# EVALUATION OF COMMERCIAL ENZYME SUPPLEMENTATION ON GROWING PIG PERFORMANCE[1]

***J. Y. Jacela[2], S. S. Dritz[2], M. D. Tokach, J. M. DeRouchey, J. L. Nelssen, R. D. Goodband, and P. Brown[3]***

## Summary

A total of 1,129 pigs were used in a 56-d study to evaluate the effect of a commercial enzyme on growth performance and assess its energy replacement value in swine diets. Pigs were blocked on the basis of pen weights and allotted to 1 of 6 dietary treatments fed in 3 phases. Dietary treatments had increasing levels of fat (0, 2.5, and 5.0%) with or without added enzyme (0.05% or 0% Agri-King REAP). Phase 1 was fed from approximately 75 to 110 lb BW, phase 2 was fed from 110 to 160 lb BW, and phase 3 was fed from 160 to 200 lb BW. Diets were based on cornmeal and soybean meal with 15% added dried distillers grains with solubles (DDGS) and balanced to a constant lysine to calorie ratio (2.98, 2.68, and 2.38 g/Mcal ME for phases 1, 2, and 3, respectively) within diet phase. Pen weights and feed intake were obtained every 2 wk from d 0 to 56 to determine ADG, ADFI, and F/G. There were no interactions ($P > 0.11$) between the addition of enzyme and added fat for ADG, ADFI, or F/G of pigs throughout the duration of the 84-d experiment. There was no difference ($P = 0.53$) in ADG, ADFI, or F/G between pigs fed diets with and without added enzyme. However, pigs fed diets with increasing added fat levels had improved (linear, $P < 0.03$) ADG and F/G. In conclusion, the addition of the commercial enzyme did not affect growth performance of pigs in this study, but ADG and F/G improved with the addition of fat in the corn-soybean meal-based diets with 15% DDGS.

Key words: enzyme, fat, growth, pig

## Introduction

Grains such as corn comprise the majority portion of swine diets mainly as an energy source. However, a fraction of nutrients in these ingredients are found in forms known as dietary fiber that monogastric animals like pigs are unable to fully digest. For this reason, use of commercial enzymes in swine diets may become an important tool in improving feeding efficiency by providing a means for the pig to digest fiber components that can then be utilized for growth. As feed costs increase, the economic value of additives like enzymes, which have the potential to improve energy digestibility and, therefore, feed efficiency, also increases. Enzymes are designed to act on specific substrates. Thus, the use of a multienzyme preparation can potentially have more beneficial effects than single enzyme preparations because it acts on several

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[2] Food Animal Health and Management Center, College of Veterinary Medicine, Kansas State University.
[3] Agri-King Inc., Fulton, IL.

substrates and releasing nutrients trapped within the indigestible components of grains.

Agri-King REAP (Agri-King Inc., Fulton, IL) is a proprietary blend of enzymes that has β-glucanase, cellulase, and protease activities. These enzymes act on dietary fiber found in the plant cell wall as well as a smaller group of storage carbohydrates found in common ingredients like cornmeal and soybean meal. Although many studies have been conducted on enzyme supplementation on pig diets, data for this relatively new enzyme product are needed to evaluate its effects in a commercial pig production setting. Therefore, this trial was conducted to evaluate the effect of a commercial enzyme (Agri-King REAP) on growth performance and assess its energy replacement value in swine diets.

## Procedures

Procedures for this trial were approved by the Kansas State University Institutional Animal Care and Use Committee. The trial was conducted in a commercial research finishing barn in southwest Minnesota. The barns were double curtain sided with 18-ft × 10-ft pens that have completely slatted flooring and deep pits for manure storage. Each pen contained 1 self-feeder and 1 cup waterer. The barn was equipped with a robotic feeding system to provide feed intake on an individual pen basis.

