Swine Species III

W397 Industry productivity analysis—Sow farm traits. C. E. Hostetler*[1] and M. T. Knauer[2], [1]*National Pork Board, Des Moines, IA,* [2]*North Carolina State University, Raleigh.*

The objective of this study was to quantify US swine production benchmarks and trends for sow farm traits from a representative database. Data were provided by a data management company representing 1.8 million sows in North America. Production records were available from 2005 to 2010. Traits included piglets per mated female per year (PMFY), litters per mated female per year (LMFY), total number born (TNB), number born alive (NBA), number weaned (NW), preweaning mortality (PM), weaning age, weaning weight (WWT), replacement rate (RR), culling rate (CR), sow mortality, lactation feed intake (LFI) and gestation feed intake (GFI). Data were analyzed in SAS using PROC MIXED. Models included year and month as fixed effects. Standard errors for PMFY, LMFY, TNB, NBA, NW, PM, weaning age, WWT, RR, CR, sow mortality, LFI and GFI were 0.12, 0.010, 0.029, 0.033, 0.035, 0.27, 0.08, 0.015, 1.42, 1.17, 0.15, 0.050 and 0.016, respectively. Means for sow reproductive efficiency and sow removal traits are shown by year in Table 1. Piglets per mated female per year, LMFY and NW increased ($P < 0.05$) from 2005 to 2010 (21.5 to 23.4, 2.31 to 2.34 and 9.30 to 10.08, respectively). Replacement rate did not differ ($P > 0.05$) between 2005 and 2010 (54.1 and 52.2%, respectively) and sow mortality decreased ($P < 0.05$) from 11.2 to 10.4%. Total number born and NBA increased ($P < 0.05$) from 11.82 to 13.03 and from 10.77 to 11.83, respectively. Weaning age and WWT increased ($P < 0.05$) from 18.9 to 20.6 d and 5.46 to 5.86 kg, respectively. Lactation feed intake increased ($P < 0.05$) from 6.11 to 6.62 kg per d and GFI decreased ($P < 0.05$) from 2.33 to 2.27 kg per d. Producers and scientists can use these sow farm benchmarks to better understand industry trends.

Table 1. Sow reproductive efficiency and removal means from 2005 to 2010

	Year					
Trait	2005	2006	2007	2008	2009	2010
Reproductive Efficiency						
PMFY	21.5^{a}	21.9^{b}	22.4^{c}	22.9^{d}	23.4^{e}	23.6^{e}
LMFY	2.31^{a}	2.34^{b}	2.34^{b}	2.35^{b}	2.34^{b}	2.34^{b}
NW	9.30^{a}	9.39^{b}	9.55^{c}	9.72^{d}	9.98^{e}	10.08^{f}
PM, %	13.7^{a}	14.1^{a}	14.0^{a}	14.2^{a}	14.0^{a}	14.8^{b}
Sow Removal						
Replacement rate, %	54.1^{ab}	57.8^{c}	56.0^{bc}	56.1^{bc}	51.4^{a}	52.2^{a}
Culling rate, %	41.9^{a}	44.2^{b}	43.4^{ab}	48.2^{c}	48.7^{c}	47.5^{c}
Sow mortality, %	11.2^{d}	10.7^{c}	10.4^{bc}	10.3^{b}	9.8^{a}	10.4^{bc}

$^{a-f}$Means within a row with different subscripts differ ($P < 0.05$).

Key Words: benchmark, reproduction, sow

W398 Welfare of Camborough sows in gestation crates or pens. W. Chaya*[1] and J. McGlone[2], [1]*Department of Animal and Food Sciences, Texas Tech University, Lubbock,* [2]*Pork Industry Institute, Department of Animal and Food Sciences, Texas Tech University, Lubbock.*

