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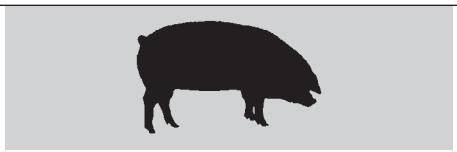

Effects of Supplemental Enzymes in Diets Containing Distillers Dried Grains with Solubles on Finishing Pig Growth Performance[1]

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ABSTRACT

Four experiments involving 4,506 pigs were conducted to determine the effects of different commercial enzymes on the growth performance of growing-finishing pigs fed distillers dried grains with solubles (DDGS). All experiments were conducted in the same commercial swine research facility. Experiments 1 and 2 used corn- and soybean meal-based diets with 15% DDGS. A β-mannanase enzyme was used in Exp. 1, and a blend of enzymes that contained β-glucanase, cellulase, and protease activities was used in Exp. 2. There were no differences (P > 0.10) in ADG, ADFI, and G:F between pigs fed diets with added enzyme and pigs fed diets without enzyme in either experiment (ADG 1.00 vs. 1.01 kg/d, and G:F 0.408 vs. 0.408; ADG 0.94 vs. 0.94 kg/d, and G:F 0.424 vs. 0.421, in Exp. 1 and 2, respectively) In Exp. 3, diets containing 45 and 60% DDGS were fed with or without 2 commercial proprietary enzyme products designed for use in diets containing DDGS. Average daily gain (0.85 vs. 0.86 kg/d) and G:F (0.370 vs. 0.373) were not different (P > 0.10) among treatments. In Exp. 4, an enzyme product with bacterial endo-1,4-β-xylanase was evaluated in diets containing 30% DDGS. Average daily gain (0.82 vs. 0.82 kg/d) and G:F (0.391 vs. 0.387) were not different (P > 0.10) among treatments. Based on the results, the different enzymes evaluated in these experiments did not enhance finishing pig growth performance when diets contained varying levels of DDGS.

Key words: distillers dried grains with solubles, enzyme, growth, swine

INTRODUCTION

The use of carbohydrate- and protein-degrading enzymes in livestock diets to improve utilization of nutrients from plant-based ingredients has received a great deal of attention over the past decade. Studies conducted in poultry have consistently shown improvements in digestibility from the use of exogenous enzymes (Wu et al., 2004; Cowieson and Adeola, 2005; Olukosi et al., 2007; Cowieson and Ravindran, 2008), but this has not always been the case in pigs (Danicke et al., 1999; Partridge, 2000). Some experiments have reported beneficial effects of dietary enzyme supplementation on pig performance, but in general, results have been inconsistent. Nevertheless, given the potential benefits of improved feed efficiency and the increasing feed costs, there is renewed interest in adding exogenous enzymes to swine diets.

The increased interest in dietary enzyme use can be attributed to the increasing use of less expensive alternative feed ingredients, most notably distillers dried grains with solubles (**DDGS**), which have a higher fiber content and lower digestibility than corn when fed to swine (Stein and Shurson, 2009). Hence, use of exogenous enzymes could potentially increase the nutritional value of DDGS by breaking down its fiber components and increasing the availability of nutrients to the pig. Experimental results suggest that DDGS can be fed

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Table 1. Details of individual experiments included in the study[1]

Trial	Duration, d	Experimental units, n	Initial BW, kg	DDGS, %	Enzyme activity of product used
1	92	47	29.6	15	β-Mannanase
2	56	42	34.4	15	β-Glucanase, cellulase, and protease
3	90	42	46.0	45 and 60	A product containing protease, amylase, xylanase, β-glucanase, pectinase, cellulase, and phytase activities, and a product containing a proprietary blend of enzymes
4	66	39	39.6	30	Bacterial endo-1,4-β-xylanase

[1]Data from 4 experiments involving 4,506 pigs.

to pigs at up to 30% of the diet before performance decreases (Cook et al., 2005; Augspurger et al., 2008; Xu et al., 2010). Knowledge about enzyme technology is growing, and the use of fiber-degrading enzymes provides an opportunity to maximize the value of DDGS for swine by improving its nutrient digestibility. This, in turn, could allow for greater inclusion rates of DDGS in swine diets than typically recommended. Therefore, we conducted 4 different experiments that used various commercial enzyme products to determine the effects of these products on the growth performance of growing-finishing pigs fed various amounts of DDGS.

