

The Use of Non-starch Polysaccharide Degrading Enzymes in Swine Diets

Non-starch polysaccharides (NSP) are complex carbohydrates and are the major component of dietary fiber sources. They include cellulose, hemicellulose, pectins, glucans, and xylanose. Since pigs do not produce enzymes to digest these compounds, NSP remain undigested through the small intestine. The presence of NSP in the digestive tract increases viscosity of digesta and can encapsulate other nutrients, preventing absorption in the small intestine. In order to make use of the energy and amino acids contained in NSP prior to the large intestine, dietary enzymes specific to NSP must be added to the diet. These enzymes include cellulase, xylanase, and β -glucanase. Often NSP enzymes are combined with other classes of enzymes to enhance diet digestibility, including enzymes responsible for breaking down oligosaccharides (raffinose, stachyose) and other antinutritional factors (mannans and galactomannans) in feed grains.

Akey has aggressively tested efficacy of various enzyme products currently on the market. If effective, NSP enzymes have the potential to improve feed efficiency, to increase ME content of the diet, and allow for removal of fat or replacement of corn with by-products. As inclusion rates of grain based by-products such as DDGS increase in swine diets, the potential benefit of NSP enzymes increases due to a rise in total NSP content of the diet. However, results of various research trials have failed to substantiate a benefit in either late nursery or grow-finish periods of production. Some of Akey's late-nursery research trials and a grow-finishing trial involving NSP enzymes are summarized below. All enzymes tested were fed according to the manufacturer's instructions, including whether or not the enzyme should be fed in corn-soybean meal (C-SBM) diets or diets containing by-products. Additionally, we used low-energy diets (no added fat) in order to create an optimal environment for detection of an NSP enzyme performance enhancement.

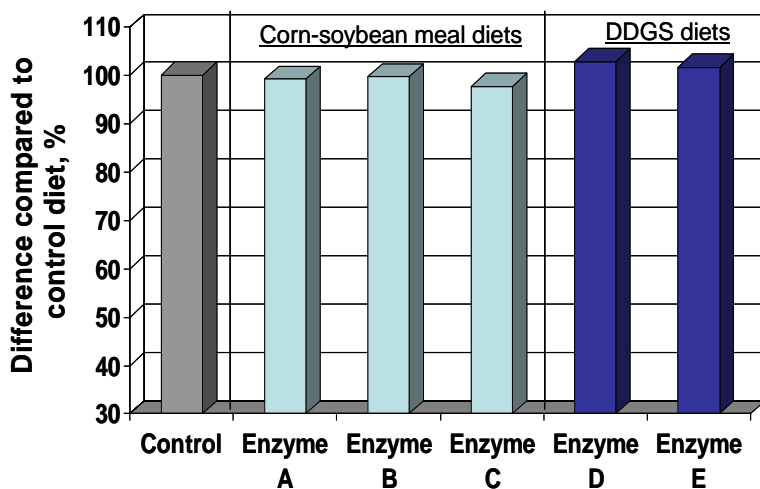


Figure 1. The effects of enzyme supplementation on ADG in either corn-soybean meal based diets or diets containing 30% DDGS in 25-60 lb pigs. The control diet represents the ADG obtained in each individual trial (either C-SBM or 30% DDGS without enzymes for the respective trials).

The effect of enzyme supplementation on ADG in both low energy C-SBM diets and diets containing 30% DDGS are shown in Figure 1. Since each enzyme was tested independently, data are reported in relation to performance obtained with the control diet. ADG of the control diet was assigned a value of 100%. Regardless of whether enzymes were added to low energy C-SBM diets or diets with 30% DDGS, ADG was similar to pigs fed the control diet. While ADG was numerically improved in pigs fed 30% DDGS diets with either enzyme D or E, this improvement was not significant. Feed cost per lb of gain (not shown) was significantly higher when enzymes were added to the diet.

