



Selection for uterine capacity improves lifetime productivity of sows[☆]



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ABSTRACT

Selection for 11 generations for uterine capacity (UC) increased litter size in gilts by 1.6 more fully formed pigs at birth compared to an unselected control line (CO) despite averaging one less ovulation. The objective of the present study was to quantify line by parity interactions and characterize litter performance traits of sows in each line at later parities. Gilts farrowed in contemporary groups of 19 litters and were maintained through four parities if successfully mated in that contemporary group. A total of 243 litters and 2639 piglets were analyzed. Fixed effects of farrowing group, line, parity (1–4), and two-way interactions involving line were fitted. Sire ($n = 57$) of the sow within farrowing group and line was fitted as a random effect. No significant line by parity interactions were observed. Parity effects were detected ($P < 0.01$) for individual piglet birth weight, pre-weaning gain, and weaning weight. Parity effects were also detected ($P < 0.05$) for total number born, average and total litter birth weight, and average and total litter weaning weight. Selection line differences for litter traits were detected ($P < 0.05$) for number stillborn piglets and approached significance ($P = 0.06$) for number of piglets weaned. Retention of sows in the herd was greater ($P < 0.05$) with an average of 2.33 parities for the UC line females compared to 1.87 parities for the CO line. This resulted in favorable cumulative lifetime productivity of the UC line for total number of piglets born, number of piglets born alive, litter birth weight, number of piglets weaned and litter weaning weight.

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1. Introduction

Economic potential of the swine industry could be enhanced by improving uterine capacity (UC), a component trait of litter size. Increased lifetime productivity of sows would be realized through improved prenatal survival. However, UC is difficult to select for directly and most improvement programs have utilized indirect measures to improve component traits, such as number of live

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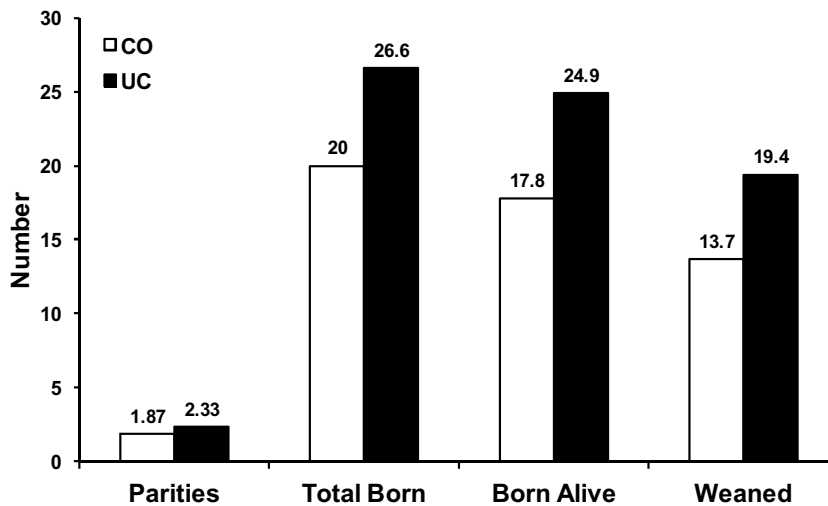


Fig. 1. Cumulative productivity per sow for average number of parities and number of pigs produced through a maximum of four parities; fixed effect of selection line was significant ($P < 0.05$) for all traits presented.

pigs at day 5. These indirect measures can put some pressure on variation in UC or piglet survival if ovulation rates are not limiting. Previous selection for 11 generations in swine for UC resulted in an estimated 1.6 more live pigs of similar birth weight at term compared to an unselected control line (CO; Freking et al., 2007). This direct selection for uterine capacity was associated with a slight decrease in ovulation rate but increased survival of fetuses, primarily by increasing survival between day 25 and 45 of gestation without altering fetal or placental weights. At day 45 of gestation approximately 64% of ova shed by UC females resulted in a live fetus, compared to only 55% of ova shed by CO females when ovulation rate is not limiting using the unilateral hysterectomy ovariectomy (UHO) model. Losses during gestation continued to occur from day 45 to 105, but line differences in number of fetuses at day 45 of gestation were essentially maintained to day 105 (Freking et al., 2007). Previous research with this selected population indicated there were line differences in gilt litters, under batch farrowing management systems. There has been no data reported on this unique selection line to quantify differences observed in gilts under intact conditions rather than UHO, and how sows are affected by parity in a continuous flow production system that is common to the current swine industry. Some information is available in the literature to suggest uterine capacity can be increased in later parities associated with selection on component traits of litter size (Gama and Johnson, 1993). However, the line in the current study is unique with respect to its independence from the ovulation rate component trait that is a part of other index selection lines.

Large litters of high-quality piglets from females that breed and rebreed at regular intervals with minimal involuntary culling provide the best opportunity for long-term profitability of the swine industry (Moeller et al., 2004). The objective of the present study was to establish the impact of direct selection for uterine capacity on potential line by parity interactions that may exist when intact gilts are able

to express lifetime performance under a continuous flow farrowing system.

2. Materials and methods

2.1. Animal populations

This study was conducted using standard production and experimental practices that were in accordance with the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 2010) and were approved by the U.S. Meat Animal Research Center (USMARC). A four-breed composite with equal contributions from Chester White, Landrace, Large White, and Yorkshire breeds was formed to estimate breed, heterosis, and recombination effects (Cassady et al., 2002). From a common base generation of this composite produced in 1986, selection was initiated during 1988 within two replicated seasons for ovulation rate estimated from laparoscopic examination of gilts in the ovulation rate (OR) line, increased uterine capacity of UHO surgically-altered gilts in the UC line, while an unselected CO line was maintained. The selection experiment proceeded for 11 generations and then all three lines were evaluated for responses in component traits (Leymaster and Christenson, 2000). Subsequent to this terminal evaluation, each line was maintained under no intentional selection pressure, in two replicated seasons farrowing annually in either March or September. Genetic diversity within each selection line and season was maintained by an intended target of ten boars and 40 gilts farrowed. Data reported for the current manuscript were generated following a change in the management system to continuous flow farrowing and keeping females of the CO and UC lines through four parities. Twenty contemporary farrowing groups including both lines produced between 2011 and 2014, with a maximum of 19 litters per contemporary group contributed to the current study (Table 1).

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