Evaluation of the Bloating Potential and Grazing Performance of AC-Grazeland Verses a Mixed AC-Grazeland and Sainfoin Pasture for Beef Cattle in Southwest Saskatchewan.

A.D. Iwaasa[1], E. Birkedal[1] and R. Jensen[2].

[1]Agriculture and Agri-Food Canada - Semiarid Prairie Agricultural Research Centre (AAFC-SPARC), Box 1030, Swift Current, SK, Canada, S9H 3X2, Iwaasa@em.agr.ca
[2]Southwest Forage Association, Box 88, Webb, SK, Canada, S0N 2X0.

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Abstract

The potential benefits of grazing alfalfa (*Medicago sativa* L.) are well documented (e.g., high yields and forage quality, excellent animal gains) and thus, many livestock producers are interested in its use. However, alfalfa's ability to cause bloating in cattle and potential death has caused many livestock producers to not consider grazing pure alfalfa stands or only alfalfa/grass mixtures in which the alfalfa constitutes less than 20% of the forage stand. The recent availability of AC-Grazeland (AC), a low bloat causing alfalfa cultivar, and the use of non-bloating legumes in mixture with alfalfa are reported grazing strategies to reduce the occurrence of bloating and may be a method to increase the ability to graze alfalfa in the pasture at higher proportions. The objective of this study was to evaluate the bloating potential or bloat reducing potential and animal grazing performance of AC verses a mixed AC and sainfoin (AC+S) pasture. In 1998, one pasture (4.9 ac) was seeded to AC, while another pasture (4.4 ac) was seeded to an AC+S mixture. Seeding rate for the AC and sainfoin (S) were 5 and 38 lbs per acre, respectively. Grazing of the two pastures were initially started in 2000 by an equal number of yearling steers. Grazing and forage data from 2002 and 2003 were used in this study. Yearling steers commenced grazing on the AC pasture at the early bud stage and the S was grazed at the early flower stage. Each steer on the AC pasture received a rumensin CRC bolus, while steers on the AC+S received no rumensin boluses. Results found that no bloating or bloat symptoms were observed in the cattle grazing from either forage treatment in 2002 and 2003. Average daily gains and total live production did not differ ($P > 0.13$) between pasture treatments. Further research is needed to evaluate longevity of AC and AC+S pastures under different grazing management for southwest Saskatchewan.

Introduction

Alfalfa (*Medicago sativa* L.) is the oldest known domesticated forage and historically has been used for more than 3,300 years. The potential benefits of grazing alfalfa are well-documented (high yields and excellent forage quality) and thus many livestock producers are interested in its use. However, proper grazing management and preventing bloat are two of the challenges when grazing alfalfa. Various strategies have been attempted to minimize potential bloat concerns, such as: pasture management and diet manipulation (alfalfa/grass mixture, a stage of maturity etc.), anti-bloating and feed additive compounds (detergents, Blocare 4511, rumensin, etc.), bloat

reduced alfalfa cultivar (AC-Grazeland) and non-bloating legumes. The use of alfalfa/grass mixtures has been the most practical bloat prevention measure for beef cattle production in Western Canada but may not always be effective.

To reduce potential alfalfa bloat concerns the use of AC-Grazeland (AC), a newly licensed low bloat variety of alfalfa has been developed and may provide a forage tool that will allow for safer grazing of alfalfa by cattle. It is important to remember that AC is not bloat free, but rather decreases the frequency and severity of acute bloats. The lower potential for bloat is a result of a reduce initial rate of digestion of the AC. Research out of Agriculture and Agri-Food Canada in Kamloops reported a reduction in bloat incidence ranging from 40 to 88% on grazing trials on range pastures. As well, the severity of bloat was reduced, as indicated by the almost complete absence of multiple distensions of the rumen per animal per day grazing AC (Majak et al. 1998).