A randomized complete block design experiment with 2 × 2 factorial rearrangement of treatments was conducted to study the effect of 2 housing systems, group pens and crates and 2 feeding systems, single drop and trickle feeding systems on lactating sow reproductive performance, litter performance, behavior, physiology and skin lesion scores. A total of 40, Camborough (Yorkshire x Landrace) gilts were allocated into groups of 5/pen or crates. Behaviors such as feeding, drinking, standing/walking, lying, sitting, agonistic behavior, and oral-nasal-facial (ONF) behavior were video recorded for 24 h at 50 to 60 d of gestation and transformed before analyses. Behavior data were collected hourly based on a 5 min interval between scan samples. Whole blood was collected via jugular puncture over heparin for determinations of plasma cortisol, white blood cell counts, % differential WBC count, neutrophils:mononuclear cell ratio, neutrophil phagocytosis, and neutrophil oxidative burst a week after behavioral observations. No significant differences were identified among housing and feeding systems for reproductive or physiological measures (except for plasma cortisol, neutrophil phagocytosis, and neutrophil oxidative burst that had not yet been assayed). Gilt ONF behavior was higher ($P < 0.05$) among crated gilts than penned gilts (LSmeans 12.7 ± 1.13 vs. 7.6 ± 1.19%). The interaction between penning and feeding system was significant for head lesion score (LSmeans for pen-drop, pen-trickle, crate-drop, crate-trickle were, respectively: 1.0 ± 0.07, 0.0 ± 0.06, 0.0 ± 0.06, and 0.13 ± 0.06; $P < 0.01$). Crated and group-penned sows had similar reproduction. With only minor differences in skin lesion score, each sow penning/feeding system supported similar sow welfare. However, the finding that Camborough gilts had more ONF behavior in crates (than pens) and more head skin lesion score in pens (than crates) differed from our previous work with Camborough-22 gilts in which these differences were not observed. Genotypes may respond differently to group housing than individual housing.

Key Words: pigs, welfare, housing

W399 Relationships of birth weight and weaning weight on performance traits in purebred pigs. R. L. Cutshaw*[1], A. Schinckel[1], J. Fix[2], M. Brubaker[3], and M. Einstein[1], [1]*Purdue University, West Lafayette, IN,* [2]*National Swine Registry, West Lafayette, IN,* [3]*Whiteshire Hamroc LLC, Albion, IN.*

The purpose of study was to evaluate the relationships of birth weight (BTW) and weaning weight (WW) with off test performance traits: Days to 113.4kg (DAYS), real-time ultrasound backfat depth (BF), and loin muscle area (LMA). Data analyses were conducted separately for sire line (SL, Hampshire and Duroc n = 2,388) and maternal line breeds (ML, Yorkshire and Landrace, n = 11,163). The data were fitted to a model that included significant ($P < 0.05$) fixed effects for breed, parity (1–6), sex, ultrasound time period, and random effects of contemporary group and sow. Significant ($P < 0.05$) covariates including WW, WW2, BTW, BTW2 were then added to the model. It was found that pigs from parity 1 dams had 1.44 (SL) and 2.21 (ML) greater ($P < 0.05$) DAYS than pigs from parity 2 and 3 dams. When covariates were added to the model, pigs from parity 1 dams averaged 1.41 (SL, $P < 0.05$) and 0.46 (ML, $P = 0.32$) less DAYS than pigs from parity 2 and 3 dams. Effects of BTW (linear and quadratic) and WW (linear and quadratic) were significant ($P < 0$ 0.01) for DAYS and accounted for 20 and 22% of the residual variance respectively. For the BF data, in the SL only BTW linear was included (−0.013 cm per kg, $P < 0.01$) while for the ML, BTW (linear and quadratic), and WW were significant ($P < 0.01$). For LMA in the SL pigs, WW (linear and quadratic) were significant ($P < 0.01$) and for the ML pigs the effects of BTW (linear and quadratic, $P < 0.01$) were significant. The inclusion of the covariates to the LMA and BF models produced small reductions in residual variances. Pigs that were the lightest at birth or weaning had smaller LMA, greater BF and required additional DAYS.

