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0752 Apparent and standardized ileal amino acids digestibility for different protein feedstuffs fed at two dietary protein levels for growing pigs.

A. O. Adebisi¹, D. Ragland², L. Adeola², and O. A. Olukosi¹, ¹Scotland's Rural College, Ayr, UK, ²Purdue University, West Lafayette, IN.

This study determined the apparent and standardized ileal amino acids digestibility (AID or SID) for growing pigs fed three protein feedstuffs with different fiber types at two dietary crude protein (CP) levels. Twenty boars (Yorkshire × Landrace) with 35 kg body weight and fitted with a simple T-cannula at the distal ileum were used. The treatments were three protein feedstuffs [soybean meal (SBM), canola meal (CM) or corn distillers dried grains with solubles, (cDDGS)] and two dietary CP levels (18 or 14%). Eighteen pigs were allocated to the experimental diets using a replicated 6 × 2 Youden square design. In each of the two experimental periods, two pigs were offered a nitrogen free diet to determine basal endogenous amino acid flow. Digesta was collected for 2 d after 5 d of adaptation. Reducing dietary CP level by 4% did not affect AID of DM and AA or SID of AA. Except for Met, Trp, Cys and Pro, AID for all the other AA were greater ($P < 0.05$) in the SBM diet compared with the CM diet. Apparent ileal digestibility for Gly and Asp was greater ($P < 0.05$) for the SBM diet compared with the DDGS diet. The AID for Ile, Leu, Phe, Val, Ala, Tyr and Asp was greater ($P < 0.05$) in the DDGS diet compared with the CM diet. There was protein feedstuff × protein level interaction ($P < 0.05$) for AID of Lys because in the diets with 18% CP, the AID of Lys was greater ($P < 0.05$) in the SBM and cDDGS diets compared with the CM diet, whereas the AID of Lys was not different among the protein feedstuffs in diets with 14% CP. Standardized digestibility was greater ($P < 0.05$) in the SBM diet compared with the CM diet for all AA except Trp and Pro, whereas the SID of Gly and Asp were greater ($P < 0.05$) in the SBM diet compared with the cDDGS diet. Standardized digestibility for Ile, Leu, Val, Ala, Tyr and Asp were greater in the cDDGS diet compared with the CM diet. It was concluded that differences in AA digestibility observed for the pigs were related to differences in chemical, including fiber, profiles of the protein feedstuffs used but independent of dietary CP level.

Key Words: amino acids, protein feedstuff, protein level

0753 Effects of high levels of nicotinic acid on growth, carcass traits, and meat quality of finishing pigs.

J. R. Flohr¹, J. M. DeRouchey¹, J. C. Woodworth¹, M. D. Tokach¹, S. S. Dritz¹, R. D. Goodband¹, T. A. Houser¹, C. A. Fedler², and K. J. Prusa², ¹Kansas State University, Manhattan, KS, ²Iowa State University, Ames, IA

A total of 1232 pigs (PIC 337 × 1050; initially 27.0 ± 0.51 kg) were used in a 98-d study to determine the influence of high doses of added nicotinic acid (NA) on growth, carcass traits, and meat quality of finishing pigs during the summer months. Average daily high, mean, and low temperatures were 27.5, 23.9, and 20.5°C, respectively. There were 28 pigs per pen and 11 replications per treatment. Four dietary treatments were made by adding 0, 350, 700, or 1050 mg/kg NA (Lonza, Allendale, NJ) to a corn-soybean meal basal diet that contained 30 mg/kg of added NA. Diets were fed in four phases with the same NA concentrations in each phase. On d 98 of the study, two pigs per pen (one barrow and one gilt) were transported to a commercial abattoir. Carcass traits and pH decline (45 min, 3, and 21 h) were measured at the abattoir. Afterward, a 40-cm segment of boneless LM was used to determine purge loss and ultimate pH following a 10-d aging period. Then 2.5-cm boneless chops were cut and used to measure subjective color and marbling, objective color (L*, a*, b*), 24-h drip loss, and NA concentration. Overall (d 0 to 98), increasing NA had no effect on ADG or G:F; however, ADFI tended ($P = 0.07$) to increase. Carcass traits were not influenced by NA. Forty-five min and 21 h pH were decreased with increasing NA ($P < 0.01$), but ultimate pH was not different. Purge loss, drip loss, and NA concentrations were not influenced by treatment. The a* and b* were increased ($P < 0.05$) with increasing NA; however, subjective color scores were not different among treatments. Overall, high doses of NA had little influence on growth, carcass traits, and meat quality of finishing pigs raised in a commercial setting.