Every cultivar of alfalfa tested can cause bloating, but sainfoin (*Onobrychis viciifolia*), birdsfoot trefoil (*Lotus corniculatus*) and cicer milkvetch (*Astragalus cicer*) do not, confirming the bloat-safe features of these alternate legume forages (Majak et al. 1995). There has been interest in grazing interseeded mixed stands of alfalfa and sainfoin (S). Researchers at Lethbridge and Kamloops have shown that bloat concerns were greatly reduced when S+alfalfa mixtures were grazed by cattle. Thus, it may be possible to control alfalfa bloat concerns by adding a little S to the forage mix. Researchers have reported that 15 to 20% S in a mix should be enough to supply the tannins needed to control bloating (McAllister personal communication 2004). However, S has never gained popular acceptance as a pasture ingredient because of its reported poor seed emergence, high seed costs, less than adequate hay production and short stand life (Jefferson et al. 1994).

More in depth review of the efficacy of ionophores in the control of legume bloat has been reported by Hall and Majak (1989). However, these feed additives, which are also antibiotics, have the potential to reduce the incidence of bloat by more than 50% but they do not prevent the occurrence of legume bloat. The CRC (antibiotic feed additive) ionophore increases the molar proportion of propionic acid and decreases methane production and as a result there is an improvement in the efficiency of energy utilization by the animal. Why the CRC ionophore helps reduce the incidence of bloat is not clearly understood but it may be related to shift in rumen bacteria population, rumen fermentation and inhibiting proteolysis (i.e., protein digestion).

Objective

The objective of this study was to evaluate the bloating potential or bloat reducing potential and animal grazing performance of AC verses a mixed AC+S pasture.

Materials and Methods

In July of 1998, two pastures were seeded. Pasture one was 4.4 ac (1.8 ha) in size and was seeded to an AC and S mixture. The AC was seeded at 5 lb ac^{-1} (5.6 kg ha^{-1}) and the S at 38 lb ac^{-1} (42.6 kg ha^{-1}). The AC was seeded in a 12 in (30 cm) row spacing and the S was seeded in between the AC rows. Pasture two was 4.9 ac (2.0 ha) in size and was seeded only to AC at 5 lb

ac^{-1} (5.6 kg ha^{-1}). Grazing of these pastures first occurred in 2000 and grazing measurements were also taken in 2002 and 2003. Due to the drought conditions experienced in Southwest Saskatchewan in 2001, both pastures were not grazed. During the 2000 grazing season all 24 steers (817 ± 26 lb) were orally implanted with a rumensin CRC bolus. Twelve steers were randomly allocated to each of the pastures. Twenty four steers were also used in the 2002 (776 ± 17 lb) and 2003 (827 ± 27 lb)grazing seasons with 12 steers randomly placed on each pasture. However, ionophores were not implanted into all steers and only steers grazing the AC received CRC boluses. For all three grazing seasons, grazing commenced when the AC forage was at the early to late bud stage and the S was at the early flower stage (Fick and Mueller 1989).

For the 2000, 2002 and 2003 grazing season, initial and final steer weights were recorded after a 12 hr shrink for both the initial and re-growth grazing period for the two pastures. Animal production values [average daily gains (ADG), total livestock production (TLP) and grazing days per acre] were calculated using adjusted initial and final steer weights. Standard methods to measure available and total forage yields using 0.25 m^2 quadrats (five per pasture) and cage enclosures (three per pasture) were conducted (Cook and Stubbendick 1986). In 2000, 2002 and 2003 forage quality compositions (five random samples per pasture) were measured (%OM, %OMD, %ADF, %NDF, %CP and total phosphorus) for each pasture. The experimental design was completely randomized with years as replicates and the treatment effects (AC and AC+S) analysed using the GLM procedure of SAS.

