Determination of carcass characteristics of finished bison heifers.

Final Report

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Introduction

Alberta's bison industry continues to grow rapidly but since the industry is still relatively new, research into bison management and production techniques remains limited (Anderson 2001; Rutley 2001a,b). Currently, only bison bulls are being finished for the bison red meat industry with bison females recruited as replacements into the breeding herds. As the bison industry grows and matures, female bison will begin to enter the meat system, both to maintain the supply of bison meat available, and to provide an outlet for lower quality females that have no place in the breeding system. The recent decline in breeding stock prices has heightened interest in finishing females for market. No studies currently exist that have examined finishing techniques for bison heifers.

Baseline research has not been conducted on carcass characteristics of finished female bison. Anecdotal evidence, from a limited number of carcasses, indicates smaller carcasses, additional back fat and somewhat more marbling when compared to males. Therefore, it remains unknown where the female carcass will fit into the present grading and marketing system and if alternate-finishing protocols will need to be developed.

The objective of this project was to test and demonstrate how bison heifers finish as compared to bison bulls on an industry standard ration (free-choice grain and hay). The project was also designed to provide a preliminary look at carcass quality (grading characteristics) of bison heifers.

Methods

Animal care protocols and designated animal husbandry interventions followed those previously ratified by the Northern Alberta Long-Term Bison Grazing Initiative Advisory Committee (Rutley 2000). The protocols were developed by the Bison Working Group Subcommittee in conjunction with and approved by the Animal Care Committee of the Agriculture and Agri-Food Research Centre (AAFC) – Lacombe, November 2000.

Animal selection was undertaken through recruitment of a cooperator producer. The Peace Country Bison Association informed its membership of the project and called for producers interested in supplying the required bison. A condition of participation was Canada Food Inspection Agency (CFIA) negative herd status. Millennium Bison Ranch of High Level was selected. All contributed bison were born in the spring 2001.

On June 14, 2002, 11 heifers and 11 bulls were tagged, weighed (initial weight), provided an appropriate dose of ivermectin and an 8-way vaccine. They were then transported in accordance with industry standard transport protocols to the Long-Term Grazing Facility at the AAFC Fort Vermilion Research Farm. Upon arrival, the bison were provided a settling period within the handling corrals. The bison were then released into the grazing paddocks where they were rotationally grazed without supplement until late summer. The 22 ha pasture area of the Long-Term Bison Grazing Facility consists of a previously established stand of predominately meadow brome and orchardgrass. Some

timothy and tall fescue are also present in the stand. No legumes were included in the seed mix and no supplemental fertilizer had been applied since establishment in 1999 (Erichsen-Arychuk 2002). On July 2002, 2 tonnes of 46-0-0 fertilizer was broadcast to supplement soil fertility (45 kg N ha^{-1}). Timely summer rains resulted in sufficient pasture to allow for hay harvest, in addition to adequate summer and extended fall grazing.

Free-choice rolled oats were provided as a supplement in late summer. On September 28, 2002 the bison were weighed (mid-project weight) and placed on a finishing ration. The ration consisted of free-choice mixed grass hay (made on site) and a 75:25 mix of rolled oats:barley (Curry 2000). Access to pasture was not restricted during fall and early winter.

Bison were weighed February 1 (final weight) and separated into two groups. The heaviest group was transported February 2 for slaughter at the Lacombe Red Meat Research Centre February 3, 2003. The second group was transported February 9 for slaughter February 10, 2003. Transport and slaughter protocols were observed at all times.

Results and Discussion

Grazing and Finishing Period

The bison used in this project all came from the same producer near High Level, Alberta and so were assumed to be relatively free from stress associated with mixing of non-herdmates (Rutley and Church, 1995). The bison were weighed on the farm June 14, 2002 immediately prior to transport. The heifers averaged 239 kg, the bulls averaged 270 kg for a group average weight of 254 kg (Table 1). As they were lighter than expected they were not weighed upon arrival at Fort Vermilion in an attempt to minimize transportation stress. As a result, shrink was not determined. In a previous study, transportation from Grande Prairie to Ft. Vermilion had resulted in a 7.5% transport shrink (Erichsen-Arychuk, 2002), which was similar to the results found from bison research at Northern Lights College in Dawson Creek, BC (Rutley 1992a).

