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Effects of sorghum wet distillers grains plus solubles in steam-flaked corn–based finishing diets on steer performance, carcass characteristics, and digestibility characteristics[1]

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ABSTRACT

Two studies were conducted to evaluate the effects of sorghum wet distillers grains (SWDGS) in finishing diets on steer performance, carcass characteristics, and nutrient digestibility. In Exp. 1, 240 steers (initial BW = 379 ± 1 kg) were fed steam-flaked corn–based diets with or without 25% SWDGS and 7.5, 10.0, or 12.5% alfalfa hay. There were no effects of alfalfa hay concentration on BW, DMI, ADG, or G:F ($P \geq 0.16$). Including SWDGS reduced ($P \leq 0.05$) ADG and G:F. Fat thickness decreased ($P = 0.03$) and DP tended to decrease ($P = 0.09$) linearly as level of alfalfa hay increased. Final BW of steers consuming diets containing 25% SWDGS were 12 kg lighter ($P = 0.05$) than those of steers fed diets without SWDGS. Hot carcass weight tended ($P = 0.09$) to be lighter for steers fed SWDGS. In Exp. 2, effects of corn processing method (steam-flaked corn and dry-rolled corn) and 20% corn wet distillers grains with solubles (CWDGS) or SWDGS inclusion on ruminal pH and in situ digestibility were evaluated. Cattle consuming diets containing SWDGS had a greater ($P \leq 0.05$) ruminal pH than steers consuming diets with CWDGS or no wet distillers grains with solubles. Including wet distillers grains with solubles did not affect ($P \geq 0.37$) steam-flaked corn or dry-rolled corn in situ DM digestibility. In situ digestibility of DM and NDF differed between CWDGS and SWDGS ($P < 0.0001$). Differences in performance and nutrient digestibility between CWDGS and SWDGS are the result of differences in the product rather than an interaction with corn processing method.

Key words: beef cattle, corn processing, digestibility, roughage concentration, sorghum distillers grains

INTRODUCTION

Grain sorghum grows well in warm regions without irrigation, making it a favorable option to corn for the

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southern plains region. Historically, Kansas and Texas have been the leaders in grain sorghum production (NASS, 2013), and sorghum continues to be used as a feedstock for ethanol production, making sorghum wet distillers grains plus solubles (**WDGS**) an available commodity for the beef industry. Distillers by-products, including WDGS, contain very little starch and are relatively high in NDF and ADF (Stock et al., 2000; Klopfenstein et al., 2008) when compared with grains that are replaced when WDGS are included in finishing diets. Roughage is included in finishing diets to help control subacute acidosis that may occur when high levels of starch are fed. Because WDGS are low in starch and high in fiber, it was assumed that including them in the diet would allow roughage levels to be reduced. This proved unsuccessful for Benton et al. (2007), who fed diets containing 30% WDGS with 0, 4, or 8% roughage and observed a positive gain response with increasing roughage levels.

A quadratic increase in G:F as level of WDGS increased was reported by Vander Pol et al. (2006), whereas Vasconcelos et al. (2007) reported a linear decrease in G:F as level of WDGS increased. Discrepancies in performance responses to dietary WDGS inclusion have been attributed to several factors including grain processing method, source of grain fermented, and use of added fat, among others (Klopfenstein et al., 2008; Cole et al., 2009). Vander Pol et al. (2006) used corn WDGS (**CWDGS**) in diets based on a 1:1 blend of dry-rolled corn (**DRC**) and high-moisture corn. Vasconcelos et al. (2007) used sorghum WDGS (**SWDGS**) in steam-flaked corn (**SFC**)–based diets because steam flaking is the most common grain processing method used in finishing diets, especially in the southern Great Plains (Vasconcelos and Galyean, 2007). Therefore, our objectives were to determine how to optimize the use of SWDGS in southern high plains finishing diets and to compare the digestibility of SWDGS to CWDGS in SFC-based diets.

