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Sows having high lifetime efficiency and high longevity associated with herd productivity in commercial herds

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Abstract

The objectives of this study were to characterize sows having high lifetime efficiency and high longevity (HE–HL), to examine the relationship between lifetime measurements, and to determine the association between the sows and herd productivity. This study was conducted by obtaining sow data with 66,262 parity records of 13,786 sows born during 1999 and herd data with mean measurements of 4-year records from 2000 to 2003 in 92 herds. Sow lifetime efficiency was defined as the sum of pigs born alive in lifetime divided by the sow life days and multiplied by 365 days. Sows were categorized into three sow groups based on the upper 25 percentile of the lifetime efficiency and parity at culling ≥ 6. The three groups were sows having 1) the upper 25 percentile of the lifetime efficiency and parity at culling ≥ 6 (HE–HL sows), 2) less than the upper 25 percentile of the lifetime efficiency and parity at culling ≥ 6 (OE–HL sows), and 3) parity at culling ≤ 5 regardless of lifetime efficiency (LL sows). Mixed-effects models were used to compare reproductive performance between the three sow groups and to identify factors associated with a proportion of a HE–HL sow in the herd. Correlation analyses were done between lifetime performances in sows and between herd productivity measurements and the proportions of three sow groups in the herd. The proportions of HE–HL, OE–HL, and LL sows in 13,786 sows were 21.8%, 24.5%, and 53.7%, respectively. Lifetime efficiency was correlated with parity at culling ($r=0.76$; $P<0.01$) and nonproductive days per parity ($r=-0.46$; $P<0.01$). From first parity to the end, HE–HL sows had the greatest numbers of pigs born alive, the highest farrowing percentage, and the shortest nonproductive days per parity ($P<0.01$). Sows aged between 186 and 227 days at first mating were 1.09 to 1.11 times as more likely to become a HE–HL sow as those aged between 249 and 269 days at first mating ($P<0.05$). Of the 92 herds, mean proportion of HE–HL sows was 23.5%, and the proportions ranged from 0 to 57.6%. A higher proportion of HE–HL sows and a lower proportion of LL sows in the herd were correlated with more pigs weaned per mated female per year ($P<0.01$). In conclusion, HE–HL sows had high efficiency from the first parity to the end, which was attributed to herd productivity.

Keywords: Fertility; Herd productivity; Lifetime performance; Longevity; Prolificacy

1. Introduction

Lifetime performance is generally measured as the number of lifetime pigs born alive (PBA) and the number of lifetime PBA per parity (Lucia et al., 1999; Serenius and Stalder, 2004). These measurements include only

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PBA or prolificacy, and are closely related to the number of parity at culling or longevity (Engblom et al., 2007). However, the number of parity at culling ignores nonproductive days and fertility that is accumulated by prolonged weaning-to-conception and culling intervals (Lucia et al., 1999). Therefore, the number of parity at culling does not directly indicate sow fertility and lifetime efficiency. Few studies reported a measurement for lifetime efficiency that included both fertility and prolificacy, and that can be measured as lifetime PBA per pig day. Higher fertility for sows should be represented by shorter nonproductive days including a higher farrowing percentage and shorter weaning-to-first-mating interval (Dial et al., 1992). High lifetime efficiency, high lifetime PBA per day, may be more accurately related to nonproductive days and sow fertility than lifetime PBA per parity. Furthermore, no study reported relationships between lifetime efficiency and other measurements such as longevity and prolificacy traits.

Both longevity and efficiency are critical for producers managing in commercial herds (Koketsu, 2007). Increased longevity in sows results in an increased opportunity to achieve greater PBA at mid-parity, lower costs of replacement gilts, and facilitating animal welfare concerns (Lucia et al., 1999; Tarrés et al., 2006; Engblom et al., 2007). Little information is available on characteristics of sows having both high lifetime efficiency and high longevity (HE–HL sows). In addition, no research was reported on the relationship between the proportion of HE–HL sows in the herd and the herd productivity measurements such as pigs weaned per mated female per year.

The age of gilt at first mating is a key factor that determines reproductive efficiency (Van Wettere et al., 2006) because mated gilts at low ages were associated with high lifetime performance and high longevity (Schukken et al., 1994; Le Cozler et al., 1998; Koketsu et al., 1999). In addition to mating age of gilts, birth season may be indirectly related to lifetime efficiency and longevity because the month of birth was reportedly related to age at first mating (Tummaruk et al., 2000). Furthermore, a reduction of PBA in parity 2 compared with parity 1 has reportedly occurred in 54% sows in commercial herds in the U.S.A., although the mean of PBA in parity 2 was greater than those in parity 1 (Morrow et al., 1992). This reduction may be also related to lifetime efficiency and longevity.

Therefore, the objectives of this study were to characterize HE–HL sows, to investigate relationships between lifetime measurements, to determine correlations between herd productivity measurements and proportions of HE–HL sows in the herds, and to identify factors associated with HE–HL sows in commercial herds.

2. Materials and methods

2.1. Herd data and exclusion criteria

All producers (approximately 140 herds) who used a recording software system (PigCHAMP) in Japan were requested to mail their data files to Meiji University, when they purchased new software or renewed their yearly maintenance contract.

Of 122 herds that were mailed to the University by 31 August 2005, 23 herds were excluded from this study, because the birth dates of sows were not recorded in the 23 herds. In seven herds, more than 50% of the recorded birth dates were 1st and 15th of the month, and those were also excluded. Mean herd measurements in the four-year duration from 2000 to 2003 were collected in 92 herds. The lactation and gestation diets of each herd were formulated by using imported corn and soybean meal. Both natural matings and AI were practiced. Sows in the study herds were mainly F_1 crossbreds of Large White and Landrace, which reproduced within the herd or were purchased from breeding companies. Breeding stock of these breeds was originally imported from the United States or Europe.

2.2. Sow data and exclusion criteria

Records of sows born in 1999 starting from birth to the last parity were extracted from data files of sows of the 92 herds. All sows with parity records were observed until culling in this longitudinal study. A sow was defined as a female pig that farrowed at least once, whereas a gilt was a female pig that never farrowed. The range of average female inventory (herd size) was from 47 to 2,981 female pigs. Of the 66,370 parity records of 13,802 sows in the 92 herds, 66,262 records of 13,786 sows were selected using the criteria that both records of removed date from the herd and records of pigs born at farrowing were available. These criteria were chosen to eliminate incomplete parity records. Hence, 66,262 parity records and 13,786 lifetime records were used for further analyses. In addition, age at first mating <150 and >365 days (125 records) and weaning-to-first-mating interval >114 days (6 records) were omitted for further analyses based on the previous reports (Koketsu and Dial, 1997; Hanenberg et al., 2001; Tummaruk et al., 2001b). Moreover, parity records with lactation length <14 days were also omitted when weaning-to-first-mating interval and farrowing percentage were analyzed, because sows with short lactation length were likely to be removed for reproductive or health problems during early lactation, and subsequent reproductive performance may be impaired.

2.3. Definitions of production measurements

Sow life days was defined as the total days from birth date to removed date from the herd. Lifetime efficiency was calculated as the sum of PBA in lifetime divided by the sow life days multiplied by 365 days (annualized lifetime PBA). Lifetime PBA was calculated as the sum of PBA from first farrowing to the last farrowing. Lifetime PBA per parity was defined as the sum of