Influence of age at first estrus, body weight, and average daily gain of replacement gilts on their subsequent reproductive performance as sows

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ARTICLE INFO

ABSTRACT

The present study investigated the influence of age at first estrus, body weight, and average daily gain (ADG) of the replacement gilts on their subsequent reproductive performance as sows. In total, 4243 Landrace × Yorkshire F1 crossbred replacement gilts were included. They were classified according to age at first estrus, body weight at entering the breeding unit, and ADG. Reproductive performance data, including age at first insemination, age at first farrowing, the number of total piglets born per litter (TB), the number of piglets born alive per litter (BA), farrowing rate, age and parity at removal, and reasons for removal were collected for 3 years. The gilts exhibited first standing estrus, entered the breeding house, and was first mated at 202.6 ± 17.7, 230.3 ± 15.0 and 236.5 ± 17.5 days of age, respectively. On average, body weight and ADG of the gilts were 139.1 ± 6.0 kg and 601.7 ± 38.2 g/day, respectively. The gilts mated at ≤ 224 days of age were younger at first estrus (200.8 vs. 206.0 days, $P < 0.001$) and had higher ADG (627.0 vs. 587.6 g/day, $P < 0.001$) than those mated at > 224 days of age. Gilts with a body weight > 150 kg at entering the breeding unit had a larger TB in the second parity than those with a body weight of 136–140 kg ($P = 0.050$). Gilts with ADG of 601–650 g/day had a larger TB in the second parity than those with ADG of 551–600 g/day ($P = 0.012$). The sows that were culled at parity 0 or 1 exhibited first estrus at 204.4 ± 0.7 days of age, while those culled at parity ≥ 5 exhibited first estrus at 198.9 ± 2.1 days of age ($P = 0.015$). It could be concluded that age at first estrus, body weight, and ADG of the replacement gilts significantly influenced their subsequent reproductive performance as sows.
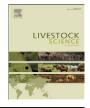
1. Introduction

To acquire a high prolific yield on the pig production, the selection of high quality gilts is necessary since the production from individual sows contributes to an overall productivity of the swine farms. The previous studies reveal that gilts and sows with history of poor production, such as repeated service, prolonged weaning-to-service interval, and abortion, possess low reproductive performance and shortened production time (Takai and Koketsu, 2007; Tummaruk et al., 2010), entailing the diminishment of herd productivity. In general, the gilts taken into the farms in order to substitute the culled sows account for 40–50% per annum (Engblom et al., 2007). In the latest decade, such substitution was higher successively because the removal rate and the proportion of sows in low and middle parities are faster and higher than they were in the past (Engblom et al., 2007). This considerably affects the production cost and the herd efficiency. Furthermore, the proportion of the gilts in general commercial swine herd account for 20–25% of the sows on production. This reflects the significance of selecting quality gilts to be the production unit in the herd.

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At the first mating, age, body weight, and estrus expression of the gilts are the major criteria to be considered. It has been suggested that the gilts should be conceived before 220 days of age (Schukken et al., 1994). Tummaruk et al. (2001) found that if age at first mating of the gilts delayed for ten days, 0.1 piglet would increase in the first litter but would decrease in the fourth and the fifth litters. In addition, Koketsu et al. (1999) revealed that if age at first insemination of gilts increased, their longevity would decrease. Tummaruk et al. (2001) found that average daily gain (ADG) of the pigs before 100 days of age influenced their reproductive performances. Furthermore, it has been demonstrated that the gilts that have low ADG tend to have low conception rate and to be removed from herd due to reproductive disturbance (Tarrés et al., 2006; Tummaruk et al., 2009a). It has been demonstrated that 15–20% of the sows are removed from herd while they can produce only one litter, and >50% of them are removed before attaining the fifth parity (Engblom et al., 2007). These indicate that rearing sows with bad performance is prone to have the sows with low productivity, contributing to be removed rapider than they should be. Undertaking research, thereby, in order to determine appropriate indicators in selecting replacement gilts are considered paramount. The objective of the present study was to investigate an influence of age at first estrus, body weight, and ADG of replacement gilts on their subsequent reproductive performance as sows.