MATERIALS AND METHODS

All animal care and management procedures were approved by the Amarillo Area Cooperative Research, Education, and Extension Team Institutional Animal Care and Use Committee composed of members from West Texas A&M University, Texas AgriLife Research, and the USDA-ARS-Conservation and Production Research Laboratory.

Exp. 1

A total of 240 crossbred steers (initial BW = 379 ± 1 kg) were used in a randomized complete block design to determine effects of alfalfa hay (**AH**) concentration in SFC-based finishing diets containing 25% SWDGS. Steers were limit fed (1.75% of BW) a common receiving diet containing 46% SFC, 45% AH, 7% glycerin, and 2% supplement (DM basis) for 7 d to minimize differences in gut fill (Klopfenstein, 2011) and weighed on 3 consecutive d (Stock et al., 1983) to obtain an initial BW for the finishing period. Steers were blocked by BW, stratified by BW within blocks, and randomly assigned to 1 of 24 pens (6 pens per treatment). Dietary treatments were then randomly assigned to pens within BW blocks. Pens housed 6, 9, or 18 steers, and the BW blocks were assigned by pen size to maintain balance in the number of steers for each treatment within blocks (1 BW block in 6 head pens, 4 BW blocks in 9 head pens, and 1 BW block in 18 head pens). Dietary treatments included a SFC-based [348 g/L (27 pounds/bushel)] control diet containing 0% SWDGS and 10% AH and diets containing 25% SWDGS with 7.5, 10.0, and 12.5% AH. All diets (Table 1) contained 5% crude glycerin and were formulated to contain equivalent ether extract and to provide 33 mg/kg monensin (Rumensin, Elanco Animal Health, Indianapolis, IN) and 8.7 mg/kg tylosin (Tylan, Elanco Animal Health). Steers were stepped up to the final finishing diets over a 21-d period using 3 steps containing 35, 25, and 15% AH after cattle were weighed onto the experiment. Diets were mixed and offered once daily in the morning in an amount to allow ad libitum intake.

Steers were vaccinated against viral pathogens using modified-live cultures of bovine rhinotracheitis virus, bovine viral diarrhea virus (Types 1 and 2), parainfluenza-3 virus, and bovine respiratory syncytial virus (Vista 5 SQ, Merck Animal Health, De Soto, KS) and clostridial bacteria including *Clostridium chauvoei*, *Clostridium septicum*, *Clostridium novyi*, *Clostridium sordellii*, and *Clostridium perfringens* Types C and D (Vision 7 with SPUR, Merck Animal Health) and were treated against internal and external parasites with an injectable anthelmintic (Ivomec Plus, Merial Ltd., Duluth, GA). All steers received an implant containing 24 mg of estradiol and 120 mg of trenbolone acetate (Revalor-S, Merck Animal Health) approximately 120 d before slaughter and were on feed an average of 154 d.

Steers were marketed by weight block when the average fat thickness of each block was visually estimated to be 1.27 cm. On the day of slaughter, feed was withheld and steers were pen weighed. A 4% shrink (NRC, 1996) was applied to determine final shrunk BW and to calculate DP. Cattle were transported 40 km to a federally inspected commercial facility (Tyson Fresh Meats Inc., Amarillo, TX) for slaughter and subsequent carcass data collection (West Texas A&M University Beef Carcass Research Center, Canyon, TX). Hot carcass weights were recorded on the day of slaughter. Twelfth-rib fat thickness, LM area, and called marbling score were recorded following a 48-h chill, and YG was calculated using carcass measurements (USDA, 1997). Live performance calculations were made using shrunk final BW, whereas carcass-adjusted final BW, ADG, and G:F were calculated using HCW and an average DP of 64.5. Dietary NE_m and NE_g values were calculated using the equivalent BW scaling approach of the NRC (1996) with a standard reference BW of 478 kg as described by Vasconcelos and Galyean (2008).