

100% for ADG, 110 and 94% for Hb concentration at wk 3, and 103 and 92% for Hb repletion. In conclusion, the bioavailability of iron in iron proteinate was similar to that of iron in ferrous sulfate.

Key Words: Pigs, Iron, Bioavailability

150 The effects of added zinc from zinc sulfate or zinc sulfate/zinc oxide combinations on weanling pig growth performance. J. C. Woodworth^{*1}, M. D. Tokach¹, J. L. Nelssen¹, R. D. Goodband¹, P. R. OQuinn¹, and T. M. Fakler², ¹Kansas State University, Manhattan, ²Zinpro Corp., Eden Prairie, MN.

Three hundred and sixty early-weaned pigs (5.5 kg and 12 d of age; Genetipork) were used to determine the influence of zinc sulfate (ZnSO₄) or ZnSO₄ and zinc oxide (ZnO) combinations on weanling pig growth performance. Pigs were blocked by initial weight and allotted randomly to each of eight dietary treatments with five pigs per pen and nine replications per treatment. The eight treatments consisted of a control diet containing no added Zn, three diets containing added Zn (100, 200, or 400 ppm) from ZnSO₄, three diets containing added Zn (100, 200, or 400 ppm) from a combination of ZnSO₄ and ZnO (50:50 ratio), or a diet containing 3,000 ppm of added Zn from ZnO. Zinc additions replaced cornstarch in the control diet. There was no additional Zn in the trace mineral premix. Diets did not contain feed grade antibiotic. All diets were fed in meal form in four phases: d 0 to 5, d 5 to 10, d 10 to 20 and d 20 to 34. For the duration of the trial, ADG and ADFI were highest ($P < .0009$) for pigs fed diets containing 3,000 ppm of Zn from ZnO compared to all other treatments. Pigs fed diets containing ZnSO₄ or combinations of ZnSO₄ and ZnO had ADG, ADFI, and G/F that were similar ($P \geq .05$) to the control diet containing no added Zn. There was no consistent effect ($P \geq .05$) on ADG, ADFI, or G/F with increasing levels of ZnSO₄ or combinations of ZnSO₄ and ZnO. These results suggest that 3,000 ppm of Zn from ZnO should be added to weanling pig diets to achieve maximum growth performance.

Key Words: Weanling Pig, Growth, Zinc

151 The effects of added zinc from an organic zinc complex or inorganic zinc sources on weanling pig growth performance. J. C. Woodworth^{*1}, M. D. Tokach¹, J. L. Nelssen¹, R. D. Goodband¹, P. R. OQuinn¹, and T. M. Fakler², ¹Kansas State University, Manhattan, ²ZinPro Corp., Eden Prairie, MN.

We conducted two trials to determine the influence of added Zn from an organic zinc amino acid complex (ZnAA) and inorganic (ZnO and ZnSO₄) Zn sources on weanling pig growth performance. In both trials, pigs were blocked by initial weight and allotted randomly to their respective treatments. In Exp. 1, 360 early-weaned barrows (initially 4.25 kg and 12 d of age, Newsham Hybrids) were fed either a control diet, diets containing added Zn (100, 200, 300, 400, or 500 ppm) from ZnSO₄ or ZnAA, or a diet containing 3,000 ppm of added Zn from ZnO. Diets did not contain feed grade antibiotic. All diets were fed in three phases: d 0 to 5, 5 to 10, and 10 to 20, and contained 165 ppm of Zn from ZnO from the trace mineral premix. For the entire trial pigs fed 3,000 ppm of Zn from ZnO had increased ($P < .07$) ADG compared to all other diets, while those fed added ZnSO₄ and ZnAA showed intermediate results relative to the negative control and the diet containing 3,000 ppm of Zn from ZnO. In Exp. 2, 360 pigs (initially 5.3 kg and 16 d of age, PIC) were fed a negative control diet containing no added Zn, one of six diets containing 165 ppm Zn from ZnO from the trace mineral premix and added ZnAA (0, 100, 200, 300, 400, or 500 ppm of Zn), or a positive control diet containing 3,165 ppm added Zn from ZnO. Diets did not contain feed grade antibiotic. All diets were fed in four phases: d 0 to 5, 5 to 10, and 10 to 20, and 20 to 34. Pigs fed the positive control diet had higher ($P < .02$) ADG and ADFI compared to all other treatments for the duration of the trial. Pigs fed diets containing ZnAA had numerically higher ADG and ADFI than pigs fed the diet containing no added Zn for the entire trial. These results suggest that 3,000 ppm of Zn from ZnO improved weanling pig growth and diets containing lower levels of Zn from an organic complexed Zn source (ZnAA) or ZnSO₄ do not elicit the same growth response as 3,000 ppm of Zn from ZnO.