The pasture responded well to the application of additional fertilizer and timely summer rains. There was sufficient forage for grazing well into the fall even after the cutting of hay (11.6% CP; 55% TDN; 2.41 Mcal kg^{-1} DE; 0.92% Ca; 0.19% P) from a portion of the pasture. This hay was used in the finishing ration. Average daily gain through the 106 day summer grazing period (June 14 to September 28, 2002) was 0.88 kg day^{-1}; 1.12 kg day^{-1} and 1.0 kg day^{-1} for heifers, bulls and all bison, respectively (Table 1). This gain is consistent with previous studies under similar conditions (Rutley 1992b, Rutley and Jahn, 1995).

Previous research has indicated that frequent weighing of bison during a finishing program can interfere with weight gain (Rutley and Church, 1995), therefore, the bison were not weighed again until immediately prior to the slaughter dates provided by the Lacombe Research Centre. Gain during the 125-day winter feeding period (September

28, 2002 to February 1, 2003) was negligible. Average daily gain was 0.00 kg day^{-1}; 0.1 kg day^{-1} and 0.05 kg day^{-1} for heifers, bulls and all bison, respectively (Table 1). Overall ADG was 0.40 kg day^{-1}; 0.58 kg day^{-1}; and 0.49 kg day^{-1}; for heifers, bulls and all bison, respectively. This gain contrasts sharply with bison bulls finished in feedlots on grain rations (Church et al. 1999; Anderson 2000; Anderson et al. 2002). Final weight was 330 kg, 405 kg, and 367 kg for heifers, bulls, and all bison, respectively (Table 1).

Throughout the feeding period, the bison had free choice access to the finishing ration, however, minimal grain was consumed (2.9 kg head^{-1} day^{-1}). This is in sharp contrast to previous studies where consumption ranged between 7.7 and 8.9 kg head^{-1} day^{-1} (Anderson 2000) and between 7.8 and 7.9 kg head^{-1} day^{-1} (Anderson et al. 2002) for bison on corn based diets. For bison bulls fed a similar diet to the current study (Church et al. 1999) grain intake ranged between 4.9 and 10.5 kg head^{-1} day^{-1}.

One possible explanation for the limited grain intake in the current study is the presence of abundant pasture in the fall period. It was observed that even once snow fell, the bison continued to forage daily within the feeding paddock. Minimal gain in a group of winter-feeding bison was previously observed (Rutley, unpublished data). However, that group of bulls were considered ready for market (~ 500 kg; 1100 lbs) and were consuming 6 kg of hay and 11 kg of grain head^{-1} day^{-1}. Another possible explanation for low grain intake is unidentified male:female interactions. Poor quality feed was eliminated as a potential problem as the hay was nutritionally adequate for feeder/finishing bison.

No apparent negative male-female interactions were observed during the grazing and finishing periods, while in transport or in lairiage. One male bison was injured during the mid project weighing and was no longer available to the project. During the final weighing one heifer injured her leg, and transport was not suitable for her so she was removed from the project.

Grading

Ten bull and 10 heifer bison were slaughtered Feb 3 and Feb 10 at the Lacombe Red Meat Center without incident. None of the heifers were pregnant upon inspection at slaughter. Grading was conducted by certified meat grader within 24 hours of slaughter using the CFIA approved bison grading system (Clarke 2000). All carcasses were assigned an A grade as follows: 7 bulls graded A1; 3 bulls and 6 heifers graded A2; 4 heifers graded A3. This was an excellent outcome considering that grain consumption was as limited as it was at 2.9 kg day^{-1} compared with an expected intake near 8 kg day $^{-1}$ and the animals were light (367 kg average weight). Previously, lightweight bison bulls (400 kg) had a grade assignment of 1-A1, 2-A2, 1-A3, 22-B2 and 11-D1, B grade due to dark colour with the D grade due to lack of finish (Janz et al. 2002.)

Bull carcasses tended to be darker than heifers; bright 1, 3; good 3, 4; medium dark 2, 1; and dark 4, 2; for bulls and heifers, respectively (Table 2). The difference in the level of back-fat could explain this result. Caution must be applied until to results of the

objective Minolta test are known, as meat colour assessment is a visual inspection at grading and is somewhat subjective. Marbling scores were: devoid 6, 8; probably devoid 4, 1; and trace 0, 1; for bulls and heifers, respectively (Table 3). There was no significant difference in fat colour, or conformation scores, between heifers and bulls.

Summary and Implications

Conclusions from this study would appear to depend on perspective. One can conclude that bison heifers can be fed to finish using the same management as bison bulls because i) there were no observed mixing or transportation problems, ii) bulls and heifers achieved the same frequency of A grade (1.0), iii) there was no difference in marbling scores (too few to tell if different), and iv) there were no significant differences in fat colour or carcass conformation.

