Abstract W61

Factors affecting weaning-to-first service interval in a Landrace-Large White swine population in Northern Thailand

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SUMMARY

Swine litter records from 2,596 sows (12,974 records) collected between 1989 and 2008 were used to determine and characterize factors affecting weaning-to-first service interval (WSI). Sows were raised in an open-house system in the northern part of Thailand and received similar feeding and management. Breed groups of sows were Landrace (L), Large White (Y) and their reciprocal crossbreds (LY and YL). Parity of sow was classified as 1, 2, 3, 4, 5, 6, and $\geq$ 7. Seasons were winter (November to February), summer (March to June) and rainy (July to October). Preliminary analyses showed no affect of age at farrowing and number of piglets at weaning on WSI. Thus, the model for WSI contained the fixed effects of year-season of farrowing of the sow, parity of the sow, lactation length, and breed group of sow, and a random residual effect. Year-season of farrowing was an important source of variation (P < 0.01). Range of WSI was from 4.60 ± 0.51 days (1991-summer) to 9.22 ± 0.87 days (1989-rainy). ***The WSI was longer (P < 0.01) for first-parity sows (7.91 ± 0.12 days) than for sows of other parities (5.72 ± 0.15 to 6.10 ± 0.12). Landrace sows had similar WSI (5.89 ± 0.09 days) to Y sows (6.00 ± 0.09 days). Crossbreds LY sows (6.23 ± 0.16 days) and YL sows (6.67 ± 0.16 days) had longer WSI than purebreds sows (P < 0.01). Heterosis estimates were 0.29 days (4.79%) for LY sows, and 0.73 days (12.20%) for YL sows. Reciprocal differences for WSI indicated that LY sows had lower production costs than YL sows. Crossbred sows had longer WSI than purebred sows, perhaps due to lower adaptability to tropical conditions and unmet higher nutritional requirements.***

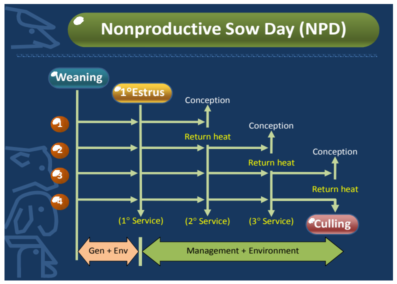
INTRODUCTION

Improvement of sow efficiency in current commercial swine production systems has focused mostly on increasing number of piglets born. However, non-productive sow days, measured either as weaning-to-first service interval (WSI) or as interval from weaning to first service of first estrus, has been frequently ignored. Weaning-to-first service interval is an economically important trait in commercial swine production because longer WSI periods increase maintenance costs and decrease sow efficiency. Researchers have found numerous factors (season, environmental temperature, nutrition, photoperiod, lactation length, parity, breed, management) to have an effect on WSI. In particular, high temperature and humidity in tropical countries may extend the WSI period. Few studies have investigated the effect of genetic and environmental factors on WSI in Thailand. A reduction in WSI under Thai tropical conditions would help increase sow efficiency and lower production costs for Thai swine producers. ***Thus, the objective of this study was to characterize genetic and environmental factors affecting WSI in a Landrace-Large White commercial swine population raised under tropical environmental conditions in northern Thailand.***

MATERIALS AND METHODS

Data, Animals, and Management. The dataset contained 12,974 litter records from 2,596 sows collected from 1989 to 2008 in a commercial swine population located in the province of Chiang Mai, northern Thailand. The average temperature in this region was 26.2°C (ranged from 12 to 38°C), and the mean relative humidity was 71.6% (ranged from 40 to 90%). Seasons were classified as winter (November to February), summer (March to June), and rainy (July to October).

Sows were kept in an open-house system. Cooling systems were foggers for breeders and a dippers for farrowing-nursling sows, and they were activated when the ambient temperature was higher than 33°C. Breeder sows were fed 2.5 kilogram of feed per day (16% crude protein and 3,200 to 3,500 kcal/kg gloss energy) divided into 2 feeding times (7:00 and 13:00). Farrowing-nursling sows were fed 5 to 6 kilograms of feed per day (17 to 18% crude protein and 4,060 kcal/kg gloss energy) separated into 4 feeding times (7:00, 10:00, 13:00, and 15:00). Piglets were weaned at around 26 days after parturition. Estrus of gilts and sows was detected by boar exposure, and artificially inseminated twice with semen from the same boar. The first insemination occurred 12 hours after estrus was detected, and the second one 12 hours later.



