with only minor treatment effects observed thereafter.

Key Words: butyric acid, growth, nursery pigs
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171 Effects of encapsulated butyric acid and copper on nursery pig growth performance from d 0 to 42 after weaning. J. A. Loughmiller*, D. Sanders, H. Feng, V. Mani, J. K. Rubach, A. L. P. De Souza, F. R. Valdez, M. J. Poss, *Kemin Industries, Des Moines, IA.*

A study was conducted evaluating the effects of propionic acid plus copper carbonate (KemTRACE Cu®, Kemin Industries, Des Moines, IA), encapsulated butyric acid (ButiPEARL, Kemin Industries, Des Moines, IA) and a novel encapsulated butyric acid plus copper carbonate (ButiPearl C, Kemin Industries, Des Moines, IA) on the growth performance of weanling pigs. A total of 350 pigs (PIC 280 × 1050; initial BW = 5.54kg) with 10 pigs/pen and 7 replicate pens/treatment were used in a 42 d study. Pigs were allocated in a randomized, complete block design based on initial BW. Diets were pelleted, corn-soybean meal based and similar within phase except for the additional copper and encapsulated butyric acid. All nutrient concentrations met or exceeded NRC (2012) estimates. Treatments were Control (N), 500 mg/kg ButiPEARL (B), 65 mg/kg Cu from KemTRACE Cu® (C), 500 mg/kg ButiPEARL + 65 mg/kg C from KemTRACE Cu® (BC); 500 mg/kg ButiPEARL C (BPC). Treatment differences were determined by LSMEANS comparisons. During d 0 to 7, no differences were observed for initial BW, ADG; ADFI ($P > 0.10$). Gain:feed was greatest for BC and BPC ($P < 0.05$). From d 7 to 21, ADG was greatest for BPC and BC ($P < 0.05$). Day 7 to 21 Gain:feed for C, BC; BPC was higher than N ($P < 0.05$). Day 21 to 42 ADG was greatest for BC ($P < 0.05$). Day 21 to 42 ADFI was greatest for BC and BPC ($P < 0.05$); gain:feed was greatest for BC ($P < 0.05$). From d 0 to 42, overall ADG and ADFI were greatest for BC and BPC, while N and B were lowest ($P < 0.05$). Overall gain:feed was greatest for BC ($P < 0.05$). Final BW was greatest for BC and BPC ($P < 0.05$). Adding BC or BPC showed the greatest growth performance improvement for pigs from d 0 to 42 after weaning.

Key Words: butyric acid, copper, nursery pigs
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172 Effects of feeding probiotic or chlortetracycline or a combination on nursery pig growth performance. H. E. Williams*, M. D. Tokach, S. S. Dritz, J. C. Woodworth, J. M. DeRouchey, R. G. Amachawadi, T. G. Nagaraja, R. D. Goodband, *Kansas State University, Manhattan.*

A total of 300 nursery pigs (initial BW 5.9 ± 0.05 kg) were used to determine the effects of feeding chlortetracycline (CTC) with or without probiotics on nursery pig performance. Pigs were weaned at approximately 21-d of age and randomly allotted to pens based on initial BW. Pigs were fed a common pelleted starter diet for 4 d and then weighed, and pens were allotted, in a randomized complete block design based on BW, to 1 of 6 dietary treatments with 10 replications/treatment. The treatments were arranged in a 2 × 3 factorial with main effects of CTC (0 vs. 440 ppm from d 0 to 42) and probiotic (0, 0.05% Bioplus 2B [Chr. Hansen USA, Inc., Milwaukee, WI], or 0.05% Poultry Star [Biomin America, Inc., San Antonio, TX]). Experimental diets were fed in 2 phases (Phase 1: d 0 to 14 and Phase 2: d 14 to 42) and all diets were fed in meal form. Diets were corn-soybean meal based and were formulated to meet the pigs' nutrient requirements for each phase of this study. The Phase 1 diets contained specialty protein sources while Phase 2 diets did not. On d 15 and 29, CTC was removed from CTC diets and non-medicated feed was fed for 1 d. For overall performance, there were no interactions ($P > 0.05$) between probiotics and CTC. Pigs fed CTC had improved ($P < 0.001$) ADG, ADFI, and overall BW compared with those fed diets without CTC. Adding Poultry Star to the diet increased ($P < 0.05$) ADFI and BW from d 0 to 14. However, there was no difference in ADG or ADFI for the overall d 0 to 42 period. In conclusion, CTC improved nursery pig performance, but there were no consistent benefits of feeding either probiotic alone or in combination with CTC.

Key Words: growth performance, nursery pig, probiotic
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Table 170.

		ButiPEARL		ButiPEARLZ			$P <$		
Item	Control	Low	High	Low	High	SEM	Source × level	Source	Level
d 0 to 7[1]									
ADG, g	108[b]	139[a]	107[b]	89[b]	109[b]	7.68	0.002	0.003	0.413
G:F, g/kg	767[ab]	833[a]	729[b]	687[b]	766[ab]	6.20	0.007	0.096	0.711
d 0 to 42									
ADG, g	481	470	456	452	446	8.88	0.693	0.130	0.260
G:F, g/kg	719	712	709	717	707	5.90	0.633	0.796	0.267

[1]Source × level interaction ($P < 0.05$)

Table 171. Effect of encapsulated butyric acid and copper on weanling pig performance, d 0 to 42

	N	B	C	BC	BPC	SEM
ADG, g	360[b]	354[b]	378[ab]	404[a]	401[a]	13
ADFI, g	511[b]	503[b]	527[ab]	548[a]	553[a]	15
G:F, g/kg	703[a]	705[a]	718[ab]	737[b]	723[ab]	22
D 42 BW, kg	20.5[b]	20.5[b]	21.5[ab]	22.5[a]	22.4[a]	0.6

[ab]Means within row differ ($P < 0.05$)

Table 172.

