Management and Nutrition of the Replacement Gilt

A thesis submitted in total fulfillment of the requirements for the degree of DOCTORATE of PHILOSOPHY

By

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Abstract

Replacement gilts and early parity sows constitute a large, and increasing, proportion of modern breeding herds. Breeding herd profitability is therefore increasingly dependant on the efficiency of gilt management strategies as well as litter size at first farrowing; however, incidences of reproductive failures and small first litter sizes are common within cohorts of replacement gilts. Hence, this thesis had two primary aims which were addressed in four experiments; one, to identify whether the puberty stimulation and mating strategies developed for genotypes of 20 to 30 years ago are suitable for today's heavier yet leaner genotypes; and two, to better understand the influence of pre-pubertal growth rate and metabolic status on reproductive maturation, puberty attainment and potential litter size.

In experiment 1, 192 Large White/Landrace crossbred gilts were used to compare the effects on puberty attainment of commencing boar exposure at 161, 182 or 203 days of age, and the effect of first mating gilts at either the pubertal or second oestrus on ovulation rate and early embryo survival. Gilts were artificially inseminated at the allocated oestrus, with the reproductive tracts collected at 22.8 $\pm$ 0.4 days after first mating (mean $\pm$ S.E.M), and the numbers of corpora lutea and viable embryos recorded. Delaying first boar contact until 182 or 203 days of age significantly ($P < 0.01$) reduced days-to-puberty and increased the proportion of gilts attaining puberty within 10 days of start of boar exposure. Gilt age at mating had no effect on potential litter size; however, there was a tendency for gilts mated at their second oestrus to shed 0.6 more ova, and possess one more embryo at day 20 of pregnancy.

Experiment 2 determined the effects of long- (chronic) and short- (acute) term moderate dietary restriction on ovarian development and oocyte developmental competence in 161- and 175- day old, pre-pubertal gilts. Both chronic and acute periods of moderate feed restriction reduced the number of medium follicles present on the ovaries of 161- and 175-day old gilts, as well as the proportion of

oocytes reaching Metaphase II *in vitro.* However, feeding level during the 14 days prior to ovary collection had the greatest effect on follicular growth and oocyte quality. Experiments 3 and 4 investigated the effects of the same dietary treatments on the timing of puberty attainment in response to boar exposure and potential litter size following mating at the pubertal oestrus. Chronic dietary restriction during the pre-pubertal period delayed puberty attainment, but the timing of the pubertal response was unaffected by acute, moderate dietary restriction of previously well-fed gilts during the period immediately prior to, and coincident with, boar exposure. Acute dietary restriction or repletion stimulated an increase or decrease, respectively, in pubertal ovulation rates; however, neither the number of viable embryo present on day 22 of gestation nor embryo survival were affected by the nutritional treatments used in these studies.

Overall, these results demonstrate that the timing and synchrony of puberty attainment is significantly improved when gilts first receive boar exposure at 182 days of age (or older). It is, therefore, concluded that sexual maturity, as measured by responsiveness to boar contact, occurs later in modern genotypes. It is also evident that within the age range investigated, delaying first mating until the second oestrus does not significantly increase either ovulation rate or embryo number at day 20 post-mating. Further, the current data provide the first evidence that despite profoundly affecting the size and morphology of the antral follicle pool as well as pubertal ovulation rates, subtle alterations in dietary intake have no affect on the number or proportion of embryos surviving the pre-and peri-implantation period. It is evident the litter size of gilts mated at the pubertal oestrus is not determined by the number of ova shed, with the current data demonstrating that increasing ovulation rates results in increased embryo mortality.

Declaration

This thesis is a record of original work and contains no experimental material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

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William van Wettere

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