Key Words: finishing pigs, niacin, nicotinic acid

Table 0753. Effects of added dietary NA on growth and meat quality of finishing pigs

Item	Dietary NA, mg/kg				SEM	Probability, $P <$	
	30	380	730	1080		Linear	Quad-ratic
d 0 to 98							
ADG, kg	0.82	0.82	0.83	0.82	0.005	0.40	0.50
ADFI, kg	2.03	2.08	2.10	2.07	0.017	0.07	0.71
G:F	0.404	0.395	0.393	0.398	0.003	0.15	0.90
L*	53.12	54.67	54.56	54.16	0.82	0.54	0.21
a*	18.20	18.30	18.89	19.05	0.39	0.05	0.58
b*	16.05	16.45	16.88	17.09	0.40	0.04	0.89

0754 Effects of sugar beet pulp and expansion on performances of lactating sows and nursery piglets.

Z. Cheng*, D. Yuan, D. Hou, Y. Chen, H. Zhang, Y. Wang, W. Jin, B. Wang, H. Lei, Q. Li, S. Jiang, S. Bai, and Z. Zhang, *Animal Nutrition & Feed Center, COFCO Nutrition and Health Institute, Beijing, China.*

Ninety-six PIC lactating sows were divided into six treatments with 16 sows per treatment. They were fed diets containing 0, 5, or 10% of sugar beet pulp for 21 d. Three treatment diets were pelleted, and the other three diets were expanded and then pelleted. The diets contained the same calculated levels of CP and DE, sows were fed three times daily. On d 21, piglets were weaned and performances of lactating sows and nursery piglets were recorded. Results indicated that total weaning weight of piglets per litter and average daily weight gain of piglets were 50.47 ± 6.14 kg/Litter and 201.70 ± 30.17 g/piglet; 51.07 ± 11.04 kg/Litter and 189.04 ± 45.89 g/piglet; and 53.43 ± 12.31 kg/Litter and 207.27 ± 41.79 g/piglet for sows fed diets containing 0, 5, or 10% of pelleted sugar beet pulp, respectively; and total weaning weight of piglets per litter and average daily weight gain of piglets were 62.19 ± 12.56 kg/Litter and 222.38 ± 36.75 g/piglet; 47.97 ± 10.63 kg/Litter and 198.13 ± 47.15 g/piglet; and 53.75 ± 7.35 kg/Litter and 193.81 ± 36.30 g/piglet for sows fed diets containing 0, 5, or 10% of expanded and then pelleted sugar beet pulp, respectively. Results also indicated that expansion has significant effects on sow feed intake, total weaning weight of piglets per litter and average daily weight gain of piglets ($P < 0.05$), feed intake was 3.26 ± 0.90 kg/d and 4.77 ± 0.71 kg/d, for sows fed pelleted and expanded diets, respectively; total weaning weight of piglets per litter was 50.47 ± 6.14 kg/Litter and 62.19 ± 12.56 kg/Litter for sows fed pelleted and expanded diets, respectively; and average daily gain of piglets was 201.70 ± 30.17 g/d and 222.38 ± 36.75 g/d for sows fed pelleted and expanded diets, respectively. There were no interactions between sugar beet pulp and diet forms ($P > 0.05$).