Results and Discussion

Steer grazing performances for 2000, 2002 and 2003 are found on Tables 1. In 2000, similar animal performances were observed for both pastures. Steer average daily gains for both pastures were more than 4.0 lb d^{-1} (1.8 kg d^{-1}), which was higher than expected. Animal performances in 2002 and 2003 were more inline to what was expected (i.e., ADG of 2.0-3.6 lb d^{-1}) and similar to other research studies (Berg 2000). Average daily gains and TLP did not differ ($P>0.13$) between the two pastures. However, ADG and TLP measurements were consistently higher for the AC+S pastures verses AC. This was unexpected, especially since the steers on the AC were orally implanted with CRC rumensin boluses and were expected to perform better than the steers on the AC+S pasture. It is unclear why these results were observed. Studies have reported that S contains tannins which can form insoluble complexes with proteins that are later released and digested and absorbed in the small intestine (Kraiem et al. 1990). In addition, S has higher energy levels (i.e., sugars and carbohydrates) than alfalfa and this can result in increase consumption and conversion (Glover 1980). Improved animal performance may be due to better utilization of the AC+S protein content as a result of increases rumen bypass protein and/or better utilization of the ammonia produced in the rumen by the rumen microbial population due to the higher energy supplied by S. Further research is needed to elucidate the potential benefits of S when in a forage mix. Grazing days per ac did not differ ($P = 0.86$) between the two pastures. Re-grazing results for 2000 and 2002 on the pasture re-growth were not analysed due to the shortness of the grazing period and the high standard deviation associated with the mean initial and final steer weights.

Table 1. Grazing Performance of Yearling Steers Orally Implanted with (+CRC) or without (-CRC) Rumensin Boluses on AC-Grazeland (AC) and AC+Sainfoin (AC+S) Pastures.

Pasture and grazing season	CRC rumensin bolus	Average daily gain (lb ac^{-1})	Total live weight production (lb ac^{-1})[1]	Grazing days ac^{-1}
2000 (June 19 to 29)				
AC	+CRC	4.2	176.4	42.0
AC+S	+CRC	4.1	188.6	46.0
2002 (June 18 to July 4)				
AC	+CRC	2.8	110.3	39.1
AC+S	-CRC	3.6	158.1	43.4
2003 (June 5 to 24)				
AC	+CRC	2.0	96.6	48.8
AC+S	-CRC	3.0	128.0	43.4

Grazing day per acre = (number of grazing days x steers)/total acreage.
[1] Total live weight production = average daily gain x grazing days per acre (Schellenberg et al. 1999).

Forage yields and qualities for 2000, 2002 and 2003 are found on Tables 2 and 3. Lower than expected available forage yields in 2002 for AC and AC+S pastures were due to the drought conditions experienced in 2001 and the dry and cool spring of 2002. Peak forage yields (sampled in July) in 2002 were closer to what was expected and this was a result of the abundant rainfall that was received later in the season. Available and peak forage yields in 2003 for AC and AC+S pastures were also good due to the good spring and early summer moisture conditions experienced in 2003. Both available and peak forage yields measurements did not differ ($P > 0.54$) between the two pastures over the three years. Forage quality measurements between the two pastures were similar (Table 3). As expected %CP and fibre values for the S when compared to AC were lower and higher, respectively. Unfortunately, forage quality measurements for 2003 for all pastures were not analyzed yet. In 2000 and 2003 the S portion of the AC+S pasture was grazed heavily, with utilization levels greater than 80%. Ditterline and Cooper (1975) reported that S is very palatable and animal prefer it to other legumes, as a result of this animals tend to overgraze the S in a mixture which support our observations. The poor utilization of AC and S in 2002 was due to the drought conditions experienced in 2001, which left stemmy old dry growth in the sward.

Table 2. Forage Production for AC-Grazeland (AC) and AC+Sainfoin (AC+S) Pastures for the 2000, 2002 and 2003 Grazing Season[1].

