Efficiency of Weight and Retail Product Gain of Brahman, Boran, Belgian Blue, Piedmontese, and Hereford or Angus Sired Crossbred Steers to Alternative Endpoints

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ABSTRACT: Data were obtained on 843 crossbred steers produced by sires of two British breeds (HAx = Hereford or Angus combined), Belgian Blue [Bb], Piedmontese [Pd]), and three tropically adapted breeds (Tx = Boran [Bo], Tuli [Tu], and Brahman [Bm]) assigned to replicated pens over three years. Quadratic regression of pen mean weights and cumulative metabolizable energy (ME) intake were used to estimate efficiencies of live weight and retail product gain (g/Mcal ME) in time (0 to 214 days) and weight (310 to 550 kg) intervals and to fat trim (21% total fat trim) and marbling (Small 00 corresponding to USDA Low Choice) endpoints. Breed effects were significant (P < 0.05) for all estimates of efficiency. Efficiency of retail product gain was significantly greater for Bb and Pd than HAx or Tx steers in time and weight intervals but not to fat trim or marbling endpoints.

Keywords: Beef breeds; Feed efficiency

Introduction

Rate and efficiency of gain from weaning to slaughter are important components of life cycle efficiency of beef production. Breed differences can be utilized to improve these characteristics. In this report, postweaning feed efficiency of six sire breeds representing diverse biological types of cattle are reported for (1) time and (2) weight constant intervals and to (3) marbling and (4) percentage fat trim endpoints.

Materials and Methods

A total of 145 Bb, 35 Pd, 130 Bm, 149 Bo, 163 Tu, and 222 HAx crossbred steers with Hereford, Angus, or Composite MARC III dams were included in this experiment. Details concerning number of sires used and numbers of progeny per sire breed were presented by Wheeler et al. (2001a). Calves were born beginning in March of 1992, 1993, and 1994. Males were castrated within 24 hours of birth and creep fed whole oats from mid-July or early August until weaning in early October at an average age of about 184 days. The growing diet contained about 2.7 Mcal ME/kg dry matter and 12.95% crude protein. The finishing diet fed from about 320 kg to slaughter contained about 3.04 Mcal ME kg of dry matter and 10.9% crude protein. Following a conditioning period of about 30 days, steers in each breed group were assigned to replicated pens (2 or 3 pens per year) and fed for an average of about 233 days. Feed provided to each pen was recorded daily and steer body weights were recorded every 28 days from an initial date (day 0, about 46 days after weaning). Representative samples of steers were slaughtered serially each year in a commercial facility in 3 groups spanning 56 days in 1993, 4 groups spanning 63 days in 1994 and 5 groups spanning 63 days in 1995. After a 24 hr chill, carcasses were evaluated for components of USDA Quality grade (marbling, maturity) and USDA yield grade. The right side of each carcass was transferred to the U.S. Meat Animal Research Center and processed into closely trimmed (8 mm fat thickness) and totally trimmed (0 mm fat thickness) boneless retail product (steaks, roasts, and lean trim with 20% chemical fat content in the lean trim), fat trim and bone (Cundiff et al., 2000; Wheeler, et al., 2001a).

Regression of live weight, fat trim %, or marbling score on days on feed was used to estimate days required for each sire breed to reach a live weight, fat trim, or marbling endpoint. Quadratic regression equations for pen mean weight on days fed, and for cumulative metabolizable energy (ME; forced through the origin on days fed) were used to estimate pen mean gain, ME consumption, and efficiency during alternate intervals of evaluation. For example, for a weight constant interval from 310 to 550 kg, the initial date (X₁), when steers averaged 310 kg, and the final date (Xₙ), when steers averaged 550 kg were determined from the weight-age curves fit for each pen of steers. The amount of ME consumed during the corresponding interval was estimated for each pen by subtraction of cumulative ME estimated from day 0 to the initial date (X₁) from the cumulative ME estimated from day 0 to the final date (Xₙ). Similarly, live weight gain was estimated for steers in each pen over three intervals: time constant (0 to 214 days on feed), 0 days to a 21% fat trim endpoint, and 0 days to a constant degree of marbling endpoint (Small 00). Daily maintenance energy can be estimated from 0.77 body weight0.75 (NRC, 1970). Thus, cumulative net energy for maintenance (NEM) was estimated by integrating the equation .77 [B₀ + B₁X + B₂X²] over the interval from X₁ to Xₙ, where X₁ denotes the initial date, Xₙ denotes the final date, B₀ is the intercept and B₁ and B₂ are linear and quadratic regression coefficients for weight on days fed (Cundiff et al., 1984). Estimates of pen mean efficiencies (8 pens of HAAX over 3 years, 6 pens of each Bm, Bo, Tu, and Bb over 3 years, and 2 pens of Pd (in only the first year) for each interval and endpoint were analyzed by analysis of variance considering breed group (df = 5), year (df = 3) and residual (df = 33) sources of variation. Sire breed-year interaction was not included because preliminary analyses indicated it was not a significant source of variation (P>0.05) for any trait.
analyzed. The residual mean square was used as the error variance for estimates of least significant difference (LSD<.05) among estimates of sire breed means for feed efficiency and component traits.

