Short Communication

Low Lifetime Efficiency Sows in Low Parity were Culled Due to Reproductive Failure in Commercial Herds

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Summary

The objective of the present study was to characterize culling patterns of low lifetime efficiency sows (LE sows), by comparing between high-performing and ordinary herds for relative frequencies of parity at culling and culling reasons, and by-parity reproductive performance. The present study analyzed 30,914 sows entered to the herds from 2001 to 2003 in 101 commercial herds. Sows were categorized into two groups on the basis of the lower percentile of the annualized lifetime pigs born alive, namely LE or ordinary lifetime efficiency sows. Additionally, two herd groups were formed on the basis of the upper 25th percentiles of pigs weaned per mated female per year, averaged over six years: high-performing herds and ordinary herds. A Chi-squared test was performed to compare relative frequencies (%) of parity at culling and culling reasons between the herd groups. Mixed-effects models were performed for comparisons in statistical analyses. More LE sows in the high-performing herds were culled due to "reproductive failure" in parity 1 (54.0 vs. 41.5%) and parity 2 (61.2 vs. 42.2%) than those in ordinary herds (P<0.05). No difference between the herd groups was found for pigs born alive in LE sows culled due to "reproductive failure" in any parity group. In summary, high-performing herds were more active in culling potential LE sows due to "reproductive failure" in low-parity than ordinary herds.

Keywords : Lifetime efficiency, Removal, Reproductive problem, Sow

Introduction

It is critical for producers and veterinarians to improve lifetime efficiency of female pigs (females)9) and to implement strict culling policy for females with suboptimal reproductive performance4, 9) in order to increase herd reproductive productivity. A previous study has reported that low lifetime efficiency sows (LE sows) exhibit poor reproductive performance across parity and increasing proportions of LE sows reduces herd reproductive productivity14). Therefore, a decision on which and when LE sows should be culled is important to improve herd productivity.

High-performing herds, based on pigs weaned per mated female per year, have higher reproductive efficiency, and these herds have better culling management including strict culling policy than ordinary herds12). Culling management for LE sows in the high-performing herds can be used as feasible targets for producers and veterinarians in best practice benchmarking3, 12). However, no study has compared culling patterns of LE sows between the high-performing and ordinary herds. Such information would increase our understanding of characteristics of LE sows and enable more refined culling management in commercial herds. Additionally, lifetime efficiency in culled females also differed between culling reasons10). Therefore, the objective of the present study was to characterize culling patterns of LE sows, by comparing between high-performing and ordinary herds for parity at culling, culling reasons and by-parity reproductive performance..

Materials and methods

Data

Japanese producers in approximately 130 herds that use PigCHAMP recording software (PigCHAMP Inc., Ames, IA, U.S.A.) were requested to mail their data files to Meiji University when they purchased new software or renewed their yearly maintenance contract. By 31 August 2007, 123 commercial farm producers had mailed their data files to the university, and the present study used data from 101 of these breeding farms that had accurate records of sow birth dates. The data analyzed were a subset of a larger dataset from an earlier study14).

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Lifetime records of female pigs entered from 2001 to 2003 were extracted from data files of 40,421 gilts and sows in the 101 herds. A total of 36,142 records of the sow lifetime records were selected using the criteria that they contained both records of parity at removal and records of pigs born at farrowing. Subsequently, 1,363 sows were excluded because there were no birth date records, and 3,865 sows were excluded because they were non-culled sows. Hence, 30,914 lifetime records were used for lifetime performance analysis in the present study.

When by-parity reproductive performance was analyzed, 7,322 sows culled for "reproductive failure" were used. These sows had 29,271 parity records, of which 3,901 parity records were omitted because they were removed parity records of sows and 12 parity records of sows were omitted because they were for sows with weaning-to-first mating interval (WMI)≥115 days. Therefore, 25,358 parity records of the 7,322 sows were used for by-parity reproductive performance analysis.

