



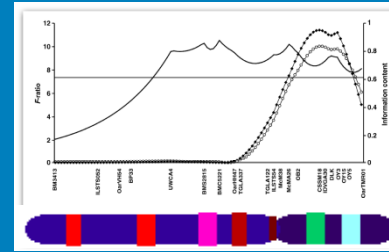
JM Macfarlane

¹ Scottish Agricultural College

² University of Aberystwyth, Aberystwyth, Wales

..., ² L. Bunger¹

Background



Walling et al. 2004

- **Texel Muscling Quantitative Trait Locus (TM-QTL)**
 - distal end of chromosome 18 in Texel sheep
 - affects loin muscling, shows paternal polar overdominance (Macfarlane et al., 2010; Matika et al., 2010)
 - increases loin muscling by 4-7% (in purebred and crossbred lambs; Walling et al., 2004; Macfarlane et al., 2009; Macfarlane et al., 2010; Masri et al., 2010)
 - no other significant effects on carcass traits in crossbred lambs (Macfarlane et al., 2009)
 - negligible effects on meat quality in crossbred (and purebred) lambs after 7 d conditioning (Lambe et al., 2010)
 - affects live and carcass weight (apparently additive action): homozygous carriers are heavier than non-carriers at a fixed age (~3-15%) (Macfarlane et al., 2011)

Objectives

- Investigate effect of 4 TM-QTL genotype classes of purebred Texel lambs
 - Homozygote non-carriers +/+
 - Heterozygote TM-QTL carrier; paternal origin TM/+
 - Heterozygote TM-QTL carrier; maternal origin +/TM
 - Homozygote TM-QTL carriers TM/TM
- on
 - weights of primal cuts
 - weight distribution
 - carcass composition

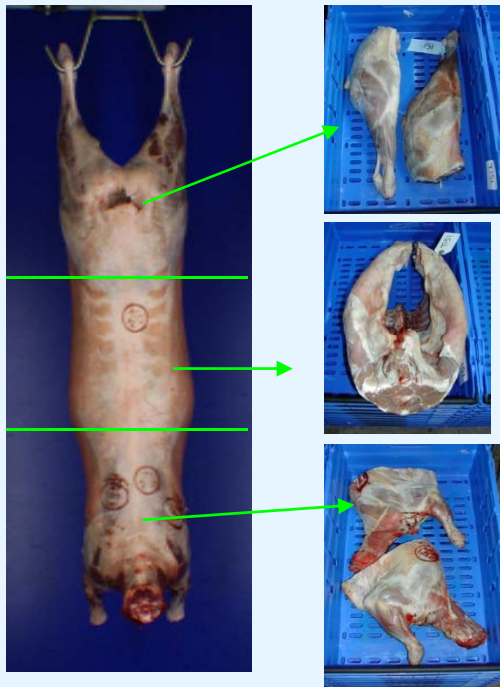
Materials & Methods: animals

- 209 Texel lambs from SAC and IBERS
- entire males and females
- genotyped for TM-QTL
 - 40 non-carriers (+/+)
 - 17 +/TM
 - 53 TM/+
 - 34 TM/TM
 - 65 unknown genotype



Materials & Methods: measurements

- Lambs slaughtered at ~20 weeks and carcasses:
 - chilled for 7, 8 or 9 days
 - weighed
 - cut into fore-quarter, saddle and hind-quarter regions



hind-quarter



saddle



fore-quarter



- regions butchered into:

- lean meat
- fat trim
- bone

Materials & Methods: variables analysed

- Variables analysed:
 - weight of
 - fore-quarter
 - saddle
 - hind-quarter
 - proportion of total carcass weight contained in
 - fore-quarter
 - saddle
 - hind-quarter
 - proportion of LMY fat trim and bone in the carcass

Materials & Methods: statistical analysis

- GLM (REML, Genstat)
- Fixed effects:
 - TM-QTL genotype
 - sex (entire male or female)
 - rearing rank (single, twin or artificial)
 - farm (SAC or IBERS)
 - dam age (2, 3, 4 years or older)
- Random effect: sire (7 sires, 3 common across farms)
- Linear covariate: carcass weight for all variables other than itself
 - CWT showed strong relationship with proportion variables, probably due to the wide range of CWT present in the data (8 – 25kg, mean 15.2 kg).