### Results and Discussion

Breed group means for feed efficiency (Mcal ME/kg gain) and its components for time constant (0 to 214 days), weight constant (310 to 550 kg), 0 days to a small 00 marbling endpoint, and 0 days to a small 00 marbling endpoint are shown in Table 1. In addition, previously reported estimates of breed group means for dressing percent (D% = carcass weight/ final live weight, Wheeler et al., 2001a) and percentage totally trimmed boneless retail product (RP%, Cundiff et al., 2000) shown in Table 1 were used to estimate efficiency of retail product gain as [(weight gain, g X D% X RP%/100)]/[Mecal ME]) for each interval of evaluation. Analyses of variance indicated that effects of breed group were significant for all traits tabulated (P < 0.05) in each interval of evaluation. Breed group differences can be compared using the LSD with (P < 0.05) for all pair-wise contrasts. The LSD appropriate for comparisons among Bm, Bo, Tu, and Bb breed groups (LSD w/o Pd) involved 6 pens per sire breed. Comparisons to Pd involving a smaller number of pens (2) required a separate estimate (LSD with P < 0.05). The LSD appropriate for comparisons of HAx (8 pens) to breed groups with 6 pens are not shown due space limitations, but were only slightly smaller (12%) than LSD w/o Pd (Table 1).
In time constant intervals, HAx did not differ significantly from Bb in efficiency of live weight gain and both were more efficient than tropically adapted Tu, Bo, and Bm sired progeny. Pd did not differ significantly from other breed groups in efficiency of live weight gain. However, for efficiency of retail product gain, Bb and Pd were both more efficient than HA, Tu, Bo, or Bm sired progeny due to significantly greater dressing percentages and retail product yields.

Results for efficiency of live weight gain in the weight constant interval were similar to those in the time constant interval. HAx and Bb were similar and significantly more efficient than the other breed groups. Differences among Bo, Tu, Pd and Bm (in order of ranking) were small and not significant for efficiency of live weight gain. However, efficiency of retail product gain was significantly greater for Bb and Pd sired progeny than HAx, Tu, Bo, or Bm sired progeny. Within the latter grouping, only HAx differed significantly from the less efficient Bm sired progeny.

Estimates of efficiency to fat trim endpoints are important biologically because of their association with energetic inputs and outputs. To this endpoint, efficiency of both live weight and retail product gain for HAx, with lowest retail product yield and greatest propensity to fatten (Cundiff et al., 2000a, Wheeler et al., 2001a), were significantly greater than that for all other breed groups, due primarily to fewer days and significantly less energy required for maintenance. The estimates for Bb and Pd are shown in italics because they required extrapolation beyond their actual days fed. A fatness endpoint of 21% would not be practical and difficult if not impossible to achieve in terminal cross progeny carrying one copy of the Bb or Pm Mh allele.

To the marbling endpoint, feed efficiency of live HAx weight gain was significantly greater for HAx than all other breed groups. Efficiency of retail product gain to the marbling endpoint, was significantly greater for HAx than Tx breed groups, but HAx did not differ significantly from Bb or Pd in efficiency to the USDA low Choice quality grade endpoint. These results and previous reports concerning tenderness and other components of palatability of steaks from longissimus and other lower valued muscles (Wheeler et al., 2001a,b) indicate that Bb or Pd sires are excellent candidates as terminal sire breeds provided producers are compensated for carcass and meat value and not just for live weight, or carcass weight and marbling.

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Literature Cited


