POSTER PRESENTATIONS

Animal Behavior, Housing, and Well-Being

9 Animal-related factors affecting piglet mortality in loose farrowing systems. Y. Z. Li*[1], J. E. Anderson[2], and L. J Johnston[1], [1]*University of Minnesota West Central Research and Outreach Center, Morris,* [2]*University of Minnesota, Morris.*

A study was conducted to investigate sow-related (sow parity, CV for birth weight within litter, early mortality of piglets) and piglet-related factors (individual birth weight, gender, cross-fostering) affecting piglet mortality in a group-farrowing system. Multiparous sows (n = 108) from 8 breeding groups were used. The farrowing barn housed 8 sows of different parity (2 to 10) in each room where sows shared a communal area and farrowed in individual pens. Piglets were weighed individually within 24 h after farrowing, at pen removal (d 10), and at weaning (d 28), from which CV within litter was calculated. Dead piglets were weighed when found. Behavior of 39 focal sows during farrowing was video-recorded, from which farrowing duration, inter-birth interval, and frequency of posture changes were determined. Data were analyzed using the Glimmix Procedure of SAS with the Tukey test for means separation. Among the 1,233 piglets born, 94.3% were born alive and 5.7% were still born. Of the live born piglets, 20% died before weaning, with 50% of the total deaths occurring during the first 3 d after farrowing. Sows of parity 5 or greater had greater piglet morality (28% vs. 14%, SE = 2.78; $P < 0.01$) and weaned smaller litters (8.6 vs. 9.8 piglets, SE = 0.30; $P < 0.05$) than sows of parity 2. Sows that farrowed piglets with CV for birth weight greater than 20% had greater piglet mortality than sows that farrowed piglets with CV less than 15%, regardless of parity. Sows that lost piglets within 24 h after farrowing lost more piglets during the entire lactation period than sows that did not lose piglets on d 1. Piglets that died during lactation were 0.28 kg lighter in birth weight (1.393 vs. 1.673 kg, SE = 0.065; $P < 0.001$) compared with piglets that survived to weaning. Neither behavior of sows at farrowing, piglet gender, nor cross-fostering affected piglet mortality. The results indicate that parity and birth weight of piglets were the major animal-related factors that contributed to piglet mortality in the loose farrowing system studied.

Key Words: piglet mortality, parity, birth weight, farrowing behavior

10 Effects of increasing stocking density on finishing pig performance. M. L. Potter,* S. S. Dritz, M. D. Tokach, J. M. DeRouchey, R. D. Goodband, and J. L. Nelssen, *Kansas State University, Manhattan.*

A total of 1,201 pigs were used in a 99-d trial to evaluate the effects of increasing stocking density on pig performance. Pens (3.0 × 5.5 m) of barrows or gilts were blocked to minimize variation due to gender and barn location. Pens of pigs were randomly allotted to 1 of 4 treatments (12 pens/treatment). Treatments were stocking pens with 22, 24, 26, or 28 pigs each, allowing 0.75, 0.69, 0.63, and 0.59 m^2/pig, respectively. Each pen had a single 3-space, 106.7 cm long dry feeder and swinging nipple waterer. Pigs were weighed and feed intake was determined on d 0, 14, 28, 42, 56, 70, 84, and 99 to calculate ADG, ADFI, and G:F. Adjustments were not made in the pens to account for space increases due to removed pigs (1.9%, 1.0%, 1.6%, and 1.5% removals for 22, 24, 26, and 28 pigs/pen, respectively). With the exception of d 56 to 70 ADG, after d 14, as stocking density increased, ADG, ADFI, and BW decreased (linear; $P \leq 0.05$). There was no difference (linear; $P = 0.91$) in overall G:F. Overall results indicate that finisher pig ADG, ADFI, and BW increased as the number of pigs/pen was reduced. However, income over feed and facility cost per pig placed was numerically optimized ($93.90 ± 2.22, $94.01, $93.41, and $92.40 for 22, 24, 26, and 28 pigs/pen, respectively; linear, $P = 0.34$) when pens were stocked with 24 pigs each, allowing 0.69 m^2 of space per pig. Although increasing stocking density reduced performance, based on a critical *k*-value of 0.035, stocking density alone should not have affected performance until pigs reached BW of 98.1, 86.2, 75.3, and 67.9 kg for 22, 24, 26, and 28 pigs/pen, respectively.