Key Words: swine, birth weight, weaning weight

W400 Length of productive life and lifetime production of Landrace, Yorkshire and crossbred sows raised under Thai tropical conditions. S. Koonawootrittriron[1], U. Nopibool[1], M. A. Elzo*[2], and T. Suwanasopee[1], *[1]Kasetsart University, Bangkok, Thailand, [2]University of Florida, Gainesville.*

Length of productive life (LPL) and lifetime production of sows are important for commercial swine operations. These traits need to be considered for the improvement of sow productivity and efficiency. The aim of this study was to characterize factors affecting LPL and lifetime piglets born alive (LB), lifetime piglets loss (LL), lifetime weaned piglets (LW), and lifetime non-productive sow days (LN) in Landrace (L), Yorkshire (Y) and F1 crossbreds between L and Y (C) sows evaluated in a Thai commercial farm. Data included records of 1,239 L, 397 Y and 153 C sows born between 2001 and 2010. The LPL was defined as the number of days between sow age at first farrowing and sow age at weaning of her last farrowing. The LB, LL, LW, and LN were the sum of all individual measurements of each trait during this period. The model included year-season and breed group (L, Y, and C) as subclass fixed effects, age at first farrowing (9 to 17 mo) as a fixed covariate, and residual as a random effect. Least squares means (LSM) were estimated for all breed groups. Year-season effects were important for all traits ($P < 0.01$). Sows that began to farrow at older ages had significantly shorter LPL (−17.4 ± 7.1 d/mo; $P = 0.01$), lower LB (−1.2 ± 0.5 piglets/mo; $P = 0.03$), and lower LW (−1.2 ± 0.5; piglets/mo; $P = 0.009$) than sows that started farrowing at younger ages. Breed group effects were significant ($P < 0.05$) for LL, LW and LN, but not for LPL and LB. Yorkshire sows had the highest LL (8.5 ± 0.4 piglets) and LW (47.6 ± 1.3 piglets), L sows had the lowest LL (7.4 ± 1.0 piglets), LW (43.6 ± 0.7 piglets), and LN (30.3 ± 0.6 d), and C sows had the highest LN (33.5 ± 1.7 d) of all breed groups. Thus, Yorkshire sows were the most productive over their lifetime (highest LW) of all breed groups in this commercial herd. This study needs to be repeated with a large number of herds in Thailand to verify if results here apply to the whole swine population in this tropical country.

Key Words: pig, production, tropical

W401 In utero heat stress alters postnatal body composition parameters in growing pigs. R. L. Boddicker*[1], N. J. Boddicker[1], J. N. Rhoades[2], S. Pearce[1], J. Johnson[1], M. C. Lucy[2], T. J. Safranski[2], N. K. Gabler[1], J. T. Selsby[1], J. Patience[1], R. P. Rhoads[3], L. H. Baumgard[1], and J. W. Ross[1], *[1]Iowa State University, Ames, [2]University of Missouri, Columbia, [3]Virginia Polytechnic Institute and State University, Blacksburg.*

Heat stress (HS) is a costly issue to the US swine industry as a result of losses in several production, reproductive, and health parameters. The study objective was to test the hypothesis that gestational HS would alter postnatal response to HS and body composition parameters. To investigate this, 48 offspring from 14 first parity crossbred gilts were exposed to 1 of 4 environmental treatments (TNTN, TNHS, HSTN, or HSHS) during gestation. TNTN and HSHS sows were exposed to thermal neutral (TN, cyclical 18–22°C) or HS conditions (cyclical 28–34°C) for all of gestation, respectively. Sows assigned to HSTN and TNHS treatments were heat-stressed for the first or second half of gestation, respectively. After a TN nursery period, at 14 weeks of age, offspring were exposed to one of 2 postnatal thermal environments for 5 weeks: constant TN (21°C) or HS (35°C). Following the subsequent thermic bouts, offspring from the HSTN group had increased back fat depth compared with all other gestational treatments (20.3, HSTN vs. 17.0, TNTN; 16.0,TNHS; and 17.5, HSHS mm, $P = 0.01$) irrespective of postnatal HS. Further, irrespective of postnatal HS, pigs from sows that experienced HS during the first half of gestation (HSHS and HSTN) had increased (13.5%) back fat depth than pigs from sows exposed to TN conditions during the first half of gestation (18.8 vs. 16.5 mm, $P = 0.03$). There was an interaction ($P = 0.04$) between gestational and postnatal environments for loin eye area, as offspring from HSHS and HSTN sows had decreased loin eye area after postnatal HS compared with the postnatal TN offspring, whereas offspring from sows in TNTN and TNHS conditions had increased loin eye area following postnatal HS compared with postnatal TN. No gestational treatment effect was observed on heat indices, feed intake, or weight gain during postnatal HS. Together, these results demonstrate prenatal heat stress alters body composition parameters during growth and development without concomitant changes in feed intake or body weight. This work was supported by USDA NIFA grant #2011-67003-30007.