On the contrary, one could conclude that bison heifers cannot be fed to finish using the same management as bison bulls based upon i) differences in body weight (size) and average daily gain, ii) greater frequency of A2 and A3 carcasses in heifers, and iii) more desirable meat colour scores in heifers (which could have market implications).

Conclusions from this project must be considered in the proper context because this is an only initial study. In addition, objective measures of meat quality have yet to be reported (Aalhus and Rutley, in progress) and all results will remain preliminary until data numbering in the hundreds has been obtained.

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References:

Anderson, V. 2000. Feeding bison bulls for meat. Pages 289-293 *in* Rutley, B.D., ed., Bison are back – 2000. Proceedings of the Second International Bison Conference, Aug 2-4, 2000, Edmonton, AB

Anderson, V. 2001. Bison research. Pages 318-326 *in* Rutley, B.D., ed., Bison are back – 2000. Proceedings of the Second International Bison Conference, Aug 2-4, 2000, Edmonton, AB.

Anderson, V., D. Burr and T. Schroeder. 2002. Protein requirements of bison bulls fed for meat. Carrington Resaerch Extension Centre Research Bulletin 2002. http://www.ag.ndsu.nodak.edu/carringt/bison/Protein.htm

Church, J.S, R.J. Hudson and B.D. Rutley. 1999. Performance of American bison (*Bos bison*) in feedlots. J. Anim. Feed Sci. **8**: 513-523.

Curry, C. 2000. Backgrounding and finishing. Pages 285-288 *in* Rutley, B.D., ed., Bison are back – 2000. Proceedings of the Second International Bison Conference, Aug 2-4, 2000, Edmonton, AB.

Clarke, D. 2000. The bison grading system – how it presently works. November 2002. http://www.bisoncentre.com/resources/bce215/bce215_grading_system.html.

Erichsen-Arychuk, C. 2002. Winter Grazing of Long Yearling Bison Bulls on Perennial Pasture. Farming for the Future Project Number: #2000PR19. January 2002. 10 pp.

Janz, J.A.M., J.L. Aalhus and M.A. Price 2002. Meat quality of bison (*Bison bison bison*) longissimus thoracis et lumborum following very fast chilling. Can. J.Anim. Sci. 82: 327-337.

Rutley, B.D. 1992a. Overnight Shrink in a Group of Finished Bison Bulls. Bison Bulletin BB92.2, February 1992.

Rutley, B.D. 1992b. Average Daily Gains in Plains Bison Backgrounded and Finished. Bison Bulletin BB92.4, December 1992.

Rutley, B.D. and J.S. Church. 1995. Feed-Weigh Station as a Method for Finishing Bison (*Bison bison*) Bulls in a Feedlot. A Report to the Peace Country Bison Association. November 1995.

Rutley, B.D. and C.M. Jahn. 1995. Factors Affecting Growth and Productivity in Peace Country Bison (*Bison bison*). A Report to the Peace Country Bison Association. November 1995.

Rutley, B.D. 2000. Ft. Vermilion Long-Term Bison Grazing Initiative. Project booklet. Summer 2000. 18 pp.

Rutley, B.D. 2001a. Bison production research. Pages 327-338 *in* Rutley, B.D., ed., Bison are back – 2000. Proceedings of the Second International Bison Conference, Aug 2-4, 2000, Edmonton, AB.

Rutley, B.D. 2001b. Research strategies for the North American bison industry. Pages 327-338 *in* Rutley, B.D., ed., Bison are back – 2000. Proceedings of the Second International Bison Conference, Aug 2-4, 2000, Edmonton, AB.

Table 1a. Weight (lb) and gain (lb day-1) of bison heifers and bulls during summer and winter feeding periods.

	June	September	ADG	February	ADG	P-ADG
All	254	360	1.00	368	0.05	0.49
Females	239	332	0.88	330	0.00	0.40
Males	270	389	1.12	405	0.10	0.58

Table 1b. Weight (kg) and gain (kg day-1) of bison heifers and bulls during summer and winter feeding periods.

	June	September	ADG	February	ADG	P-ADG
All	560	793	2.20	809	0.11	1.08
Females	525	730	1.94	727	-0.01	0.88
Males	595	855	2.46	891	0.23	1.28

Table 2. Meat colour scores for 20 finished bison.

Category	Heifers	Bulls
Bright	3	1
Good	4	3
Medium Dark	1	2
Dark	2	4

Table 3. Marbling scores for 20 finsihed bison

Category	Heifers	Bulls
Devoid	8	6
Probably Devoid	1	4
Trace	1	--