Table 1. Effect of increasing stocking density on pig performance

	Pigs per pen					
Item	22	24	26	28	SEM	Linear, $P <$
BW, kg						
d 0	28.5	28.6	28.4	28.6	1.10	0.95
d 14	41.7	41.8	41.4	41.6	1.48	0.73
d 28	54.1	53.4	52.6	52.8	1.87	0.05
d 42	68.8	67.8	67.0	66.8	2.21	0.007
d 56	82.2	80.8	80.0	79.2	2.74	<0.001
d 70	98.3	96.5	95.5	94.9	3.12	<0.001
d 84	111.6	109.4	108.5	107.2	3.30	<0.001
d 99	125.8	122.9	121.8	119.8	3.24	<0.001
d 0 to 99						
ADG, kg	0.98	0.95	0.94	0.92	0.023	<0.001
ADFI, kg	2.52	2.43	2.39	2.36	0.095	<0.001
G:F	0.39	0.39	0.39	0.39	0.007	0.91

Key Words: growth, pig, space allowance, stocking density

11 Effects of mixing late-finishing pigs just before marketing on performance. M. L. Potter,* S. S. Dritz, M. D. Tokach, J. M. DeRouchey, R. D. Goodband, J. R. Bergstrom, and J. L. Nelssen, *Kansas State University, Manhattan.*

A total of 512 pigs were used in a 15-d trial to determine the effects of mixing late-finishing pigs from 1 or 2 barns at different stocking densities on pig performance. Pigs from 2 barns (north or south barn) were placed in 32 pens in the north barn at densities of 12 or 20 pigs/pen. Pens were allotted to 1 of 4 mixing treatments (8 pens/treatment). Treatments were: (1) non-mixed pens with 12 north barn pigs (none), (2) mixing 6 north barn pigs with 6 south barn pigs (mix1), (3) mixing 10 north barn pigs with 10 south barn pigs (mix2), and (4) mixing 10 north barn pigs with 10 more north barn pigs (mix3). A common diet was fed to pigs. Pigs were weighed and feed intake measured on d 0, 8, and 15 to determine ADG, ADFI, and G:F. Data were analyzed by a model including the effects of treatment and initial average BW. Gender was used as a random effect. All responses were adjusted to an average initial BW (166.0 kg). Pen inventories had a larger effect on performance than mixing, with pigs stocked at 12 pigs/pen having greater overall ADG ($P \leq 0.06$) and ADFI ($P \leq 0.02$) than those stocked

at 20 pigs/pen. Overall, there was no difference in performance for non-mixed pigs and mixed pigs when stocked at a similar density (12 pigs/pen). On d 15, non-mixed (129.8 ± 0.79 kg) and mix1 (129.8 ± 0.77 kg) pigs were heavier ($P < 0.01$) than mix3 (127.2 ± 0.77 kg) pigs with mix2 (128.2 ± 0.78 kg) pigs intermediate ($P \geq 0.07$). Although performance was negatively affected immediately after mixing, overall performance of mixed pigs was not different than that of non-mixed pigs.

Table 1. Mixing effect on performance

Item	None	Mix1	Mix2	Mix3	P<
d 0 to 8					
ADG, g	863 ± 91	800 ± 89	717 ± 90	660 ± 89	0.13
ADFI, g	3307 ± 128^{a}	3092 ± 124^{ab}	2837 ± 126^{b}	2882 ± 124^{b}	0.02
G:F	262 ± 21	256 ± 21	249 ± 21	228 ± 21	0.37
d 8 to 15					
ADG, g	981 ± 44^{ab}	1052 ± 43^{a}	894 ± 43^{bc}	850 ± 42^{c}	0.01
ADFI, g	3594 ± 106^{a}	3645 ± 103^{a}	3277 ± 105^{b}	3226 ± 103^{b}	0.003
G:F	275 ± 11	290 ± 11	271 ± 11	263 ± 11	0.38
d 0 to 15					
ADG, g	918 ± 56^{a}	918 ± 54^{a}	800 ± 55^{ab}	749 ± 54^{b}	0.01
ADFI, g	3442 ± 114^{a}	3350 ± 111^{a}	3041 ± 112^{b}	3042 ± 111^{b}	0.006
G:F	267 ± 10	274 ± 10	261 ± 10	246 ± 10	0.12

Key Words: growth, mixing, pig

12 A comparison of using pen versus individual sow as the experimental unit when evaluating data from sow housing studies. A. R. Hanson*[1], A. E. DeDecker[2], J. L. Salak-Johnson[2], and P. M. Walker[1], *[1]Illinois State University, Normal, [2]University of Illinois, Urbana.*

