CaP levels and fermentable substrates on intestinal CaP net absorption, phytate (*myo*-inositol hexakisphosphate, $InsP_6$) hydrolysis, intestinal microbiota, microbial metabolites, and innate immune cell numbers using 32 crossbred pigs (initial BW 54.7 kg). In a 2 × 2 factorial arrangement, pigs were fed either a corn-soybean meal (SBM) or corn-field pea diet with either low (4.4 g Ca/kg; 4.2 g total P/kg) or high (8.3 g Ca/kg; 7.5 g total P/kg; supplemented with monocalcium phosphate) CaP content. Digesta and feces samples were examined for P, Ca, inositol phosphate isomers, and TiO_2. After 3 wk of diet adaptation, feces were collected by rectal stimulation to determine 16S rRNA gene copy numbers by qPCR and bacterial metabolite analyses. Blood was analyzed for immune cell numbers. Jejunal (−9.6 vs. 18.3%), cecal (−1.8 vs. 26.3%), and total tract P (3.6 vs. 22.1%) net absorption were lower ($P < 0.01$) for the low than high CaP diets. Diet did not affect $InsP_6$ hydrolysis in digesta. The jejunal $InsP_6$ concentration was lower ($P < 0.05$; 21.5 vs. 31.5 μmol/g DM) for the low than high CaP diets. Jejunal (1.6 vs. 1.2 μmol/g DM) and cecal (2.2 vs. 1.8 μmol/g DM) concentration of $Ins(1,2,4,5,6)P_5$ tended to be greater ($P < 0.10$) for the SBM than field pea diets. Gene copy numbers of *Bacteroides-Prevotella-Porphyromonas* were lower ($P < 0.05$) for pigs fed the high than low CaP diets. The *Clostridium* cluster IV tended to be greater ($P < 0.10$) and fecal acetate and propionate concentrations were lower ($P < 0.05$) for the field pea than SBM diets. Blood granulocyte, neutrophil, and monocyte numbers were lower ($P < 0.05$) for pigs fed the low CaP diet combined with SBM 3 wk after diet adaptation compared to the other diets. Diets low in CaP increased the abundance of proteolytic *Bacteroides-Prevotella-Porphyromonas* and in combination with SBM might impair the first line of defense and limited the activation of cellular adaptive immune response, thereby possibly increasing the risk for intestinal disturbances. For the corn-field pea diets, the greater SCFA concentration may indicate increased saccharolytic fermentation activity, which may be favorable for gut health, whereas the abundance of *Clostridium* cluster IV in feces, that is known to be less healthy, was greater for field pea.

Key Words: immune system, intestinal microbiota, phosphorus
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181 Effects of increasing copper from Tri-basic copper chloride or a Cu-amino acid complex on growth performance of nursery pigs. C. B. Carpenter[1,*], J. C. Woodworth[1], J. M. DeRouchey[1], M. D. Tokach[1], R. D. Goodband[1], S. S. Dritz[1], J. L. Usry[2], [1]*Kansas State University, Manhattan,* [2]*Micronutrients, Indianapolis, IN.*

Many U.S. swine nutritionists supplement swine diets with added Cu to promote growth of weanling pigs. However, there is little research comparing different organic and hydroxyl Cu sources for their growth promoting benefits. Thus, the objective of this study was to compare the effects of increasing added Cu from Tri-basic CuCl (TBCC, IntelliBond-C; Micronutrients, Indianapolis, IN) or Cu-AA (Mintrex-Cu; Novus, St. Charles, MO) on growth performance of nursery pigs. A total of 665 pigs [Group 1; 350 barrows (DNA 200 × 400; initially 6.4 kg)] and [Group 2; 315 barrows and gilts (DNA 241 × 600; initially 5.2 kg)] were used. There were 5 pigs/pen and 10 replications/treatment in group 1 and 5 pigs/pen and 9 replications/treatment in group 2. Pens of pigs were allotted by BW to 1 of 7 dietary treatments arranged as a 2 × 3 factorial plus a control diet, with main effects of Cu source (TBCC or Cu-AA) and level (75, 150, or 225 ppm). Data were analyzed as a randomized complete block design using PROC GLIMMIX (SAS Inst. Inc., Cary, NC) with pen as the experimental unit and dietary treatment as the fixed effect. Random effects of group and block within group were included in the model. All diets, including the control, contained a trace mineral premix formulated to contribute 17 ppm of Cu from $CuSO_4$ in the complete diet. Experimental diets were fed in two phases from d 0 to 14 and d 14 to 35. Overall, there were no Cu source × level interactions observed. Increasing Cu increased ADG (linear, $P = 0.048$) and final BW (linear, $P = 0.019$) with no effect on ADFI. This resulted in a tendency for improved G:F (linear, $P = 0.052$) with increasing dietary Cu. In summary, Cu source did not affect growth performance and because the growth benefits were linear, it is unknown from our study if increasing added Cu beyond 225 ppm would further improve growth.

Key Words: copper source, growth, nursery pig
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Table 179.

	Total Cu, ppm							
	Control	$CuSO_4$		$CuSO_4$/Cu-AA				Probability, *P* <
Item[1]	17	70	130	70	100	130	SEM	Cu Source
ADG, kg	0.87	0.88	0.89	0.89	0.89	0.87	0.010	0.573
ADFI, kg	2.43	2.46	2.47	2.44	2.46	2.38	0.029	0.045
G:F	0.358	0.359	0.360	0.363	0.362	0.368	0.0030	0.051
HCW, kg	93.04	93.84	93.89	93.72	94.73	92.92	1.353	0.547
Carcass G:F	0.259	0.260	0.259	0.264	0.263	0.266	0.0025	0.033

[1]**No effect of Cu leve**l: linear $P > 0.125$ and quadratic $P > 0.205$