Definitions and categories

Lifetime efficiency was measured by annualized lifetime pigs born alive that was calculated as lifetime pigs born alive divided by the sow lifetime days multiplied by 365 days. Sows were categorized into two groups based on the lower 25th percentile of annualized pigs born alive: LE sows (13.3 pigs or fewer) and ordinary lifetime efficiency (OE) sows. Additionally, herd productivity was measured as pigs weaned per mated female per year, averaged over six years. Two herd groups were formed on the basis of the upper percentile of pigs weaned per mated female per year, averaged over six years: high-performing herds (23.4 pigs or more) and ordinary herds. Records for parity 5 or higher were categorized into parity 5.

Culling reasons were grouped under three categories based on the previous study: "reproductive failure," "low litter performance" and "Others." "Reproductive failure" included no heat, did not conceive, failure to farrow, found not pregnant, negative pregnancy check and abortion. "Low litter performance" included farrowing productivity and small litter size. "Others" included downer, lameness, unsoundness, joint infection, injury, peripartum or lactation problem, unknown and nonspecific reasons. Farrowing percentage was defined as the number of farrowed sows divided by number of first serviced sows multiplied by 100.

Statistical analysis

All statistical analyses were performed by SAS (SAS Inst. Inc., Cary, NC). The LE and OE sows were separately analyzed. A Chi-squared test was used to compare differences in the relative frequency of parity at culling or culling reasons of LE and OE sows between the herd groups. Root transformation was carried out for WMI when it was used as a dependent variable. After the analyses, a back-transformation was performed. Two-level analysis was also applied using a herd at level 2 and an individual record at level 1. Continuous variables were analyzed by linear mixed effects model using the MIXED procedure with a Tukey-Kramer multiple comparisons test. Binomial variables were analyzed with mixed-effects logistic regression models using the GLIMMIX procedure. Contrasts were used to compare farrowing percentage between the herd groups.

A Model was constructed to compare between the herd groups for number of pigs born alive (PBA), number of weaned pigs, adjusted 21-day litter weight, WMI and farrowing percentage of

<table>
<thead>
<tr>
<th>Parity at culling</th>
<th>LE sows(^2)*</th>
<th>Ordinary herds</th>
<th>OE sows(^2)</th>
<th>Ordinary herds</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-performing herds</td>
<td>1,988</td>
<td>5,732</td>
<td>8,389</td>
<td>14,805</td>
</tr>
<tr>
<td>Ordinary herds</td>
<td>58.5</td>
<td>47.3</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>20.7</td>
<td>23.8</td>
<td>3.6</td>
<td>3.4</td>
</tr>
<tr>
<td>3</td>
<td>10.9</td>
<td>14.0</td>
<td>6.3</td>
<td>6.9</td>
</tr>
<tr>
<td>4</td>
<td>5.7</td>
<td>6.6</td>
<td>9.4</td>
<td>9.8</td>
</tr>
<tr>
<td>5 or higher</td>
<td>4.2</td>
<td>8.3</td>
<td>80.4</td>
<td>79.7</td>
</tr>
</tbody>
</table>

Frequencies of within columns add up to 100%.

\(^*\) The frequency of parity at culling in LE sows differed between the herd groups (P<0.05).

\(^1\) Two herd groups were categorized on the basis of the upper percentile of pigs weaned per mated female per year: high-performing herds (23.4 pigs or more) and ordinary herds.

\(^2\) Sows were classified into two groups on the basis of the lower percentile of annualized lifetime pigs born alive: LE sows (13.3 pigs or fewer) and OE sows.
LE and OE sows culled due to "reproductive failure." The independent variables were herd groups, parity groups and the two-way interaction between the herd groups and parity groups. The herd and the interaction between farrowing year and three periods based on four-farrowing month intervals in a year within the herds were used as the random intercept in the model. The three periods based on the four month farrowing intervals in the year was used to account for a part of the correlations of data within a sow in the model.

Results

Table 1 shows relative frequencies (%) of parity at culling of LE or OE sows in the high-performing and ordinary herds. Relative frequency of parity at culling in LE sows differed between the two herd groups (P<0.05), whereas there were no such differences in OE sows. In 7,720 LE sows, the proportions (%) of LE sows culled in parity 1 and 2 in the high-performing herds were 58.5 and 20.7%, respectively. Meanwhile, those in ordinary herds were 47.3 and 23.8%, respectively.