A total of 1,129 pigs (PIC 337 × C22) were blocked on the basis of pen weights and allotted to 1 of 6 dietary treatments. The dietary treatments were increasing levels of fat (0, 2.5, and 5.0%) with or without added enzyme (0.05 or 0% Agri-King REAP). Diets were fed in 3 phases with phase 1 fed from approximately 75 to 110 lb BW, phase 2 fed from 110 to 160 lb BW, and phase 3 fed from 160 to 200 lb BW (Table 1). Diets were based on cornmeal and soybean meal with 15% added dried distillers grains with solubles and balanced to a constant lysine to calorie ratio (2.98, 2.68, and 2.38 g/Mcal ME for phases 1, 2, and 3, respectively) within diet phase. Pigs from each pen were weighed as a group every 2 wk from d 0 to 56 to determine ADG. Feed delivery data generated through the automated feeding system every weigh day were used to calculate feed consumption per pen and determine ADFI and F/G.

Statistical analysis was performed by analysis of variance by using the MIXED procedure of SAS. Data were analyzed as a randomized complete block design with pen as the experimental unit. Linear and polynomial contrasts were used to determine the main effects of increasing fat levels.

## Results and Discussion

There were no significant interactions (*P* > 0.32; Table 2) between the addition of enzyme and increasing fat additions for any of the time periods or overall.

Pigs fed diets with added enzyme had lower (*P* = 0.04; Table 3) ADG from d 0 to 28 than pigs fed diets without enzyme. From d 28 to 56, however, ADG and feed intake were greater (*P* < 0.03) for pigs fed diets with added enzyme. There was no difference (*P* = 0.94) in growth performance between pigs fed diets with and without added enzyme from d 0 to 56. Addition of enzyme did not affect F/G (*P* > 0.51) in any phase or for the overall 56-d period.

The addition of fat improved (linear, *P* < 0.01) F/G, and feed intake tended to decrease (*P* < 0.06) as fat levels were increased from 0 to 5% in the diet for the d 0 to 28 period. In the second period (d 28 to 56), feed intake was lower and F/G improved (linear, *P* < 0.01) as the level of fat addition increased. For the overall period (d 0 to 56), ADG increased, ADFI decreased, and F/G improved (linear, *P* < 0.01) as fat was increased from 0 to 5%. For every 1% added fat, F/G was improved 1.3 and 1.2% in pigs fed 2.5 and 5.0% added fat in their diets, respectively. The observed improvement in feed efficiency for every 1% added fat in this study was lower than the previously reported improvement of 1.8% for every 1% increment of added fat in growing-finishing pig diets. In conclusion, the addition of the commercial enzyme did not affect growth performance of pigs in this study. As expected, ADG and F/G improved with the addition of fat in the diets.