Key Words: sugar beet pulp, pellet, expansion, lactation sows, piglets

0755 The evaluation of narasin in grow-finish swine

diets. L. Greiner¹, R. Barrett¹, A. Graham*¹, and J. Connor², ¹*Carthage Innovative Swine Solutions, Carthage, IL*, ²*Carthage Veterinary Service, Ltd, Carthage, IL.*

A total of 1180 pigs were placed on study at approximately 27.0 ± 2.6 kg in a wean-to-finish barn to determine if feeding narasin improves feed conversion and average daily gain during the grow-finish period. Pigs were sorted by gender, with the lower 10% being sorted off and the rest gate-cut into a total of 48 test pens. Pens were randomly allocated to one of three treatments: control, narasin included at 15 ppm (S1), or narasin included at 20 ppm (S2). Treatments were randomly assigned

within a block. Narasin was fed from d 0 to d 63. Diets consisted of 20% dried distillers grain with solubles (DDGS) from d 0 to 42, 20% DDGS from d 42 to 63, and then 0% DDGS from d 63 to market. Diets met or exceeded NRC (2012) recommendations. Pen weights and feed intake information were collected at each diet phase change to allow for calculation of ADFI and G:F by period. Data that were collected and analyzed included: wean-to-finish mortality (non-value pigs), full value pigs, non-full value pigs/culls (sub-standards at weaning and culls sold to secondary market), finishing ADG (pens), finishing ADFI (pens), G:F (pens), and days to 90 kg HCW. Data were analyzed as an incomplete block design using PROC MIXED, and starting average pig weight was used as a covariate. Data were reported as LSMEANS. The feeding of narasin resulted in no differences in ADG, ADFI, or G:F from d 0 to 21 of the study, regardless of inclusion rate. However, feeding narasin at both 15 and 20 ppm inclusion improved G:F from d 21 to 42 (0.431, 0.443 and 0.440, respectively; $P < 0.003$). Narasin inclusion improved G:F from d 0 to 63 (0.428, 0.435, 0.434, respectively; $P < 0.01$). Once narasin was removed from the diet at d 63 (approximately 89 kg BW), there were no differences in performance. After the removal of narasin from the diet, there were no further improvements or residual impacts on growth performance. Overall, from d 0 to 63, the feeding of narasin at either 15 or 20 ppm improved G:F when compared to control-fed pigs.

Key Words: grow-finish, narasin, pigs

0756 Replacement value of maize offal in diets of weaned pigs supplemented with chicken offal meal.

A. O. K. Adesehinwa*¹, E. O. Akinfala², and O. O. Adeleye³, ¹*Institute of Agricultural Research & Training, Obafemi Awolowo University, Ibadan, Nigeria*, ²*Dep. of Animal Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria*, ³*Federal University of Agriculture, Abeokuta, Nigeria.*

Young pigs have been reported in earlier studies to utilize up to 13.66% maize offal (MO) (a by-product of maize milling consisting mainly of the aleurone layer and some adulterants of germs and endosperm), as replacement for 25% maize in a 54.62% maize-based diet supplemented with chicken offal meal (COM) (ground dried poultry processing by-product comprising heads, viscera, feathers, beaks, etc.) but not 50% replacement of maize with 27.26% MO. Seventy-two weanling pigs (8.84 ± 0.2 kg body weight) were therefore randomly allotted to six dietary treatments of 0, 13.66, 16.34, 19.03, 21.70, and 24.39% MO representing 0, 25, 30, 35, 40, and 45% replacements of maize in 53.34% maize-based diet (containing 20% crude protein) enriched with COM to determine the replacement value of MO for maize in a complete randomized design. There were three pigs per pen and four replicate pens per treatment group. Weekly record of feed intakes and weight gains were taken for the 56-d trial period.

