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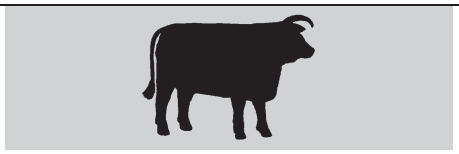

Optimum inclusion of alkaline-treated corn residue and distillers grains fed to calf-fed steers[1]

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ABSTRACT

A 180-d finishing study was conducted to evaluate inclusion rates of modified distillers grains plus solubles (MDGS) and alkaline-treated corn residue (ATCR) on performance and carcass characteristics. Crossbred steer calves (n = 378; initial BW = 320 ± 7 kg) were used in a 2 × 3 + 1 factorial treatment arrangement. Factors included inclusion rate of MDGS (20 or 40%; DM basis) and ATCR (10, 20, or 30%; DM basis). In addition, a dry-rolled corn, 20% MDGS, and 5% untreated-corn-residue control was fed. There was a distillers inclusion–by–treated corn residue interaction for both carcass-adjusted G:F (P < 0.10) and G:F based on final live BW (P < 0.05). However, no interactions were observed between ATCR and MDGS inclusion for DMI (P = 0.47), ADG (P = 0.21), or carcass characteristics (P > 0.21). Intakes were not affected by treatment (P > 0.18). Daily gain decreased linearly (P < 0.01) as ATCR increased within 20% MDGS; however, ADG quadratically decreased (P < 0.01) when ATCR was added to the 40% MDGS diets, with ADG equivalent between 10 and 20% and decreasing at 30% inclusion. Similar to ADG, G:F decreased linearly (P < 0.01) when ATCR was increased from 10 to 30% in diets with 20% MDGS. However, G:F decreased quadratically (P < 0.01) when ATCR increased in diets with 40% MDGS; similar G:F was observed for the 10 and 20% ATCR diets and then decreasing when ATCR increased to 30%. Dressing percentage decreased linearly (P < 0.01) when ATCR was included in the 40% MDGS diets and decreased quadratically (P = 0.05) when fed with 20% MDGS. A linear decrease in fat depth was observed as ATCR increased in both 20 and 40% MDGS-based diets. Within 20% MDGS, steers fed the control diet had the greatest (P < 0.01) final BW, ADG, and G:F when all ATCR inclusions were evaluated. These data suggest that 10 or 20% ATCR can be fed with 40% MDGS included in the diet without negatively affecting ADG and G:F; however, if only 20% MDGS is fed, then 10% or less ATCR should be fed.

Key words: alkaline treatment, calcium oxide, corn residue, distillers, feedlot cattle

INTRODUCTION

Corn markets are variable, and in times of high prices, cattle producers need alternative low-cost feed options. An increase in commodity price is often paired with a subsequent increase in production (NASS, 2014). For every 1 kg of grain produced, there is approximately 1 kg of corn residue produced (Klopfenstein, 1978). Therefore, when corn production is increased, corn residue becomes more abundant and may serve as a lower-cost roughage. However, maturity of the corn plant at the time of grain harvest leads to residue digestibility of approximately 50% or less (Klopfenstein, 1978). Although corn replacement with corn residue for finishing cattle would be a cheap alternative, dietary NE_g would be dramatically reduced (NRC, 1996), therefore decreasing ADG and G:F (Owens, 2011).

However, feeding value of low-quality corn residue can be improved by alkaline treatment with calcium oxide. Klopfenstein (1978) stated

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that chemical treatment increases the extent of cellulose and hemicellulose digestion, while also increasing the rate of cellulose and hemicellulose digestion. Improved digestion can be attributed to the swelling of the forage fiber, therefore allowing microbial attachment (Tarkow and Feist, 1968). Shreck et al. (2012) observed similar ADG and G:F when 15 percentage units of corn and 5% corn residue were replaced with 20% CaO-treated corn residue in a diet containing 40% modified distillers grains. In a similar study, Johnson et al. (2015) found that when 20% CaO-treated corn residue replaced 15 percentage units of corn and 5% untreated corn residue, ADG and G:F were not different in one study but were lower than the control diet in a second study. However, in a commercial study, cattle fed 35% wet distillers grains with solubles (**WDGS**) and 20% CaO-treated corn residue tended to have decreased ADG and G:F compared with the control cattle (Cooper et al., 2014). In these studies, at least 35% modified or wet distillers plus solubles was included along with treated corn residue. One hypothesis is that inclusion of modified or wet distillers grains plus solubles interacts positively with inclusion of CaO-treated corn residue relative to maintaining ADG and G:F.

