) **Moist or dry extrusion processing influences growth performance and nitrogen digestibility in the early weaned pig.** K.G. Friesen*, J.L. Nelssen, R.D. Goodband, K.C. Behnke, M.D. Tokach, and L.J. Kats. Kansas State University, Manhattan.

e hundred pigs (initially 5.9 kg BW and 21 d of age) were used to evaluate the erences between moist and dry extrusion. The experiment was designed as a domized complete block with four dietary treatments. Pigs were fed either a positive rol diet containing corn, 20% dried skim milk and 20% dried whey or a corn-bean meal-lactose diet with non-extruded soybean meal (SBM), dry extruded soybean al (DSBM), or moist extruded soybean meal (MSBM)) replacing milk protein on an ysine (1.4%) and isolactose basis (24.4%). Chromic oxide was included (.25%) as undigestible marker for determining apparent DM and N digestibility on d 14 rweaning. Pig weight and feed disappearance were recorded weekly to determine G, ADFI, and gain to feed ratio (G/F). From d 0 to 14 postweaning, ADG, ADFI, l G/F were greater ($P < .05$) for pigs fed a milk based diet compared to pigs fed a bean meal based diet regardless of extrusion processing. However, pigs fed either BM or DSBM had increased ($P < .05$) ADG and G/F, while ADFI tended to rease ($P < .10$) compared to pigs fed SBM. Apparent DM and N digestibilities (d were similar between all four dietary treatments. Average daily gain was greatest < .05) for pigs fed a milk-based diet compared to pigs fed a SBM-based diet from to 28 postweaning. Pigs fed extruded SBM (moist or dry) had increased ($P < .05$) G compared to pigs fed SBM. Average daily feed intake was improved ($P < .05$) pigs fed either MSBM or DSBM compared to pigs fed a SBM-based diet. Feed iciency was greatest ($P < .05$) in pigs fed a milk-based diet (d 0 to 28). Pigs fed BM had greater ADG ($P < .05$) and G/F ($P < .11$) than pigs fed DSBM from d 0 28 postweaning. These data suggest that extrusion processing can improve SBM ality for inclusion in diets for the early-weaned pig. However, moist extrusion of M results in a higher quality product for inclusion in high nutrient dense starter ets.

Item	Milk	SBM	DSBM	MSBM	CV
ADG d 0-14, g[ab]	318	168	222	236	9.8
ADFI d 0-14, g[ac]	322	254	268	290	9.5
G/F d 0-14[ab]	.99	.66	.83	.81	10.0
DM dig. d 14, %	94.5	89.9	91.0	90.3	1.0
N dig. d 14, %	91.3	86.3	89.3	89.0	1.7
ADG d 0-28, g[abd]	358	181	313	354	6.5
ADFI d 0-28, g[b]	417	363	449	472	7.4
G/F d 0-28[abc]	.86	.50	.70	.75	8.2

[a]Milk vs all SBM diets ($P < .05$).
[bc]SBM vs MSBM and DSBM ($P < .05$) and ($P < .10$), respectively.
[da]MSBM vs DSBM ($P < .05$) and ($P < .11$), respectively.

Key Words: Pigs, Soybean meal, Extrusion

101 Efficacy of a copper-lysine chelate as a growth promotant for weanling pigs. R.D. Coffey, K.W. Mooney*, G.L. Cromwell, and H.J. Monegue, University of Kentucky, Lexington.

