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Effects of feeding nucleotides in diets containing corn germ meal or dried corn distillers grains and solubles on the performance and health of receiving and growing calves[1]

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ABSTRACT

To improve profitability of newly arrived stressed feeder cattle, it is essential to minimize feed costs and health issues while optimizing growth performance. Effects of nucleotides (NA; PSB Complex; DSS Global LLC, McCormick, SC) in diets containing corn germ meal (CGM) or dried corn distillers grains with solubles (DDGS) on the health and performance of receiving and growing cattle were analyzed in 3 experiments. In Exp. 1, 213 crossbred heifers (BW 262 ± 67 kg) were used to compare CGM- and DDGS-containing diets and to determine the effects of NA in an 84-d trial. Treatments were a 2 × 3 factorial arrangement: 2 by-product–containing diets (CGM and DDGS) and 3 amounts of NA (0, 2, and 4 g/d). There were no effects of NA, corn by-product, or their interaction on growth performance ($P \geq 0.15$). Experiment 2 evaluated performance and immunity effects of NA using 240 crossbred heifers (BW 268 ± 34 kg) in a 56-d trial. The diet contained DDGS, and treatments were 0, 2, and 4 g/d of NA. There were no effects of NA on growth performance ($P \geq 0.18$) or fecal IgA concentration ($P = 0.15$). Experiment 3 used 4 ruminally cannulated Holstein heifers in a 4 × 4 Latin square design. Treatments were arranged as a 2 × 2 factorial: 2 by-product–containing diets (GCM and DDGS) and 2 amounts of NA (0 and 3 g/d). No treatment effects were observed for digestion. Ruminal pH was greater when NA was included ($P < 0.05$). Based on our results, diets can be formulated to contain 24.5% CGM (DM basis) in place of DDGS and maintain animal performance and digestibility. In our experiments, there was no benefit of supplementing NA in growing diets.

Key words: corn germ meal, dried corn distillers grains and solubles, nucleotide, receiving cattle

INTRODUCTION

To improve profitability of newly arrived stressed feeder cattle, it is essential to minimize feed costs and health issues while optimizing growth performance. During the receiving and growing phase, calves typically are recently weaned and experience various physical and psychological stressors that can create health issues and depress feed intake (Galyean and Hubbert, 1995). The selection of ingredients low in cost while providing adequate nutrients is especially important during this phase of production. By-products are commonly used in growing and receiving diets because of availability, nutrient value, and cost (Leupp, 2008). Corn germ meal (**CGM**) is a by-product manufactured by the corn wet milling industry, has medium protein and energy content, and is often used in swine and poultry diets (Blanchard, 1992). Very little information exists on the feeding value of CGM (solvent extracted) for beef cattle.

Feeding nucleotides (**NA**), a natural, immune boosting feed additive, may improve the gastrointestinal health of an animal (Uauy et al., 1990; Lee et al., 2007). Nucleotides are subunits of nucleic acids such as DNA or RNA that are composed of a phosphate group, a 5-carbon sugar, and a nitrogenous base. Nucleotides are naturally found in all feedstuffs (Clifford and Story, 1976), but most feedstuffs contain a lower concentration than milk (Mateo et al., 2004). Supplemental NA are required in growing young animals because they are susceptible to disease, infection, or inflammation of the intestinal tissue (Uauy et al., 1990). Overall, there is contrasting literature published on supplementing NA to pigs and rats (Uauy et al., 1990; Sauer et al., 2012). There is very little research on supplementing NA to ruminants (Kehoe et al., 2008; Mashiko et al., 2009), and to our knowledge there is no research on

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the addition of NA to receiving and growing diets for beef cattle.

The objectives of these experiments were to determine (1) the effects of diets formulated with CGM in comparison to those formulated with dried corn distillers grains with solubles (**DDGS**) on growth performance and digestibility, and (2) the effects of NA on growth performance, digestibility, and mucosal immunity of receiving and growing cattle.

MATERIALS AND METHODS

Animal care practices were approved by the Kansas State University Institutional Animal Care and Use Committee protocols 3299.8 and 3574.