**Table 1. Diet composition (as-fed basis)[1, 2]**

| Item | Fat, % | Phase 1 | | | Phase 2 | | | Phase 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 2.5 | 5.0 | 0 | 2.5 | 5.0 | 0 | 2.5 | 5.0 |
| Ingredient, % | | | | | | | | | | |
| Corn | | 60.59 | 56.54 | 52.45 | 64.73 | 60.82 | 56.92 | 68.76 | 64.98 | 61.21 |
| Soybean meal (46.5% CP) | | 22.36 | 23.86 | 25.40 | 18.37 | 19.78 | 21.18 | 14.39 | 15.67 | 16.94 |
| DDGS[3] | | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 |
| Choice white grease | | 0.00 | 2.50 | 5.00 | 0.00 | 2.50 | 5.00 | 0.00 | 2.50 | 5.00 |
| Monocalcium P (21% P) | | 0.15 | 0.20 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Limestone | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Salt | | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| Vitamin premix with phytase[4] | | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.13 | 0.13 | 0.13 |
| Trace mineral premix | | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.13 | 0.13 | 0.13 |
| L-lysine HCl | | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | | | | | | | | | | |
| Calculated analysis | | | | | | | | | | |
| Standardized ileal digestible (SID) amino acids | | | | | | | | | | |
| Lysine, % | | 1.00 | 1.03 | 1.07 | 0.90 | 0.93 | 0.96 | 0.80 | 0.83 | 0.85 |
| Methionine:lysine ratio, % | | 30 | 29 | 28 | 31 | 30 | 30 | 33 | 32 | 31 |
| Met & Cys:lysine ratio, % | | 61 | 59 | 58 | 63 | 62 | 60 | 67 | 65 | 63 |
| Threonine:lysine ratio, % | | 62 | 61 | 61 | 62 | 62 | 61 | 63 | 63 | 62 |
| Tryptophan:lysine ratio, % | | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| Total lysine, % | | 1.15 | 1.18 | 1.22 | 1.04 | 1.07 | 1.10 | 0.93 | 0.96 | 0.98 |
| CP, % | | 19.9 | 20.2 | 20.6 | 18.4 | 18.7 | 19.0 | 16.9 | 17.1 | 17.4 |
| SID Lysine:calorie ratio, g/Mcal ME | | 2.98 | 2.98 | 2.98 | 2.68 | 2.68 | 2.68 | 2.38 | 2.38 | 2.38 |
| ME, kcal/lb | | 1,520 | 1,571 | 1,621 | 1,523 | 1,575 | 1,626 | 1,525 | 1,576 | 1,627 |
| Ca, % | | 0.51 | 0.52 | 0.53 | 0.47 | 0.47 | 0.47 | 0.45 | 0.46 | 0.46 |
| P, % | | 0.46 | 0.47 | 0.48 | 0.41 | 0.41 | 0.41 | 0.40 | 0.40 | 0.39 |
| Available P, % | | 0.31 | 0.32 | 0.33 | 0.27 | 0.27 | 0.27 | 0.25 | 0.25 | 0.25 |

[1] Phase 1 was fed from 75 to 110 lb, phase 2 was fed from 110 to 160 lb, and phase 3 was fed from 160 to 200 lb.
[2] Agri-King REAP (Agri-King Inc., Fulton, IL) added at 0.05% in all phases at increasing levels of fat to make the enzyme treatments.
[3] Dried distillers grains with solubles.
[4] Provided 898 FTU/kg phytase with an expected phytate P release of 0.14% for phase 1, 898 FTU/kg phytase with an expected phytate P release of 0.13% for phase 2, and 748 FTU/kg phytase with an expected phytate P release of 0.12% for phase 3.

**Table 2. Effect of enzyme at increasing levels of fat on growth performance[1,2]**

| | No Enzyme | | | Enzyme | | | | Probability, *P* < |
|---|---|---|---|---|---|---|---|---|
| | Added fat,% | | | Added fat, % | | | | |
| Item | 0 | 2.50 | 5.0 | 0 | 2.50 | 5.0 | SE | Enzyme × Fat |
| Weight, lb | | | | | | | | |
| d 0 | 75.9 | 75.7 | 75.6 | 75.7 | 76.0 | 74.51 | 1.8 | 0.93 |
| d 28 | 135.1 | 135.8 | 134.9 | 132.9 | 133.8 | 133.7 | 2.4 | 0.98 |
| d 56 | 191.3 | 193.9 | 192.8 | 190.9 | 192.4 | 193.1 | 2.6 | 0.94 |
| d 0 to 28 | | | | | | | | |
| ADG, lb | 2.04 | 2.07 | 2.03 | 1.97 | 1.99 | 2.04 | 0.03 | 0.32 |
| ADFI, lb | 4.76 | 4.54 | 4.50 | 4.54 | 4.40 | 4.42 | 0.10 | 0.75 |
| FG | 2.34 | 2.20 | 2.21 | 2.30 | 2.21 | 2.17 | 0.04 | 0.73 |
| d 28 to 56 | | | | | | | | |
| ADG, lb | 2.08 | 2.13 | 2.14 | 2.12 | 2.16 | 2.21 | 0.02 | 0.80 |
| ADFI, lb | 5.38 | 5.37 | 5.09 | 5.48 | 5.51 | 5.36 | 0.07 | 0.44 |
| FG | 2.59 | 2.52 | 2.38 | 2.58 | 2.54 | 2.43 | 0.04 | 0.72 |
| d 0 to 56 | | | | | | | | |
| ADG, lb | 2.06 | 2.10 | 2.09 | 2.04 | 2.07 | 2.12 | 0.02 | 0.33 |
| ADFI, lb | 5.06 | 4.94 | 4.78 | 4.99 | 4.93 | 4.87 | 0.08 | 0.58 |
| FG | 2.46 | 2.35 | 2.29 | 2.44 | 2.38 | 2.30 | 0.03 | 0.79 |

