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Effect of dietary inclusion of wet or modified distillers grains plus solubles on performance of finishing cattle[1]

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ABSTRACT

Two experiments evaluated the effects of dietary inclusion of corn wet distillers grains plus solubles (WDGS) or partially dried modified distillers grains plus solubles (MDGS) on finishing cattle performance and carcass characteristics. Experiment 1 used 288 steers (BW = 351 ± 11 kg). Cattle were weighed, stratified within block, and assigned randomly to pens (8 steers/pen; 6 pens/treatment) to evaluate 0, 10, 20, 30, 40, and 50% (DM basis) dietary inclusion of WDGS replacing a blend of high-moisture and dry-rolled corn. Experiment 2 used 288 steers (BW = 332 ± 17 kg) to evaluate the effects of MDGS inclusion with similar methodology as Exp. 1. In Exp. 1, quadratic responses ($P < 0.01$) were observed for DMI, final BW, ADG, and G:F as WDGS inclusion increased. The greatest G:F was observed at 40% WDGS inclusion. Results indicated a decrease in feeding value from 178 to 121% the value of corn as WDGS inclusion increased from 10 to 50% of diet DM. In Exp. 2, feeding MDGS up to 50% of diet DM resulted in improved performance relative to corn-fed cattle. Quadratic responses ($P < 0.01$) were observed for final BW, ADG, and DMI as MDGS dietary inclusion increased from 0 to 50%. A linear increase ($P < 0.01$) was observed for G:F as MDGS inclusion increased. The feeding value of MDGS was 125 to 111% the value of corn and decreased as dietary inclusion of MDGS increased. These data demonstrate feedlot cattle performance improvement when WDGS or MDGS replace corn.

Key words: by-product, corn, distillers grains plus solubles, finishing cattle

INTRODUCTION

The dry milling industry has expanded rapidly in recent years, thereby increasing corn utilization and production of distillers grains. Distillers grains plus solubles (**DGS**) are commonly used in cattle diets and may be used as either a protein supplement at low inclusion levels (15–20% of DM) or for energy at greater inclusion levels (Klopfenstein et al., 2008). Much research has been done on feeding wet distillers grains plus solubles (**WDGS**) to cattle. Typically WDGS are 28 to 32% DM. Inclusion level of WDGS is known to alter cattle performance, and feeding value typically declines as inclusion increases (Larson et al., 1993; Ham et al., 1994; Lodge et al., 1997a; Trenkle, 1997a,b; Al-Suwaiegh et al., 2002).

Many dry milling plants have made a change to their production process and now partially dry the grains before adding the solubles stream back to the grains to produce modified distillers grains plus solubles (**MDGS**). The MDGS are typically 48 to 54% DM (Trenkle, 2007; Luebbe et al., 2011). An advantage of drying WDGS to produce MDGS is reduced transportation costs; however, drying WDGS may also change the feeding value of MDGS relative to WDGS. In addition, the feeding value of both WDGS and MDGS may change as inclusion level increases (Ham et al., 1994; Trenkle, 2008; Nuttelman et al., 2011). Therefore, 2 feedlot finishing experiments were conducted to determine finishing performance and carcass characteristics of feedlot steers fed 0 to 50% WDGS or MDGS (DM basis) when replacing a 1:1 ratio of

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dry-rolled corn (**DRC**) and high-moisture corn (**HMC**) combination.

MATERIALS AND METHODS

All procedures used were approved by the University of Nebraska's Institutional Animal Care and Use Committee.

Exp. 1—WDGS

A 126-d finishing experiment used 288 British crossbred yearling steers (BW = 351 ± 11 kg) in a completely randomized design. Steers were received at the University of Nebraska's Agricultural Research and Development Center (Ithaca, NE) as weaned calves in the fall. Upon arrival, steers were weighed, vaccinated (Hemophilus Somnus Bacterin, Intervet-Schering Plough, Millsboro, DE; Pyramid-4 + Presponse, Pfizer Animal Health, New York, NY; Vision-7 with Spur, Intervet-Schering Plough), poured with a parasiticide (Cydectin, Intervet-Schering Plough), and weaned on smooth bromegrass (*Bromus inermis*) pastures. After weaning, steers grazed corn residue supplemented with 2.27 kg/d (DM basis) of wet corn gluten feed (Sweet Bran, Cargill, Blair, NE) over the winter and returned to cool-season grass pastures in early spring. Five days before the experiment, steers were transported to the feedlot and limit-fed a diet consisting of a 1:1 ratio (DM basis) of alfalfa hay and wet corn gluten feed at 2.0% of BW to collect accurate initial BW (Watson et al., 2013). Steers were weighed individually on d 0 and 1 with BW averaged to obtain initial BW and poured with an insecticide (Elector, Elanco Animal Health, Greenfield, IN) on d 0. Steers were stratified by BW and assigned randomly to pen based on d 0 BW (8 steers/pen); pen was assigned randomly to dietary treatment. There were 6 treatments and 6 replications per treatment.

