1, 2, and 3+ sows failed to meet DBC 46, 44, and 49%, respectively. For WSI, parity 1 and 2+ sows failed to meet DBC 73 and 26%, respectively. A 1 d increase in LL improved ($P < 0.01$) subsequent TNB for parity 1 and 2+ sows by 0.045 and 0.073 piglets, respectively, and reduced WSI for parity 1 and 2+ sows by −0.060 and −0.052 d, respectively. A one piglet increase in NBA improved ($P < 0.01$) subsequent TNB for parity 1 and 2+ sows by 0.132 and 0.166 piglets, respectively. Yet increased NW reduced ($P < 0.01$) subsequent TNB for parity 1 and 2+ sows by 0.075 and 0.048 piglets, respectively. Sows mated d 7 and 8 after weaning had lower ($P < 0.01$) subsequent TNB when compared to all other sows (11.52 and 11.59 vs. 12.27). Using the NSRG, poor WSI and subsequent TNB of parity 1 sows suggest inadequate nutrition in lactation. To increase litter size, the production system should evaluate lactation nutrition, consider extending LL, allow sows displaying estrus 7 and 8 d post-weaning to be bred on the next cycle, and not cross-foster excess piglets onto parity one females.

Key Words: reproduction, swine, troubleshooting
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070 Evaluation of the impact of errors in the sorting of pigs for market on sort loss at a range of marketing ages. Y. Que*, F. A. Cabezon, A. P. Schinckel, *Department of Animal Sciences, Purdue University, West Lafayette, IN.*

The BW growth curves for 25, 4000-head finishing barns were simulated to 1) evaluate the impact of sorting errors on sort loss at different mean carcass weights (CW) and 2) demonstrate that the magnitude of sort loss due to inaccurate sorting is affected by the pigs' mean CW. Two types of errors were evaluated, BW estimation error (BWEE) and percentage of pigs not visually evaluated (PNVE). Pigs are not evaluated when the targeted number of pigs are identified and sorting stops with heavier pigs than those sorted not being evaluated. Four levels of BWEE with SD's of 0, 4, 6, and 8% of BW and 4 levels of PNVE (0, 8, 16, and 24%) were simulated. Sort loss was calculated using a market value system for a U.S. pork processor (IPC, Delphi, IN). Pigs were initially marketed in 3 marketing cuts, 25% at 169, 25% at 179, and the remaining 50% at 193 d of age. Marketing ages for the pigs were shifted in weekly intervals with mean ages of 155.5, 162.5, 169.5, 176.5, 183.5, 190.5, 197.5, 204.5, and 211.5 d of age. Two variables, number of pigs with sort loss and mean sort loss per pig in the barn, were fitted to a model including the fixed effects of level of marketing age (AGE), BWEE, PNVE, their interactions and random effect of replicate barn using the MIXED procedure of SAS®. The main effects of AGE, BWEE, and PNVE and AGE × PNVE, AGE × BWEE, and AGE × BWEE × PNVE interactions impacted both variables ($P < 0.001$). The effects of BWEE and interaction of BWEE × PNVE impacted ($P < 0.001$) both variables at all ages. The difference in sort loss/pig produced by the least accurate sorting (BWEE = 8% and PNVE = 24%) increased as the mean CW increased from $1.00 at 93 kg to $4.53 at 103 kg. Sort loss/pig increased more rapidly with increased CW at higher levels of BWEE and PNVE. The effect of inaccurate sorting to increase sort loss is minimized when the mean CW is close to the middle of the pork processor's acceptable CW range and increases as CW increases to those approaching the upper acceptable CW range and is dependent on the marketing grid.

