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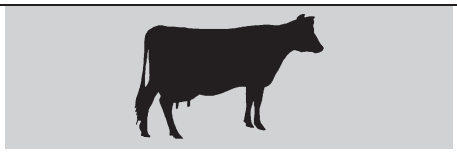

Ensiling characteristics of distillers wet grains with corn stalks and determination of the feeding potential for dairy heifers[1]

J. L. Anderson,* K. F. Kalscheur,*[2,3] PAS, A. D. Garcia,* D. J. Schingoethe,* D. P. Casper,* PAS, and D. H. Kleinschmit,†[4] PAS

*Dairy Science Department, South Dakota State University, Brookings 57007; and †AgriKing Inc., Fulton, IL 61252

ABSTRACT

The characteristics and feeding potential of corn distillers wet grains with solubles ensiled with corn stalks were evaluated in a 2-part experiment. Six individual batches of 66.7% distillers wet grains with solubles and 33.3% corn stalks (on an as-fed basis) were mixed and ensiled in 2 plastic silage bags. A set of 3 batches was left untreated (UNT), and the other set of 3 batches was treated (TRT) with a silage additive. Silos were sampled for analysis on d 0, 7, 14, and 21 after ensiling. The ensiling study was followed by a 6-wk randomized complete block design feeding study using 12 dairy heifers (initial BW of 213.8 ± 3.03 kg) with 3 diets. Treatment diets were (1) control (CON) consisting of 30.3% grain mixture and 69.7% alfalfa and orchard grass hay, (2) 99% UNT blend and 1% mineral premix, and (3) 99% TRT blend and 1% mineral premix on a DM basis. In the ensiling study, blends were similar in DM, CP, ADF, pH, lactic acid, and acetic acid. In the feeding study, body frame measurements and ADG were similar among heifers fed all diets. Dry matter intakes were greater and G:F was less ($P < 0.01$) for heifers fed CON compared with UNT and TRT diets. Total-tract DM digestibility was greater ($P < 0.05$) for heifers fed CON and TRT compared with UNT. Digestibility of NDF, ADF, and CP was less for heifers fed CON and UNT diets compared with TRT. Ensiled distillers wet grains with solubles with corn stalks can make a quality feed for heifers.

Key words: distillers wet grains with solubles, corn stalks, dairy heifer

INTRODUCTION

Distillers wet grains with solubles (**DWGS**) is a high-quality, economical, readily available feed in the upper Midwest, but long-term storage can be an issue. A series of experiments (Nishino et al., 2003; Nishino and Hattori, 2007; Wang and Nishino, 2008) demonstrated that combining various feedstuffs with wet brewers grains improved ensiling characteristics and aerobic stability. Ensiling DWGS with corn, brome-grass hay, corn silage, or soy hulls results in high-quality blends that are very palatable to dairy cattle (Anderson et al., 2009; Ramirez-Ramirez et al., 2011). Corn stalks (**CSK**) are also readily available and may be a viable option for ensiling with DWGS. When feeding DWGS combined with other feedstuffs such as CSK, dietary intake may be regulated by fiber and bulk density of the diet (Lahr et al., 1983; Quigley et al., 1986).

There has been limited research on the effects of silage additives on the

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[2] Corresponding author: kenneth.kalscheur@ars.usda.gov
[3] Current address: US Dairy Forage Research Center, USDA-ARS, 1925 Linden Drive West, Madison, WI 53706.
[4] Current Address: Zinpro Inc., Eden Prairie, MN 55344.

ensiling characteristic of DWGS. In this study, SiloKing GPX (AgriKing Inc., Fulton, IL) was chosen as the ensiling additive because it is a mixture of bacterial inoculants, chemical additives, and enzymes. The ensiling additive was a proprietary formulation consisting of lactic acid–producing bacteria (*Lactobacillus plantarum*, *Enterococcus faecium*, and *Pediococcus pentosaceus*), fermentation extracts (from *Aspergillus oryzae*, *Trichoderma longibrachiatum*, and *Bacillus subtilis*), antioxidants (butylated hydroxytoluene), and antifungal agents including organic acids, such as sorbic.

The objective of this research was to evaluate the ensiling characteristics and feeding potential of ensiled DWGS and CSK with or without ensiling additive. It was hypothesized that heifer growth performance and total-tract nutrient digestibility when fed either of the ensiled blends would be maintained compared with heifers fed a control diet (hay and grain mixture). It was further hypothesized that heifers fed the treated blends of DWGS and CSK would have better nutrient utilization compared with heifers fed the untreated blend.

