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# Herd management procedures and factors associated with low farrowing rate of female pigs in Japanese commercial herds

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ABSTRACT

The objective of the present study was to compare management procedures and production factors between low-farrowing-rate herds (LFR herds) and the remaining herds (Non-LFR herds). The questionnaires were sent to the producers of 115 herds that use the same recording system. The questionnaire requested information about management procedures in 2008: (i) daily frequencies of estrus detection: once or twice a day; and (ii) the timing of first insemination. Data from 93 completed questionnaires (80.9%) were coordinated with the reproductive data of individual female pigs from the recording system. The data included 78,321 service records from 37,777 sows and gilts. Herds were classified into two groups on the basis of the lower 25th percentile of farrowing rate: LFR herds (76.5% or lower) and Non-LFR herds (76.6% or higher). At the herd level, a two-sample *t*-test, was used to compare the surveyed management procedures between the two herd groups. At the individual level, two-level mixed-effects models were applied, by using a herd at the level two and an individual record at the level one to determine associations between low farrowing rate and management procedures or production factors in gilts and sows. Gilt and sow models were separately constructed. Means (±SEM) of farrowing rate in LFR herds and Non-LFR herds were $71.3 \pm 0.92$ and $85.5 \pm 0.54$%, respectively. The lower farrowing rates of gilts and sows in LFR herds were associated with once-daily estrus detection, late timing of first insemination and single mating ($P < 0.05$). In LFR herds that detected estrus only once a day, the farrowing rate decreased by 10.5% in first-serviced gilts and by 4.2% in reserviced sows compared with twice daily estrus detection ($P < 0.05$). However, there was no such association in Non-LFR herds ($P > 0.05$). The LFR herds had higher percentages of single-mated gilts and sows than Non-LFR herds ($P < 0.05$). Fewer LFR herds than Non-LFR herds performed first insemination immediately after first estrus detection for gilts or by 6–12 h for sows ($P < 0.05$). In order to improve the farrowing rate in LFR herds, we recommend detecting estrus twice a day and performing first insemination earlier after first estrus detection; immediately for gilts and by 6–12 h for sows. Additionally, increasing the percentage of multiple inseminations can effectively improve the farrowing rate.



## 1. Introduction

A low farrowing rate is a major concern in commercial breeding herds because a high occurrence of returns to service increases the number of nonproductive days of female pigs (Dial et al., 1992; Koketsu and Sasaki, 2009). The increase in nonproductive days of female pigs has a negative effect on herd reproductive productivity (Vargas et al., 2009b), measured as pigs weaned per mated female per year (Dial et al., 1992). Additionally, decreased farrowing rate is also an indicator of reproductive failure such as failure to conceive or farrow (Dial et al., 1992),

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leading to removal of female pigs from herds at low parity and increases in replacement costs (Tummaruk et al., 2010). Therefore, increasing farrowing rate is a key factor to improve herd reproductive productivity and profitability (Anil et al., 2005; Young et al., 2010).

Low farrowing rate is highly associated with production factors such as single mating, high age of gilts at first mating (AFM) and prolonged weaning-to-first-mating interval (WMI; Koketsu et al., 1997; Xue et al., 1998; Tummaruk et al., 2007). Additionally, management procedures can also affect farrowing rate (Young et al., 2010). Such management procedures include inaccurate estrus detection and late timing of inseminations (Bracken et al., 2003; Vargas et al., 2009a). It is recommended that management procedures are changed for sows depending on WMI because the duration of estrus in sows varies with WMI (Kemp and Soede, 1996). However, few studies have focused on herds with lower farrowing rate (LFR herds) to examine how management procedures and production factors relate to the lower farrowing rate of gilts and sows with different WMI. Therefore, the objective of the present study was to examine management procedures and production factors associated with low farrowing rate of gilts and sows in commercial herds by means of comparing the management and production factors between LFR herds and Non-LFR herds.