Traits and Data Preparation. Weaning to first service interval (WSI) was measured as the length of time in days between weaning date and date of first service after weaning. If the value of WSI was longer than 25 days, it was truncated to 25 days because sows not expressing estrus within 25 days of weaning were usually culled (Johnson, 1997; Ehlers et al., 2005). Breed group of sows was classified as Landrace (L), Large White (Y), and reciprocal crossbreds (LY and YL). Sow parity was defined as 1, 2, 3, 4, 5, 6, and $\geq$ 7. Sows with lactation length (LL) shorter than 7 days were culled, and piglets were weaned at or before 35 days. Thus, LL was limited to a range from 7 to 35 days.

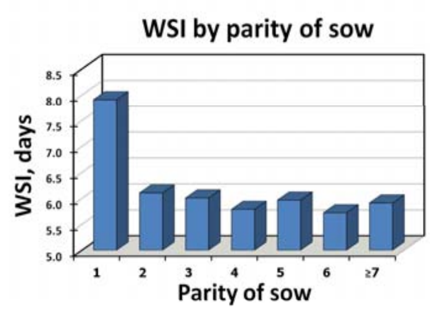
Data Analysis. Farrowing year-season (FYS), parity (PR), lactation length (LL), breed group (BG), age at farrowing (AF), and number of piglets weaned (NPW) were tested for their effect on WSI using the GLM procedure of SAS. Preliminary analyses showed non-significant effects of NPW and AF. Thus, the final model for WSI contained the fixed effects of FYS, LL, PR and BG, and a random residual effect. Least square means (LSM) for WSI were estimated for all subclasses of the factors included in the model.

Heterosis for WSI was calculated using LSM for purebred and crossbred groups. Heterosis differences (HD) were calculated for each crossbred progeny group (LY and YL) separately as the difference between crossbred progeny group LSM and the average LSM of the parental purebred groups (L and Y). Heterosis percentages (HP) for LY and YL were obtained as 100 times their HD divided by the average parental purebred LSM.

RESULTS AND DISCUSSION

The overall mean for WSI of sows in this population was 6.26 ± 4.53 days. Factors affecting WSI were FYS, LL, PR and BG (P < 0.01).

Farrowing Year-Seasons. Year-season of farrowing was an important source of variation for WSI (P < 0.01). Range of WSI was from 4.60 ± 0.51 days (1991-summer) to 9.22 ± 0.87 days (1989-rainy). ***This wide range of WSI across year-seasons may have been influenced by variability in climatic conditions (temperature and humidity), ability of temporary workers, and adaptability of imported purebred sows during the period of the study.***



Parity. The WSI was longer (P < 0.01) for first-parity sows (7.91 ± 0.12 days) than for sows of other parities (5.72 ± 0.15 to 6.10 ± 0.12). Longer WSI in primiparous sows may have been related to higher nutritional requirements for their own growth than those of multiparous sows. These higher nutritional demands for growth in addition to nutritional demands to produce milk for their first litter may have strained their ability to return estrus as quickly as multiparous sows weaning. Multiparous sows, being more mature than primiparous sows, may have had more energy reserves for returning to estrus after weaning sooner. In addition, multiparous sows normally have a larger number of receptors for reproductive hormones conducing to a fuller expression of estrous. Thus, estrus could be more easily detected in multiparous than in primiparous sows. More difficult estrus detection in primiparous sows may have affected service date, potentially making their WSI longer.

Lactation Length. The estimate of the regression coefficient for WSI on LL was -0.14 ± 0.02 days WSI/day LL (P < 0.01). This value indicated that WSI decreased by 0.14 days for each day of increase in LL. This negative relationship suggested that a combined period of LL and WSI may be sufficient to allow a normal reproductive cycle to continue with a successful pregnancy because the uterine environment appears to be ready to maintain pregnancy 21 to 28 days postpartum (Palmer et al., 1965; Mabry et al., 1996).