Key Words: marketing, sort loss, pork
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071 Evaluation of the impact of the magnitude of errors in the sorting of pigs for market on the optimal market weight. J. Cheng*, F. A. Cabezon, Y. Que, A. P. Schinckel, *Department of Animal Sciences, Purdue University, West Lafayette, IN.*

The objective was to estimate the impact that the accuracy in which pigs are sorted for marketing has on the optimal market carcass weight (CW) and economic returns. Two types of errors were evaluated in a stochastic model, BW estimation error (BWEE) and percentage of pigs not visually evaluated (PNVE). Pigs are not evaluated when the targeted number of pigs are identified and sorting stops with heavier pigs than those sorted not being evaluated. Four levels of BWEE with SD's of 0, 4, 6, and 8% of BW and 4 levels of PNVE (0, 8, 16, and 24%) were simulated. Initially, pigs were marketed in 3 marketing cuts (MCUT), 25% at 169, 25% at 179, and the remaining 50% at 193 d of age. The timing of marketing was shifted in 7 d intervals with mean marketing ages of 155.5 to 211.5 d with mean CW's of 75.7 to 108.7 kg. Sort loss was calculated using a market system for a U.S. pork processor (IPC, Delphi, IN). Mean for sort loss ($/pig) values for the pigs in the barn were fitted to a polynomial function of mean CW for each combination of BWEE and PNVE. The increase in mean sort loss for each unit increase in CW above 93 kg increased as BWEE and PNVE increased. Pork production costs were estimated using an industry spreadsheet. A base price of $1.433/kg of CW was used to produce a small profit per pig. Lean premium (LPREM, $/100 kg CW) for gilts was estimated as LPREM = 0.4665 – 0.00198 CW, kg ($R^2 = 0.99$) and for barrows was LPREM = 0.4176 – 0.00216 CW, kg ($R^2 = 0.99$). The optimal CW's to maximize profit/pig and daily returns above daily costs were estimated for each combination of BWEE and PNVE. With accurate sorting, (BWEE = 0, PNVE = 0%) the optimal mean age for the 3 MCUT strategy was 190.5 d (176, 186, and 200 d MCUTs) at a mean CW of 97.0 kg and profit of $3.35/pig. With less accurate sorting (BWEE = 8%, PNVE = 24%), the optimal mean age decreased to 184.5 d with mean CW of 93.4 and profit of $2.00/pig. The optimal market ages and CW's decreased as the accuracy of sorting pigs decreased. The impact of inaccurate sorting of market hogs on the optimal market BW is impacted by several

factors (marketing grid, feed costs, market prices, etc.).

Key Words: sort loss, pork, marketing
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072 Effects of supplemental betaine to semen extenders on semen quality in boars. D. W. Lugar[1,*], W. A. Krom[1], J. A. Proctor[1], P. D. Mings[1], K. R. Stewart[2], [1]*Purdue University, West Lafayette, IN,* [2]*Department of Animal Sciences, Purdue University, West Lafayette, IN.*