Because of variable distillers inclusions possible under different economic scenarios, producers need to know whether inclusion of distillers grains plus solubles affects ADG and G:F when alkaline-treated corn residue replaces a portion of corn grain. Therefore, the objective of this study was to identify the maximum amount of treated forage that can be fed in combination with 2 inclusions of MDGS without negatively affecting cattle performance and carcass characteristics.

MATERIALS AND METHODS

A 180-d finishing trial was completed using 378 crossbred steers (BW = 320 ± 7 kg). Steers were received as calves at the University of Nebraska beef research facility located at the Agricultural Research and Development Center (Mead, NE) in October 2012. Upon arrival, steers were individually weighed and identified with 3 ear tags; were vaccinated with a modified live virus vaccine for protection against infectious bovine rhinotracheitis, bovine viral diarrhea, parainfluenza 3, respiratory syncytial virus, and *Mannheimia haemolytica* and *Pasteurella multocida* bacteria (Vista Once, Merck Animal Health, De Soto, KS); received an injectable for protection against external parasites (Cydectin Injectable, Boehringer Ingelheim, St. Joseph, MO); and were orally drenched for protection against internal parasites (Safe-Guard, Merck Animal Health). Until trial initiation, calves were assigned to pens and received 1 of 2 receiving rations for approximately 25 d (Peterson et al., 2014) after initial processing. Following the receiving trial, steers were limit fed a diet containing 50% sweet bran and 50% alfalfa hay (DM basis) at 2.0% of BW for 5 d before initiation of the finishing study to minimize gutfill variation (Watson et al., 2013). On d 0 and 1, steers were individually weighed with BW averaged to get an accurate initial BW (Stock et al., 1983). On d 1, steers were vaccinated for prevention of *Clostridium chauvoei*, *Clostridium semticum*, *Clostridium novyi*, *Clostridium sordellii*, and *Clostridium perfringens* Types C and D (Vision 7, Merck Animal Health); given a booster of modified live infectious bovine rhinotracheitis, bovine viral diarrhea Types I and II, parainfluenza 3, and bovine respiratory syncytial virus (Vista 5, Merck Animal Health); and implanted with Revalor-XS (Merck Animal Health, containing 4 mg of estradiol and 20 mg of trenbolone acetate).

Based on first-day weights, steers were separated into 2 weight blocks, stratified by BW within block, and assigned randomly to 1 of 42 pens. Pens were assigned randomly to 1 of 7 treatments, with 6 pens per treatment and 9 steers per pen. There were 3 replications per block. A generalized randomized block design was used with a 2 × 3 + 1 factorial treatment design. Factors were level of modified distillers grains plus solubles (**MDGS**; 20 or 40% of the diet DM) and inclusion of alkaline-treated corn residue (**ATCR**) fed at 10, 20 or 30% of diet DM (Table 1) as a replacement for dry-rolled corn (**DRC**). A control diet was also fed that contained 71% DRC, 20% MDGS, and 5% untreated corn residue. Previous in vitro digestibility studies (Shreck et al., 2011) showed that treating corn residue with 5% CaO (DM basis) at 50% DM resulted in improved residue digestibility; therefore, the same process was used for this study. All corn-stalk round bales used for this study were harvested from the same field. All corn residue was tub ground (Mighty Giant, Jones Manufacturing, Beemer, NE) through a 2.54-cm screen (Shreck et al., 2012) and stored under a roof in a commodity bay. Chemical treatment involved adding CaO as a powder (0- to 0.098-cm granular standard quicklime, Mississippi Lime Co., St. Louis, MO) to ground residue, followed by immediate hydration to 50% DM with water addition. Calcium oxide was added at 5% of corn residue on a DM basis. Feed trucks dispensed treated residue into a concrete bunker with 3 concrete walls, piled approximately 2 m high, followed by covering with plastic. This treatment process was completed every 2 wk continuously throughout the trial, allowing for residue to be exposed for at least 1 wk before feeding. Untreated residues were ground and stored under roof with no added moisture or chemical. Modified distillers grains plus solubles were purchased from a commercial ethanol plant (Green Plains, Central City, NE) and delivered as needed (approximately 1 semi load per week). All diets contained 4% dry supplement, which was formulated for 33 mg/kg of monensin (Rumensin, Elanco Animal Health, Greenfield, IN) and to provide 90 mg per steer daily of tylosin (Tylan, Elanco Animal Health) with estimated DMI of 10 kg. Calcium oxide (formulated to contain 71% Ca based on molecular weights) replaced limestone in diets containing 20 and 30% alkaline-treated corn