AN INTERDISCIPLINARY STUDY OF MATERNAL PRODUCTIVITY IN BEEF CATTLE

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ABSTRACT

Maternal productivity, defined as weight of cow-calf output per unit of feed consumed on an annual basis is complex with many component traits interacting with on-farm management to determine overall production efficiency. This thesis implemented an interdisciplinary research approach that integrated qualitative social science and quantitative animal science to examine the output components of maternal productivity. Such an approach generated an understanding about factors associated with maternal productivity from both an animal science perspective and also as perceived by seedstock breeders.

The initial qualitative research revealed divergence in seedstock breeder's perspectives on topics associated with maternal productivity. Specifically, attitudes to animal management with regard to grazing management, cow energy reserve fluctuation and the utilisation of fat reserves were varied. Breeder's attitudes on these topics were associated with divergence in perspectives on the importance of selection for production traits including yield, growth and milk compared with selection for perceived resilience traits including subcutaneous fat and earlier maturity pattern.

The outcomes from the initial qualitative research drove the analysis of animal performance data collected through the Cooperative Research Centre for Beef Genetic Technologies Maternal Productivity Project. These analyses included understanding

- the repeatability of cow body composition traits
- associations of Breedplan EBVs with cow energy reserves
- genetic correlations between cow body composition traits,
- associations between genetic merit, nutrition and cow body energy reserves with reproductive rate

Objectively measured body composition traits had moderate to high between time repeatability. In addition, Breedplan EBVs for EMA, Rib, Rump (P8) and IMF were closely related to the equivalent

ultrasound measure in Angus and Hereford cows at pre-calving and weaning in the first two parities. Breedplan carcass EBVs were not associated with cow body composition change during lactation. Together these results indicate that currently available Breedplan carcass EBVs change cow body composition, and that selection for increased fatness at a young age will result in cows that are fatter.

Cow body composition traits were moderately heritable and had high to very high between time genetic correlations indicating that at the genetic level, cow body composition traits are genetically very similar across time (pre-calving and weaning) and age (first and second parity).

P8 and Rib EBV and pre-calving P8 and rib fat depth were associated with several components of reproductive rate with varying effects depending on parity, calving season and nutrition. The importance of genetic and phenotypic fatness on reproductive rate was larger in autumn calving and low nutrition production systems.

Breeders viewed results presented on associations between reproductive rate and EBVs and energy reserves as unsurprising and also as supporting their varied perspectives and current selection direction. In addition, weighting of EBVs in a selection index was associated with variance in calving rate. The implications of these results are that the varied selection emphasis by breeders involved in this project may be appropriate.

Relationships between lifetime cow maternal productivity, supply chain profitability, on-farm production system and genetic merit need to be addressed to enable beef breeders to make informed animal selection and management decisions.

By working closely with livestock breeders, and listening to, and understanding their observations, perspectives and beliefs on maternal productivity, and also in analysing animal performance data, there has been considerable benefit in generating a greater understanding of the production system and the

interactions that occur within it. The outcome of this approach has been to firstly demonstrate and explain the varied perspectives held by seedstock breeders on associations between genetic merit and maternal productivity; and secondly, using animal performance data demonstrate how and why many of the observations and contrasting perspectives of breeders appear justified.

DECLARATION

I, Stephen Lee certify that this work contains no material that has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Stephen John Lee
Date:

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PUBLICATIONS

Lee S, Donoghue K, Hebart M, Pitchford W. (2011) Milk and weight EBVs are associated with cow and calf gain during lactation but carcass EBVs are not. Proceedings of 19th AAABG conference, Perth, 127-130.

Lee S, Nuberg I, Pitchford W. (2010) Interdisciplinary research raises concerns about selection for production on energy reserves in beef cows. Proceedings of 9th World Congress on Genetics Applied to Livestock Production, Leipzig.

Hancock B. and Lee S. (2010) Beef CRC Maternal Project Communications Workshop final report, Albury.

Lee S, Nuberg I, Pitchford W. (2009) Breeder perspectives on fat and female management. Proceedings of 18th AAABG, Adelaide, 600-603.

LIST OF ABBREVIATIONS

ABRI	Agricultural Business Research Institute
AGBU	Animal Genetics and Breeding Unit
AI	artificial insemination
BCS	body condition score
BWt	birth weight
CG	contemporary group
CI	calving interval
CRC	Cooperative Research Centre
CV	coefficient of variation
CWt	carcass weight
d	days
DTC	days to calving
EBV	estimated breeding value
EMA	eye muscle area
EPD	expected progeny difference
GL	gestation length
Hip Ht	hip height (cm)
ICL	independent culling level
IDR	interdisciplinary research
IMF	intramuscular fat
LL	lactation length
LMC	lean meat content
LSM	least square mean
M	male
Mat Pat	maturity pattern
Max	maximum
MCWt	mature cow weight
ME	metabolisable energy
mgt	management
Milk	Milk EBV
Min	minimum
Max	maximum
n.s.	not significant
NBA	number born alive

NFI	net feed intake
nut	nutrition
Obs	observation
obstime	observation time
P	P value (usually from F test)
P8	rump fat depth measured at P8 site
P8 EBV	Rump Fat EBV
PC	pre-calving
RBY	retail beef yield
RFI	residual feed intake
Rib EBV	Rib Fat EBV
r_G	genetic correlation
rib	rib fat depth
SD	standard deviation
se	standard error
Vp	phenotypic variance
W	weaning
Wt	weight
WTS	Interval from weaning to first service
*	$P < 0.05$
**	$P < 0.01$
***	$P < 0.001$