Exp. 1. Receiving and Growing Cattle Performance

A total of 213 crossbred heifers (BW = 262 ± 67 kg) were shipped from 3 separate sources (Searcy, AR, 772 km; Snook, TX, 1,073 km; and Melbourne, AR, 716 km) to the Kansas State University Beef Stocker Unit during a 5-d period from June 15 to 19, 2015. The heifers were used in a complete block design with a 3 × 2 factorial arrangement of treatments to determine the feeding value of a diet containing CGM in comparison to a diet containing DDGS and the effect of adding NA (PSB Complex, DSS Global LLC, McCormick, SC) at 3 inclusion levels (0, 2, and 4 g/d). Calves were blocked by source (n = 3), stratified by arrival weight within each block, and assembled into pens containing 11 or 12 heifers. Pens within each block were randomly assigned to 1 of the 6 treatments, which allowed 3 pens per treatment, with a total of 18 pens for the experiment. Each of the 18 pens were of equal size (9.1 × 15.2 m) and soil surfaced with a concrete fenceline bunk (9.1 m) that was attached to a 3.6-m concrete apron.

The 6 treatment diets are described in Table 1. Diets within CGM or DDGS were formulated to include the same amount of each ingredient with the exception of the NA. There were 3 different NA supplements mixed and pelleted, and they were formulated to provide 0, 2, or 4 g of NA/heifer daily when DMI was 8.2 kg/d. At this inclusion level, the NA treatments provided 0, 242, and 489 mg of NA/kg of dietary DM. According to the product website (www.psbcomplex.com, accessed December 4, 2016), PSB Complex "can withstand the heat and moisture of the extrusion process," suggesting that our inclusion of the NA in a pelleted supplement was appropriate. Diets were formulated to be isocaloric and isonitrogenous. As a result, CGM and DDGS diets included different amounts of specific ingredients: CGM diets had greater inclusions of prairie hay, and DDGS diets had larger inclusions of cracked corn and alfalfa hay.

At the time of arrival, calves were weighed individually and ear tagged with an individual identification number. Calves were held in 6 pens overnight with free-choice access to prairie hay and water. The day after arrival (d 0), heifers were weighed, tagged with a pen number, and vaccinated for respiratory and clostridial diseases. For protection against clostridial bacteria, a 7-way clostridial modified-live vaccine (Vision 7 Somnus with Spur, Merck Animal Health, Madison, NJ) was used, and a modified-live vaccine for protection against infectious bovine rhi-

Table 1. Composition of diets (% of DM) containing corn germ meal or dried corn distillers grains and solubles and a nucleotide additive fed during Exp. 1, 2, and 3

	Corn germ meal, nucleotide additive, g/d			Dried distillers grains, nucleotide additive, g/d		
Ingredient	**0**	**2**	**4**	**0**	**2**	**4**
Cracked corn	25.5	25.5	25.5	29.0	29.0	29.0
Corn germ meal	24.5	24.5	24.5	—	—	—
Dried distillers grains	—	—	—	22.0	22.0	22.0
Prairie hay	18.0	18.0	18.0	10.7	10.7	10.7
Alfalfa hay	13.0	13.0	13.0	22.8	22.8	22.8
Corn steep liquor	7.0	7.0	7.0	7.0	7.0	7.0
Corn gluten meal	4.0	4.0	4.0	0.5	0.5	0.5
Limestone	1.5	1.5	1.5	1.5	1.5	1.5
Mineral supplement[1]	1.0	1.0	1.0	1.0	1.0	1.0
Nucleotide additive[2]	5.5	5.5	5.5	5.5	5.5	5.5

[1]Mineral supplement was formulated to contain (DM basis) 18.7% Ca, 4.14% P, 0.24% Mg, 0.43% K, 26.88% NaCl, 10.62% Na, 16.38% Cl, 1.43% S, 399.41 mg/kg Fl, 35.66 mg/kg Co, 177.79 mg/kg I, 775.26 mg/kg Fe, 6,516.67 mg/kg Mn, and 4,018.94 mg/kg Zn.

[2]Nucleotide additive was formulated to provide 0, 2, or 4 g/heifer daily when DMI was 8.2 kg/d. At this inclusion level, the nucleotide additive provided 0, 242, or 489 mg/kg of dietary DM.