Abstract W447

Effect of Proportion of Non-Productive Sow Days on Lifetime Production Traits in Swine under Thai Tropical Conditions

Udomsak Noppibool[*], Skorn Koonawootrittriron[*], Mauricio A. Elzo[†] and Thanathip Suwanasopee[*]

[*]Department of Animal Science, Kasetsart University, Bangkok 10900, Thailand

[†]Department of Animal Sciences, University of Florida, Gainesville, FL 32611-0910, USA

SUMMARY

The proportion of non-productive days (**PNPD, %**) over the lifetime of a sow is an indicator of her production efficiency. Sows with lower **PNPD** would have larger production efficiency. The objective of this study was to investigate the effect of **PNPD** on lifetime number of piglets born alive (**LBA**), lifetime number of piglets weaned (**LPW**), lifetime piglets' birth weight (**LBW**), lifetime piglets' weaning weight (**LBW**), lifetime non-productive sow days (**LNPD**), and length of productive life (**LPL**). The dataset included 1,222 lifetime production records from 882 Landrace (**L**) and 340 Yorkshire (**Y**) sows that had their first farrowing from 2001 to 2008. Sows received similar management and health care under an open-house system in Thailand. The fixed linear model considered the fixed effects of first-farrowing year-season, breed of sow (**L** and **Y**), age at first farrowing and **PNPD**, and the random effect of residual. First-farrowing year-season influenced (P < 0.0001) **LBW** and **LWW**. Age at first farrowing had no effect on any trait. Breed of sow only affected **LPW** (P = 0.0109) and **LPL** (P = 0.0358). Yorkshire sows had larger **LPW** (52.50 ± 1.31 piglets vs. 48.67 ± 0.86 piglets) and longer **LPL** (772.55 ± 19.82 d vs. 727.68 ± 12.44 d) than **L** sows. Sows with higher **PNPD** had significantly (P < 0.0001) smaller **LBA** (-3.79 ± 0.42 piglets/%), **LPW** (-3.27 ± 0.37 piglets/%), **LBW** (-6.05 ± 0.70 kg/%), **LWW** (-25.63 ± 3.06 kg/%) and **LPL** (-48.99 ± 5.39 d/%), but larger **LNPD** (3.77 ± 0.26 d/%). These results indicated that reducing **PNPD** would increase the lifetime production efficiency of sows in this population.

INTRODUCTION

Lifetime production efficiency of sows is important for commercial swine production. Length of productive life (**LPL**; the number of days between sow age at first farrowing and age at weaning of her last farrowing) and lifetime non-productive days (**LNPD**; the sum of weaning-to-conception intervals for all parities of the sow, where conception was defined to be the day of insemination that resulted in pregnancy) are economically important traits. Increasing **LPL** and reducing **LNPD** of sows in the population would potentially reduce costs and increase profits. However, sows with longer **LPL** may have either shorter or longer **LNPD**. Similarly, sows with shorter **LNPD** may also have either shorter or longer **LPL**. Thus, the proportion of non-productive days over the lifetime of a sow (**PNPD**; 100 times the sum of non-productive days over all parities divided by the length of productive life; **100*LNPD/LPL**, %) is a reasonable parameter to evaluate sow lifetime production efficiency**.** However, **PNPD** studies were unavailable in Thailand. Sows with lower **PNPD** should have higher lifetime production efficiency. Swine producers could use sow **PNPD** as a management, culling, and genetic selection tool. Thus, the objective of this research was to ***evaluate the effect of PNPD on LBA, LPW, LBW, LWW, LNPD and LPL in Landrace and Yorkshire sows raised in an open-house system under Thai tropical conditions.***

MATERIALS AND METHODS

Data, Animals, and Traits. The dataset consisted of pedigree and phenotypic records from 882 Landrace (**L**) and 340 Yorkshire (**Y**) sows farrowed from 2001 to 2008 in a commercial swine farm in Thailand. All sows had completed their productive life and had been removed from the production system. Traits were the proportion of non-productive days (**PNPD**, %), lifetime number of piglets born alive (**LBA**, piglets), lifetime number of piglets weaned (**LPW**, piglets), lifetime piglets' birth weight (**LBW**, kg), lifetime piglets' weaning weight (**LWW**, kg), lifetime non-productive days (**LNPD**, d), and length of productive life (**LPL**, d). The **PNPD** was defined as the sum of non-productive sow days divided by the length of productive life. The **LPL** was defined as the number of days between the date at first farrowing and the date at last weaning or removal from the herd. The **LNPD** was defined as the number of days that a sow or gilt is neither pregnant nor nursing piglets. The **LBA**, **LPW**, **LBW**, and **LWW** were the sum of all individual measurements of each trait during the lifetime of a sow.