Results: region weights

- When adjusted for carcass weight, no effect of TM-QTL on:
 - **weight** of hind-quarter, saddle or fore-quarter (g)

	HIND ¼ wt	SADDLE wt	FORE ¼ wt
+/+	2650	1678	2804
+ / TM	2637	1705	2768
TM / +	2666	1678	2791
TM / TM	2645	1708	2808
ave s.e.d.	21.4	31.3	28.7

- When **not** adjusted for carcass weight, all region weights heavier for TM/TM than +/+ (8.7 to 13.5%)

Results: weight distribution

- When adjusted for carcass weight, no effect of TM-QTL on:
 - **proportion** of total carcass weight contained in hind-quarter, saddle or fore-quarter

	HIND ¼ wt/CWT	SADDLE wt/CWT	FORE ¼ wt/CWT
+/+	0.183	0.115	0.194
+/TM	0.182	0.116	0.192
TM/+	0.184	0.115	0.193
TM/TM	0.183	0.117	0.194
ave s.e.d.	0.0016	0.0019	0.0019

Results: carcass composition

- LMY/CWT was 1.36 to 2.37% higher in TM/TM compared to the other groups
 - difference significant only for TM/TM vs. +/TM
- No effect of TM-QTL on proportion of fat trim or bone

	LMY /CWT	FAT /CWT	BONE /CWT
+/+	0.586 ^{ab}	0.043	0.304
+/TM	0.581 ^b	0.042	0.306
TM/+	0.587 ^{ab}	0.039	0.308
TM/TM	0.595 ^a	0.042	0.301
ave s.e.d.	0.0053	0.0034	0.0055

Summary

TM-QTL previously reported to:

- increase loin muscling with paternal polar overdominant pattern of inheritance (i.e. effect expressed only in animals inheriting a single copy from sire alone)
- increase live weight and carcass weight at a fixed age in animals carrying two copies

Summary

- TM-QTL previously reported to:
 - increase loin muscling with paternal polar overdominant pattern of inheritance (i.e. effect expressed only in animals inheriting a single copy from sire alone)
 - increase live weight and carcass weight at a fixed age in animals carrying two copies
- **This study** showed that, when corrected for carcass weight,
 - TM-QTL does not affect weights of fore-quarter, saddle and hind-quarter regions
 - although TM/+ have increased dissected loin weight this does not translate to increased saddle weight
 - TM-QTL does not affect distribution of weight across the carcass

Summary

- TM-QTL has a small effect on carcass composition
 - TM/TM lambs had slightly higher LMY% compared to other groups
- TM-QTL could benefit the sheep industry by increasing meat yield in carcasses of equal weight if homozygote carrier lambs were produced
- This is in addition to previously reported benefits:
 - increased weight of loin muscle in heterozygote carriers inheriting TM-QTL from their sire
 - increased carcass weight at a fixed age (or shorter time to finish to a fixed weight) in TM/TM

Summary

- TM-QTL shows additive effects on body/carcass weight –
 - homozygote carrier lambs need to be produced
 - TM-QTL needs to segregate in female line (Mules, etc.)
- TM-QTL increases weight of loin muscle in TM/+ (paternal overdominance)
 - homozygous rams should be used
 - but, homozygous rams are not elite in purebred scheme
- Use within the sheep industry requires a more general genetic test!!
and consideration of mode of inheritance