Pasture and grazing season	Available yield (lb ac^{-1})	Peak yield (lb ac^{-1})	% Pasture utilization
2000			
AC	2623	2400	54.9
AC mix	1472	1538	59.4
S mix	218	66	85.6
2002			
AC	986	1429	35.5

AC mix	736	2069	32.1
S mix	80	93	48.5
2003			
AC	2505	2829	47.6
AC mix	1990	2549	42.4
S mix	260	48	83.8

[1]Available yields were harvested in June when the alfalfa and sainfoin were at the early-late bud and early flower stages, respectively. Peak yields were harvested at the end of July when the alfalfa and sainfoin were at full flower stages.

Table 3. Forage Quality for AC-Grazeland (AC) and AC+Sainfoin (AC+S) Pastures for the 2000 and 2002 Grazing Season[1, 2].

Pasture and sample site	%OM	%OMD	%ADF	%NDF	%CP	%Total P
2000						
AC	90.0	66.8	22.6	28.3	17.3	0.16
AC mix	90.0	67.3	20.9	26.2	18.2	0.16
S mix	92.7	61.5	19.7	23.4	14.8	0.18
2002						
AC	90.0	69.2	23.8	28.7	22.4	0.27
AC mix	90.1	69.6	21.6	26.2	22.0	0.27
S mix	NA	NA	15.2	25.8	20.6	0.25

[1]Forage quality measurements were done on the available forage yields.
[2]Organic matter (OM), organic matter digestibility (OMD), acid detergent fibre (ADF), neutral detergent fibre (NDF), crude protein (CP), total phosphorus (TP) and NA = results not available.

Alfalfa is considered to be more bloat provocative when it is immature. Berg et al. (1996) observed severe bloats occurring on lush, immature alfalfa forages. All AC forages grazed in 2000, 2002 and 2003 were at the early to late bud stage, and therefore had the greatest potential to cause bloating symptoms. In addition, the 2000, 2002 and 2003 grazing seasons had frequent rainfalls, often making forage material lush and wet. The above mentioned conditions should have made the potential for bloating to occur more likely. However, for all study years, only a few cattle were observed with slight distensions and no cattle were treated for bloating. In the 2000 grazing season, AC and AC+S did not result in any bloat symptoms occurring. The reduction and/or prevention of bloating symptoms could have been a result of the AC, S and/or the CRC rumensin. In the 2002 and 2003 grazing season, CRC boluses were not administered to the steers grazing the AC+S. This was done to determine if the CRC treatment provided more bloat protection benefit than the S. No incidences of bloating were observed in 2002 and 2003 for steers grazing AC and AC+S. Researchers (Berg 2000) have concluded that the sward needs to at least contain about 15 to 20% S for bloat prevention. The observed S percentages of the AC+S sward in 2000, 2002 and 2003 were 13%, 10% and 12%, respectively. Since the grazing of the AC pasture in 2002 and 2003 did not result in any bloat symptoms being observed it is not clear how much additional benefit S may have contributed to bloat prevention. Although, research studies (Dubbs 1975; Jefferson et al. 1994) have reported that S in mixture with alfalfa do not persist beyond 2 to 3 years. However, this was not observed in our results even though S was generally grazed heavily and the stand has been in production for five years under various extreme environmental conditions (i.e., drought of 2001).

Conclusion

For years 2000, 2002 and 2003, no incidences of bloating were observed for any steers grazing AC or AC+S pastures. Results from this study found that the use of a bloat reducing alfalfa cultivar can reduce the occurrence of bloating and can be an effective method to prevent bloat symptoms from occurring. In this study, the mixing of S with AC may not necessarily provide any additional bloat prevention over just grazing AC. However, S mixed with AC may provide some additional nutritional benefits that improve animal productivity. Further research is needed on S and S plus alfalfa mixtures to clearly determine the benefits of this non-bloating legume on animal grazing performance. The use of AC is just another management tool to assist producers in reducing the incidence of bloating and is not bloat free; therefore, proper grazing management is still needed to properly benefit from AC's improved bloat prevention ability.

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