[1] A total of 1,129 pigs (initially 75.8 lb) with 27 pigs per pen were used with 7 replications per treatment.

[2] One pen on the 5% fat with enzyme treatment was excluded from data analysis as an outlier.

**Table 3. Effect of enzyme and increasing levels of fat on growth performance[1,2]**

| | Enzyme | | | Fat | | | | Probability, $P <$ | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Fat | |
| Item | No | Yes | SE | 0% | 2.50% | 5.0% | SE | Enzyme | Linear | Quadratic |
| Weight, lb | | | | | | | | | | |
| d 0 | 75.7 | 75.4 | 1.0 | 75.8 | 75.8 | 75.1 | 1.3 | 0.81 | 0.69 | 0.81 |
| d 28 | 135.3 | 133.5 | 1.4 | 134.0 | 134.8 | 134.3 | 1.7 | 0.36 | 0.87 | 0.75 |
| d 56 | 192.7 | 192.1 | 1.5 | 191.1 | 193.1 | 193.0 | 1.8 | 0.80 | 0.47 | 0.62 |
| d 0 to 28 | | | | | | | | | | |
| ADG, lb | 2.05 | 2.00 | 0.02 | 2.01 | 2.03 | 2.03 | 0.02 | 0.04 | 0.32 | 0.67 |
| ADFI, lb | 4.60 | 4.45 | 0.06 | 4.65 | 4.47 | 4.46 | 0.07 | 0.07 | 0.06 | 0.34 |
| FG | 2.25 | 2.23 | 0.02 | 2.32 | 2.20 | 2.19 | 0.02 | 0.51 | 0.001 | 0.08 |
| d 28 to 56 | | | | | | | | | | |
| ADG, lb | 2.12 | 2.16 | 0.01 | 2.10 | 2.15 | 2.17 | 0.02 | 0.03 | 0.01 | 0.61 |
| ADFI, lb | 5.28 | 5.45 | 0.04 | 5.43 | 5.44 | 5.22 | 0.05 | 0.01 | 0.01 | 0.09 |
| FG | 2.50 | 2.52 | 0.02 | 2.59 | 2.53 | 2.41 | 0.03 | 0.54 | 0.0001 | 0.27 |
| d 0 to 56 | | | | | | | | | | |
| ADG, lb | 2.08 | 2.08 | 0.01 | 2.05 | 2.09 | 2.10 | 0.01 | 0.94 | 0.01 | 0.54 |
| ADFI, lb | 4.93 | 4.93 | 0.04 | 5.02 | 4.94 | 4.83 | 0.05 | 0.95 | 0.01 | 0.84 |
| FG | 2.37 | 2.37 | 0.02 | 2.45 | 2.37 | 2.30 | 0.02 | 0.82 | 0.0001 | 0.77 |

[1] A total of 1,129 pigs ( initially 75.8 lb) with 27 pigs per pen were used with 21 replications per treatment for the enzyme effects and 14 replications per treatment for the fat levels.
[2]One pen on the 5% fat with enzyme treatment was excluded from data analysis as an outlier.