Two pigs/replicate were randomly selected and bled at the first and last weeks of the trial to determine the serum total proteins, albumin, globulin, creatinine, urea, cholesterol, and glucose. All statistical data were subjected to ANOVA, and, where statistical significance were observed, the means were compared using the Duncan's multiple range test (SAS). The results indicated that the increasing levels of MO resulted in increased levels of crude fibre (5.83, 6.57, 6.83, 7.05, 7.27, and 7.38%) and decreased levels of predicted metabolizable energy (ME) contents of the diets (3531.01, 3459.51, 3447.60, 3416.08, 3410.05, and 3372.47 Kcal ME/kg), while the dry matter intake (0.85, 0.84, 0.80, 0.82, 0.87, and 0.85 kg) was not ($P > 0.05$) affected for the 0, 25, 30, 35, 40, and 45% MO levels, respectively. The diets and the constituent nutrients were efficiently utilized in terms of G:F (0.56, 0.54, 0.58, 0.54, 0.56, and 0.54), ME intake per gain (6361.82, 6277.67, 5991.78, 6382.28, 6067.30, and 6199.02 Kcal ME) to support comparable ($P > 0.05$) gains (0.47, 0.49, 0.48, 0.47, 0.51, and 0.48 kg), though slight variations were observed with the ME intake. The performance of pigs fed up to 45% MO replacement of maize were comparable ($P > 0.05$) to those fed the maize-based control diet.

Key Words: maize offal, weaned pigs, non-conventional feedstuff

0757 The effects of standardized ileal digestible lysine level with or without tribasic copper chloride on growth performance, carcass characteristics, and fat quality in finishing pigs. K. F. Coble^{*1}, S. S. Dritz¹, J. L. Usry², J. E. Nemechek¹, M. D. Tokach¹, J. M. DeRouchey¹, R. D. Goodband¹, J. C. Woodworth¹, and G. M. Hill³, ¹Kansas State University, Manhattan, ²Micronutrients, Social Circle, GA, ³Michigan State University, East Lansing.

A total of 1248 pigs (initially 28.9 kg BW) were used in a 120-d study to determine the effects of added tribasic copper chloride (TBCC; IntelliBond C; Micronutrients, Indianapolis, IN) and increasing standardized ileal digestible Lys on growth performance, carcass characteristics, liver Cu concentration, and carcass fat quality in finishing pigs. Pens of pigs were al-

lotted to one of six dietary treatments, balanced on average pen weight in a randomized complete block design with 26 pigs per pen and eight replications per treatment. Treatments were arranged in a 3 × 2 factorial with main effects of SID Lys (85, 92.5, and 100% of the estimated requirement) and added Cu (0 or 150 ppm) from TBCC. All diets were corn-soybean meal-based with 30% distiller's dried grains with solubles, 15% bakery meal and 17 ppm Cu from CuSO₄ provided from the trace mineral premix. There were no TBCC × SID Lys interactions observed for growth performance or liver Cu concentrations. Increasing SID Lys increased ($P < 0.01$) ADG, G:F and final BW (Table 0757). Pigs fed 150 ppm TBCC tended ($P < 0.10$) to have increased ADG, G:F and final BW. Liver Cu concentrations were greater ($P < 0.01$) in pigs fed TBCC and tended to decrease (quadratic; $P < 0.09$) as SID Lys increased. In pigs fed TBCC, jowl fat iodine value (IV) calculated from the fatty acid analysis of all three fat layers, increased with increasing SID Lys but not in pigs fed diets without TBCC (Lys × TBCC interaction; $P < 0.03$). In summary, SID Lys did not influence the response to TBCC in this experiment.

Key Words: finishing pig, copper, lysine, iodine value

0758 Effects of hard red winter wheat particle size on finishing pig growth performance and caloric efficiency. J. A. De Jong^{*}, J. M. DeRouchey, M. D. Tokach, R. D. Goodband, and S. S. Dritz, Kansas State University, Manhattan.