MATERIALS AND METHODS

Procedures used in the experiments were approved by the Kansas State University Institutional Animal Care and Use Committee. The 4 different experiments used a total of 4,506 pigs of the same genetics (L337 × 1050; PIC, Hendersonville, TN). The first trial (Exp. 1) began on October 24, 2007, and the last trial (Exp. 4) ended on April 30, 2009. All experiments were conducted in the same commercial swine research facility located in southwestern Minnesota. The barns were naturally ventilated and double curtain sided. Pens were 5.5 × 3.0 m with completely slatted flooring and deep pits for manure storage. Each pen was equipped with a single-sided self-feeder and a cup waterer. Each barn had an automated feeding system (FeedPro, Feedlogic Corp., Willmar, MN) capable of delivering and recording the amount of feed to individual pens.

Information on the 4 trials is shown in Table 1. In Exp. 1, a total of 1,269 pigs were assigned to treatments in a 2 × 2 × 2 factorial arrangement. The treatments were porcine circovirus type 2 vaccine dose (half or full), enzyme (with or without), and sex (barrow or gilt). Pigs were assigned to pens in the wean-to-finish facility, identified by treatment with colored ear tags, and vaccinated according to the vaccine treatment twice in 2-wk intervals. The enzyme used was a commercially available β-mannanase (Hemicell, ChemGen Corp., Gaithersburg, MD; Table 2) added at 0.05% of the diet.

In Exp. 2, a total of 1,129 pigs were assigned to treatments in a 2 × 3 factorial arrangement. The dietary treatments were increasing levels of fat (0, 2.5, and 5.0%) with or without added enzyme (0 or 0.05% Agri-King REAP, Agri-King Inc., Fulton, IL). The commercial enzyme used was a proprietary blend of enzymes that had β-glucanase, cellulase, and protease activities. Diet samples were analyzed and confirmed by the manufacturer to have the appropriate enzyme activities. Diets were fed in 3 phases, with phase 1 fed from 34 to 50 kg, phase 2 fed from 50 to 73 kg, and phase 3 fed from 73 to 91 kg BW (Table 3). As in Exp. 1, diets were based on corn and soybean meal, had 15% added DDGS, and were balanced to a constant Lys-to-calorie ratio [2.98, 2.68, and 2.38 g standardized ileal digestible (**SID**) Lys/Mcal ME for phases 1, 2, and 3, respectively] within diet phase.

In Exp. 3, a total of 1,032 pigs were allotted to a control treatment (approximately 30% DDGS) and 6 additional treatments in a 2 × 3 factorial arrangement based on DDGS level (45 or 60%) and enzyme used [none, Allzyme (200 g/ton) or enzyme A (500 g/ton)]. Allzyme is a commercial enzyme blend containing protease, amylase, xylanase, β-glucanase, pectinase, cellulase, and phytase (Allzyme SSF, Alltech Inc., Nicholasville, KY), and enzyme A is a proprietary multienzyme product (Alltech Inc.). We were unaware of the specific activity of the enzymes included in enzyme A. However, the manufacturer indicated the enzyme blend was designed for use in diets that contained DDGS, as was Allzyme. Diets were fed in 4 phases, from approximately 45 to 58 kg, 58 to 84 kg, 84 to 104 kg, and 104 to 123 kg BW for phases 1 to 4, respectively (Table 4). During the first 2 wk of the experiment (phase 1), the 60% DDGS treatments contained only 45% DDGS to allow for an adjustment period to higher levels of DDGS in the diets. Regardless of treatment, levels of DDGS were reduced to 20% in all diets during the last 12 d of the experiment. This adjustment was done to help alleviate the effect of decreased carcass yield when pigs are fed high levels of DDGS before market (Linneen et al., 2008).

In Exp. 4, a total of 1,076 pigs were randomly allotted to 1 of 3 treatments balanced by average BW within sex. A diet with 3% added fat (control