160 **Effects of dry-extruded whole soybeans on growth performance of early-weaned and finishing pigs.** I.H. Kim, M.R. Cabrera, J.D. Hancock, R.H. Hines, L.L. Burnham, and A.L. Beasley*, Kansas State University, Manhattan.

Two experiments were conducted to determine the effects of various soybean preparations on growth performance in nursery pigs and on growth performance, carcass merit, and stomach lesions in finishing pigs. For the nursery experiment, 144 pigs (4.7 kg avg BW) were fed in three phases from d 0 to 35 postweaning (i.e., d 0 to 7 at 1.55% lysine, d 7 to 21 at 1.25% lysine, and d 21 to 35 at 1.15% lysine). Treatments were a soybean meal (SBM)-based regimen, a dry-extruded whole soybeans (DEWS) regimen, and a specially processed soy products (SP) regimen (i.e., soy isolate for d 0 to 7, soy concentrate for d 7 to 21, and extruded soy flour for d 21 to 35). On d 35 postweaning, the pigs were switched to the same soybean meal-based grower diet (.9% lysine) for a period of 3 wk. For d 0 to 7, pigs fed DEWS and SP had 25% greater ADG and 28% greater gain/feed (G/F) than pigs fed the SBM-based control diet ($P < .001$). For d 0 to 35 and overall (d 0 to 56), pigs fed the various soybean protein sources had similar growth performance. For the finishing experiment, 150 pigs (51 kg avg BW) were fed sorghum-based diets for 76 d. Treatments were SBM, 50:50 blend (protein basis) of SBM and DEWS, and DEWS. All diets were formulated to the same lysine:DE ratio (i.e., 2.1 g lysine/Mcal of DE). The pigs were slaughtered for collection of carcass data and stomachs. Overall, ADG (linear effect, $P < .06$) and G/F (linear effect, $P < .001$) increased, and ADFI (linear effect, $P < .02$) decreased, as the concentration of DEWS in the diets was increased. Dressing percentage (DP) increased (linear effect, $P < .01$), with no effect ($P > .25$) on backfat thickness (BF), fat free lean index (FFLI), or stomach lesions as DEWS concentration was increased. In conclusion, DEWS are an acceptable alternative to SBM in diets for nursery pigs, and the added energy (fat) from DEWS improved growth performance in finishing pigs without decreasing carcass leanness.

| | Nursery | | | |
|---|---|---|---|---|
| Item | SBM | DEWS | SP | CV |
| d 0 to 7 | | | | |
| ADG, g | 209 | 240 | 281 | 10.7 |
| ADFI, g | 467 | 440 | 467 | 12.1 |
| G/F | .448 | .546 | .602 | 19.0 |
| d 0 to 35 | | | | |
| ADG, g | 349 | 349 | 354 | 9.9 |
| ADFI, g | 708 | 667 | 726 | 9.4 |
| G/F | .493 | .523 | .488 | 12.2 |
| d 0 to 56 | | | | |
| ADG, g | 413 | 417 | 422 | 7.3 |
| ADFI, g | 934 | 944 | 957 | 3.5 |
| G/F | .442 | .442 | .441 | 8.7 |

| | Finishing | | | |
|---|---|---|---|---|
| Item | SBM | SBM/DEWS | DEWS | CV |
| ADG, kg | .83 | .82 | .87 | 3.9 |
| ADFI, kg | 2.72 | 2.60 | 2.51 | 4.5 |
| G/F | .305 | .315 | .347 | 4.6 |
| DP, % | 73.7 | 74.5 | 74.8 | .7 |
| BF, mm | 28.9 | 29.3 | 29.9 | 4.3 |
| FFLI, % | 47.1 | 47.0 | 46.9 | .9 |
| Lesions | .06 | .00 | .10 | 546.0 |

**Key Words:** Pigs, Soybeans, Carcass, Ulcers

161 **Roasting and extruding affect ileal digestibility of nutrients from soybeans in growing pigs.** I.H. Kim*, J.D. Hancock, R. H. Hines, and M.S. Kang, Kansas State University, Manhattan.