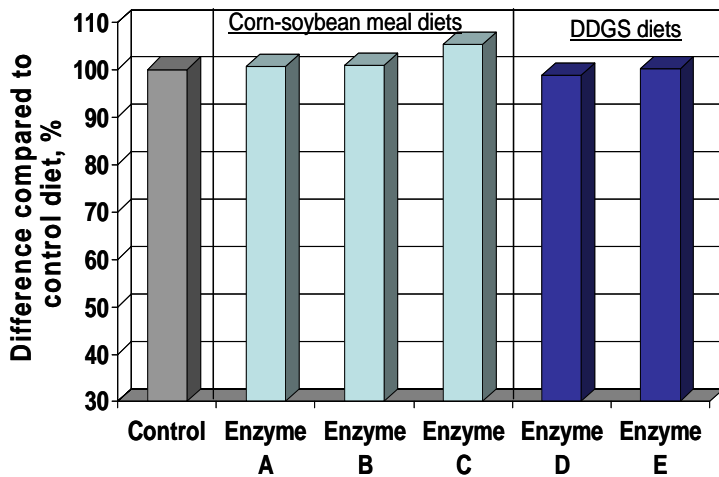


Figure 2. The effects of enzyme supplementation on F:G in either corn-soybean meal based diets or diets containing 30% DDGS in 25-60 lb pigs.

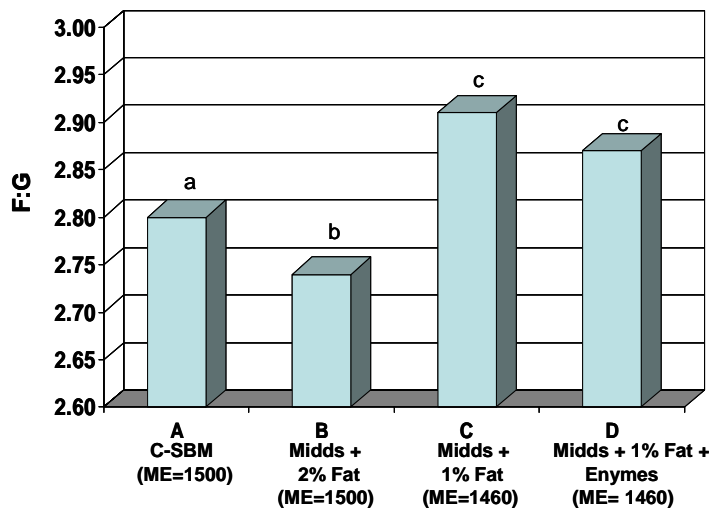


Figure 3. The effects of NSP enzymes on F:G in grow-finishing pigs (70-260 lbs) fed diets containing 10-20% wheat midds. Superscripts with different letters differed.

The effect of enzyme supplementation on F:G in both low energy C-SBM diets and diets containing 30% DDGS are shown in Figure 2. Again, the control diet was assigned a value of 100%. No differences were detected in feed conversion between pigs fed the control diet and pigs fed the control diet + enzymes. None of the NSP enzyme treatments tested resulted in an improvement in animal performance compared to pigs fed the control diets.

Akey research trials have also been conducted with grow-finish pigs fed enzymes in diets containing by-products (Figure 3). The effect of an enzyme in low energy diets containing 10-20% wheat midds (B) was compared to a low energy diet with no enzyme (C), an adequate energy wheat midds diet (D), and a control corn-soybean meal diet (A). ADG was not different among dietary treatments. Feed conversion was similar between pigs fed the low-energy wheat midds diet either with or without the enzyme. Additionally, feed conversion was worse for pigs fed the low energy diets compared to pigs fed the adequate energy wheat midds diet. These data indicate that the enzyme tested was not effective in releasing enough energy to result in an improvement in feed conversion and is not an adequate replacement for dietary fat.

While the concept behind the use of NSP enzymes is intriguing, Akey research results compiled with over 15 different NSP enzyme mixtures does not warrant usage of these products in swine diets. Neither feed conversion nor gain has been improved with the addition of any of the NSP enzyme products tested in either late nursery or grow-finishing pigs. The inability of NSP enzymes to improve feed conversion or gain in low-energy swine diets indicates they cannot reduce feed costs either directly or by replacing fat (or corn) in swine diets. In fact, feed cost per lb of gain usually increases when directly comparing low-energy diets to low-energy diets supplemented with enzymes. Akey will continue to research new NSP products as they are brought to the market and continue to keep our customers current on these new technologies.