Climate, Nutrition, and Management. Seasons were winter (November to February; 3.8 °C to 37.7 °C and 49.0 % to 83.0 % RH), summer (March to June; 13.8 °C to 42.4 °C; 44.0 % to 84.0 % RH), and rainy (July to October; 14.0 °C to 39.0 °C; 74.0% to 90.0 % RH). All gilts and sows were managed in an open-house system with foggers (gilts and non-lactating sows) or dippers (nursing sows) that were activated when the ambient temperature rose above 33°C. All sows and gilts received the same management, feeding and health care. Non-lactating sows and gilts received 2.5 kg of concentrate daily (16% of crude protein and 3,200 to 3,500 kcal/kg of energy; two feeding times). Nursing and farrowing sows were fed 5 to 6 kg of concentrate daily (17 to 18% of crude protein and 4,060 kcal/kg of energy; four feeding times). Mating was done by artificial insemination using fresh semen all year round. Reasons for culling included health problems and low production performance.

Statistical Analysis. Means and SD in this population were 58.55 (SD = 24.38) piglets for **LBA**, 50.61 (SD = 21.79) piglets for **LPW**, 94.99 (SD = 40.65) kg for **LBW**, 381.43 (SD = 180.16) kg for **LPW**, 31.88 (SD = 15.88) d for **LNPD**, 746.17 (SD = 313.33) d for **LPL**, and 4.45 (SD = 1.66) % for **PNPD**. Individual traits (***LBA***, ***LPW***, ***LBW***, ***LWW***, ***LNPD***, and ***LPL***) were analyzed using the mixed model procedure of SAS. The model considered first farrowing year-season, breed group (**L** and **Y**), age at first farrowing, and proportion of non-productive days as fixed effects, and residual as a random effect. Least squares means for all traits were estimated for **L** and **Y**, and compared using t-tests. Significant differences were considered at $\alpha = 0.05$.

RESULTS AND DISCUSSION

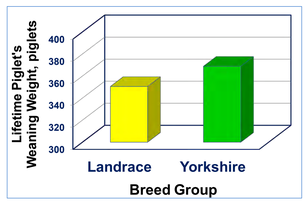
First farrowing year-season significantly influenced **LBW** and **LWW** (P < 0.0001) only. The least squares means (LSM) ranged from 47.40 ± 5.75 piglets (2002-summer) to 64.70 ± 3.24 piglets (2008-rainy) for **LBA**, 43.18 ± 5.13 piglets (2002-summer) to 56.70 ± 2.45 piglets (2006-winter) for **LPW**, 53.29 ± 10.81 kg (2002-rainy) to 107.15 ± 5.34 kg (2008-summer) for **LBW**, 192.35 ± 47.23 kg (2002-rainy) to 447.03 ± 23.35 kg (2008-summer) for **LWW**, 28.04 ± 3.61 (2002-summer) to 35.15 ± 2.26 d (2003-rainy) for **LNPD** and 664.68 ± 54.01 d (2008-winter) to 812.04 ± 34.19 d (2007-rainy) for **LPL**. The LSM of lifetime production traits (**LBA**, **LPW**, **LBW** and **LWW**) tended to increase across year-season subclasses, whereas year-season trends were close to be zero for **LNPD** and **LPL**. Increases in lifetime production traits may have been due to improvements in management, nutrition as well as sow replacement practices over the years of the study.

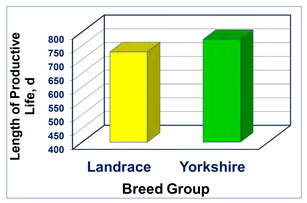
Table 1. Least squares means for lifetime production traits and length of productive life in Landrace and Yorkshire

Traits	Breed Groups	
	Landrace	Yorkshire
Lifetime piglets born alive, piglets	57.42 ± 0.97	57.51 ± 1.47
Lifetime piglets weaned, piglets	48.67 ± 0.86[a]	52.50 ± 1.31[b]
Lifetime piglets' birth weight, kg	89.83 ± 1.64	88.24 ± 2.44
Lifetime piglets' weaning weight, kg	350.55 ± 7.12	368.86 ± 10.67
Lifetime non-productive sow days, d	31.15 ± 0.61	32.89 ± 0.92
Length of productive life, d	727.68 ± 12.44[a]	772.55 ± 19.82[b]

[a, b] Least squares means within the same row with different superscripts differed (P < 0.05)

The **L** and **Y** sows had similar LSM for **LBA**, **LBW**, **LWW**, and **LNPD** (**Table 1**). However, **Y** sows had higher LSM than **L** sows for **LPW** (52.50 ± 1.31 piglets vs. 48.67 ± 0.86 piglets; P = 0.0109) and for **LPL** (772.55 ± 19.82 d vs. 727.68 ± 12.44 d; P = 0.0358). This result differed from Keonouchanh (2002), who reported that **L** and **Y** had similar **LPL**. In a Polish pig population, Sobczynska *et al.* (2013) reported that **L** sows had shorter, but not significant than **LPL** than **Y** sows. Similar results was found by Serenius and Stalder (2004) in Finish pig populations. Differences between **L** and **Y** for **LPL** found here were likely due to a combination of breed differences and adaptability animals of each breed to the open-house environmental conditions in this production system.





