

# Utilizing Distillers Grains in growing heifer diets and effects of source on ruminal and intestinal digestibility

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**Executive Summary: (Key words:** Distillers Grains, Dairy Heifer, Rumen Degradability)

Over the years as the ethanol industry has developed the processing of distillers grains has also changed. There is a relative abundance of research conducted on feeding distillers grains to beef cattle and lactating cows, but less is available on feeding it to growing dairy heifers. Research (Anderson et al., 2009 and Anderson et al., 2015d) demonstrated that distillers wet grains with solubles (**DWGS**) can be fed as a large proportion of dairy heifer diets, but consequently dietary fat content increased. Other recent research (Anderson et al., 2015 a, b and c) determine if increased dietary fat from distillers dried grains with solubles (**DDGS**) affected growth, metabolism, and long-term performance of heifers. Thirty-three Holstein heifers ( $133 \pm 18$  d old) were used in a 24-wk RCBD feeding trial. Heifers were fed one of the following treatment diets: 1) a control diet containing corn and soybean products (**CON**), 2) a low-fat diet containing reduced-fat DDGS and corn (**LFDG**) and 3) a high-fat diet containing traditional high-fat DDGS (**HFDG**). All had 40% grass hay, 25% corn silage, and 35% concentrate mix (DM basis). Diets were balanced to be isonitrogenous and isocaloric, but not isolipidic. The HFDG contained 4.8% fat (DM basis) compared to 2.8% in CON and LFDG, which had more starch. Body weights (BW), frame measurements, and blood samples for metabolite and hormone analyses were taken throughout the trial. Post-trial data were collected on reproduction and lactation. Body growth was similar among treatments. Total tract digestion of DM was similar among treatments, but CP and fiber digestion were greater in heifers fed HFDG compared to CON and LFDG. Most metabolites and metabolic hormones analyzed were similar among treatments. Cholesterol increased in heifers fed HFDG compared to CON and LFDG. Progesterone analysis indicated heifers fed HFDG were pubertal at lower BW and age compared to LFDG or CON. Fat from DDGS can be fed in replacement of starch from corn to growing pre-pubertal dairy heifers and maintain growth performance, nutrient utilization, and subsequent reproductive and lactation performance.

In follow-up, two studies were conducted to evaluate the effects of limit-feeding heifers DDGS with varying forage to concentrate ratios. First, a 16-wk feeding trial (Manthey et al., 2016, 2017a and 2017b) was conducted using 48 Holstein heifers to evaluate effects of dietary treatment on dry matter intake (DMI), average daily gain (ADG), growth performance, rumen fermentation, and nutrient digestibility. Treatments were 1) 30% DDGS, with the diet fed at 2.65% of body weight (BW) (**30DG**), 2) 40% DDGS, with the diet fed at 2.50 % of BW (**40DG**), and 3) 50% DDGS, with the diet fed at 2.35% of BW (**50DG**). The remainder of the diet consisted of grass hay and 1.5% mineral mix. Heifers were individually limit-fed using Calan gates. There were no differences in growth parameters; however, gain: feed and nutrient digestibility increased

with increasing amounts of DDGS. There was a quadratic response of plasma urea nitrogen and a quadratic tendency for cholesterol. After heifers completed the feeding trial, data were collected to assess post trial reproductive and lactation performance, which were comparable among treatments. A second study (Manthey and Anderson, 2018) was conducted to determine the effects of feeding a corn and soybean product based concentrate mix or distillers dried grains with solubles (**DDGS**) concentrate mix with ad libitum grass hay to dairy heifers. A 16-wk feeding trial was conducted using 24 heifers to evaluate the effect of diet on DMI, growth performance, rumen fermentation, metabolic profile, and nutrient digestibility. Treatments were 1) corn and soybean product concentrate mix (**CON**), and 2) DDGS based concentrate mix (**DDG**). Both concentrate mixes were limit-fed at 0.8% of BW and grass hay was offered ad libitum. Dry matter intake and growth parameters did not differ between treatments. Rumen fermentation was shifted, but metabolic profile was maintained for heifers fed DDG. Results from these studies indicate that the fat and protein in DDGS can be used as a replacement for the starch in corn in limit-fed heifer diets with varying forage to concentrate ratios to maintain growth performance, nutrient digestibility, and metabolic profile without detrimental effects to long-term performance.

In all of our recent research with feeding heifers DDGS average daily gains have been between 0.95 – 1.0 kg/d and greater than anticipated according to formulations by the Dairy NRC, 2001. It is speculated that the NRC overestimates the energy requirements of heifers and underestimates the digestibility and energy content of DDGS. As the ethanol industry has evolved processing methods have continued to improve and change which means investigation into the quality, variation, and digestibility of dried distillers grains with solubles (DDGS) is warranted. Two methods, in vitro and in situ (Krogstad et al., 2018a and b), were used to evaluate the digestibility of 6 different DDGS samples (DG1, DG2...). The DDGS differed in source (ethanol plant) and fat content. It was hypothesized that fat content of the DDGS may impact rumen degradability and fiber utilization. The in situ experiment used 3 ruminally cannulated primiparous Holstein cows to evaluate the ruminal dry matter, fiber, and protein digestibility of the DDGS. The various DDGS samples were incubated in the cows for 0, 2, 4, 8, 16, 24, 48, 72, and 120 h. Dry matter and fiber degradation using two different bag types (Dacron vs. F57) were also compared. The in situ showed that the magnitude of the digestion was affected by bag type used. Total digestible protein (TDP) was also different across treatments, DG4 and DG5 being greater than the remaining DDGS. Rumen degradable NDF was also influenced by bag type with DG4 having the greatest RDNDF. Additionally, a 24 h rumen in vitro study was conducted with the same DDGS. It was found that although DM degradation did vary among the DDGS, fiber degradability varied less and was not affected as much by fat content as hypothesized. The VFA profile and gas production differences were observed among treatments, with DDGS favoring production of propionate over acetate. Differences in DDGS digestibility and utilization appear to be more dependent on other processing factors rather than fat content.

Overall, distillers grains performs well in heifers diets and is a very flexible feedstuff that can be used in a variety of inclusion rates and with different feeding strategies, provided overall nutrient requirements are met. Digestibility of DDGS is affected by source and methods of testing. Digestibility fractions vary compared to

previous research (Kleinschmit et al., 2007, and Cao et al., 2009) which warrants further investigation and demonstrates the quality of DDGS is evolving with the ethanol industry.

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