GENETIC PARAMETERS FOR LEAN MEAT YIELD, MEAT QUALITY, REPRODUCTION AND FEED EFFICIENCY TRAITS FOR AUSTRALIAN PIGS

by

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DECLARATION

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in prepearing this thesis, and all sources used, have been acknowledged in this thesis

Signature

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ABSTRACT

Data from 3350 Large White and Landrace boars, recorded between July 1992 and June 1995, was used to estimate genetic parameters for performance, carcase and meat quality traits. Manufacturing traits were available on a subset of approximately 1000 animals. This data set was linked with data from 6050 Large White and Landrace sows that farrowed from January 1990 to March 1995.

In total, 36 traits were analysed including average daily gain from three to 18 weeks (ADG1) and from 18 to 22 weeks (ADG2), life time average daily gain (ADG3), feed intake (FDINT), feed conversion ratio (FCR) and lean meat growth (LEANG). Heritability estimates for these traits were 0.27, 0.13, 0.27, 0.23, 0.15 and 0.28, respectively. Carcase traits included real time ultra sound and Hennesy Chong measurements. Heritability estimates for backfat measurements and lean meat percentage ranged from 0.44 to 0.63 while from the two muscle depth measurements only muscle depth recorded with real time ultra sound was heritable (0.21). Further carcase traits analysed were the weight of the whole back leg (BLW, $h^2 = 0.22$) and the slash boned ham (LMW, $h^2 = 0.38$). Meat quality traits included pH45 and pH24, colour of the *m. longissimus dorsi* (CLD) and *m. multifidus dorsi* (CMD), drip loss percentage (DLP) and intramuscular fat content (IMF). Estimates of heritabilities were 0.15, 0.14, 0.29, 0.30, 0.23 and 0.35, respectively. Heritability estimates for ham yield (HAM) and middle yield (MID) were 0.11 and 0.06. Reproductive traits of the sow included litter size ($NBA_{1,2,3}$), litter birth weight ($LBW_{1,2,3}$) and average piglet weight at birth ($ABW_{1,2,3}$) for the first three parities as well as 21 day litter weight for the first parity ($LW21_1$). Estimates ranged from 0.07 to 0.22.

The genetic correlation between ADG1 and ADG2 was 0.32. Differences in age, housing system and gut filling at the beginning and end of testing contributed to this low relationship which might also be the reason for favourable genetic relationships between ADG1 and leanness in contrast to unfavourable genetic correlations between ADG2 and leanness. The favourable relationship between ADG1 and leanness might be due to a lower feed intake capacity in regard to the protein deposition capacity of these young boars. ADG1 is primarily during the protein accretion phase while ADG2 is during the fat accretion phase. Genetic

correlations between FDINT and backfat measurements ranged from 0.54 to 0.63 and was negative with LMW (-0.11).

Genetic correlations between meat quality traits reflected characteristics of pale soft and exudative (PSE) meat. An increase in IMF, FDINT and FCR was related to dark, firm and dry (DFD) meat. Genetic correlations between backfat measurements and ultimate meat quality (pH24, CLD, DLP) were not significantly different from zero. An increase in LMW will lead to a higher incidence of PSE (rg with DLP: 0.36).

Genetically, PSE meat is related to a lower HAM and a higher MID. PSE meat had a higher uptake of brine which was better retained in MID, since middles were left intact and not derinded and defatted. This explains positive genetic correlations between backfat and MID ranging from 0.27 to 0.43.

Reproductive performance of the sow in the first litter should be regarded as a different trait than performance in later parities (rg's from 0.52 to 0.79). $NBA_{1,2,3}$ were negatively correlated with ADG1,2,3 (rg's from -0.01 to -0.42) while $LBW_{1,2,3}$ and $ABW_{1,2,3}$ had positive genetic correlations with ADG ranging from 0.08 to 0.42. This indicates that reproductive traits should be analysed in a multitrait analysis.

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ABBREVIATIONS

PRODUCTION TRAITS:

ADG1	Average daily gain from three to 18 weeks
ADG2	Average daily gain in test station from 18 to 22 weeks
ADG3	Lifetime average daily gain
FDINT	Feed intake recorded in test station from 18 to 22 weeks
FCR	Feed conversion ratio defined as feed intake over growth rate, recorded in test station from 18 to 22 weeks
LEANG	Lean meat growth

CARCASE TRAITS:

LFDP2	Backfat depth at P2 measured with real time ultrasound
LFD3/4	Backfat depth between the third and fourth last ribs measured with real time ultrasound
LMD3/4	Muscle depth of m. longissimus dorsi between the third and fourth last ribs measured with real time ultrasound
FDP2	Backfat depth at P2 measured with Hennesy chong grading machine
FD3/4	Backfat depth between third and fourth last ribs measured with Hennesy Chong grading machine
MD3/4	Muscle depth between third and fourth last ribs measured with Hennesy Chong grading machine
BLW	Weight of whole left back leg
LMW	Weight of slash boned left back leg
LEAN	Lean meat percentage derived from Hennesy Chong measurements on carcase
LEANL	Lean meat percentage derived from real time ultrasound measurements on live animal

MEAT QUALITY TRAITS:

pH45	pH measured 45 minutes after slaughter
pH24	pH measured 24 hours after slaughter
CLD	L-value of Minolta chromamometer of *m. longissimus dorsi*

CMD L-value of Minolta chromamometer of *m. multifidus dorsi*

DLP Drip loss percentage

IMF Intra muscular fat content

MANUFACTURING TRAITS

HAM Ham yield expressed as percentage of ham weight after processing to green weight

HAMD Ham yield expressed as difference of ham weight after processing to green weight

MID Yield of middle expressed as percentage of middle weight after processing to green weight

MIDD Yield of middle expresses as percentage of middle weight after processing to green weight

REPRODUCTION TRAITS

$NBA_{1,2,3}$ Litter size in first to third parity

$LBW_{1,2,3}$ Litter birth weight in the first to third parity

$ABW_{1,2,3}$ Average piglet weight at birth in the first to third parity

$LW21_1$ Litter weight at 21 days in the first parity

FIXED EFFECTS AND COVARIATES

FS Farrowing season defined in three month classes

AI Artificial insemination

FU Farrowing unit

N Number of weighed piglets for litter weight at 21 days

Period Period of time between farrowing date and weighing date of litter