Four crossbred barrows (avg initial BW of 39 kg) were fitted with T-cannulas at the distal ileum and used in a 36-d metabolism experiment (4 x 4 Latin square) to determine the effects of roasting and extruding full-fat soybeans on nutrient utilization. The soybeans were mill-run, and for the roasting and extrusion treatments, processing conditions were those deemed usual for soybeans (i.e., a throughput of approximately 454 kg/h and an average exit temperature of 127 °C in a Roast-A-Tron® roaster vs a throughput of approximately 680 kg/h and an average barrel temperature of 143 °C in an Insta-Pro® dry-extruder). Treatments were: 1) soybean meal; 2) roasted soybeans; 3) extruded soybeans; and 4) soybeans extruded with an extrusion enhancer ($Na_2SO_3$). The soybean meal and full-fat soybeans preparations were incorporated into cornstarch-based diets formulated to .9% lysine, .65% Ca, and .55% P. Apparent total tract digestibilities of DM ($P < .04$) and GE ($P < .01$) were greater for soybean meal vs full-fat soy products because of the relatively low digestibilities for roasted soybeans. Ileal digestibilities of DM ($P < .08$), GE ($P < .02$), and N ($P < .001$) were greater for pigs fed the extruded soybeans treatments than pigs fed roasted soybeans. Apparent digestibilities of amino acids followed the same pattern as N digestibility. Indeed, availabilities for lysine, methionine, and threonine measured at the terminal ileum were 30, 31, and 31% greater, respectively, for the extruded soybeans treatments than for roasted soybeans ($P < .001$). Availability of total essential amino acids (TEAA) measured at the terminal ileum was 80.3% for soybean meal, 63.9% for roasted soybeans, 81.7% for extruded soybeans, and 84.8% for soybeans extruded with $Na_2SO_3$. In conclusion, nutrient availabilities tended to be greatest in extruded soybeans, intermediate in soybean meal, and lowest in roasted soybeans for growing pigs.

| | | Soybeans | | | |
|---|---|---|---|---|---|
| Item | Soybean meal | Roasted | Extruded | $Na_2SO_3$ | CV |
| Ileal digestibility, % | | | | | |
| DM | 75.7 | 71.5 | 75.6 | 80.1 | 7.9 |
| GE | 76.5 | 70.1 | 78.1 | 81.2 | 7.9 |
| N | 76.3 | 62.2 | 77.6 | 81.5 | 5.7 |
| Lysine | 82.6 | 67.1 | 86.2 | 88.5 | 4.8 |
| Methionine | 80.9 | 63.9 | 82.7 | 84.1 | 4.5 |
| Threonine | 74.1 | 58.4 | 74.5 | 78.9 | 7.4 |
| TEAA | 80.3 | 63.9 | 81.7 | 84.8 | 4.9 |

**Key Words:** Pigs, Soybeans, Extrude, Roast, Sodium Sulfite, Digestibility

162 **Sodium sulfite and extrusion affect the nutritional value of soybean products for nursery pigs.** L. L. Burnham*, J. D. Hancock, I. H. Kim, T. L. Gugle, and R. H. Hines, Kansas State University, Manhattan.

A total of 150 weanling pigs (avg initial BW of 6.5 kg) was used in a 28-d growth assay to determine the effects of sodium sulfite as an extrusion enhancer for soy products. Treatments were: 1) SBM (SBM); 2) SBM with sodium sulfite added (SBM+); 3) extruded SBM (Ext SBM); 4) SBM extruded with sodium sulfite (Ext SBM+); 5) extruded whole soybeans (Ext SB); and 6) whole soybeans extruded with sodium sulfite (Ext SB+), arranged in a 3 x 2 factorial. The extruded soybean preparations were processed in a dry-extruder (Insta-Pro) with barrel temperatures of 169°C for SBM and 147°C for soybeans. For d 0 to 14, pigs fed SBM had greater ADFI ($P < .02$) with lower G/F ($P < .007$) compared to pigs fed the extruded soy products. For d 14 to 28, there were no differences in ADG or G/F among pigs fed diets with SBM and those fed diets with the extruded soy products ($P > .15$). However, pigs fed extruded soybeans had greater ADG than pigs fed extruded SBM, and pigs fed sodium sulfite had greater ADG and ADFI compared to those not fed sodium sulfite ($P < .02$). However, the positive response in ADG and G/F to the addition of sodium sulfite resulted with SBM and Ext SBM treatments, and not with the Ext SB treatment (interaction effect, $P < .04$). Overall (d 0 to 28), pigs fed extruded soybeans had greater ADG ($P < .01$) and G/F ($P < .08$) than pigs fed extruded SBM. Also, pigs fed diets with sodium sulfite had greater ADG, ADFI, and G/F compared to those fed diets without sodium sulfite ($P < .04$). In conclusion, pigs fed extruded soybeans had improved growth performance compared to pigs fed extruded SBM, but the benefits of adding sodium sulfite were inconsistent.

