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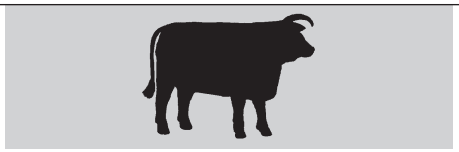

Influence of timing of growth implant administration on performance and health of newly received beef cattle[1,2]

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ABSTRACT

A total of 442 Angus and crossbred steers (initial BW = 243 ± 13.1 kg) were used in a randomized complete block design to evaluate the effect of implant timing on performance and health of newly received steers. Treatments included administration of a growth implant (Revalor-XS; Merck Animal Health, Summit, NJ) on d 0 of the experiment (ARR) or d 28 (DEL). On d 0, 5 steers from each pen were injected with ovalbumin (OVA) to evaluate a primary humoral immune response. On d 28, the same 5 steers received a secondary OVA injection, and 5 additional steers from each pen received a single OVA injection. Final BW (P = 0.02) and ADG d 0 through slaughter (P = 0.03) were greater for DEL compared with ARR (BW: 636 vs. 627 ± 8.3 kg; ADG: 1.78 vs. 1.74 kg ± 0.029, respectively). Steers implanted on arrival had greater DMI (P ≤ 0.02) d 0 to 28, d 29 to 56, and d 57 to 112 and lower (P ≤ 0.03) G:F d 57 to 112, d 113 to 169, d 170 to slaughter, and d 0 to slaughter (0.175 vs. 0.186 ± 0.003) when compared with DEL steers. On a pen mean basis, BW at d 28 and ADG d 0 to 28 were numerically higher (P = 0.25) for ARR steers as compared with DEL steers (294 vs. 291 ± 1.8 kg and 1.80 vs. 1.71 ± 0.061 kg, respectively). Hot carcass weight was numerically greater (P = 0.16) for DEL compared with ARR steers (383 vs. 378 ± 3.6 kg, respectively). Steers implanted on arrival tended (P < 0.07) to have greater OVA IgG concentration after OVA administration. These results suggest that delaying the time of growth implant administration of newly received cattle had minimal effects on animal performance, health, and immune response. The observed improvements in feedlot performance from d 0 through slaughter that were observed for the DEL versus ARR steers were likely due to timing of slaughter relative to depletion of implant active ingredients.

Key words: feedlot, health, immune response, implant, weaning

INTRODUCTION

Duff and Galyean (2007) suggested that transportation, marketing, commingling, and reduced feed intake upon arrival to the feedlot that is frequently seen in high-risk calves can contribute to health challenges and may have a negative effect on immunity. The relationship between stress and immunity is complex. Acute phase protein concentrations in the blood of cattle increase in response to stress (Conner et al., 1988). The acute phase proteins are produced after stimulation from proinflammatory cytokines. Proinflammatory cytokines have also been shown to inhibit growth and increase proteolysis in animals (Johnson, 1997). Activating this immune response for the production of the acute phase proteins increases the demand of the animal for nutrients, specifically protein, for the purpose of replacing lost tissues (Arthington et al., 2005).

The cattle industry has routinely used growth promoting implants for more than 55 years to improve ADG and feed conversion (Belk et al., 1989). Griffin et al. (2009) investigated the effects of delayed implanting on feedlot performance and carcass

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merit and reported no difference for BW, ADG, or carcass measurements between implanting cattle on arrival into the feedlot or delaying growth implant administration for 30 d after arrival. Griffin et al. (2009) suggest that more research is needed on strategies for implanting high-risk cattle. Protein is required by calves to mount an immune response (Arthington et al., 2005), and growth promoting implants direct dietary protein toward muscle deposition (Rumsey et al., 1981; Rumsey, 1982). This increase in protein demand coupled with reduced intake for high-risk cattle for several days or weeks following arrival in the feedlot may result in increased sickness and reduced performance during the first few weeks in the feedlot. Because of the lack of published information, Duff and Galyean (2007) questioned the effect that growth implants may have on the immune system of highly stressed calves. Therefore, the objective of this experiment was to evaluate the effect of the timing of growth implant administration of newly received beef steers on performance and immunity.

MATERIALS AND METHODS

Experimental Design

Before the initiation of this experiment, care, handling, and sampling of animals described herein were approved by the Colorado State University Animal Care and Use Committee.