Dietary treatments presented in Table 1 consisted of 0, 10, 20, 30, 40, and 50% dietary inclusion of corn WDGS (DM basis) replacing a 1:1 ratio of DRC and HMC (**0WDGS**, **10WDGS**, **20WDGS**, **30WDGS**, **40WDGS**, and **50WDGS**, respectively). The WDGS were produced at a commercial ethanol plant (Abengoa Bioenergy, York, NE) and delivered once weekly to the research facility and stored in an open-front commodity barn. Each load received at the research facility was sampled, and the sample was then frozen and sent to a commercial laboratory (Ward Laboratories Inc., Kearney, NE) for analysis of DM (AOAC, 2000; 934.01), CP (AOAC, 2000; 968.06) using a combustion-method N analyzer (Leco FP 2000, St. Joseph, MI), ether extract (Ankom technology XT20 fat analyzer, Macedon, NY), and sulfur (AOAC, 2000; 968.08).

Alfalfa hay and supplement were included in all final diets at 5.0% (DM basis). Cattle were adapted to finishing diets over a 21-d period with a series of 4 diets containing 45, 35, 25, and 15% alfalfa hay (DM basis) for 3, 4, 7, and 7 d, respectively, with the corn blend replacing alfalfa hay. The inclusion of WDGS was the same in the adaptation diets as the final experimental diets for each treatment. Diets were formulated to meet or exceed NRC (1996) requirements for RDP, metabolizable protein (**MP**), Ca, P, and K. Monensin (Rumensin, Elanco Animal Health), tylosin (Tylan, Elanco Animal Health), and thiamine were fed at 27, 8, and 12 mg/kg, respectively.

Bunk reading was conducted daily at 0600 h, and steers were fed once daily at 0800 h with a Roto-Mix model 420 mixer/delivery box feed truck (Roto-Mix, Dodge City, KS). Feed ingredient samples were collected weekly and composited by month. Feed refusals were collected as needed for DM determination. Ingredients and feed refusals were oven-dried for 16 h at 100°C to determine DM content (AOAC, 2000; method 934.01). Steers were given a trenbolone acetate and estradiol combination implant on d 28 (Revalor-S, Intervet-Schering Plough). Steers were slaughtered on d 126 at a commercial abattoir (Tyson Fresh Meats, West Point, NE). Hot carcass weight and liver scores (Brink et al., 1990) were recorded on day of slaughter. Both twelfth rib fat thickness and LM area were measured after a 24-h chill and USDA marbling score was recorded.

Exp. 2—MDGS

A 176-d finishing experiment was conducted utilizing 288 British crossbred steer calves (BW = 332 ± 17 kg) in a randomized block design. Upon arrival calves were vaccinated (Bovi-Shield Gold 5 and Somubac, Pfizer Animal Health) and given a parasiticide (Dectomax Injectable, Pfizer Animal Health). Sixteen days after arrival, animals were revaccinated (Bovi-Shield Gold 5, Somubac, and Ultrachoice 7, Pfizer Animal Health). Steers were managed on smooth brome pastures before trial initiation. Five days before initiation of the experiment, steers were limit fed in feedlot pens using the same procedures as Exp. 1. Cattle were blocked by BW, stratified within BW block, and assigned randomly to pen based on d 0 BW (8 steers/pen). There were 6 treatments and 6 replications per treatment.

Dietary treatments presented in Table 2 consisted of 0, 10, 20, 30, 40, and 50% dietary inclusion of MDGS (DM basis) replacing a 1:1 ratio of DRC and HMC (**0MDGS**, **10MDGS**, **20MDGS**, **30MDGS**, **40MDGS**, and **50MDGS**, respectively). All diets included alfalfa hay and supplement at 7.5 and 5.0% (DM basis), respectively. The supplement used for 0MDGS and 10MDGS treatments were formulated to provide 13.5% CP using 1.28 and 0.64% urea, respectively. All diets were formulated to meet or exceed RDP and MP requirements (NRC, 1996). Corn gluten meal was included in the 0MDGS diet at 3.5% (DM basis) for 51 d and then reduced to 1.75% until d 100. Similarly, corn gluten meal was included in the 10MDGS diet at 1.75% until d 51 and then removed from the diet. Corn gluten meal replaced the corn blend in the diets until the NRC (1996) model predicted that the MP requirement was met with the