A total of 288 pigs (43.8 kg BW) were used in an 83-d trial to determine the effects of hard red winter wheat particle size on finishing pig growth performance and caloric efficiency. Caloric efficiency (CE) was calculated using the ingredient energy values from NRC (2012) ME and INRA (2004) NE. Pigs were allotted to one of three dietary treatments with six pens/treatment and eight pigs/pen. The same wheat-soybean meal-based diets were used for all treatments. Diets were fed in mash form. The three dietary treatments included hammer-mill ground wheat to particle sizes of 728, 579, and 326 μm, respectively. From d 0 to 40, decreasing wheat particle size decreased (linear; $P < 0.03$) ADFI (2.29, 2.24, 2.20 kg), but improved (quadratic; $P < 0.01$) G:F (0.400, 0.413, 0.409) and

Table 0757. Dietary SID Lys level with or without tribasic copper chloride in finishing pigs

	TBCC, ppm						Probability, $P <^1$		
	0			150			SID Lys		
SID Lys, %	85.0	92.5	100.0	85.0	92.5	100.0	TBCC	Linear	Quadratic
d 120 BW, kg	122.8	125.4	126.2	123.7	125.8	129.0	0.07	0.01	0.76
ADG, kg	0.80	0.81	0.82	0.80	0.82	0.84	0.10	0.01	0.74
ADFI, kg	2.18	2.20	2.19	2.19	2.19	2.23	0.65	0.23	0.95
G:F	0.365	0.370	0.373	0.365	0.374	0.380	0.09	0.01	0.58
Liver Cu, ppm	13	13	12	33	33	26	0.01	0.18	0.09
Jowl IV ²	84.2	84.6	83.6	82.7	83.6	85.5	0.74	0.16	0.87

¹SEM were 1.52, 0.007, 0.032, 0.004, 3.3, and 0.801 for d 120 BW, ADG, ADFI, G:F, liver Cu, and jowl IV, respectively.

²Linear TBCC × Lys interaction ($P < 0.03$).

CE (7.89, 7.65, 7.72 Mcal ME/kg) and (5.84, 5.66, 5.71 Mcal NE/kg) basis, with no change ($P > 0.24$) in ADG (0.92, 0.93, 0.90 kg/d). From d 40 to 83, decreasing wheat particle size increased (quadratic; $P < 0.01$) ADG (0.92, 0.90, 0.95 kg/d), and improved (linear; $P < 0.01$) G:F (0.319, 0.322, 0.336) and CE (9.92, 9.83, 9.44 Mcal ME/kg and 7.45, 7.38, 7.08 Mcal NE/kg), with no change ($P > 0.23$) in ADFI (2.87, 2.80, 2.84). Overall from d 0 to 83, reducing wheat particle size improved (linear; $P < 0.01$) G:F and CE on both an ME and NE basis, with no difference in ADG or ADFI. Fine grinding wheat was detrimental to feed intake in early finishing but improved ADG in late finishing and G:F for both periods and overall.

Key Words: finishing pig, particle size, wheat

Table 0758. Effects of hard red winter wheat particle size on finishing pig growth performance and caloric efficiency

d 0 to 83,	Wheat particle size, μm			SEM	Probability $P <$	
	728	579	326		Linear	Quadratic
ADG, kg	0.92	0.91	0.93	0.01	0.47	0.50
ADFI, kg	2.59	2.53	2.53	0.03	0.13	0.43
G:F	0.354	0.361	0.367	0.002	0.01	0.82
Caloric efficiency, Mcal/kg gain						
ME	8.94	8.76	8.62	0.06	0.01	0.75
NE	6.67	6.53	6.43	0.05	0.01	0.75

0759 The effects of dietary zinc oxide and chlortetracycline on nursery pig growth performance.

J. A. Feldpausch*, J. A. De Jong, M. D. Tokach, S. S. Dritz, J. C. Woodworth, R. G. Amachawadi, H. M. Scott, J. L. Nelssen, and R. D. Goodband, *Kansas State University, Manhattan.*

