Timing of post-insemination movement of sows into loose-sow gestation housing and its subsequent effects on reproductive efficiency

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Abstract

The latest trend in moving toward loose-sow gestation housing systems and away from crated systems has created concerns regarding reproductive efficiency for pork producers thinking about implementing this type of system. Many factors are involved that can dictate whether a genetic line of sows can make the move to loose-sow housing. One factor is aggression, which may determine the timing in which sows can be moved into the pen for gestation. Aggressive sows that fight during the critical embryo implantation period may have deleterious effects on their reproductive efficiency. The objective of this study was to determine whether there are differences in reproductive performance between sows moved directly into loose-sow gestation housing 0-1 days post insemination versus sows moved after 35 days post insemination. Secondarily, aggression was characterized for a subset of sows within treatment and analyzed for its effect on reproductive efficiency. Sows from three genetic lines of Babcock breeding stock were randomly designated to a treatment within each week of mating. Two treatment groups were created, their designation being based on when the sows were added to loose-sow pen gestation housing. Treatment 1 (STALL) consisted of sows remaining in stall gestation until after day 35 of pregnancy, and treatment 2 (PEN) consisted of sows moved to pen gestation housing between day0 and day1 post last service. Results indicated no significant difference between treatment means for timing of movement. Incidence rate of aggressive behavior between sow movement treatments approached significance suggesting a potential higher incidence rate within dynamically moved females. Nonetheless, trait differences between sows grouped according to whether or not they were the recipient of aggressive social behavior were not significant. Holding sows in stalls for 35 days prior to moving to loose-sow pen gestation is not necessary as it has no significant detrimental effects on reproduction.

Background

- Loose-sow gestation housing has increased in popularity
  - Management ease
  - Consumer/advocacy demand
  - Legislative action
- Many factors play a role in successfully making the switch over to loose-sow housing
  - Aggression
  - Structural solidity
  - Feeding practices
  - Managerial decisions
- Previous docility research suggests conduciveness of sows for loose-sow housing
  - Human-approach test performed previously indicated 97% docility level.

Objective

- Characterize Babcock Genetics Inc. sow lines for use in loose-sow gestation housing
  - Determine correct timing of movement for mated sows into loose-sow housing
  - Characterize aggression during introduction into loose-sow housing
  - Evaluate reproductive efficiency in a loose-sow housing system

Materials

- ANIMALS
  - 660 pure-line mating records of mixed parity and genotype
    - Artificial Insemination; 1 to 3 services as long as standing heat is exhibited
- TREATMENT
  - (PEN) – Moved to pens 0-3 days post last service
    - Entered pen dynamically over 14 days
  - (STALL) – Moved to pens after day35 post last service
    - Formed a static group of pen-gestated sows ranging between 36-49 days of gestation
- AGRESSION SCORES
  - Incidence of vulva biting and lesions were recorded on a 0-3 scale indicating zero, <5 superficial lesions, <10 superficial or <5 deep lesions, or >10 superficial or >5 deep lesions
    - STALL – 5 days post-entry into pen
    - PEN – While the pen was dynamically filled (14 days)
- FEEDING
  - Standard gestation rations fed to condition based on objective A-mode ultrasound back-fat measurement
    - Pen housing: Electronic feeding in total enclosure
      - All sows previously trained to the system
    - Stall housing: Feed drop tubes

Statistical Analyses

- Power of detection α=.05: 80% for farrow rate difference of ≥1.7%; 70% for litter size difference of ≥ .38 pigs
- Total born, Total born live, stillborns, mummies, and #weaned
  - General linear mixed animal model: $y = \mathbf{X\beta} + \mathbf{Zu} + \mathbf{Wp} + e$
    Where: $\boldsymbol{\beta}$ is a vector of management factors - CG, parity, line, treatment, age1stmate covariate
    $\boldsymbol{u}$ is a vector of animal breeding values (BV) with variance $\mathbf{A}\sigma^2_u$ where $\mathbf{A}$ = Add. Rel. matrix
    $\boldsymbol{p}$ is a vector of permanent environmental effects of repeated records of the dams
    $\mathbf{X}$, $\mathbf{Z}$ and $\mathbf{W}$ are incidence matrices relating phenotypes to fixed factors, BVs and dams respectively
- Farrowing rate and aggression scores analyzed as a deviation from expectation of equal treatment means using a $\chi^2_{df=1}$ distribution: $\chi^2 = \sum \frac{(O-E)^2}{E}$
- LS estimates for the treatment x line interaction of stillborn pigs, as well as LS estimates for sows with or without aggression scores were identified similar to the other traits of interest, however including only sire and dam as the random effects:
  $y = \mathbf{X\beta} + \mathbf{Z}_s\mathbf{u}_s + \mathbf{Z}_d\mathbf{u}_d + e$

Results

Table 1. Number of litter observations within genotype by treatment

Trt \ Line	Geno1	Geno2	Geno3	Total
PEN	48	54	183	285
STALL	45	77	129	251
Total	93	131	312	536

Table 2. Mixed model contrasts shown as the difference between the STALL and PEN treatments for each trait.

Treatment \ Trait	Farrow Rate	Total Born	Born Alive	Stillborn* GenoA	Stillborn* GenoB	Stillborn* GenoC	Mummies	# Weaned	Fertility Index+
STALL minus PEN	-1.94	0.19	0.08	-0.84	0.06	0.42	0.027	-0.55	-0.02
P- value	0.5239	0.4206	0.7385	0.0502	0.8782	0.0805	0.432	0.2214	NA

*Genotype x Treatment Interaction present at p = 0.0383; +Number Born Alive per 100 sows bred

Table 3. Trait differences between sows having or not having lesions ('sows without lesions' minus 'sows with lesions')

Treatment \ Trait	Total Born	Born Alive	Stillborn	Mummies	# Weaned
PEN	0.47	0.83	-0.39	0.026	0.18
p-value	0.4387	0.1766	0.3537	0.7493	0.8679
STALL	-0.64	-0.08	-0.48	-0.065	-0.32
p-value	0.1859	0.8781	0.1988	0.419	0.7536

Table 4. Treatment x Aggression breakdown

Treatment \ Aggression	Sows Studied	Signs of fighting
Dynamic	118	44 (37.3%)
Static	339	97 (28.6%)
χ^2 Test Statistic		0.079

Discussion

- No significant differences between treatment groups for reproductive traits of interest suggests there is no obvious detrimental effect from timing of movement.
- A significant line x treatment interaction on the trait of stillborn piglets suggests a possible line susceptibility for this trait.
- Incidence rate of aggressive behavior between treatment groups suggests a potentially higher rate in dynamically moved sows.
- Lack of significant differences between trait means for sows grouped according to aggression exposure suggests social behaviors were not aggressive enough to pose a threat to subsequent reproductive efficiency.

Summary

- Reproduction was not suppressed due to mixing of sows directly after mating.
- Results point toward successful implementation of Babcock's genetic lines in loose-sow gestation housing.
- Sows can be moved directly into gestation pens post-insemination without the feared loss in reproductive efficiency.

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