

# INFLUENCE OF MANAGEMENT SYSTEMS ON CARCASS TRAITS, MEAT QUALITY, AND SENSORY ATTRIBUTES OF BISON BULLS

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## I. INTRODUCTION

In the bison industry, both heifers and bulls are marketed and harvested at various ages generally ranging from 20 to 36 months [1], which contributes to product variation [2]. Bulls represent the greatest proportion of the slaughter mix [3] and the bison industry does not routinely performance castration, leaving males intact throughout the growing and finishing phase. This makes bulls available for breeding during the finishing phase, which is a management strategy that can be utilized. This management strategy results in marketing bison bulls after breeding at an older chronological age. Research in other species has concluded that older, intact males produce tougher meat than younger, castrated males [4]. However, no research has evaluated the impact of animal age and use in the breeding herd on carcass traits, meat quality, and sensory attributes of bison bulls. We hypothesised that bison bulls finished at a younger age and not used in the breeding herd would have improved carcass traits and meat quality compared to older bulls utilized in the breeding herd. The objective was to evaluate the influence of management system (Young –not used in the breeding herd and harvested at 30 months vs. Mature –used in the breeding herd and harvested at 36 months and) on carcass characteristics, meat quality, and sensory characteristics of bison bulls.

## II. MATERIALS AND METHODS

Grass-finished bison bulls were assigned to one of two management systems: 1) Young bulls (n = 98) harvested at 30 months of age with no exposure to the breeding herd or 2) Mature bulls (n = 24) harvested at 36 months of age following use in the breeding herd. Hot carcass weight, kidney fat percentage, and objective color ( $L^*$ ,  $a^*$ ,  $b^*$ ) of the ribeye were recorded 24 hours postmortem. Ribeye area, backfat thickness, marbling score, skeletal maturity, lean color, and external fat color were determined by United States Department of Agriculture (USDA) graders. Strip loins were collected from a subsample of Young carcasses (n = 30 carcasses closest to the treatment average hot carcass weight), and all 24 strip loins were analysed from the Mature bulls. Ultimate pH was recorded and strip loins were fabricated into 2.54-cm steaks. Four steaks were assigned to age for 4, 7, 14, or 21 days prior to freezing for Warner-Bratzler shear force (WBSF) analysis. One steak was designated for evaluation of collagen and was frozen immediately. Two steaks designated for a trained and consumer sensory panel were aged for 14 days and frozen. Subjective carcass data including fat color, lean color, and skeletal maturity were analysed as binomial proportions using the GLIMMIX procedure of SAS with management treatment included as the fixed effect. Objective carcass measures and collagen content were analysed using the MIXED procedure of SAS, with management treatment as the fixed effect. Cook loss and WBSF samples subjected to different aging periods were analysed as repeated measures for effects of management system, aging, and their interaction with peak temperature included as a covariate. Trained and consumer sensory data were analysed using the MIXED procedure of SAS for the fixed effect of management system with panelist included as a random effect. Carcass served as the experimental unit for carcass and meat quality analyses and individual panelist served as the experimental unit for sensory analysis. Means separation means was performed by LSD with a Tukey's adjustment and the significance was considered at  $\leq 0.05$ .

## III. RESULTS AND DISCUSSION

Mature bulls had greater ( $P < 0.01$ ) hot carcass weight, ribeye area, kidney fat percentage, and marbling compared to Young bulls. Management system did not influence ( $P > 0.05$ ) the proportion of bulls in each ossification category. A greater proportion of ( $P < 0.05$ ) of Young bulls were classified as having slightly bright red lean color compared to Mature bulls, while a greater proportion of Mature bulls were classified as having red lean color (Table 1). A greater percentage ( $P < 0.05$ ) of Mature bulls were classified as having yellow fat color compared to Young bulls. This is supported by an increased ( $P < 0.0001$ )  $b^*$  (yellowness) value of the external fat of Mature carcasses. The WBSF values were affected ( $P < 0.0001$ ) by the interaction of postmortem aging and management system. Steaks from Young bison bulls were more tender at all aging time points compared to steaks from Mature bison bulls. Steaks from Mature bulls required 21 days of aging to reach the minimum tenderness threshold value according to the USDA-Agricultural Marketing Service tenderness standard. Variation in tenderness between treatment groups is likely not due to differences in collagen as total collagen was greater ( $P < 0.05$ ) in steaks from Young bulls. Consumer panelists rated steaks from Mature bulls higher ( $P < 0.05$ ) for toughness intensity and flavor liking and lower ( $P < 0.05$ ) off-flavor intensity. No treatment differences ( $P > 0.05$ ) were detected by consumer panelists for overall liking, aroma liking, texture liking, juiciness intensity, or meat flavor intensity. Trained panelists rated steaks from Young bulls higher ( $P < 0.0001$ ) for flavor intensity, while ratings for toughness and juiciness were increased ( $P < 0.0001$ ) for Mature bulls.

**Table 1.** Least squares mean for effect of animal age on lean maturity of Young or Mature bison bulls.

Lean Maturity <sup>4</sup>	Young Bulls <sup>1</sup>	Mature Bulls <sup>1</sup>	SEM <sup>2</sup>	P-value <sup>3</sup>
Red, %	11.22	29.17	9.278	0.0343
Slightly Bright Red, %	75.51	33.33	9.623	0.0003
Moderately Bright Red, %	12.24	16.67	7.607	0.5678

<sup>1</sup>Treatments: Young bison bulls (n=98) slaughtered at 29 months of age. Mature bison bulls (n=24) slaughtered at 36 months of age

<sup>2</sup>Standard error of the mean

<sup>3</sup>Probability of difference among least square means

<sup>4</sup>Subjective lean maturity assigned by USDA

#### IV. CONCLUSION

Bulls used in the breeding herd and marketed at 36 months of age produced heavier carcasses. However, Mature bulls were significantly tougher at all postmortem aging days and required 21 days of aging to reach an acceptable level of tenderness, which was detected by both trained and consumer panelists. To avoid palatability issues, carcasses or primal cuts should be aged for a minimum of 21 days from Mature bison bulls that have been utilized in the breeding herd.

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