A total of 240 weaned pigs (PIC 1050; initially 6.08 ± 0.60 kg) were used in a 47-d study to compare the effects of added Zn from ZnO, alone or in combination with a low or high dose of chlortetracycline (CTC) on nursery pig growth performance. Pigs were allotted to pens at weaning (d 0) and fed a common starter diet with no antimicrobial for 5 d before the start of the experiment. On d 5, pens of five pigs were allotted to one of six dietary treatments, balanced on average pen weight in a randomized complete block design with eight replications per treatment. Dietary treatments were arranged in a 2×3 factorial with main effects of added ZnO (0 vs. 2500 ppm of Zn) and CTC (0, 55, or 441 mg/kg feed). Pigs were fed experimental diets from d 5 to 26 after weaning followed by a common corn-soybean meal-based diet without antimicrobial from d 26 to 47. Pigs on the 55 mg/kg treatment received CTC continuously from d 5 to 26; however, to comply with FDA guidelines, CTC was removed from the diets of pigs fed 441 mg/kg CTC on d 15, then added again from d 16 to 26. All diets contained at least 110 ppm of Zn from ZnO in the trace mineral premix. No ZnO \times CTC interactions were observed. Pigs fed added ZnO had increased ($P = 0.001$) ADG, ADFI, and BW during the treatment period but decreased G:F ($P = 0.025$) from d

26 to 47 when a common diet was fed. Overall (d 5 to 47), pigs fed added ZnO had increased ($P < 0.05$) ADG and ADFI. Pigs fed CTC had increased (linear, $P < 0.05$) ADG, ADFI, and BW during the treatment period. Overall, pigs fed CTC tended to have increased (linear, $P < 0.10$) ADG and ADFI, but G:F tended (quadratic, $P = 0.070$) to increase then decrease as CTC increased. In summary, ZnO and CTC increased ADG and ADFI but had a minimal effect on feed efficiency.

Key Words: nursery pig, zinc, chlortetracycline

Table 0759. Effect of zinc oxide and chlortetracycline on pig growth

Added Zn, ppm	0	0	0	2500	2500	2500	SEM
CTC, mg/kg	0	55	441	0	55	441	
d 5 to 26							
ADG, g	355	378	386	397	397	417	7.9
ADFI, g	504	514	528	549	542	570	11.9
G:F	0.705	0.737	0.731	0.725	0.734	0.732	0.0128

0760 Efficacy of Biomin BBSH 797 to biotransform deoxynivalenol to the metabolite de-epoxy-deoxynivalenol in serum of pigs.

S. Schaumberger*¹ and U. Hofstetter², ¹BIOMIN Holding GmbH, Herzogenburg, Austria, ²Biomin Holding GmbH, Herzogenburg, Austria.

The mycotoxin deoxynivalenol (DON) and its metabolites are important biomarkers to demonstrate the efficacy of DON deactivating products in vivo. The aim of this study was to prove the capability of Biomin BBSH 797 to detoxify DON to the metabolite de-epoxy-deoxynivalenol (DOM-1) in the gastrointestinal tract of pigs. Therefore, DON and DOM-1 were measured in the serum of pigs. A total of 124 weaned piglets (mixed sex, approx. 28 d) were adapted for 2 wk. After adaptation, 24 animals were randomly assigned to three experimental groups, according to weight, gender and overall condition. Control group received no DON and no BBSH 797. The second group only received 2 $\mu\text{g}/\text{kg}$ of naturally DON contaminated wheat and the third group received two $\mu\text{g}/\text{kg}$ DON and 1.7×10^8 cfu BBSH 797/kg feed. During the experimental phase, piglets were fed restrictively twice a day. Serum samples of all animals in all groups were taken on four consecutive days. Sample 1 (blank serum sample) was taken before feeding the experimental diets. All other serum samples were taken 1.5, 4, 10, and 24 h after feeding the experimental diets. Serum samples were analysed for DON and DOM-1 concentrations by LC/MS-MS method. There were no significant differences in blank serum samples between the three groups. Due to the presence of DON in the standard diet, small amounts of DON and DOM-1 produced by the native intestinal flora were also found in the blank samples. On d 3 of the trial, DON concentration 1.5 h after feeding was more than four times higher in serum of the DON group compared to the control and the DON+BBSH group ($P = 0.02$). DOM-1 concentrations in serum (d 3, 1.5 h) were

