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Growth-promoting implants and nutrient restriction before feeding: Effect on finishing performance, carcass composition, carcass quality, and consumer acceptability of beef[1]

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ABSTRACT

*The objectives of this experiment were to determine the effect of a prefinishing implant strategy and plane of nutrition on feedlot performance, carcass characteristics, and beef quality. Calves were weaned in the fall (n = 120 and 96 for yr 1 and 2, respectively) and finished as calves (**CFED**) or following a growing-backgrounding program with ADG of 0.45 (**RSTR**) or 0.91 kg/d (**UNRSTR**). Before finishing, half of each group received hormonal implants with 200 mg of progesterone and 20 mg of estradiol benzoate for steers or 200 mg of testosterone propionate and 20 mg of estradiol benzoate for heifers (**IMPL**), whereas the other half did not receive an implant until entry into the feed yard (**DLY**). Growing phase ADG was greater (P < 0.01) for IMPL, but subsequent finishing ADG was not affected (P = 0.98). Greater HCW (P < 0.01) was observed with UNRSTR than CFED or RSTR, but no effect (P = 0.92) of implant was noted. Marbling scores and ratings for tenderness, juiciness, and flavor were greater (P < 0.01) for CFED than UNSTR or RSTR. Whereas IMPL cattle tended (P = 0.06) to have lower marbling scores than DLY cattle. Steaks from IMPL had greater (P = 0.03) shear force values, as well as lower (P ≤ 0.05) ratings for tenderness, juiciness, and beef flavor intensity than DLY. Results indicated that CFED produced higher quality carcasses and more palatable beef than RSTR, and prefinishing IMPL negatively affected beef quality and palatability.*

Key words: carcass quality, finishing performance, implant, nutrient restriction, tenderness

INTRODUCTION

Several different aspects of cattle management can affect the quality of beef carcasses, including age entering the feedlot, implant strategy used, and plane of nutrition before finishing. Cattle that have been fed on a high plane of nutrition or fed on an energy-dense diet before entry into the feedlot have been shown to have

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a greater degree of finish entering the finishing phase compared with cattle that have been nutritionally restricted (Baker et al., 1992). Furthermore, when comparing cattle at equal back fat thicknesses, Griffin et al. (2007) found that cattle fed after an extensive growing period required fewer days on feed to produce a quality carcass, along with depositing intramuscular fat at a greater rate and having greater ADG compared with calves finished directly after weaning. Cattle fed as calves often produce higher YG carcasses, but in many instances the QG has been equal to or greater than cattle fed as yearlings (Smith and Lunt, 2007).

Anabolic implants were first used in cattle production systems in the United States in the 1950s to accelerate BW gains, improve carcass leanness, increase red meat yield, and improve feed efficiency (Johnson et al., 2013). However, along with the benefits of using steroidal implants on growth performance, potential negative effects on tenderness, intramuscular fat, palatability, and flavor of beef exist, causing a less-than-desirable eating experience for the consumer (Roeber et al., 2000). Limited evidence exists reporting the interactive effects of implants and plane of nutrition in the backgrounding phase on feedlot performance and carcass characteristics. Thus, the objectives of the current experiment were to determine the relationship between implant status and energy balance prefinishing and their effects on prefinishing and feedlot phase performance, carcass quality characteristics, and sensory panel evaluations of cooked beef palatability.

MATERIALS AND METHODS

Treatments and Animal Management

All procedures in the following experiments were reviewed and approved by the University of Arkansas Institutional Animal Care and Use Committee. This experiment was considered a randomized complete block with a spilt-plot design; there were 3 finishing system treatments and 2 growth-promoting implant treatments in this experiment. Cattle were finished as calves (**CFED**) or were finished as yearlings, following a restricted (**RSTR**) or unrestricted growth (**UNRSTR**) growing period. Half of the cattle in each backgrounding group were implanted (**IMPL**) during backgrounding and growing periods and implants of the other half were delayed until feedlot entry (**DLY**).

Cattle used for both years originated from the University of Arkansas Southwest Research and Extension Center (**SWREC**; Hope, AR) from the spring-calving cow herd of predominantly (75 to 87%) Angus ancestry. In the current experiment, 120 (n = 40 heifers and 80 steers) and 96 calves (n = 39 heifers and 57 steers) were used for yr 1 and 2, respectively. Calves were weaned by removal from dams on October 6, 2009, in yr 1 and on October 5, 2010, in yr 2. Following collection of weaning BW data, treatment for internal and external parasites (Ivomec Plus, Merial Inc., Duluth, GA), vaccination for respiratory diseases (Cattlemaster 4, Zoetis, Florham, NJ), and with a 7-way Clostridial plus *Haemophilus somnus* (Vision 7 *somnus*, Bayer Corp., Shawnee Mission, KS), calves were shipped approximately 2 km to the SWREC feedlot facility. Calves were then allowed to acclimate to facilities and feeding management and recover from stress of separation from dam for 28 d before the initiation of the experiment on November 3, 2009, in yr 1 and on November 2, 2010, in yr 2. Cattle were fed in mixed-sex pens by allocation within sex and BW groups to pens so that pen BW and sex representation were equalized across treatments. Pens were then randomly assigned to treatments (n = 4 pens/treatment; n = 10 calves/pen yr 1 and n = 8 calves/pen in yr 2). All cattle were revaccinated with the previously mentioned products 14 d after initial vaccination.

For implantation, a moderate-potency implant was used that supplied 200 mg of progesterone and 20 mg of estradiol benzoate (Synovex-S; Zoetis) for steers or 200 mg of testosterone propionate and 20 mg of estradiol benzoate (Synovex-H; Zoetis) for heifers. These implants were applied to IMPL-treated calves at the end of the weaning period (28 d postweaning for CFED, RSTR, and UNRSTR treatments) and at the midpoint of the growing phase (February 19, 2010, in yr 1 and February 14, 2011, in yr 2 for the RSTR and UNRSTR treatments). All cattle (both IMPL and DLY treatments) were implanted upon arrival at the feedlot at the end of the prefinishing period for CFED (December 17, 2009, in yr 1 and December 14, 2010, in yr 2) and UNRSTR and RSTR (April 22, 2010, in yr 1 and May 3, 2011, in yr 2) and at the midpoint of the finishing period.

Feeding Management and Diets

Calf Treatment. Calves in the CFED treatment were preconditioned for 44 d in yr 1 and 42 d in yr 2. During this time CFED (n = 40) were provided growing diets designed to produce estimated ADG of 1.15 kg/d before being shipped to the feed yard. Diets fed to CFED for the preconditioning period were based on mixed bermudagrass (*Cynodon dactylon*) or dallisgrass (*Paspalum dilatatum*) hay, with ground corn and soybean hulls as the primary concentrate energy sources (Table 1). The CFED cattle were started on 40% roughage, and the roughage level was stepped down at 2-wk intervals to 30 and, finally, 20% roughage.

In yr 1, CFED groups were shipped 597 km to a commercial feed yard (Alfadale Stock Farm, El Reno, OK) on December 17, 2009. At the feed yard, cattle were divided by sex and fed steam-flaked corn-based finishing diets (Table 2) in mixed treatment groups until the average fat thickness over the twelfth rib for each group reached 1 cm, based on visual estimation. Cattle were then transported 491 km to Cargill Red Meat Solutions (Plainview, TX) for slaughter.