INVESTIGATIONS INTO VARIATION IN GROWTH PERFORMANCE OF CATTLE AT PASTURE

A dissertation submitted in partial fulfillment of the requirements for the Masters in Applied Science (Animal Science) at Massey University

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ERRATA

Page ii Line 19.	Bulls gained 18% *more weight* than steers…
Page ii Line 24.	1.45-1.70 *(not 1.45-170).*
Page ix.	Tables 2.2 -3.5 should be on Pages 35-54.
Page xiv.	M/D *ME concentration (MJ per kg DM).*
Page 8 Line 23.	….*exhibits……. It increases…*
Page 13 Line 7 *et seq.*	…*correlations…*
Page 13 Line 17.	…hybrid *vigour…*
Page 16 Line 3.	*Baker et al. (1992)*
Page 17 Line 6.	…than *Angus* cattle…
Page 17 Line 15.	Galbraith and Topps (1981),
Page 17 Line 26.	…less *favourable…*
Page 19 Line 1.	… of *their* own…
Page 19 Line 4.	They *used* several…
Page 20 Line 27 *et seq.*	Voisinet *et al.* (1997a)…$P<0.05$). These *authors* hypothesised…
Page 24 Line 12.	…dictate *the* tests used.
Page 24 Line 28.	Ewbank *(1992)…*
Page 25 Line 26.	Tennessen *et al. (1984)* …
Page 26 Line 8.	Mohan Raj *et al.* (1992)…
Page 26 Line 22.	Brinks *et al.* (1962)…
Page 30 Line 7.	Holmes and Wilson *(1984)…*
Page 36 Line 16.	…or *its* inverse…
Page 38 Line 15.	…autumns *and* 0.12…
Page 41 Line 14.	…14 days *post-weaning…*
Page 42 Line 2 .	…in Table *3.1.*
Page 47 Line 22.	…a covariate *where* appropriate…
Page 63 Line 27 *et seq.*	…*OMIs…*
Page 67 Line 21.	…were not *repeatable…*

ABSTRACT

Burnham, D.L. 2000. Investigations into variation in growth performance of cattle at pasture. M.Appl.Sc.Thesis, Massey University, New Zealand. 89pp.

The aim of this experiment was to examine relationships between the growth rate (LWG) and estimates of voluntary feed intake, feed conversion efficiency (GFE), temperament, susceptibility to chronic (longer-term) stress, indices of mature weight and indices of metabolic rate within groups of similar cattle run together. Sixty Hereford x Angus cross 9 month old male cattle (30 bulls and 30 steers) were allocated to either the fastest growing two-thirds or slowest growing third (Restricted-Slow Group (RS)), based on their growth rate over a 100 day period commencing on d0. The fastest growing two-thirds were randomly allocated between the Fast (F) and Restricted-Fast (RF) groups. Restriction of growth of the RF and RS treatment groups commenced on d112. Treatment group F cattle (10 bulls, 10 steers) were grown rapidly to achieve slaughter weights of 550 and 525kg for bulls and steers at 16-18 months of age, respectively. Treatment group RS and RF were fed to achieve a similar weight at about 25 months of age. The trial was therefore a 3 x 2 factorial with 3 growth path groups and 2 castration groups.

Bulls gained 18% faster than steers in the F treatment group up to slaughter (1.10±0.03 and 0.93±0.03kg/d, respectively, $P<0.001$). No significant difference was found between liveweight gains of bulls and steers of the RF and RS groups (0.56±0.02 vs. 0.51±0.02kg/d, respectively, NS).

Organic matter intakes (OMI) measured using chromium intraruminal capsules ranged between 1.45-170,1.19-1.53, 0.89-1.02 and 0.94-1.20kg OMI/100kg LWT/d for the four separate intake periods. These values were all lower than predicted values, reflecting possible poor pasture quality and/or inaccurate measurement of OMI. During the d90-100 period under *ad libitum* feeding the bulls were significantly more efficient than the steers (0.24±0.01 vs. 0.18±0.01kg

LWG/kg OMI, $P<0.001$), and F and RF cattle had significantly higher feed conversion efficiency (GFE) than RS cattle (0.23 ± 0.01 vs. 0.16 ± 0.02 kg LWG/kg OMI, $P<0.005$). During the later intake periods the fast-growing F treatment group was significantly more efficient at food conversion than the restricted groups (RF and RS) on all occasions. No differences in temperament, as assessed by stepping rate and subjective scoring in a weigh crate, and flight distance measures, were found between bulls and steers. The RF treatment group had a consistently lower, but not always significantly different, temperament scores than the F or RS groups. Plasma cortisol levels were significantly ($P<0.001$) lower in bulls than in steers on all occasions. No sex differences existed in muscle glycogen content. Weight-adjusted withers heights was lower ($P<0.05$) in bulls than in steers on d208, 306 and 579, however there was no differences between the treatment groups. At slaughter the treatment F cattle had shorter carcass lengths, lighter livers, greater fat depths and kidney fat weights ($P<0.001$) than the RF and RS groups. Bulls had shorter femur bones, lower fat depth and kidney fat weight and liver weights, than steers ($P<0.005$) of the same carcass weight.

Relationships were evaluated across all 60 cattle together by expressing each trait as a residual for each animal relative to the mean for its sex by treatment group. Measures of average daily gain, OMI, GFE and muscle glycogen levels were not very repeatable over time as measured by correlation coefficients. Temperament indices (range 0.31-0.71, $P<0.05$) and cortisol levels (range 0.29-0.48, $P<0.05$) were repeatable over time. Weight-adjusted height measurements (range 0.36-0.48, $P<0.01$) were also repeatable when all 60 cattle were measured. Relationships were investigated between various measurements and LWG prior to the measurement, LWG to 16 months of age and LWG to slaughter. No significant consistent relationships were observed between various long-term growth rates and either GFE, temperament, indices of-mature weight or -chronic stress. Moderate but inconsistent relationships were found between OMI and longer-term gain. It appears from this study that no consistent relationships between the various measurements and longer-term LWG exist in the cattle studied.

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LIST OF ABBREVIATIONS

ADG	average daily gain
B.	Bos
cm	centimetre (m $x10^{-2}$)
CP	crude protein
d	day
DM	dry matter
DMI	dry matter intake
°C	degrees Celsius
g	grams
GFE	gross feed efficiency
hd	head
ha	hectare
kg	kilogram (g $x10^{3}$)
kJ	kilojoule (j $x10^{3}$)
km	kilometre (m $x10^{3}$)
l	litre
LWT	liveweight
LWG	liveweight gain
µl	microlitre (l $x10^{-6}$)
µm	micrometre (m $x10^{-6}$)
µmol	micromol (mol $x10^{-6}$)
m	metre
M/D	ME content per kg DM
ME	metabolisable energy
MEI	metabolisable energy intake
mg	milligram (l $x10^{-3}$)
MJ	megajoule (J$x10^{6}$)

ml	millilitre (l x10^{-3})
mm	millimetre (m x10^{-3})
mmol	millimols (M x10^{-3})
ng	nanogram (g x10^{-9})
n	number
NS	not significant
OM	organic matter
OMI	organic matter intake
%	percentage
P	probability
pm	after noon
®	registered trademark
rpm	revolutions per minute
SE	standard error
vs.	versus
w/v	weight per volume
wt-adj.	weight-adjusted