Table 2 shows relative frequencies (%) of parity at culling of LE or OE sows in the high-performing and ordinary herds. Relative frequency of parity at culling in LE sows differed between the two herd groups (P<0.05; Table 2). In parity 1 and 2, the proportions of LE sows culled due to "reproductive failure" in the high-performing and ordinary herds were 54.0 and 41.5% in parity 1, and were 61.2 and
42.2% in parity 2, respectively. From parity 3 to 5, those proportions were between 21.3 and 42.4% in both the herd groups. Additionally, the proportions of LE sows culled due to "low litter performance" in the high-performing herds were between 1.9 and 34.5%, whereas those in ordinary herds were between 2.5 and 16.0% from parity 1 to 5.

By-parity reproductive performance in LE and OE sows culled for "reproductive failure" is shown in Table 3. No difference between the herd groups was found for PBA in LE sows. However, LE sows culled due to "reproductive failure" in the high-performing herds had shorter WMI than those in ordinary herds across parity (P<0.05). In contrast to LE sows, there were no differences between the two herd groups in PBA and number of weaned pigs of OE sows culled due to "reproductive failure." In both LE and OE sows, no difference between the two herd groups was found for farrowing percentage in any parity. The LE and OE sows culled due to "reproductive failure" in the high-performing herds had 4.8 and 3.6 kg heavier adjusted 21-days litter weights than those in ordinary herds, respectively (P<0.05).

Discussion

The present study showed that 50–60% of LE sows in high-performing herds were culled due to "reproductive failure" in parity 1 and 2, although those in ordinary herds were about 40%.

<table>
<thead>
<tr>
<th>Parity</th>
<th>LE sows</th>
<th>Ordinary herds</th>
<th>OE sows</th>
<th>Ordinary herds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>High-performing herds</td>
<td>Number of pigs born alive</td>
<td>High-performing herds</td>
<td>Number of pigs born alive</td>
</tr>
<tr>
<td>1</td>
<td>1,034</td>
<td>2,254</td>
<td>1,587</td>
<td>2,447</td>
</tr>
<tr>
<td>2</td>
<td>406</td>
<td>1,128</td>
<td>1,584</td>
<td>2,441</td>
</tr>
<tr>
<td>3</td>
<td>154</td>
<td>551</td>
<td>1,458</td>
<td>2,281</td>
</tr>
<tr>
<td>4</td>
<td>62</td>
<td>239</td>
<td>1,200</td>
<td>1,919</td>
</tr>
<tr>
<td>5 or higher</td>
<td>21</td>
<td>138</td>
<td>1,611</td>
<td>2,843</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>High-performing herds</td>
<td>Number of weaned pigs</td>
<td>High-performing herds</td>
<td>Number of weaned pigs</td>
</tr>
<tr>
<td>1</td>
<td>1,034</td>
<td>2,254</td>
<td>1,587</td>
<td>2,447</td>
</tr>
<tr>
<td>2</td>
<td>406</td>
<td>1,128</td>
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<td>3</td>
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<td>4</td>
<td>62</td>
<td>239</td>
<td>1,200</td>
<td>1,919</td>
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<tr>
<td>5 or higher</td>
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<td>1,611</td>
<td>2,843</td>
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<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>High-performing herds</td>
<td>Adjusted 21-day litter weight, kg</td>
<td>High-performing herds</td>
<td>Adjusted 21-day litter weight, kg</td>
</tr>
<tr>
<td>1</td>
<td>1,509</td>
<td>3,629</td>
<td>10,339</td>
<td>63.1 ± 0.12c</td>
</tr>
<tr>
<td>2</td>
<td>789</td>
<td>1,863</td>
<td>1,586</td>
<td>2,439</td>
</tr>
<tr>
<td>3</td>
<td>357</td>
<td>1,021</td>
<td>1,555</td>
<td>2,400</td>
</tr>
<tr>
<td>4</td>
<td>143</td>
<td>505</td>
<td>1,406</td>
<td>2,195</td>
</tr>
<tr>
<td>5 or higher</td>
<td>58</td>
<td>132</td>
<td>1,522</td>
<td>2,629</td>
</tr>
</tbody>
</table>

Within a column, means without a common superscript differed (P<0.05).