## 2. Materials and methods

### 2.1. Questionnaire and reproductive data in participating herds

In March 2009, questionnaires regarding management procedures were sent to the producers of 115 commercial breeding herds in Japan that use the PigCHAMP recording system (PigCHAMP Inc., Ames, IA, U.S.A.). We asked the producers to complete the questionnaires based on 2008 information so that it would match with their most recent reproductive data, from 2008. The questionnaire requested information about management procedures: (i) daily frequencies of estrus detection: once or twice a day; (ii) the type of boar contact: direct boar contact or no direct boar contact; and (iii) the timing of first and second insemination by WMI. No direct boar contact includes fence-line boar contact between a boar and female pigs housed in individual stalls (Patterson et al., 2002) and also housing female pigs adjacent to boars (Kemp et al., 2005). The timings of first and second inseminations for first-serviced gilts and reserviced female pigs (gilts and sows) were categorized into two respective groups: first time of insemination = "immediately" and "6–12 h or later" after first estrus detection; second time of insemination = at "6–12 h" and "24 h or later" after first estrus detection. The timings of first and second inseminations for first-serviced sows were also categorized into two respective groups: first time of insemination = "immediately and 6–12 h" and "24 h or later" after first estrus detection; second time of insemination = at "24 h" and "48 h or later" after first estrus detection.

Of the 115 producers, 98 (85.2%) returned their completed questionnaires and mailed their 2008 reproductive records to Meiji University by November 2009. Five of these herds were excluded from the present study: two were producing only purebred pigs, two did not record the number of matings and one had no reproductive data. The herd-level management survey data were coordinated with reproductive performance data of individual female pigs that were extracted from the PigCHAMP recording system data for 2008 mailed by each producer. The reproductive data included mating frequencies.

Female pigs in the studied herds were mainly crossbreds between Landrace and Large White, either produced within the herds or replacement gilts purchased from national (gilt source group A) or international breeding companies (gilt source group B). Breeding stocks in the national breeding companies were originally imported from the U.S.A. or Europe, and have been further improved in Japan.

### 2.2. Exclusion criteria of reproductive data

The present study included 82,909 service records from 38,949 female pigs serviced during 2008 in 93 herds. Records of gilts with no AFM data (564 records), and records of sows with no WMI data (153 records) were not used. Gilts with AFM <150 days or >365 days (75 records) were considered as extreme (Tummaruk et al., 2001; Babot et al., 2003) and these data were excluded. Records of sows with WMI 120 days or later (21 records) were also considered as extreme, and were deleted (Le Cozler et al., 1997). Additionally, records of sows with lactation length 0–13 days were not used because they were more likely to have poor reproductive performance, and the records with lactation length 29 days or longer were omitted because they might have been used as nurse sows (3374 records). So, we focused on gilt and sow records for females with lactation length between two and four weeks. These exclusions left 78,722 service records in 38,143 female pigs. Finally, reproductive records of gilts in six herds (401 service records) were excluded because these herds only had records of gilts that had their first farrowing, resulting in a farrowing rate for these gilts of 100% across all AFM. Therefore, a total of 78,321 service records from 37,777 female pigs were used for further analysis.

### 2.3. Definitions and categories

A mating (either artificial insemination or natural mating) was defined as any single insemination or mating of a female pig during the estrus period. A service included one or more inseminations or mating during and within a maximum period of 10 days of estrus (PigCHAMP Reports Manual, 1996). A reservice was defined as returning to estrus to be serviced again within the same parity after a female pig's first service. Farrowing rate was estimated as the number of female pigs that farrowed divided by the number of serviced female pigs multiplied by 100.

Herds were classified into two herd groups on the basis of the lower 25th percentile of farrowing rate: LFR herds (76.5% or lower) or Non-LFR herds (76.6% or higher). The number of matings was divided into two groups: single and multiple matings. The AFM was categorized into six 21-day interval groups based around the median of 247 days AFM: 152–215, 216–236, 237–257, 258–278, 279–299 or