Zinc is a trace mineral with multifunctional properties including a role in normal growth, immunity, skin integrity, and an essential component in a multitude of enzyme reactions. Organic trace minerals offer the opportunity to feed less total mineral because of improved bioavailability compared to inorganic sources. MINTREX®Zn (ZnMin) contains 2 HMTBa ligands chelated with one Zn molecule. This study examined the effect of Zn source and level on weaned pig performance. Pigs with an average initial weight of 7.06±0.13 kg were blocked by sow parity (1 vs. 2-4 vs. 5+) and randomly assigned to one of five Zn diets: 120:0, 0:0, 60:0, 30:30, and 0:60 ppm Zn as ZnO:ZnMin, respectively. Complex diets were formulated to meet or exceed the requirements of weaned pigs except for Zn. Diets were fed in 3 different phases (0 to 10, 11 to 21, and 21 to 35 days postweaning). No differences in ADG or ADFI were detected from 0 to 10 or 11 to 21 days of study (P > 0.15). Pigs fed the 0:0 (0.933±0.050) zinc diet had 13% lower GF than pigs fed the 120:0 (1.074±0.050) and 30:30 (1.079±0.050) ppm Zn diet (P < 0.05) from 0 to 10 days. No differences in GF were detected between treatments from 11 to 21 days of study (P > 0.15). Pigs fed the 120:0 (563±15 g/d) had 10% greater ADG (P < 0.05) than the 0:0 (507±15 g/d) and 60:0 (520±15 g/d) fed pigs, but similar ADG to pigs fed the 30:30 and 0:60 Zn diets (P > 0.10) from 21 to 35 days. Pigs fed the 120:0 (0.696±0.007), 30:30 (0.692±0.007), and 0:60 (0.683±0.007) had similar GF (P> 0.15), but higher than pigs fed the 0:0 Zn diet (0.663±0.007; P < .05) from 21 to 35 days. Overall, from 0 to 35 days, no differences in final bodyweight, ADG or ADFI were detected between treatments (P >0.10). Pigs fed the 120:0 (0.742±0.005), 30:30 (0.747±0.005), and 0:60 (0.738±0.005) had similar GF (P > 0.20), but were all higher than the 0:0 Zn diets (0.717±0.005; P < 0.05). These results suggest that at least 21 days postweaning are needed to elicit signs of a Zn deficiency and dietary Zn concentrations can be reduced by feeding MINTREX®Zn.

Key Words: Zinc, Source, Swine

194 Combination of organic and inorganic trace minerals for sows and weaned pigs. G. J. M. M. Lima*[1], F. Catunda[2], W. Close[3], L. C. Ajala[1], and F. Rutz[4], [1]*Embrapa – Swine and Poultry Res. Center*, *Brazil*, [2]*Alltech*, *Brazil*, [3]*Close Consulting*, *U.K.*, [4]*UFPel*, *Brazil*.

This study was conducted to determine the effects of combining inorganic and organic sources of trace minerals (TM) on the performance of sows along five consecutive parities and their offspring. In Experiment 1, 80 gilts were randomly divided and given two diets: T1 – TM supplemented with inorganic sources (120 ppm Zn, 40 ppm Mn, 120 ppm Fe, 15 ppm Cu, 0.3 ppm Se); T2 – TM supplemented with a combination of inorganic and organic sources in the following amounts: 80 + 40 ppm Zn, 20 + 20 ppm Mn, 30 + 90 ppm Fe/kg, 5 + 10 ppm Cu, 0 + 0.3 ppm Se, 0 + 200 ppb Cr, respectively. In Experiment 2, 96 weaned piglets from T1 and T2 fifth parity sows were equally allotted to receive diets with either inorganic or inorganic + organic TM, at the same levels described, in a 2 X 2 factorial experiment. In both experiments there was no significant interaction among main factors (P>0.05). Sow reproductive variables as well as piglet weights at birth and at weaning were not affected by treatments (P>0.05). Combination of inorganic and organic TM significantly increased the number of live piglets at birth (10.93 ± 0.17 vs. 11.80 ± 0.17, P=0.0003) and at weaning (10.16 ± 0.16 vs. 10.90 ± 0.15, P=0.0008) and decreased the number of stillbirths (0.48 ± 0.05 vs. 0.30 ± 0.05, P=0.007) and mummies (0.10 ± 0.03 vs. 0.04 ± 0.03, P=0.12). Milk selenium was increased (28.71 ± 1.99 vs. 38.94 ± 2.00 ppb, P=0.0004) with the inclusion of organic TM. In Exp. 2, there was no significant effects of sow or piglet dietary treatments or their interaction (P>0.05) except for feed conversion ratio, which was better for piglets born from sows that were fed T2 diets (1.67 ± 0.02 vs. 1.62 ± 0.02, P=0.06). While the combination of inorganic and organic TM confirms previous positive effects on litter size, this finding has yet to be completely understood. It may be hypothesized that the increase of bioavailability of the organic TM sources is responsible for part of the verified benefits. In addition, it may be that inorganic TM at NRC levels have detrimental effects.