highest in the DON+BBSH group and differed significantly ($P = 0.00$) from the control as well as the DON group. To conclude, biomarker analysis of pig serum samples revealed a significant reduction of DON concentration and a simultaneously significant increase of the metabolite DOM-1 in Biomin BBSH 797 treated animals. These results demonstrate the efficacy of Biomin BBSH 797 to detoxify DON in vivo.

Key Words: Biomin BBSH, deoxynivalenol, biotransformation

0761 The effect of superdosing phytase on inositol and phytate concentration in the gastrointestinal tract and its effect on pig performance. P. Wilcock¹,

C. L. Bradley^{*1}, J. J. Chewning², and C. L. Walk¹,
¹*AB Vista Feed Ingredients, Marlborough, UK,*
²*Swine Research Services, Inc., Springdale, AR.*

Dietary phytate has been shown to be detrimental to piglet performance and the use of superdosing levels of phytase can improve performance through phytate destruction rather than phosphorus provision. This extra phosphoric effect of superdosing phytase has not been widely tested in older pigs and therefore this trial was conducted to determine if increasing phytase (Quantum Blue) levels would improve performance in grower pigs (22.8 to 56.5 kg). In addition, inositol and phytate (IP6) levels were measured in the stomach and duodenum to determine if these were correlated to phytase dose and performance. Pigs ($n = 300$) were allocated to one of five treatments (five pigs per pen and 12 replicate pens per treatment): T1, commercial diet formulated to meet the pigs nutrient

requirements, except AVP and Ca were reduced 0.15% and 0.16% (equivalent of 500 FTU/kg phytase matrix), respectively; T2 was T1 with the addition of 500 FTU/kg phytase to target an AVP (0.32%) and Ca (0.71%) adequate diet; T3, T4 and T5 were T1 with, 1000, 1500, and 2000 FTU/kg phytase, respectively. All pigs were fed a two-phase feed program (0 to 21 d and 21 to 35 d) with gain, feed intake and FCR determined for the complete feeding period. At 35 d, six pigs per treatment of average BW were selected, penned individually and fed twice per day with the same treatment feed as previously fed. At 42 d each pig was fed 1.5 kg for 30 min, and after an additional 60 min pigs were slaughtered and stomach and duodenum contents were removed for phytate and inositol analyses. There was a linear increase in ADG ($P < 0.01$) and ADFI ($P < 0.01$) and a linear improvement in FCR ($P < 0.01$) as phytase dose increased. There was a linear increase in inositol ($P < 0.01$) in the stomach/duodenum and a quadratic ($P < 0.01$) decrease in IP6 with increasing levels of dietary phytase. There is a good relationship between gastrointestinal phytate breakdown ($R^2 = 0.95$), inositol production ($R^2 = 0.93$), and FCR improvement. In conclusion supplementing grower diets with dietary phytase to doses exceeding commercial levels (> 500 FTU/kg) linearly improved performance (T1, 51.8 kg; T2, 54.5 kg; T3, 55.1 kg; T4, 55.7 kg; T5, 56.5 kg) and feed conversion (T1, 2.07; T2, 1.95; T3, 1.94; T4, 1.89; T5, 1.88) which may be linked to IP6 breakdown and inositol production in the gastrointestinal tract.

Key Words: phytase, phytate pig