By definition, an experimental unit (EU) is the smallest unit upon which a treatment is imposed in an experiment. In feeding trials where animals are group-fed, growth performance is analyzed using pen as the EU. However, if these animals are individually-fed, then the individual animal can serve as the EU. Analyzing data related to measures of animal welfare is more challenging when animals are kept in groups, because many measures of well-being are affected by the individual animal rather than the group of animals; thus data should not be analyzed on a pen-basis. The purpose of this evaluation was to compare the results and data interpretation based on statistical analysis in which the EU is either the pen or individual animal, when analyzing data of a previously reported study (JAS, Vol. 88, E Suppl. 2:461). For both statistical analyses, performance and lesion score data were analyzed using the GLM procedure of SAS to evaluate the effects of diet (D; control or high-fiber), floor space allowance (FS; 1.7 or 2.3 m^2 per sow), and interactions. Sow parity (SP) was used as a fixed effect and included in the interactions only when individual animal was used as EU. Replicate was a covariate in all analyses. The Mixed procedure of SAS with repeated measures was used (when appropriate) to include day of gestation (GD) in the model and interactions. Significance was detected when $P \leq 0.05$. When data were analyzed using individual animal as EU, significant effects of D x SP and D x SP x GD were found for sow performance (ADG and sow BW, respectively), and a significant effect of FS x SP was detected for total skin lesion severity. If pen was used as the EU, treatment interactions with SP were not detected, partly because SP was excluded from model. Pen mean SP could be included as a covariate, but mean SP limits interpretation of results because sows from different parities may respond differently to treatments. These data imply that researchers should consider using individual animal as the EU rather than pen for all measurements except ADFI, DMI and G:F for loose housing studies when there are a large number of sows per pen and a limited number of pens are utilized, so that the effect of sow parity level can be evaluated.

Key Words: experimental unit, sow housing analyses, sow welfare, group housing

13 Comparison of CO_2 versus mixed CO_2:Argon gas at different flow rates using the Smart Box euthanasia device as a humane and effective method of piglet euthanasia. L. Sadler*[1], C. Hagen[2], C. Wang[1], and S. Millman[1], *[1]Iowa State University, Veterinay Diagnostic and Production Animal Medicine, Ames, [2]Value-Added Science and Technologies, Ames.*

The objective of this study was to compare the effectiveness of CO_2:Argon (CA) gas mixture relative to CO_2 when applied to weaned piglets 15 to 20 d of age. A total of 180 piglets, BW 4.6 ± 0.7 kg, were utilized. A 2 × 4 factorial design compared 2 gas mixtures (100% CO_2 and 50:50 CA) and 4 flow rates: slow (SL), medium (MD), fast (FT), and prefill (PF); 20%, 35%, 50%, and prefill with 20%, chamber volume per minute respectively. Two piglets were placed in a plastic chamber with the lid and one side composed of Plexiglas to facilitate behavior observations. A Smartbox device (Euthanex Corp, Palmer, PA) was used to supply gas at controlled rates. Piglets were scored using direct observation for latency to perform 3 behaviors associated with insensibility: loss of posture (LP), last movement (LM) and gasping (GSP). Open mouth breathing (OMB) occurred before insensibility and was used as an indicator of distress. LP, GSP, and OMB were analyzed using univariate product-limit estimation of the survival curves. LM data was log-transformed and analyzed using a mixed model with fixed effects of sex and trt, and blocked by day of trt. Significance was determined at $P \leq 0.05$ using a Sidak correction for multiple comparisons. Mean treatment latencies for LM ranged from 269 ± 73 s (PF CO_2) to 775 ± 216 s (SL CA). Latency for LM was significantly greater in CA trts, with average differences ranging from 123 s longer (PF) to 246 s longer (SL). Gas trts did not differ for OMB, GASP or LP. Gas flow rate significantly affected LM, with SL taking longer than MD, FT, or PF (CO_2 529 ± 181, 312 ± 40, 274 ± 27, 296 ± 73; CA 774 ± 216, 467 ± 37, 397 ± 32, 491 ± 209). For all other parameters, no significant differences were observed for flow rate. In conclusion, CA and SL prolonged the latency for insensibility, as measured by LM and did not confer advantages for measures of distress (OMB). We are further exploring the aversiveness of gas mixtures and flow rates using more sensitive video and acoustic analysis.

Key Words: swine, euthanasia, carbon dioxide, argon

14 Impact of floor space on the grow-finish performance of barrows and gilts in a commercial facility. C. M. Shull*[1], M. Ellis[1], B. A. Peterson[2], B. F. Wolter[2], R. Bowman[2], C. M. Peterson[2], C. L. Puls[1], L. Ochoa[1], and B. W. Isaacson[2], *[1]University of Illinois, Urbana, [2]The Maschhoffs, Carlyle, IL.*

The effects of floor space and gender on growth performance and carcass characteristics were evaluated in a commercial wean-to-market facility using a randomized complete block design with a 2 × 3 factorial arrangement of treatments: 1) floor space (0.56 and 0.65 m^2/pig; 154 and 132 pigs/pen, respectively); 2) gender (barrows, gilts, and mixed-gender). There were an equal number of barrows and gilts