

Session 16:

Effects of the Texel Muscling QTL (TM-QTL) on lamb tenderness

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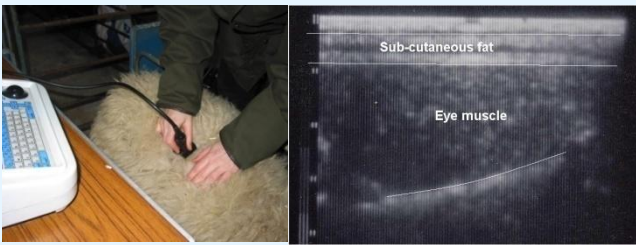
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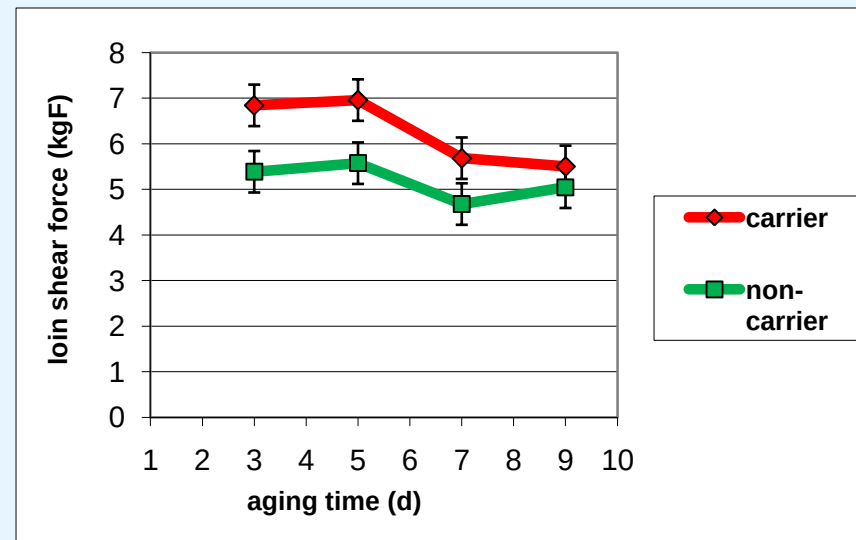
Introduction – direct effects of TM-QTL

- TM-QTL: Texel muscling quantitative trait locus
 - identified in pure-bred UK Texel sheep (chr 18)
 - increases loin muscling:
 - ultrasound muscle depth increased 4–7% in Texel lambs (Walling et al., 2004)
 - similar effects in crossbred lambs confirmed using ultrasound, CT and dissection (Macfarlane et al., 2009)
 - no substantial effects on muscling in other body regions



Introduction – indirect effects of muscling QTL on meat tenderness

- *Callipyge* mutation also on chr 18 (Cockett *et al.*, 1996, 1999)
 - larger effect: increased muscling (~30%); reduced fatness
 - extremely tough meat, even after 24d aging (Duckett *et al.*, 1998)
- TM-QTL in crossbred lambs (Lambe *et al.*, 2010)
 - TM-QTL carriers – tougher loin
 - no significant difference in toughness with > 7d aging
 - no effect on leg tenderness



Aims

- Investigate indirect TM-QTL effects on meat quality in purebred Texel lambs:
 - shear force tenderness (loin and leg)
 - sensory loin tenderness (assessed by taste panel)
- Investigate effects of TM-QTL:
 - inherited from sire

Methods – animals recorded



- Texel lambs
 - entire males and females
 - from 2 research farms, TM-QTL segregating
 - 7 sires carrying TM-QTL (3 common across farms)
- Pre- and post-slaughter measurements
 - ultrasound depth of loin muscle (UMD) pre-slaughter
 - slaughtered: average age 20 wks, CWT 15 kg
 - electrical stimulation; 7-9 d aging
 - one leg muscle and loin muscle dissected and weighed
 - right muscles - shear force
 - left loin – 40 to taste panel (14 untrained assessors; scale 1-10)