Three 28-d experiments involving 478 crossbred pigs weaned at 4 weeks of age were conducted to evaluate the efficacy of a copper-lysine chelate (Cu-lys; CuPLEX 100™, Zinpro Corp., Edina, MN) as a growth promotant for weanling pigs. This product contains 10% Cu and 48% lysine. In each experiment, a fortified corn-soybean meal-dried whey (15%) basal diet containing 110 ppm chlortetracycline was used. L-lysine HCl was used to make all diets isolysinic (1.20% lysine). Treatments in Exp. 1 and 2 were (1) basal, (2) + 100 ppm Cu from Cu-lys, (3) + 200 ppm Cu from Cu-lys, (4) + 100 ppm Cu from $CuSO_4$ and (5) + 200 ppm Cu from $CuSO_4$. Each diet was fed to 5 reps of 5-7 pigs/pen from an average of 7.9 to 16.9 kg. Pooled daily gain, daily feed and feed/gain were 286, 348, 347, 319, 325 g/d; 526, 654, 635, 586, 606 g/d; 1.85, 1.89, 1.84, 1.84, 1.89 for the 5 treatments, respectively. Both sources of Cu increased growth rate and feed intake ($P < .01$), and Cu-lys was more effective ($P < .05$) than $CuSO_4$. Cu at 100 ppm was as effective as at 200 ppm. Pigs fed 200 ppm Cu from Cu-lys had lower ($P < .10$) liver Cu concentrations (70 ppm) of DM than pigs fed 200 ppm Cu from $CuSO_4$ (221 ppm). Treatments in Exp. 3 were (1) basal; (2) + 50, (3) + 100, or (4) + 200 ppm Cu from Cu-lys; and (5) + 50, (6) + 100 or (7) + 200 ppm Cu from $CuSO_4$. Diets were fed to 4 reps of 5 or 7 pigs/pen from an average of 7.6 to 17.3 kg. Daily gain, daily feed and feed/gain were 294, 316, 370, 377, 319, 362, 377 g/d; 593, 617, 693, 726, 613, 656, 684 g/d; 2.02, 1.96, 1.87, 1.92, 1.92, 1.81, 1.82. Pigs fed Cu consumed more feed and gained faster and more efficiently ($P < .10$) than pigs fed the basal diet. Growth rate responded quadratically ($P < .10$) to increased levels of Cu, and Cu-lys and $CuSO_4$ were equally efficacious. Daily gain and daily feed were lower ($P < .10$) with 50 ppm Cu as compared to 100 or 200 ppm Cu, and 100 or 200 ppm Cu were equally effective. Liver Cu concentrations tended to be lower ($P < .20$) in pigs receiving 200 ppm Cu from Cu-lys (153 ppm) than in pigs receiving 200 ppm Cu from $CuSO_4$ (221 ppm). These results indicate that Cu-lys is an effective growth promotant for weanling pigs.

Key Words: Pigs, Copper, Chelates

102 Efficacy of substituting the dipeptide L-lysyl-glycine for L-lysine HCl in starter pig diets. J. A. Hansen*, J. L. Nelssen, S. A. Blum[1], R. D oodband, M. D. Tokach, K. G. Friesen, L. J. Kats, J. L. Laurin, and S. S. Dritz. Kansas tate University, Manhattan, and [1]Lonza, Inc., Fairlawn, NJ.

total of 180 (21 ± 2 d of age) pigs were used in a growth assay to compare additions of -lysine HCl, 98% (78.5% lysine), and the dipeptide L-lysyl-glycine HCl (50% lysine) a starter pig performance and N utilization. Pigs were blocked (n = 5) by initial wt (6.3 g) and assigned to treatments according to ancestry and sex. Feed and water were vailable ad libitum for 21 d postweaning (11.7 kg final wt). The control diets were rmulated to .9 and 1.1% lysine using a corn-soybean meal mixture containing 15% ible grade dried whey. Lysine sources were added to the .9% lysine basal diet to bring te total dietary content to 1.0 and 1.1%. Methionine and threonine were supplemented maintain the minimal ratio described by NRC (1988) for the 5 to 10 kg pig. Results of rowth performance from d 0 to 21 postweaning are presented below. Serum samples ere obtained on d 7, 14 and 21 for analysis of urea N. Data were analyzed as a ndomized complete block design and means were separated using Bonferroni paired t-sts. Single df contrasts were used to evaluate differences between the two lysine ources and levels. No differences in daily gain or daily feed intake were observed etween treatments. Pigs fed the 1.0% lysine, lysyl-glycine supplemented diet had lower ed utilization compared to pigs fed the 1.1% lysine corn-soybean meal control diet. In eneral, pigs consuming the 1.1% lysine corn-soybean meal control diet had higher urea l than pigs consuming the reduced protein diets and those consuming the 1.1% lysine, ysyl-glycine supplemented diet had the lowest urea N. Pigs consuming the diets ontaining lysyl-glycine had lower urea N than pigs fed the lysine HCl diets on d 21. In onclusion, differences in growth were not observed between the dietary lysine sources or evels; however, amino acids appeared to be more efficiently utilized when supplied from ysyl-glycine rather than lysine HCl as evidenced by the lower serum urea N on d 21.