Breed Groups. Purebred L sows had similar WSI (5.89 ± 0.09 days) to Y sows (6.00 ± 0.09 days) under the environmental conditions of northern Thailand. On the other hand, crossbred LY sows (6.23 ± 0.16 days) and YL sows (6.67 ± 0.16 days) had longer WSI than purebreds sows (P < 0.01), and LY crossbreds had shorter WSI than their reciprocal YL crossbreds (P < 0.05). The main purpose for producing crossbred sows in this commercial farm was to increase number of piglets born alive (9.38 ± 0.06 piglets for L, 9.21 ± 0.06 piglets for Y, 9.40 ± 0.10 piglets for LY, and 9.76 ± 0.10 piglets for YL); WSI was not considered. However, this mating scheme produced an undesirable effect: higher WSI in crossbred sows, and consequently higher costs of production. Higher WSI in crossbred sows may be an indication that they were less adapted than purebred sows under northern Thailand tropical conditions. Alternatively, they may simply reflect a redistribution of nutrients to compensate for a higher level of milk production needed to feed larger litters of piglets in crossbred sows. Perhaps a higher level of nutrition for crossbred sows lower WSI to comparable levels to those of purebred sows.

Further studies are needed to evaluate the relationship between level of nutrition and breed groups as well as associations between WSI and production traits such as number of piglets born alive and weaning weight of piglets. Information from these studies will help design a more comprehensive swine mating and selection strategy in northern Thailand.

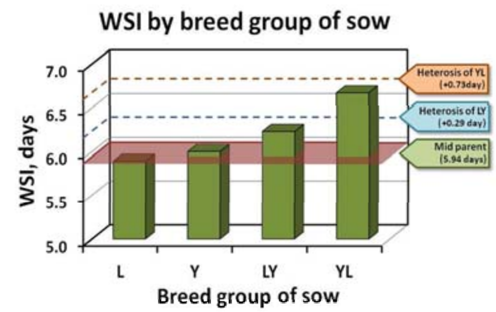


Table 1. Least square means , standard error, and heterosis for weaning to first service interval (WSI) by breed group[1]

Breed Group	Number of sows	WSI (days)	Heterosis (days)	Heterosis (%)
Landrace (L)	5,741	5.89 ± 0.09[a]	-	-
Large White (Y)	4,136	6.00 ± 0.09[ab]	-	-
Landrace x Large White (LY)	936	6.23 ± 0.16[b]	0.29	4.8
Large White x Landrace (YL)	952	6.67 ± 0.16[c]	0.73	12.2

[1]Different superscripts indicate P < 0.05

Heterosis. Heterosis estimates for WSI were 0.29 days (4.8%) for LY sows, and 0.73 days (12.2%) for YL sows. Differences in heterosis effects for WSI between reciprocal crossbred groups may be related to differences in allocation of nutrients for reproduction (number of piglets born alive: 9.40 ± 0.10 piglets for LY, and 9.76 ± 0.10 piglets for YL; P < 0.01) and milk production (number of piglets weaned; 8.29 ± 0.09 piglets for LY, and 8.38 ± 0.09 piglets for YL). Crossbred YL sows may have depleted their energy reserves to a greater extent than LY sows, thus they needed more time (longer WSI) to cope with their energy balance and return to their reproductive cycle. Reciprocal differences also suggested that LY sows had lower production costs due to shorter WSI than YL sows.

FINAL REMARKS

- ***Primiparous sows had longer WSI than multiparous sows***
- ***There was a low negative association between WSI and lactation length***
- ***Landrace and Large White sows had similar WSI***
- ***Crossbred sows had longer WSI than purebred sows***
- ***Reciprocal LY sows had shorter WSI than YL sows***

REFERENCES

Ehlers, M. J., J. W. Mabry, J. K. Bertrand, and K. J. Stalder. 2005. Variance components and heritabilities for sow productive traits estimated from purebred versus crossbred sows. J. Anim. Breed. Genet. 122: 318-324.

Johnson R. 1997. Genetic basis for variation in weaning to estrus and weaning to farrowing interval in sows. *Proc.* NSIF http://www.nsif.com/conferences/1997/johnson.htm.

Mabry, J. W., M. S. Culberson, and D. Reeves. 1996. Effects of lactation length on weaning-to-first-service interval, first-service farrowing rate, and subsequent litter size. Swine Health and Production 4: 185-188.

Palmer, W. M., H. S. Teague, and W. G. Venzke. 1965. Histological changes in the reproductive tract of the sow during lactation and early postweaning. J. Anim. Sci. 24:1117–1125.