

128 Interactive effects of betaine (Betafin³-BCR), crude protein, and net energy on growth, carcass traits, and serum metabolites of gilts. J. O. Matthews¹, L. L. Southern, and T. D. Bidner, *LSU Agricultural Center, Baton Rouge.*

An experiment was conducted to determine the interactive effects of betaine (BET), CP, and NE on growth and carcass traits of 120 gilts (initial and final BW, 54 and 111 kg). Treatments were replicated (RCB; BW and ancestry) with four pens of three or four pigs each. Treatments were in a 2x2x2 factorial arrangement with two levels each of BET (0 or .125%), CP [adequate (ACP) or inadequate (ICP)] and(or) NE (0 or 6% added fat). Diets were formulated on the basis of an ideal amino acid pattern. Diets within CP level were formulated to a constant ratio of lysine to NE. The experiment was divided into early (EF; 54 to 76 kg) and late finishing (LF; 76 to 111 kg) periods. Within the high NE diets, the ACP and ICP contained .85 and .72 % Lys in the EF and .76 and .65 % Lys in the LF. Within the low NE diets, the ACP and ICP contained .79 and .67 % Lys in the EF and .71 and .60 % Lys in the LF. The low and high NE diets contained 2.68 and 2.88 Mcal/kg NE for the EF and 2.71 and 2.92 Mcal/kg NE for the LF. The ICP diet decreased ADG in the low NE diets but not in the high NE diets (CP, P<.01; NE, P<.07; CPxNE, P<.01). The ICP diet decreased (P<.01) gain:feed but increased (P<.04) ADFI. Betaine tended to decrease (P=.11) ADFI and increase (P=.19) gain:feed, and increased (P<.04) carcass length. The high NE diet decreased (P<.10) dressing percentage. The ICP diet decreased (P<.05) longissimus muscle area, fat free lean, percentage lean, lean gain per day, lean:fat, and serum urea nitrogen (SUN) concentrations, but increased (P<.09) tenth rib fat, total fat, percentage fat, and leaf fat. The high NE diet increased (P<.01) SUN. Total serum protein (TP) was increased (P<.10) in pigs fed ACP. Betaine increased TP in the low NE diets, but not in the high NE diets (BETxNE, P<.08). Serum cholesterol concentrations were not affected (P>.10) by treatments. The effect of betaine on carcass muscle and fat may depend on the NE (fat) content of the diet.

Key Words: Pigs, Betaine, Growth, Carcass Traits

129 Multiple response criteria for assessing zinc status in weanling pigs fed diets containing sub-requirement levels of Zn from ZnO, Zn polysaccharide complex, and Zn methionine. T. M. Salzer¹, G. C. Shurson¹, L. J. Johnston², and D. D. Gallaher¹, *University of Minnesota, ¹St. Paul, and ²Morris.*

Two experiments were conducted to determine the effect of 0, 25, 50 and 75 ppm supplemental dietary Zn, supplied by either ZnO, Zn polysaccharide complex (ZnP), or Zn methionine (ZnM) on ADG, ADFI, G:F, plasma superoxide dismutase activity (SOD), plasma alkaline phosphatase activity (AP) and retention of Zn, Cu, Fe and P in weanling pigs. Ten experimental corn-soy-20% dried whey, iso-nutrient diets met or exceeded NRC (1988) requirements for all nutrients except Zn. A total of 500 crossbred pigs (6 pens/trt) weaned at 25 ± 4 d were used in a 4-wk growth assay, and 60 pigs weaned at 31 ± 2 d were housed in individual stainless steel metabolism crates for a nutrient balance assay (7 d adjustment and 5 d collection). Pigs in both assays were blocked by initial weight, sex and litter and assigned to dietary treatments. Initial and final blood samples were obtained by venipuncture from each pig in the nutrient balance assay. Linear and quadratic effects of dietary supplementation level within Zn source were statistically analyzed using orthogonal polynomials. ADG (246 g/d) and ADFI (490 g/d) tended to increase linearly as Zn supplementation level increased within Zn source (P < .1), but were not different between sources (P > .1). Pigs fed ZnO diets tended to have higher G:F (P < .08) compared to pigs fed ZnP. In all Zn sources, there was a linear interaction Zn level x time for ADG (P < .01). Initial SOD and AP were not different among Zn sources (P > .25). Final AP increased linearly for both ZnO and ZnM (P < .02) and quadratic for ZnP (P < .04), but was not different among Zn sources. Final SOD activity/mg of protein increased linearly (P < .06) for ZnM, was greater for ZnM compared to ZnO (P < .01), and tended to be higher for ZnP compared to ZnM (P < .1). For all Zn sources, Zn retention increased linearly (P < .001) as dietary Zn concentration increased, but was not different among Zn sources. Copper retention decreased linearly as Zn level increased within source (P < .05). These results suggest that AP and SOD are the most sensitive indices among the response criteria used in this study for evaluating Zn level and source. Based upon final SOD values, ZnP tended to be superior to ZnM and ZnM was superior to ZnO among the sources compared.

