

Data Collection. Prior to pasture turnout, cows were milked to determine milk production on a basal ration (used as a covariate). Shrunk weights of all the experimental animals were taken at the beginning and end of the experiment. Average daily gains and total gain per head and per hectare for both cows and calves were determined by monthly weighing. As well, carrying capacity was estimated by totalling cow-calf grazing days ('testers' plus 'put and take' animals) obtained from each paddock.

Before entering and after exiting a paddock, hand clippings of quadrats were taken to estimate forage productivity. Also, forage productivity of grazed paddocks was estimated 1-2 times weekly as needed and stocking rates were adjusted to maintain equal herbage available per cow-calf pair in each pasture.

Two milking samples for determination of yield and quality were collected on July 13 and August 11, using a portable milking machine. Samples were collected approximately 12 hours apart and milk production for a 24 hour period was calculated. Oxytocin injections were used to aid milk let-down.

RESULTS AND DISCUSSION
Cows were turned out to pasture on June 13 and were taken off on August 21. The shorter than anticipated grazing period resulted due to much drier growing conditions than average in late-June, July, August and September. This resulted in very little pasture regrowth and a much shorter than normal grazing season (69 vs. 120 days). Alfalfa-based pastures contained 75-80% alfalfa and 20-24% meadow bromegrass compared to 0% alfalfa and 100% meadow bromegrass for the grass-based pastures (Table 1). Available forage production tended to be greater on fertilized compared to unfertilized pastures (2304 vs. 1728 kg ha^{-1}; P=0.06) and this resulted in increased carrying capacity on fertilized compared to unfertilized pastures (96.7 vs 79.3 cow grazing days ha^{-1}; P=0.03). However, the increase in production due to fertilization was much smaller than what would be commonly observed under average rainfall conditions.

Cow average daily gain (0.15 kg d^{-1}) and milk production (4.82 kg d^{-1}) were not affected (P>0.05) by either pasture type, fertility level or sex of calf (Table 2). However, calf average daily gains were 11% higher when grazed on legume-based pastures compared to those on the grass-based pastures (1.20 vs. 1.08 kg d^{-1}; P=0.01). No effects of fertility or sex of calf were observed on calf growth rate. The better calf performance on alfalfa-based pastures also resulted in

more gain per head than was possible for calves on brome-grass based pastures (84 vs. 77 kg head^{-1}; P=0.01). Legume-based pastures also tended to produce greater total calf gain per hectare than grass-based pastures (153.8 vs. 132.0 kg ha^{-1}; P=0.07). The economic benefits of these treatments will need to be evaluated. Blood urea nitrogen (BUN) levels were elevated to the upper end of the normal range (2.8 to 8.0 mmol L^{-1}) in cows grazing alfalfa-grass pastures (7.79-8.09 mmol L^{-1}). Values were in the middle of the normal range in cows grazing fertilized grass pastures (5.01 mmol L^{-1}) , and were at the low end of the range for cows grazing unfertilized grass pastures (3.53 mmol L^{-1}). It is not known at this time if the slightly elevated BUN levels seen in cows grazing alfalfa dominant pastures will depress reproductive efficiency in beef cows.

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Table 1
Effect of forage type and fertilization practices on pasture productivity

Pasture treatments	Grass: alfalfa ratio	Available forage production (kg/ha)	Carrying capacity (cow days/ha)	Total calf gain/head (kg/hd)	Total calf gain/ha (kg/ha)
Alfalfa/grass, Fertilized	24.1:75.9	2338	93.6	83.5	157.5
Alfalfa/grass, Unfertilized	20.0:80.0	2012	87.0	84.5	150.0
Grass, Fertilized	100:0	2270	99.7	76.8	152.4
Grass, Unfertilized	100:0	1444	71.6	77.1	111.5
SEM	1.8	222	5.2	1.7	9.9
P-values:					
Forage	0.0001	NS	NS	0.0142	0.0921
Fertility	NS	0.0606	0.0290	NS	0.0702
Forage X Fertility	NS	NS	NS	NS	NS

Table 2
Effect of pasture type, fertility and sex of calf on productivity of cow-calf pairs

Treatments	Cow average daily gain (kg/day)	Cow average daily gain (kg/day)	Cow milk production (kg/day)	Blood urea nitrogen (mmol/litre)
Pasture treatments				
Alfalfa/grass, Fertilized	0.21	1.19	4.83	8.09
Alfalfa/grass, Unfertilized	0.08	1.21	5.02	7.79
Grass, Fertilized	0.07	1.04	4.82	5.01
Grass, Unfertilized	0.27	1.12	4.60	3.53
SEM	0.10	0.03	0.23	0.12
P-values:				
Forage	NS	0.0136	NS	0.0001
Fertility	NS	NS	NS	0.0015
Forage X Fertility	NS	NS	NS	0.0069
Calf sex				
Steer	0.21	1.16	4.96	6.42
Heifer	0.11	1.12	4.67	5.79
SEM	0.06	0.03	0.20	0.27
P-value	NS	NS	NS	NS