Key Words: Litter Size, Reproductive Performance, Milk Composition

195 Effects of copper sulfate, tri-basic copper chloride, and zinc oxide on weanling pig growth and plasma mineral levels. N. W. Shelton*[1], M. D. Tokach[1], J. L. Nelssen[1], R. D. Goodband[1], S. S. Dritz[1], J. M. DeRouchey[1], and G. M. Hill[2], [1]*Kansas State University*, *Manhattan*, [2]*Michigan State University*, *East Lansing*.

Two four-wk experiments were conducted to determine the effects of increasing dietary Zn and Cu levels on weanling pig performance. In each experiment, 180 21-d old weanling pigs (PIC; 5.65 kg in Exp. 1, and 5.98 kg in Exp. 2) were allotted to six treatments with five and six replications in Exp. 1 and 2, respectively. Control diets contained 165 ppm Zn and 16.5 ppm Cu provided by the trace mineral premix. In Exp. 1, treatments were arranged as a 2 × 3 factorial using two levels of added Cu from tri-basic copper chloride (TBCC; 0 or 150 ppm) and three levels of added Zn from ZnO (0, 1500, or 3000 ppm from d 0 to 14 and 0, 1000, or 2000 ppm from d 14 to 28). From d 0 to 28, TBCC increased (P<0.01) ADG (375 vs 344 g/d) and ADFI (509 vs 469 g/d) over control pigs. Increasing dietary Zn increased (linear, P<0.003) ADG and ADFI from d 0 to 14 (184, 192, and 233 g/d; 226, 238, and 279 g/d) and d 0 to 28 (342, 352, and 385; 463, 479, and 525). Dietary Cu had no (P>0.63) effect on plasma Cu. The only Cu × Zn interaction was for plasma Zn (P<0.03) with plasma Zn increasing to a greater extent when Zn was added to diets without TBCC than when added to diets with TBCC. In Exp. 2, treatments were arranged as a 2 × 3 factorial using two levels of added Zn from ZnO (0 or 3000 from d 0 to 14 and 0 or 2000 from d 14 to 28) and three Cu treatments (control, 125 ppm from TBCC, or 125 ppm from $CuS0_4$). There were no Zn × Cu interactions (P>0.21). From d 0 to 28, adding TBCC and $CuS0_4$ increased (P<0.01) ADG (304, 333, and 359 g/d), ADFI (465, 490, and 506 g/d) and G:F (0.65, 0.68, and 0.71). Adding dietary ZnO also increased (P<0.01) overall ADG (315 vs 349 g/d) and ADFI (466 vs 507 g/d). The greatest response to ZnO was from d 0 to 14 where ADG (175 vs 225 g/d), ADFI (227 vs 255 g/d), and G:F (0.77 vs 0.88) were all increased (P<0.02). Contrary to many earlier trials, the growth responses from Zn and Cu were additive in these experiments.

Key Words: Weanling Pig, Zinc, Copper

196 Effects of various copper sources on copper bioavailability in broiler chickens. B. J. Min*[1], S. J. Park[2], R. A. Samford[3], and S. W. Kim[1], [1]*North Carolina State University*, *Raleigh*, [2]*Texas Tech University*, *Lubbock*, [3]*Albion Advanced Nutrition*, *Clearfield, UT*.

A total of 560, 1 d old, broiler chickens was used to determine bioavailability of copper when various dietary copper sources were used. Twenty