2. Materials and methods

2.1. Animals and managements

The current study was performed in a commercial swine herd in the middle part of Thailand. The total number of sow on production was approximately 3500 sows. In total, 4243 completed records of Landrace × Yorkshire F1 crossbred gilts entering the herd during 2006–2008 were included in the study. The replacement gilts were brought from a swine breeding herd and were kept in the gilt pools for at least 60 days before sending to the breeding unit. All the replacement gilts were vaccinated against foot-and-mouth disease virus (FMDV), classical swine fever virus (CSFV), Aujeszky's disease virus (ADV), porcine parvovirus (PPV) and porcine reproductive and respiratory syndrome virus (PRRSV) between 154 and 210 days of age. Moreover, an acclimatization was conducted before service, by grouping the replacement gilts with the weaned sows selected for removal for about 28 days. The acclimatization process was initiated by introducing such weaned sows to the gilts' pen at 154–196 days of age with a ratio of one sow per 6–10 gilts. The sows used for acclimatization were rotated on a weekly basis and were removed from the herd after acclimatization. Using this acclimatization process, the gilts were exposed to many types of viral pathogens circulating within the herds (e.g., PRRSV, PPV and enterovirus) before sending to the breeding unit.

The gilts were kept in a pen by a group size of 15–20 gilts/pen with a density of 1.5–2.0 m²/head. A fence line boar contact was applied to the gilts for estrus induction from 168 to 224 days of age. The detection of estrus and the boar exposure were routinely performed on a daily basis until the gilts exited the gilt pools. Estrus detection was carried out by back pressure test, together with an observation of the reddening and swelling of the vulva. Those expressing a standing response in front of the boar with clear vulvar symptoms were defined as beginning of estrus. The estrus detection was monitored by experienced technicians; date of standing estrus was daily recorded into the herd book.

Gilts were accommodated in conventional–open houses, providing with a natural light for 10–12 h per day. The outdoor 24-h average temperature and humidity in the area of study during 2006–2008 were 29.4 °C/72.4%, 28.5 °C/79.7% and 27.1 °C/64.2% in the hot (from 15 February to 14 June), rainy (from 15 June to 14 October), and cool (from 15 October to 14 February) seasons, respectively. The average minimum–maximum daily temperatures were 24.9–35.0 °C, 24.9–33.3 °C and 22.4–32.7 °C in the hot, rainy, and cool seasons, respectively. Temperature inside the houses was controlled by electrical fans and water sprinklers to help reduce high ambient temperature.

The gilts were weighed before being sent to the breeding unit. ADG from birth to exiting the gilt pools was calculated [ADG (g/day)=((body weight when exiting the gilt pool − 1.5)/age at exit) × 1000] (Tummaruk et al., 2009b). Flushing was performed about 10–14 days before mating. In general, the herd was recommended to breed the replacements at age 224 days onwards with a body weight of, at least, 130 kg at the second or later observed estrus. The gilts reaching 224 days of age and showing estrus at least once were weighed and sent to the breeding unit. All of the gilts were mated by artificial insemination and were fed by commercial feed (Mittraphap Feed Mill Co. Ltd., Lopburi, Thailand) formulated by rice–corn–soybean–fish base containing 14.5–18.5% crude protein (CP), 3050–3250 kcal/kg metabolizable energy (ME), and 0.9–1.1% lysine. Pregnant gilts and sows were fed twice a day (1.5–3.5 kg/day/head) of gestation feed (3050 kcal/kg ME, 14.5% CP and 0.9% lysine), and lactating sows were fed with 5.0–7.0 kg/day of lactation feed (3250 kcal/kg ME, 18.5% CP and 1.1% lysine).

2.2. Gilt classification

The replacement gilts were classified by age at first estrus, body weight at entering the breeding unit, and ADG. The classification criteria were based on both frequency distribution of the three parameters (Fig. 1) and the number of observations in each group. Each class of the parameters represented different characters of the gilts (e.g., from poor to excellent) and included at least 100 gilts. In addition, the criteria for classifying the gilts were also decided based on a number of previous studies demonstrating the physiological limitation of these parameters in gilts reared under tropical climate (Tummaruk et al., 2007, 2009b). For age at first estrus, categorization into five groups was performed: ≤180 days ($n=487$), 181–200 days ($n=916$), 201–210 days ($n=1074$), 211–220 days ($n=772$), and ≥221 days ($n=391$). For body weight, the gilts were classified into six groups: ≤130 kg ($n=295$), 131–135 kg ($n=680$), 136–140 kg ($n=1652$), 141–145 kg ($n=723$), 146–150 kg ($n=301$), and >150 kg ($n=147$). For ADG, the gilts were divided into four groups: ≤550 ($n=433$), 551–600