	Corn-Soybean		Lysine HCl		Lysyl-glycine		
ysine, %:	.9	1.1	1.0	1.1	1.0	1.1	SE
Daily gain, g	248	270	276	253	218	280	16
Daily feed, g	417	418	460	413	395	432	18
Gain/feed	593[yz]	646[y]	600[yz]	613[yz]	547[z]	643[y]	16
d 7 urea N, mg/dl	11.0[yz]	14.0[y]	9.5[z]	9.2[z]	9.7[z]	8.5[z]	7
d 14 urea N, mg/dl	12.5[y]	13.6[y]	9.6[z]	8.4[z]	8.9[z]	8.6[z]	6
d 21 urea N, mg/dl[a]	12.3[x]	13.0[x]	10.8[xy]	8.5[yz]	9.1[yz]	7.9[z]	5

[a]Contrast of lysine HCl vs lysyl-glycine ($P = .05$)
[yz]Means within a row lacking a common superscript letter differ ($P < .05$).

Key Words: Pigs, Amino Acids, Performance

103 Effects of added lysine to starter diets containing primarily zein protein and formulated to provide .14% tryptophan. M. S. Carlson*, C. R. Hamilton, and G. W. Libal, South Dakota State University, Brookings.

Seventy-two nursery pigs (10.7 kg) were used to study the effects of dietary lysine level on the performance of pigs fed diets containing corn gluten meal (CGM) for 28 d postweaning. Pigs were weaned at about 25 d of age and allotted to six dietary treatments and three replicates (wt blocks) in a randomized complete block design. The basal diet contained corn, CGM, and soybean meal formulated for .14% tryptophan and .50% lysine (LYS). L-lysine·HCL was added to the basal diet to produce four dietary LYS levels (.50, .65, .80, and .95%). Also included were two corn-soybean meal diets formulated to contain .14% tryptophan and .50% LYS either with (+REF) or without (-REF) .45% added LYS. Calculated levels of all other nutrients met or exceeded requirements. For the overall 28-d period increasing dietary LYS had a quadratic effect ($P < .01$) on ADG and gain/feed. Increasing dietary LYS resulted in a linear decrease for ADFI ($P < .01$) and orts ($P < .01$). Pigs fed the +REF diet had greater ($P < .05$) ADG (.24 vs .11 kg/d) and gain/feed (.37 vs .32) than pigs fed the CGM diet containing .95% LYS. Orts were lower ($P < .01$) for pigs fed the -REF diet than for those fed the CGM diet containing .50% LYS (.04 vs .34 kg/d). These data suggest .65% LYS to be adequate for 10- to 20-kg pigs fed high-zein diets containing .14% tryptophan. Additional LYS supplied as L-lysine·HCL depressed ADFI, resulting in concomitant decreases in ADG and gain/feed.

Effects of added L-lysine·HCl on the performance of starter pigs

	Diets with CGM: dietary lysine, %			
Item	.50	.65	.80	.95
ADG, kg/d[a]	.21	.30	.22	.16
ADFI, kg/d[b]	.70	.80	.63	.51
Orts, kg/d[c]	.34	.07	.15	.11
Gain/feed[a]	.30	.37	.35	.32

[a]Quadratic ($P < .01$).
[b]Linear ($P < .01$).
[c]Linear ($P < .10$).

Key Words: Pigs, Corn gluten meal, Lysine