CTC	-	+	-	+	-	+		
Bioplus 2B[1]	-	-	+	+	-	-		Probability < P
Poultry Star[1]	-	-	-	-	+	+	SEM	CTC
d 0 to 42								
ADG, g	424	469	405	482	445	473	13.16	0.001
ADFI, g	644	726	625	727	687	728	16.22	0.001
G:F	0.658	0.645	0.645	0.664	0.648	0.650	0.0003	0.795
BW, kg								
d 42	24.2	25.6	23.6	26.1	24.8	25.8	0.052	0.001

[1]No significant interactive or main effects of BioPlus 2B or Poultry Star ($P > 0.05$).

173 Evaluation of dose response effects of Butipearl C on nursery pig growth performance from d 0 to 42 after weaning. J. A. Loughmiller*, A. L. P. De Souza, J. K. Rubach, H. Feng, D. Sanders, V. Mani, F. R. Valdez, M. J. Poss, *Kemin Industries, Des Moines, IA.*

A study was conducted to evaluate the effects of a novel encapsulated butyric acid plus copper carbonate product (ButiPearl C; Kemin Industries, Des Moines, IA) on weanling pig growth performance. A total of 350 pigs (PIC 280 × 1050; initial BW = 5.86 kg) with 10 pigs/pen and 7 replicate pens/treatment were used in a 42 d study. Pigs were housed in a commercial research nursery and allocated in a randomized, complete block design based on initial BW. Diets were pelleted, corn-soybean meal based and were similar within phase except for the addition of the ButiPEARLC (BPC). All nutrient concentrations met or exceeded NRC (2012) requirement estimates. Treatments were arranged as a dose titration of BPC at 0, 250, 500, 750, and 1000 mg/kg of feed. Data were analyzed using a mixed model with orthogonal contrasts. During d 0-7 after weaning, ADG and G:F tended to increase as pigs were fed diets containing up to 500 and 750 mg/kg of BPC, respectively (quadratic, $P < 0.07$). During the same period, ADFI increased when diets containing up to 500 mg/kg of BPC were fed (quadratic, $P < 0.05$). From d 7 to 21, no linear or quadratic effects were observed for ADG, ADFI, or G:F ($P > 0.40$). During d 21 to 42, ADG and G:F increased as pigs were fed diets containing up to 1000 mg/kg BPC (quadratic, $P < 0.01$). During this same period, ADFI increased as pigs were fed diets containing BPC levels up to 1000 mg/kg (quadratic, $P < 0.05$). Overall results (d 0 to 42) showed improved ADG, G:F, and final BW for pigs fed diets with up to 750 mg/kg BPC (quadratic, $P < 0.05$). Overall ADFI increased in pigs fed diets containing up to 1000 mg/kg BPC (linear, $P < 0.04$). These results indicate that pig growth performance was optimized when they were fed diets containing up to 750 mg/kg BPC from d 0 to 42 after weaning.

Key Words: butryic acid, copper, nursery pigs
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174 Effects of dietary lysine level and amino acid ratios on nursery pig performance. A. B. Clark[1,*], M. D. Tokach[1], J. M. DeRouchey[1], S. S. Dritz[1], J. C. Woodworth[1], R. D. Goodband[1], K. J. Touchette[2], M. Allerson[3], *[1]Kansas State University, Manhattan, [2]Ajinomoto Heartland, Inc., Chicago, IL, [3]Holden Farms Inc., Northfield, MN.*

A total of 2268 pigs (PIC 327×L42, initially 7.3 kg BW) were used in a 28-d growth study with 54 pigs/feeder (experimental unit) and 6 replications/treatment. Pigs were randomly allotted to pens at weaning and fed a common starter diet for 8 d. Pens were then blocked by BW and allotted to 1 of 7 dietary treatments in a randomized complete block design. Treatments were arranged in a [2 × 3]+1 factorial with 2 levels of standardized ileal digestible (SID) Lys, low (1.25%) and high (1.35%), and 3 SID amino acid (AA) ratios relative to Lys (industry, 95% of maximum performance, and maximum performance), as well as a control (1.35% SID Lys). Industry ratios were 55% Met+Cys:Lys, 62% Thr:Lys, 18% Trp:Lys, 65% Val:Lys, and 52% Ile:Lys. Maximum diet ratios were 60% Met+Cys:Lys, 65% Thr:Lys, 21% Trp:Lys, 72% Val:Lys, and 52% Ile:Lys. The 95% ratios were formulated to target 95% of maximum performance and were 56% Met+Cys:Lys, 62% Thr:Lys, 19% Trp:Lys, 67% Val:Lys, and 52% Ile:Lys. Diets