Within a row, means without a common superscript differed (P<0.05).

1 Two herd groups were categorized on the basis of the upper percentile of pigs weaned per mated female per year: high-performing herds (23.4 pigs or more) and ordinary herds.

2 Sows were classified into two groups on the basis of the lower percentile of annualized lifetime pigs born alive: LE sows (13.3 pigs or fewer) and OE sows.
This finding indicates that high-performing herds are more active to cull potential LE sows in low parity than ordinary herds in order to reduce nonproductive days and to improve herd productivity. In fact, LE sows culled due to “reproductive failure” in the high-performing herds had shorter WMI, which was a part of nonproductive days, than those in ordinary herds across parity. Female pigs culled due to “reproductive failure” had the greatest lifetime nonproductive days. Additionally, reducing the proportion of nonproductive days in low parity sows can improve lifetime reproductive efficiency of sows. We recommended detecting estrus of potential LE sows more accurately by practicing twice estrus detection program with a matured boar to reduce nonproductive days of potential LE sows.

Our study suggests that high-performing herds are more active in letting potential LE sows foster extra piglets from other sows than ordinary herds. It appears that producers in the high-performing herds pay extra attention for potential LE sows and use fostering techniques for potential LE sows in early parity. The procedure of letting sows foster extra piglets from sows having high PBA can minimize variation in litter size and weaning weight within litters.

The LE sows in both the herd groups also had a high occurrence of “low litter performance” from parity 3 to 5, but more high-performing herds culled potential LE sows with parity 3 or higher due to “low litter performance” than ordinary herds. It appears that high-performing herds have culling guidelines for mid-parity sows different from ordinary herds. Previous studies found that “low litter performance” was a common reason for sows with parity 4 or higher, and sows culled due to “low litter performance” had low PBA and prolonged nonproductive days per parity.

In conclusion, high-performing herds were more active in culling potential LE sows due to “reproductive failure” in low-parity than ordinary herds. Additionally, high-performing herds had culling guidelines and fostering techniques for potential LE sows different from ordinary herds.

Finally, the present study is an observational study using records from commercial herds. The results could be biased by factors that we did not measure, such as genetics, herd health and nutrition. Even with such limitations, this study provides swine producers with valuable information about culling reasons for low lifetime efficiency sows and their reproductive profile by the culling reasons.

Acknowledgements

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References

短報

繁殖農場における低産次の低生涯生産性母豚は繁殖障害により淘汰された

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要旨

本研究は、高繁殖生産性農場（High農場）と普通繁殖生産性農場（Ordinary農場）間で、低生涯生産性を示す母豚（LE母豚）の淘汰産次と淘汰理由の頻度分布割合、産次ごとの繁殖成績を比較することにより、LE母豚の淘汰パターンを特徴付けることを目的とした。本研究では、101農場における2001-2003年に導入された30,914頭の母豚を分析に用いた。母豚は、年間化生涯生殖産子数の下位25パーセントタイルを基に、LE母豚と普通生涯生産性母豚の2グループに分類された。また、農場は年間種付け豚数あたり産豚豚数の上位25パーセントタイルを用いて、High農場とOrdinary農場の2グループに分類した。農場グループ間での淘汰産次と淘汰理由の頻度分布割合（%）の比較に、カイ自乗検定を用いた。統計分析には対等効果モデルを用いた。High農場のLE母豚は、Ordinary農場のLE母豚よりも、"繁殖障害"により産次1（54.0 vs. 41.5%）と産次2（61.2 vs. 42.2%）で多く淘汰された。どの産次グループにおいても、"繁殖障害"で淘汰されたLE母豚の生存産子数に、農場グループ間で差はみられなかった。結論して、High農場はOrdinary農場よりも、産次1と2において積極的にLE母豚を"繁殖障害"で淘汰していた。

キーワード：生涯生産性、淘汰、繁殖問題、母豚

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