| | SBM | SBM+ | Ext SBM | Ext SBM+ | Ext SB | Ext SB+ | CV |
|---|---|---|---|---|---|---|---|
| d 0 to 14 | | | | | | | |
| ADG, g | 200 | 210 | 200 | 230 | 200 | 220 | 13.3 |
| ADFI, g | 420 | 390 | 390 | 380 | 320 | 370 | 11.3 |
| G/F | .476 | .538 | .513 | .605 | .625 | .595 | 11.3 |
| d 14 to 28 | | | | | | | |
| ADG, g | 350 | 450 | 330 | 430 | 440 | 440 | 13.5 |
| ADFI, g | 900 | 1,000 | 870 | 990 | 920 | 970 | 10.0 |
| G/F | .389 | .450 | .379 | .434 | .478 | .454 | 11.0 |
| d 0 to 28 | | | | | | | |
| ADG, g | 280 | 340 | 270 | 330 | 320 | 330 | 10.7 |
| ADFI, g | 660 | 700 | 630 | 690 | 620 | 670 | 8.6 |
| G/F | .424 | .486 | .429 | .478 | .516 | .493 | 8.9 |

**Key Words:** Pig, Soybean, Extrusion, Sodium Sulfite

163 **The effect of spray-dried plasma source on starter pig performance.** J. W. Smith, II, B. T. Richert, W. B. Nessmith, Jr.*, J. L. Nelssen, R. D. Goodband, and M. D. Tokach. Kansas State University, Manhattan.

A total of 416 pigs (initially 4.3 kg and 15 d of age) was used in a 28 d growth assay to evaluate the effects of spray-dried plasma source on starter pig performance. Pigs were blocked by weight and allotted to one of four dietary treatments in a randomized complete block design with 6 replicate pens per treatment. Three spray-dried plasma sources were tested: bovine, porcine, and plasma collected from only sows. Plasma sources (5%) and lactose replaced dried skim milk in the control diet to form the experimental diets. Experimental diets were fed during phase I (d 0 to 14 postweaning) and all pigs were fed a common phase II (d 14 to 28 postweaning) diet. Phase I diets were formulated to 1.5% lysine and .42% methionine. The phase II diet was formulated to 1.25% lysine and .36% methionine. Phase I diets were fed in a pelleted form and the phase II diet was fed in a meal form. From d 0 to 7, pigs fed the diets with plasma grew faster ($P < .05$) than the pigs fed the control diet and the pigs fed the diet containing sow plasma were more efficient ($P < .05$) than the pigs fed the control diet. From d 0 to 14, pigs fed diets containing porcine and sow plasma grew faster ($P < .05$) than the pigs fed the control and bovine plasma diets. Pigs fed either swine plasma source were more efficient ($P < .05$) than pigs fed the control diet. During phase II when pigs were fed a common diet, pigs that were fed diets containing sow and bovine plasma diets in phase I had higher feed intakes ($P < .05$) than pigs that were fed the control diet. Overall (d 0 to 28), pigs fed the porcine plasma diet grew faster ($P < .05$) and pigs fed the sow plasma diet more efficiently ($P < .05$) than pigs fed the control diet. In conclusion, plasma source influenced starter pig performance in this trial. Plasma of a porcine origin promoted greater ADG from d 0 to 14 postweaning than bovine plasma.

| | | Spray-Dried Plasma Source | | | | |
|---|---|---|---|---|---|---|
| | | Control | Bovine | Porcine | Sow | CV |
| d 0 to 7 | ADG, g | 114[a] | 154[b] | 168[b] | 168[b] | 20 |
| | G/F | .75[a] | .81[ab] | .86[ab] | .88[b] | 15 |
| d 0 to 14 | ADG, g | 191[a] | 209[a] | 232[b] | 232[b] | 14 |
| | G/F | .77[a] | .79[ab] | .87[b] | .87[b] | 12 |
| d 0 to 28 | ADG, g | 272[a] | 281[ab] | 295[b] | 286[b] | 12 |
| | G/F | .62[a] | .67[ab] | 67[ab] | .67[ab] | 7 |

[ab]Means in row with differeint superscripts differ ($P < .05$).

Key Words: Plasma protein, Starter pigs, Performance