Key Words: swine/porcine, heat stress, body composition

W402 Implementing a total traceability system for the pig chain based on electronic ear tags and molecular markers. P. Grassi[1], G. Caja*[1], J. H. Mocket[1], A. Costa[1], J. Soler[2], M. Gispert[2], J. Tibau[2], M. A. Rojas-Olivares[1], and A. Sánchez[1], *[1]Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain, [2]Institut de Recerca i Tecnologia Agroalimentàries, Monells, Girona, Spain.*

A total of 1,540 crossbreed pigs of similar origin and production conditions (weaned 28 d, slaughtered 100 kg BW) were used in 3 experiments to assess on the implementation of a total traceability system based on electronic identification (e-ID) and molecular markers (DNA). Pigs were tagged by 3 types of electronic ear tags and carcasses audited by DNA. In Exp. 1, piglets (n = 1,033) were e-ID at birth with ear tags (EF1, plastic double button FDX-B transponder, 2.6 g), biopsied (n = 30) and slaughtered under commercial conditions. No EF1 losses were reported until weaning, but fattening losses were 6.3%. Losses of EF1 during transportation and slaughtering were 41.9%, resulting in 54.3% overall traceability. Auditing 18 carcasses by a panel of 12 DNA microsatellites showed 83.3% matching rate. In Exp. 2, 133 weaned piglets were e-ID (EH, plastic double button HDX transponder, 4.4 g) and biopsied (n = 56). Fattening and slaughtering were done under experimental conditions. On-farm losses were 1.5% and no losses were observed at slaughter, overall traceability being 98.5%. Auditing 56 carcasses by DNA microsatellites showed 98.0% matching rate. In Exp. 3, 374 weaned piglets were e-ID with 453 ear tags of 3 types: EF1 (n = 151), EF2 (plastic double button FDX-B transponder, 4.2 g; n = 140) and EH (n = 162). Biopsies for auditing were 97. Fattening was done in the farm of Exp. 1 and slaughtering in 3 commercial slaughterhouses. By ear tag type (EF1, EF2 and EH), on-farm losses were 1.7, 1.9 and 0.9%, and failures 5.0, 5.6 and 0.9%. On-farm traceability was 93.3, 92.5 and 98.3% (the last differing at $P < 0.05$), respectively. Additionally 5.3, 4.0 and 0.9% ear tags were lost or failed during transportation, respectively. Slaughtering losses were 22.1, 13.3 and 4.5% and failures were 6.3, 5.3 and 0%, resulting in 71.6, 81.3 and 95.5% slaughterhouse traceability, respectively. Overall traceability was 63.6, 70.1 and 92.4% for EF1, EF2 and EH, respectively ($P < 0.05$). Auditing 23 carcasses by DNA microsatellites resulted in 85.1% matching rate. Ten samples of each ear tag type were collected across the experiments for studying their features and performances under laboratory conditions. Separation

strength of EF1 from Exp. 1 was weaker ($P < 0.05$) than the rest of ear tags and reading distances varied dramatically according to the reader, technology and orientation toward the antenna used (0.3 to 33.4 cm). In conclusion, the EH ear tags were more efficient than EF1 and EF2 for tracing pigs under commercial conditions. On-farm traceability depended on piglet age, device used and fattening and slaughtering conditions. Traceability auditing by DNA varied by sample quality and matching rates ranged between 83.3 and 98.0%. Finally, the use of quality electronic ear tags and DNA analysis are recommended for implementing a total traceability system in the pig industry.

Key Words: traceability, electronic identification, ear tag