fed diets that were heat processed, regardless of regrinding. Considering these results, it was not surprising that pigs fed mash diets had greater (P = 0.05) ADG and ADFI (P = 0.01) than those fed pelleted diets. When directly comparing diets conditioned at 60 rpm, fed either as whole pellets or reground to mash consistency, pigs fed pelleted diets had improved (P = 0.01) G/F due to lower ADFI (P = 0.004) but similar ADG (P = 0.60). This unexpected negative impact of pelleting on ADG may be due to a negative influence of heat treatment on palatability. The expected improvement in G/F from pelleting (6.8%) was observed but was lost when diets were reground to near original mash particle size. This may indicate that diet form (high quality pellets vs. mash) impacts G/F more than degree of starch gelatinization or other intrinsic factors associated with conditioning ingredients.

Key Words: gelatinization, pelleting, starch

158 **Effects of corn particle size and diet form on growth performance of 6–22 kg nursery pigs.** G. E. Bokelman*, C. K. Jones, J. R. Kalivoda, M. D. Tokach, J. M. DeRouchey, C. R. Stark, *Kansas State University, Manhattan.*

A total of 192 pigs (PIC 1050, initially 6.7 kg and 31 d of age) were used in a 35-d study. Pigs were allotted to 1 of 4 dietary treatments (6 pigs/pen and 8 pens/treatment). The 4 nutritionally similar diets were arranged in a 2 × 2 factorial consisting of 1) corn ground to ~387 µm in meal form, 2) corn ground to ~703 µm in meal form, 3) treatment 1 in pellet form, and 4) treatment 2 in pellet form. Data were analyzed using the GLIMMIX procedure of SAS. Overall (d 0 to 35), there were no effects of corn particle size (P > 0.24). However, pigs fed mash diets had improved overall ADG compared to those fed pelleted diets (P = 0.01; 0.43 vs. 0.39 kg/d), which was primarily driven by greater ADFI. In fact, pigs fed mash diets had greater ADFI during all periods (P < 0.02). Still, feed efficiency was improved by pigs consuming mash diets compared to those consuming pelleted diets from d 0 to 14 (P < 0.0001; 0.57 vs. 0.68), but there were no differences from d 14 to 35 or overall. There was no corn particle size × feed form interaction on ADG or ADFI (P > 0.17), but pigs fed pelleted diets from 700 µm corn had improved overall feed efficiency compared to pigs fed any of the other three treatments (P < 0.05), including those fed pelleted diets from 400 µm corn. As expected, the diet manufactured in mash form from the 700 µm corn resulted in the poorest feed efficiency numerically. This research suggests that feed efficiency is slightly improved by feeding 400 vs. 700 µm corn in mash diets, but pelleting does not further improve feed efficiency when corn is ground to a fine particle size. Interestingly, pelleting diets manufactured from larger particle size corn improved feed efficiency more than those made with smaller particle size in this experiment. More research is needed to confirm and explain this finding.

Key Words: nursery pig, particle size, pelleting

159 **Influence of the zinc to phytate ratio and superdoses of phytase on piglet growth performance.** C. L. Walk[1,*], J. J. Chewning[2], P. Wilcock[1], *[1]AB Vista Feed Ingredients, Marlborough, United Kingdom, [2]Swine Research Services, Inc., Springdale, AR.*

Previous in vitro data indicates zinc (Zn) may bind to phytate at a Zn to phytate ratio of 4 to 1, which reduces Zn absorption. Phytase improves Zn absorption through the hydrolysis of phytate. An experiment was conducted to evaluate the Zn to phytate ratio and phytase supplementation (Quantum Blue) on piglet performance from weaning (d 0) to d 21. Pigs (5.2 ± 0.9 kg; n = 1280) were housed at 10 pigs/pen with 8 replicate pens/diet. Diets were arranged as a 2 × 4 × 2 factorial with 2 levels of phytate (analyzed at normal, 0.50%, or high, 0.67%), 4 levels of Zn from zinc oxide (ZnO; 0, 1000, 2000 or 3000 ppm) and 2 levels of phytase (0 or 2500 FTU/kg). Phytate was increased by the inclusion of 2.5% full fat rice bran, and diets were formulated to meet the nutrient requirements of the pig (NCR, 1998), including calcium (0.86%) and available phosphorus (0.52%). This resulted in a Zn to phytate ratio ranging from < 1.0 to > 4.0 in the normal and high phytate diets as ZnO increased. Data were analyzed as a factorial in JMP, and significant means were separated using contrasts. There was no effect of Zn to phytate ratio on performance from d 0 to 21. ZnO supplementation increased ADFI from d 0 to 7 (quadratic P = 0.05) and decreased ADFI from d 14 to 21 (linear P < 0.02). ADG increased as Zn supplementation increased from d 0 to 7 (quadratic P < 0.04). Zn supplementation improved FCR from d 0 to 7 (quadratic P = 0.02) and from d 0 to 21 (linear P < 0.03). Pigs fed high phytate tended to gain less than pigs fed normal phytate from d 7 to 14 (P < 0.07) and d 0 to 21 (P < 0.09). In addition, pigs fed high phytate were less efficient than pigs fed normal phytate from d 0 to 7 (P < 0.03). Phytase improved ADG and FCR from d 0 to 7 (P < 0.05), d 7 to 14 (P < 0.05), and d 0 to 21 (P < 0.05). In conclusion, small increases in phytate resulted in decreases in piglet ADG and FCR, thereby highlighting the antinutritive effect of phytate. Zn supplementation improved performance with a peak around 2000 ppm. However, there was no significant effect of Zn to phytate ratio on performance or phytase efficacy and phytase significantly improved ADG and FCR regardless of the level of phytate or Zn supplemented.

Key Words: phytase, phytate, piglet

160 **The effect of feeding β-mannanase in starter diets on nursery pig growth, feed intake, and feed efficiency performance in a commercial wean-finish setting.** S. A. Crowder[1,*], T. L. Weeden[1], W. I. Snyder[1], T. A. Meyer[1], C. C. Hankins[1], R. A. Arentson[2], J. E. Ferrel[2], *[1]Purina Animal Nutrition LLC, Shoreview, MN, [2]Elanco Animal Health, Greenfield, IN.*

Nine hundred weanling pigs (initial BW = 7.59 ± 0.012kg; 21 d age) were used to evaluate the effect of a commercially available enzyme Hemicell HT®1.5x (HT) in corn-soybean meal-dried