The objective of this study was to determine the effects of supplemental betaine in semen extender on estimates of semen quality. Eight intact male pigs were used in a 4×2 factorial study replicated for 3 wk. Semen was collected from each animal one time per week, diluted into a commercial semen extender (Enduraguard Plus; MOFA, Verona, WI) containing 0, 0.6, 1.2, or 2.4% betaine, and evaluated following dilution (d 1) and after 4 d of storage at 17°C (d 4). Evaluations included sperm motility and mobility estimations using computer assisted sperm assessment (Ceros II, IMV Technologies) and morphological assessment. Statistical ANOVA was performed using the mixed procedure of SAS (9.4). Main effects for statistical analysis included treatment, week, day of analysis, and all interactions. Extender pH and semen concentration were used as covariates and laboratory and collection technician as random effects, where appropriate. On d 1, motility increased with 1.2% betaine ($P = 0.045$) and tended to increase with 0.6% ($P = 0.074$) compared to 0%, whereas 2.4% betaine was lower than 0.6% and 1.2% ($P < 0.001$ and $P = 0.002$, respectively). Percent motile sperm LS means for 0%, 0.6%, 1.2%, and 2.4% on d 1 were 69.15, 76.29, 76.97, and 65.58% ± 2.95, respectively. Straight line velocity was increased for 0.6% and 1.2% compared to 0% ($P = 0.048$ and $P = 0.015$, respectively). On d 4, motility ($P < 0.001$), straight line velocity ($P < 0.001$), and percent normal sperm ($P \leq 0.023$) in the 2.4% betaine samples were reduced compared to all other treatments. There was a treatment by day of storage by week interaction for percent of sperm with tail abnormalities ($P = 0.042$). In general, the addition of 2.4% betaine caused an increase in tail abnormalities. The treatment effect LS means for tail abnormalities for 0%, 0.6%, 1.2%, and 2.4% were 4.24, 5.27, 5.20, and 11.62% ± 1.62, respectively. Regardless of day of evaluation, linearity was decreased in the 2.4% betaine treatment ($P < 0.001$) and tended to increase in the 0.6% and 1.2% compared to 0% ($P = 0.093$ and $P = 0.070$, respectively). The results of the current study indicate that the addition of 0.6 or 1.2% betaine to semen extenders can improve sperm motility and mobility without adverse effects on normal sperm morphology. In addition, supplemental betaine at 2.4% has negative effects on estimates of semen quality.

Key Words: betaine, boar, semen extender
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073 Effect of tail docking on welfare and performance of pigs during nursery and growing-finishing periods. Y. Li*, L. J. Johnston, *West Central Research and Outreach Center, University of Minnesota, Morris, MN.*

Tail docking of pigs is under scrutiny due to concerns about animal welfare. To reevaluate the consequences of raising pigs without tail docking under modern, commercial-like conditions, a study was conducted to compare welfare, behavior, and performance of pigs with and without tail docking. Pigs farrowed to 37 sows were used with half of each litter tail-docked (docked) after birth and remaining pigs left with tails intact (intact). During the nursery period, pigs ($n = 336$, initial wt = 7.8 ± 1.5 kg) were housed in 20 docked pens and 22 intact pens (8 pigs/pen). During the growing-finishing period, pigs ($n = 240$, initial wt = 24.9 ± 2.9 kg) were housed in 8 pens (4 pens each of docked and intact, 30 pigs/pen) for 16 wk (avg final wt = 126.2 ± 10.3 kg). Weight gain and feed intake were recorded. All pigs were assessed for tail damage and skin lesions every 4 wk and during outbreaks of tail biting. Behaviors were video-recorded twice weekly for 13 wk during the growing-finishing period. Carcass weights and incidence of carcass trim loss were recorded. More intact pigs experienced tail damage during both nursery (41% vs. 2%; chi-square = 75.7; $P < 0.0001$) and growing-finishing (89% vs. 48%; chi-square = 76.2; $P < 0.0001$) periods than docked pigs. Intact pigs spent more time tail biting (0.31% vs. 0.06%; $P < 0.001$) and tended to spend less time drinking (1.58 vs. 1.77%; $P < 0.10$) compared to docked pigs. Intact pigs experienced the first outbreak of tail biting at 11 wk of age, which occurred 6 wk earlier compared to docked pigs. Furthermore, 21% of intact pigs vs. 5% ($P < 0.001$) of docked pigs were removed due to tail damage. Tail docking did not affect ADG (nursery: 0.48 vs. 0.49 kg, SE = 0.04; growing-finishing: 0.86 vs. 0.87 kg, SE = 0.01 for docked and intact pigs, respectively) or skin lesions of pigs. For pigs that were not removed, ADFI was not different between pens with docked pigs and pens with intact pigs. As a consequence of carcass trim loss, carcass contamination, and mortality, 90% of intact pigs vs. 97% of docked pigs were harvested for full value. These data suggest that raising pigs without tail docking in a confinement housing system increases incidence of tail biting and tail damage, resulting in higher morbidity, reduced value, and compromised welfare of pigs.

Key Words: tail docking, performance, pigs
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