Key Words: Zinc, Mineral Retention, Enzymes

130 The impact of phase feeding pharmacological concentrations of zinc to early-weaned pigs. M. S. Carlson¹, G. M. Hill and J. E. Link, *Michigan State University, E. Lansing.*

Benefits of feeding pharmacological concentrations of zinc (Zn) to 21 day conventionally-weaned pigs in nursery has been documented, however, several management questions remain. The objective of this research was to determine if feeding 3000 ppm Zn during different weeks of the nursery period affects growth in the early-weaned pig. Pigs(n=120) were weaned at an average of 11.5 days(\bar{x} =3.8 kg) and fed diets containing either 150 ppm Zn(adequate) or 3000 ppm Zn (high) from zinc oxide in a four phase four wk nursery period. Treatments were: (a) Adequate Zn fed wk 1-4, (b) High Zn fed wk 1, (c) High Zn fed wk 2, (d) High Zn fed wk 1-2, (e) High Zn fed wk 2-3, and (f) High Zn fed wk 1-4, typical of previous research. ADG was greatest for pigs fed High Zn wk 1-2 or wk 1-4 (P=.02). During any given wk, pigs fed High Zn had higher plasma Zn, lower plasma Cu and higher plasma Fe than those fed adequate Zn (P<.05). RBC Cu-Zn superoxide dismutase activity was unaffected (P>.05). In conclusion, early-weaned pigs should be fed pharmacological concentrations of zinc at least the first two weeks of the nursery period for increased growth performance.

Impact of Zn Phase Feeding after 4 Weeks

Parameter	Weeks on High Zinc (3000 ppm)					
	0	1	2	1-2	2-3	1-4
ADG, g/d	250 ^b	253 ^b	245 ^{bc}	268 ^a	210 ^c	267 ^a
Plasma Zn, mg/dl	.86 ^{bc}	.81 ^c	.95 ^{bc}	1.06 ^b	2.29 ^a	2.43 ^a
Plasma Cu, mg/dl	1.14 ^a	1.09 ^{ab}	.98 ^b	.99 ^b	.83 ^c	.82 ^c
Plasma Fe, mg/dl	1.69 ^{bc}	1.86 ^b	1.93 ^{ab}	2.24 ^a	1.71 ^{bc}	2.14 ^a

Key Words: zinc, early-weaned pig

131 The effects of energy density and lysine:calorie ratio on growth performance of the 9 to 25 kg pig. J. W. Smith, II, M. D. Tokach, R. D. Goodband, J. L. Nelissen, W. B. Nessmith, Jr., J. R. Bergstrom, K. Hongtrakul, J. A. Loughmiller, and R. E. Musser, *Kansas State University, Manhattan.*

Three hundred-thirty six barrows (initially 9.9 kg and 31 d of age) were used in a 21 d growth assay to evaluate the effects of dietary energy density and lysine:calorie ratio on growth performance. Pigs were allotted in a 3 X 4 factorial arrangement with six replicate pens per treatment. There were 4 or 5 pigs per pen with equal number of pigs per pen within replicate. Pigs were fed increasing levels of choice white grease (CWG; 0, 3, and 6%) and lysine:calorie ratios (L:C; 3, 3.45, 3.9, and 4.35 g lysine/Mcal ME). Basal energy levels were 3.25, 3.380, and 3.51 Mcal ME/kg diet for the three basal diets, respectively. All diets contained .15% L-lysine HCl and were formulated to .80% Ca and .70% P. Methionine and threonine were maintained relative to lysine with the addition of DL-methionine and L-threonine. For the entire trial, increasing L:C improved ADG and ADFI (linear, P < .01). Increasing CWG decreased ADFI (linear, P < .01). Feed efficiency improved as CWG and L:C increased (linear and quadratic, P < .01). Tenth rib backfat depth decreased as L:C increased (P < .001) and increased as CWG increased (linear, P < .01). These data indicate that CWG can be added to improve the efficiency during the late nursery phase. The addition of CWG or any other fat source must be evaluated based upon cost compared to gains in efficiency due to a lack of a response in ADG. Lysine:calorie ratio must be evaluated based upon ADG and G:F.

d 0 to 21	Choice White Grease, %			g Lysine:Mcal ME				CV
	0	3	6	3.0	3.45	3.9	4.35	
ADG, g	613	613	622	572	613	636	640	5.3
ADFI, g	999	944	931	981	962	962	922	5.6
G:F	.61	.65	.67	.58	.64	.66	.69	3.1
10th rib fat depth, mm	7.7	7.9	8.13	8.4	8.2	7.8	7.5	14.0

Key Words: Pigs, Nursery, Energy, Lysine:Calorie Ratio, Lysine