Key Words: Weanling Pig, Growth, Zinc

152 Mineral composition of spray-dried animal plasma and spray-dried blood cells. G. L. Cromwell^{*1}, G. M. Hill², D. C. Mahan³, G. C. Shurson⁴, and T. L. Ward⁵, ¹University of Kentucky, Lexington, ²Michigan State University, E. Lansing, ³Ohio State University, Columbus, ⁴University of Minnesota, St. Paul, ⁵Consolidated Nutrition, L.C., Decatur, IN.

Spray-dried animal plasma (plasma) and spray-dried blood cells (cells) are two relatively new feed ingredients available to the swine industry. These two products are commonly used in pig starter feeds. Very little information is available on the mineral composition of these two products. In fact, values for only about half of the mineral elements known to be required by pigs were listed for these two blood products in the NRC's 1998 Nutrient Requirements of Swine. Therefore, representative samples of plasma and cells were obtained from three companies that are the major suppliers of these products to the feed industry (plasma from American Protein Corporation, Ames, IA; DuCoa, Highland, IL; and Merrick's, Union Center, WI; and cells from American Protein Corporation and Merrick's). The samples of plasma and cells from American Protein Corporation and Merrick's were of mixed porcine and bovine origin. Separate samples of plasma from porcine and bovine were obtained from DuCoa. The samples were analyzed for minerals at the laboratories represented by the five authors listed above. Mean analytical values (air-dry basis) for the plasma and cells were, respectively: DM: 91.8, 92.1%; CP: 78.8, 94.3%; ether extract: .08, .05%; Ca: .15, .015%; P: 1.48, .34%; Na: 2.76, .55%; Cl: 1.19, .61%; K: .02, .80%; Mg: .03, .02%; S: 1.02, .49%; Fe: 77, 2,618 ppm; Cu: 18, 3 ppm; Zn: 13, 16 ppm; Mn: 2.5, .4 ppm; and Se: 1.6, 1.0 ppm. The Na and Cl in the plasma samples ranged from 2.14 to 3.07 and from 1.05 to 1.43%, respectively. In cells, Na and Cl were similar for the two sources (.53 vs .56 and .61 vs .61%, respectively). Most of the mineral concentrations were similar to those listed in the NRC's 1998 Nutrient Requirements of Swine except for concentrations of Mg and K in plasma which were approximately 10 times lower in our study.

Key Words: Feed Composition, Plasma, Blood Cells

153 Spray dried animal blood cells in diets for weanling pigs. Q. Zhang^{*}, T. Veum, and D. Bollinger, University of Missouri, Columbia, MO USA.

A 28-day experiment with two trials was conducted to evaluate the effects of increasing levels of spray dried blood cells (SDBC) in Phase 1 (P1) (d 0-14) diets. A total of 288 crossbred pigs were weaned at an average of 19 days of age and 6.1 kg BW and allotted to treatments (Trt) by litter, sex and weight. P1 Trt 1 to 5 were made by replacing corn and soybean meal on a total lysine basis with 0, .9, 1.8, 2.7 or 3.6% SDBC. Trt 1 to 5 contained 2% spray dried animal plasma (SDAP). Trt 6 contained 4% SDAP and 0% SDBC. The P1 diets contained 20% dried whey (DW), 10% lactose, mineral and vitamin supplementation, lard to equalize ME at 3.39 Mcal/kg, 1.50% lysine, and .45% methionine. In P2 (d 14-28) all pigs were fed the same diet containing 0% SDAP, 1.8% SDBC, 20% DW, 1.4% lysine, .43% methionine and 3.4 Mcal of ME/kg. Gain:feed ratio in P1, P2 or overall was not affected ($P > .13$) by the level of SDBC in P1. For week 1, P1, and overall there were quadratic responses ($P < .05$) for ADFI and ADG because of the sharp decline ($P < .05$) in ADFI and ADG for pigs fed the diet containing 3.6% SDBC compared to the other Trt. However, there was a linear increase ($P < .03$) in overall BW and ADG with increasing level of SDBC up to 2.7%. For P2, ADG and ADFI were not affected ($P > .06$) by P1 dietary Trt. In conclusion, increasing levels of SDBC in the P1 diet up to 2.7% did not reduce pig performance, whereas 3.6% SDBC reduced pig performance. Increasing SDAP from 2% to 4% in the P1 diet did not improve pig performance.

Key Words: Performance, Weaning Pigs, Blood Cells

154 Menhaden fish meal and spray dried animal plasma in weanling pig diets. T. L. Veum^{*}, D. W. Bollinger, and C. Mitchell, University of Missouri, Columbia, MO USA.

An experiment with two trials was conducted to evaluate Menhaden fish meal (MFM) as a partial substitute for spray dried animal plasma (SDAP; AP920[®]) in Phase (P) 1 diets (d 0-14) that were pelleted and crumbled, and P2 (d 14-28) diets that were pelleted. Crossbred pigs (total n=270) were weaned at an average of 6.0±.01 kg BW and 21±.2