

milk-supplementation treatments. An equal number of older parity sows (Parity 2 and above) were also randomly assigned to each of the 2 treatments. Ten farrowing rooms of 22 crates each were used with 11 crates per treatment in each room. There were an equal number of first parity females per treatment per room. Litters were equalized across treatments within 24 h post-partum. Individual piglet birth weights were collected after equalization of litters for 2,476 piglets. Litters receiving milk supplementation were supplemented with a phase 1 milk-replacer via a re-circulating system with a Crown Cup™ beginning 24 h post-partum for approximately 5 d, after which they received a phase 2 milk replacer until weaning at 20 d of age. At weaning, 2,272 pigs remained and were individually weighed. Weaning weight (6.39 kg vs. 6.11 kg) and ADG (240 g vs. 227 g) of pigs from litters receiving supplemental milk were higher ($P < 0.001$) than control litters. This resulted in a reduction ($P < 0.05$) in the percentage (2.08% vs. 4.30%) of lightweight (< 3.63 kg) pigs at weaning. In conclusion, milk supplementation improved performance of suckling pigs. Further research is needed to determine if there are subsequent reproductive benefits for sows with litters receiving supplemental milk.

Key Words: supplemental milk replacer, piglets, sows

160 Use of spray-dried red blood cells and isoleucine supplementation in pig starter diets. R. B. Hinson^{*1}, G. L. Allee¹, and J. D. Crenshaw², ¹University of Missouri, Columbia, ²APC Inc., Ankeny, IA.

Eight hundred forty weanling pigs (avg. initial weight = 4.73 kg; avg. age = 16 days) were used to determine the effect on pig performance of phase 1, 2 and 3 starter diets containing 0, 2, 4, or 6% spray-dried blood cells (SDBC) or 4% and 6% SDBC supplemented with L-Ile at a 62% SID Ile:Lys ratio. Fish meal (FM) was the primary protein source replaced by SDBC. Dietary phases 1, 2, and 3 were 7 d periods respectively after weaning. From d 21 to d 42 postweaning all pigs were fed a common corn-soybean meal diet. Pigs were allotted to treatments in a RCBD with 7 replicate pens/treatment and 20 pigs/pen. Average daily gain (phase 1-3) and ADFI (phase 1 and 2) were reduced ($P < 0.04$; Linear, $P < 0.04$) when more than 2% SDBC was included in the diet without the addition of L-Ile. Cumulative data for the phase 1-3 periods yielded similar results with ADG (197, 195, 152, and 143 g/d respectively for 0, 2, 4, and 6% SDBC) and ADFI (263, 252, 204, and 166 g/d respectively for 0, 2, 4, and 6% SDBC) being reduced ($P < 0.001$; Linear, $P < 0.001$) when SDBC was added to the diet at more than 2% without the addition of L-Ile. In all phases and parameters, when L-Ile was supplemented to the 4 and 6% SDBC diets, performance was restored to levels similar ($P > 0.05$) to the 0 and 2% SDBC diets (phase 1-3 ADG: 197, 195, 204, 190 g/d; phase 1-3 ADFI: 263, 252, 266, and 243 g/d respectively for 0 and 2% SDBC and 4 and 6% SDBC + L-Ile). Results by phase and cumulative data (phase 1-3) indicated that 2% SDBC effectively replaced FM and provided equal performance. However 4% or 6% SDBC without L-Ile reduced ($P < 0.001$) ADFI and ADG and this response resulted in lower ($P < 0.003$) final BW at 42 d. Supplementation with L-Ile to 4% and 6% SDBC corrected the reduction ($P < 0.001$) in ADFI and ADG. Spray-dried blood cells can be utilized as a protein source in phase 1-3 nursery diets at 2% without the addition of L-Ile. Higher levels of

SDBC (i.e. 4 to 6%) can be utilized provided a minimum SID Ile:Lys ratio of 62% is maintained.

Key Words: spray-dried blood cells, pigs, isoleucine

161 Effects of humidity on flow ability of specialty protein ingredients used in weanling pig diets. E. E. Carney, C. N. Groesbeck*, R. D. Goodband, M. D. Tokach, S. S. Dritz, J. L. Nelssen, and J. M. DeRouchey, *Kansas State University, Manhattan.*

An experiment was conducted to determine the effects of humidity on flow ability of specialty protein sources as measured by angle of repose. Angle of repose is the maximum angle in which a pile of ingredient retains its slope. A large angle of repose represents a steeper slope and poorer flow ability. Five specialty protein sources were evaluated; fish meal, powdered and granulated blood meal, and powdered and granulated blood plasma. Specialty protein sources were added at 0, 2.5, 5.0, 7.5, and 10% to a 70:30 corn-soybean meal blend. The experiment was conducted at two humidity levels, 34 or 64%. Temperature was held constant at 32 degrees Celsius. The experiment was conducted in an environmentally-controlled nursery to minimize temperature and humidity fluctuations. All samples were placed into the barn 24 hr before the experiment was conducted to allow for acclimation to the environmental conditions. Humidity and temperature recorders measured the minimum and maximum temperature and humidity during the experiment. A specialty protein source $\times$ inclusion level $\times$ humidity interaction ($P < 0.01$) was observed. Angle of repose increased with increasing inclusions of powdered animal plasma and fish meal indicating poorer flow ability. There was little change in flow ability with increasing inclusions of powdered blood meal. Angle of repose decreased as granulated animal plasma and blood meal inclusions increased, indicating better flow ability. As humidity level increased from 34 to 64% angle of repose increased resulting in poorer flow ability. In conclusion, these data confirm that the humidity, inclusion percentage, and ingredient form (powder or granulated) will affect flow ability of diets when fed in meal form. Humidity increased angle of repose, decreasing flow ability of meal diets. Specialty protein sources in powder form reduce flow ability, while granulated specialty protein sources improve flow ability.

Key Words: angle of repose, flowability, humidity

162 Variation in maize particle size and pelleting in a Maillard Reaction Product containing complementary feedingsuff on the performance of post weaning piglets. M. J. Hutchinson^{*1,3}, M. E. McCann^{1,2}, and V. Beattie³, ¹Queens University Belfast, Belfast, Down, Northern Ireland, ²Agri-Food and Biosciences Institute, Belfast, Down, Northern Ireland, ³Devenish Nutrition Limited, Belfast, Down, Northern Ireland.

The inclusion of synthetic amino acid in the diet of post-weaned pigs has advantages and disadvantages and other ways of delivering amino acids are of interest to the feed industry. The Maillard Reaction is the