Acknowledgements



ENGLISH BEEF & LAMB EXECUTIVE



MEAT PROMOTION WALES



QUALITY MEAT SCOTLAND

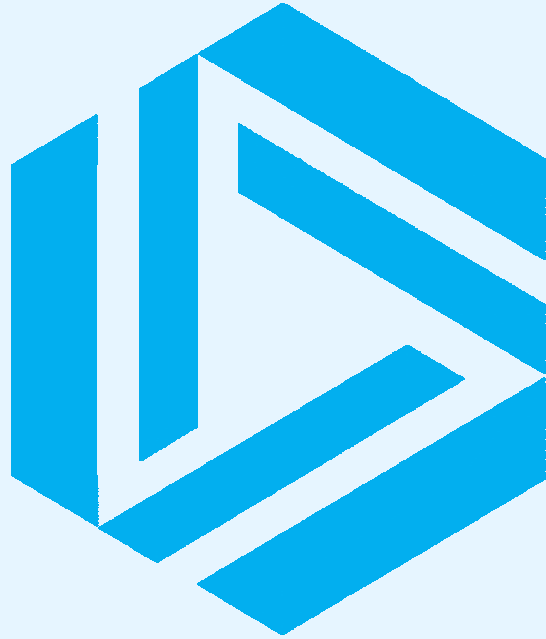


SHEEP SOCIETY



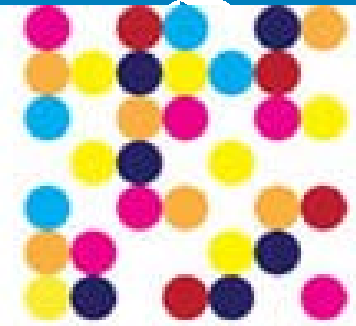
PASSION FOR BETTER FOOD





SAC

Success through **Knowledge**



ICQG 2012

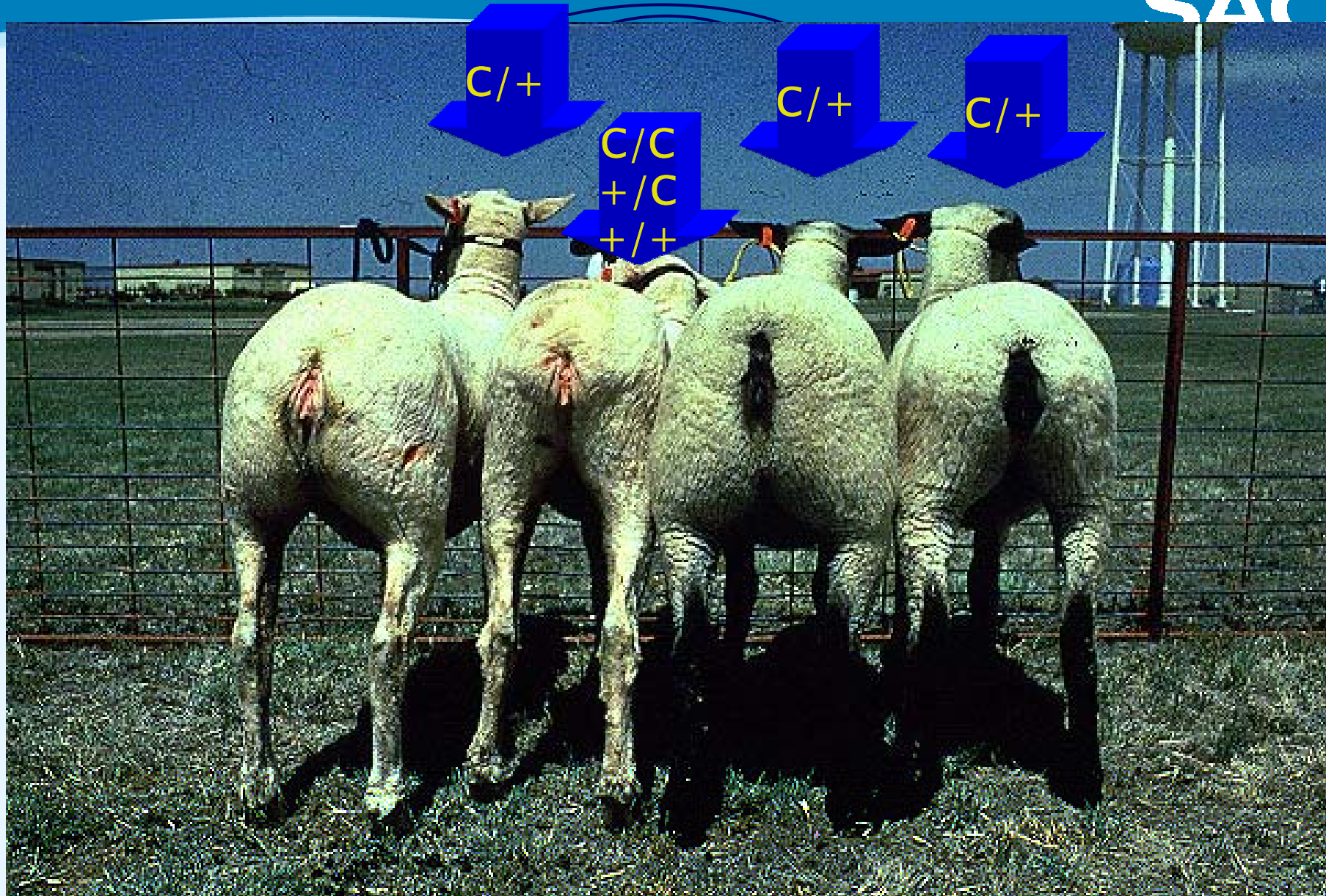
**4th International Conference on Quantitative
Genetics: Understanding Variation
in Complex Traits**
Edinburgh, 17 – 22 June 2012

Supported by



For further details please visit the
website www.icqg2012.org.uk

Polar overdominance



$+/TM$ $TM/+$

Additive

 $+/+$

0

 TM/TM TM/TM $+/TM$

Polar OD

 $+/+$ $TM/+$