Regression coefficient estimates of phenotypes from all traits on age at first farrowing were negative and had high standard errors. Estimates were -0.24 ± 0.15 piglets for **LBA** (P = 0.1200), -0.16 ± 0.14 piglets for **LPW** (P = 0.2508), -0.26 ± 0.25 kg for **LBW** (P = 0.2927), -1.52 ± 1.10 kg for **LWW** (P = 0.1661), -0.05 ± 0.10 d for **LNPD** (P = 0.6303), -1.68 ± 1.95 d for **LPL** (P < 0.3891) per day of age at first farrowing. ***These regression estimates implied that age at first farrowing was not a major source of variation for lifetime production traits, non-productive sow days, and length of productive life in this swine population.*** Sows that had their first farrowing at younger ages had similar lifetime production and length of productive life as sows that farrowed at older ages.

Table 2. Regression coefficients of lifetime production traits and length of productive life on proportion of non-productive days

Traits	Regression Coefficients for PNPD (%)	P-value
Lifetime piglets born alive, piglets	-3.79 ± 0.42	< 0.0001
Lifetime piglets weaned, piglets	-3.27 ± 0.37	< 0.0001
Lifetime piglets' birth weight, kg	-6.05 ± 0.70	< 0.0001
Lifetime piglets' weaning weight, kg	-25.63 ± 3.06	< 0.0001
Lifetime non-productive sow days, d	3.77 ± 0.26	< 0.0001
Length of productive life, d	-48.99 ± 5.39	< 0.0001

The **PNPD** significantly affected all traits (P < 0.0001). Estimates of the regression coefficient of each trait on **PNPD** (**Table 2**) show that for each 1% increase in **PNPD** there will be a decrease in **LBA** (-3.79 ± 0.42 piglets/%), **LPW** (-3.27 ± 0.37 piglets/%), **LBW** (-6.05 ± 0.70 kg/%), **LWW** (-25.63 ± 3.06 kg/%), and **LPL** (-48.99 ± 5.39 d/%), and an increase in **LNPD** (3.77 ± 0.26 d/%). Thus, reducing **PNPD** would improve **LBA**, **LPW**, **LBW**, **LWW**, **LNPD** and **LPL**.

PNPD = 100*LNPD / LPL

The **PNPD** is the proportion of **LNPD** (non productive days) over **LPL.** Larger **PNPD** indicate sow reproductive failure during return to estrus and conception after weaning. Sows with larger **PNPD** tended to have longer weaning-to-first-mating intervals, longer weaning-to-conception intervals, lower lifetime production, and higher risk of culling due to problems with their reproductive performance. The opposite occurred with productively efficient sows that had small **PNPD** (small **LNPD** and long **LPL**) values. ***Thus, PNPD (100*LNPD/LPL) was a good indicator of sow lifetime production efficiency in this population.*** It could be used as a tool for management and culling decisions, and for genetic improvement programs. Selecting larger numbers of productively efficient sows as parents will increase little size and number of piglets weaned in future generations (Sasaki and Koketsu, 2008).

FINAL REMARKS

- ***First farrowing year-season influenced LBW and LWW.***
- ***Age at first farrowing was not significant for any trait.***
- ***Y sows had larger LPW and longer LPL than L sows.***
- ***Sows with larger PNPD had smaller LBA and LPW , lighter LBW and LWW, shorter LPL , and longer LNPD.***

LITERATURE CITED

Keonouchanh, S. 2002. Genetic analysis of sows longevity and lifetime productivity in two purebred swine herds. MS Thesis. Chulalongkorn University, Thailand. 80 p.

Sasaki, Y. and Y. Koketsu. 2008. Sows having high lifetime efficiency and high longevity associated with herd productivity in commercial herds. Livest. Sci. 118: 140–146.

Serenius, T. and K.J. Stalder. 2004. Genetics of length of productive life and lifetime prolificacy in the Finnish Landrace and Large White pig populations. J. Anim. Sci. 82: 3111-3117.

Sobczynska, M., T. Blicharski and M. Tyra. 2013. Relationships between longevity, lifetime productivity, carcass traits and conformation in Polish maternal pig breeds. J. Anim. Breed. Genet. DOI:10.1111/jbg.12024.