MATERIALS AND METHODS

Ensiling Study

Evaluation of the ensiling characteristics of DWGS with CSK with or without ensiling additives was conducted by preparing 6 batches of the blend. Round bales of CSK were coarsely preground through a vertical tub grinder and then blended with DWGS at a ratio of 1 part CSK and 2 parts DWGS (on an as-fed basis) in a vertical mixer wagon. This ratio was chosen so that the blends would be approximately 40 to 45% DM. The first 3 batches mixed and ensiled were untreated (**UNT**) to avoid cross contamination between ensiled feedstuffs. The subsequent 3 batches were then treated (**TRT**) with the ensiling additive, which was applied at a rate of 1 kg/1 t of feed (as fed). Each batch containing approximately 5.5 t of blended feedstuff was ensiled into a 2-linear-m section of a 2.74-m -diameter silo bag using a Roto-Press bagger (Model 890, Sioux Automation Center Inc., Sioux Center, IA). The 3 batches of each feedstuff were ensiled consecutively into one bag. From each ensiled batch, samples were taken for nutrient analysis and fermentation characteristic on d 0, 7, 14, and 21 of ensiling. The sample collection was performed by cutting a crisscross section of approximately 20 by 20 cm into the vertical side of the bag at approximately 1 m of height, removing approximately 0.5 to 1 kg of feedstuff into a bucket, and then digging by hand approximately 30 cm into the silage. After sample collection, the initially removed material was then repacked in the hole, and the silo bag was taped closed to avoid air infiltration and spoilage. At least 0.5 m was maintained between successive sampling locations. Samples were kept at −20°C until laboratory analysis.

Heifer Feeding and Digestibility Study

All animal care and use was according to a protocol approved before the start of the experiment by the South Dakota State University Institutional Animal Care and Use Committee. Twelve dairy heifers (213.8 ± 3.03 kg of BW, 195 ± 26 d old) consisting of 9 Holsteins and 3 Brown Swiss were used in a randomized complete block design experiment lasting 6 wk. Heifers were blocked by age, weight, and breed into 4 blocks of 3 heifers each. Each heifer was randomly assigned within block to 1 of 3 treatment diets. The 3 treatment diets (Table 1) consisted of (1) control diet (**CON**) with approximately 30% grain mixture and 70% orchard grass–alfalfa blended hay, (2) an untreated diet (**UNT**) containing 99% of the UNT DWGS–CSK blend and 1% vitamin and mineral premix, and (3) a treated diet (**TRT**) with 99% of the TRT DWGS–CSK blend and 1% vitamin and mineral premix on a DM basis. The blends were ensiled for 1 mo before the start of the experiment. Diets were formulated to be isocaloric and meet or exceed nutrient requirements for growing heifers according to the NRC (2001).

Before the start of study there was a 2-wk training period to acclimate heifers to the Calan Broadbent feeding system (American Calan Inc., Northwood, NH). The CON diet (Table 1) was fed to all heifers during the training period and was used because it was the standard diet being fed at the South Dakota State University Dairy Research and Training Facility at the start of the study. For the CON diet, each component (grain mixture and hay) was weighed out for each heifer at feeding. The CON diet was limit fed (to approximately 2.45% of BW) to regulate intake and meet nutrient requirements as specified in the Dairy NRC (2001). The 2 DWGS–CSK blend diets were fed ad libitum for approximately 5% refusal rates. The vitamin and mineral premix was hand mixed into the DWGS–CSK blend at the appropriate ratio at feeding. Heifers were fed once daily at approximately 0900 h. Feed samples were taken weekly and then composited by 3-wk periods for nutrient analysis.

Body weights and frame measurements were collected on 2 consecutive days at the beginning and end of the study, and on 1 d during wk 2 and 4 at 4 h after feeding. Skeletal frame measurements included wither and hip heights, heart girth, and body length. Body length was measured from the top point of the withers to the end of ischium. Body condition scores were recorded by 3 independent observers using a scale of 1 to 5, with 1 being emaciated and 5 being obese (Wildman et al., 1982).

Total-tract nutrient digestion was measured during wk 6. For the last 13 d of the study, heifers were each fed 10 g of titanium dioxide daily as an external marker. The marker was hand mixed in the top layer of the ration in each Calan box. Fecal samples were then collected the last 3 d of the study in rotational schedule such that when composited by heifer, every 3 h over a 24-h period was represented. Orts left from the last 3 feedings