A total of 442 newly received Angus and Angus crossbred steers (initial BW = 234 ± 13.1 kg) were selected from an initial group of 453 steers originating from the Eastern Colorado Research Center (**ECRC**) herd and 2 Colorado private ranches. The ECRC steers were raised on pastures located adjacent to the research feedlot, and the cattle from the private ranches were transported 50 or 250 km to the feedlot. Upon arrival to the ECRC research feedlot, individual BW was recorded, an individual electronic identification tag was applied, and steers received a respiratory vaccine (Bovi-Shield Gold FP5 L5 HB; Zoetis, Madison, NJ), a vaccination for the prevention of Clostridial disease (One Shot Ultra 8; Zoetis), an injectable dewormer (Promectin; VEDCO Inc., Saint Joseph, MO), and a pour-on product for the prevention of external parasites (Saber; Merck Animal Health, Whitehouse Station, NJ).

After initial processing, all steers were ranked by BW within ranch source, and individuals that were beyond ±3 SD from the mean and individuals showing health problems upon feedlot arrival were excluded from further consideration for the experiment. Remaining steers were assigned a random number from 1 to 1,000 using the RAND function of Microsoft Excel 2003 (Microsoft Inc., Seattle, WA). A sufficient number of steers with the lowest random numbers were removed from further consideration for the experiment to reach the 442 steers required for the experiment. Steers were ranked by BW within ranch source, and each successive pair of ranked steers was assigned to treatments 1 or 2 using the lowest or highest random number assigned to the paired steers, respectively. This process was repeated until all steers were assigned to treatment. Within each treatment per ranch, the lightest 25 or 23 steers (depending upon ranch of origin) were assigned to a single pen, then the next heaviest 25 or 23 steers were assigned to a second pen, and finally the heaviest 25 or 23 steers were assigned to a third pen. Thus, 3 pens per ranch source with 23 or 25 steers per pen for a total of 9 pens per treatment were used for the experiment.

After processing, and on the day of allotment to treatments and pens, steers received the assigned implant treatment. Arrival (**ARR**) treatment received an implant of Revalor-XS (40 mg of estradiol and 200 mg of trenbolone acetate; Merck Animal Health, Summit, NJ). Delayed (**DEL**) treatment received no implant at this time. Steers were revaccinated on d 28 as is standard operating procedure for ECRC. At this time the DEL treatment received a Revalor-XS (Merck Animal Health) implant. Individual BW was collected every 28 d for each pen of cattle until d 56, and then individual BW was collected every 56 d through slaughter.

On d 0, a solution containing OVA (Sigma-Aldrich, St. Louis, MO), Freund's Incomplete Adjuvant (Sigma-Aldrich), and sterile PBS was injected into the neck of 5 steers from each pen both subcutaneously (2 mL) and intramuscularly (1 mL) as described by Ward et al. (1993). The OVA stock solution was composed of 160 mg of crystallized OVA (chicken egg albumin) dissolved in 60 mL of PBS (pH 7.4), which was prepared approximately 1 d before use. On the day of the inoculation, the OVA and PBS solution was mixed with 60 mL of Freund's Incomplete Adjuvant. A total of 4,000 μg of OVA was administered to each animal. This was repeated on d 28 using the same 5 steers from each pen and 5 new steers in each pen. Administering the OVA in this manner allowed for the evaluation of a primary OVA IgG response (d 0) and a primary and secondary OVA IgG response following d 28 and for a primary response on d 28.

Blood samples were taken on d 0, 7, 14, 28, 30, 35, 42, 56, 84, 112, 140, and 169 and before slaughter. Blood was collected via jugular venipuncture (10-mL volume in BD Vacutainer tubes; Franklin Lakes, NJ) from all steers that received OVA. Blood was collected in both a sodium heparinized and nonheparinized vacutainer tubes. Blood samples were placed on ice after being collected and then transported back to the laboratory in Fort Collins, Colorado. Blood samples were centrifuged at 931 × *g* for 25 min at 4°C. Plasma samples were then collected and frozen at −20°C for analysis of IgG specific to OVA. Ovalbumin antibody titers were determined using an ELISA procedure as described by Engvall and Perlmann (1972). Optical density was read at 405 nm.

Steers were housed in dirt surfaced pens measuring 12.2 × 42.7 m with a single automatic water fountain shared between every 2 pens. Each pen was equipped with fence-line con-