Methods – lamb genotypes

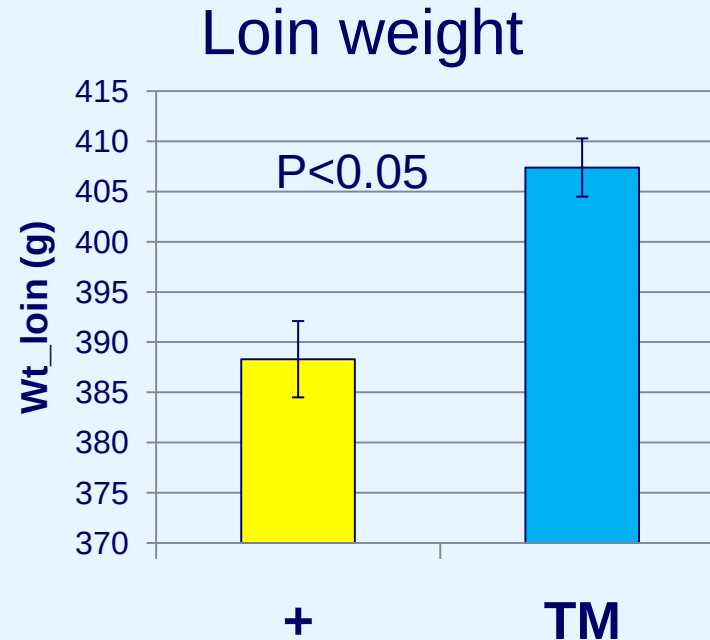
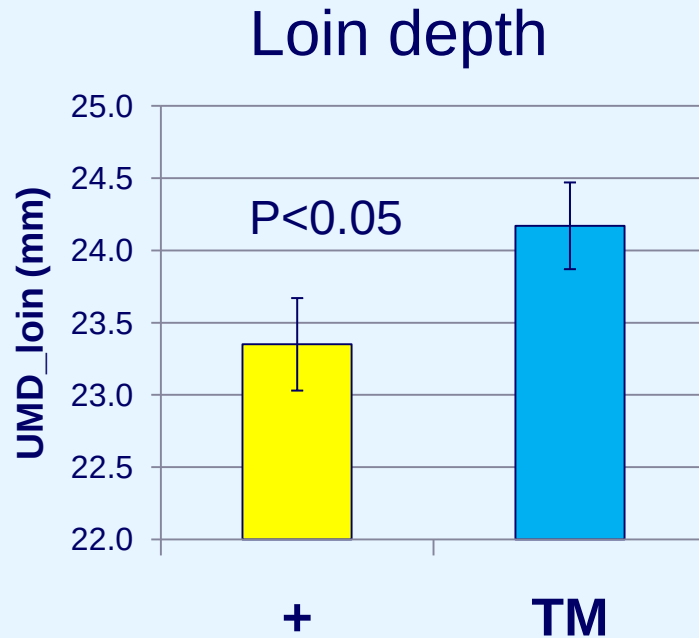
- Genotyped using 5 microsatellite markers
- Identification of haplotype inherited from sire
 - wildtype (+) , TM-QTL (TM), or unknown (?)
 - ? due to recombinant haplotypes or missing marker info
 - within-family linkage disequilibrium

	Number of records per sire haplotype			Total
	+	TM	?	
shear force loin	83	116	10	209
shear force leg	83	116	10	209
sensory tenderness	13	18	(9)	40

Methods - statistical analyses

- Restricted maximum likelihood (REML) using Genstat (Payne et al., 2005)
- Dependent variables:
 - loin depth (UMD_loin) and weight (Wt_loin)
 - shear force of loin (ShF_loin) and leg (ShF_leg) muscles
 - sensory loin tenderness assessed by taste panel (TP_loin)
- Model terms included:
 - TM-QTL genotype (fixed effect)
 - for TP_loin: lamb ID, assessor (r), sample order (f)
 - for other traits: sire (r), sex, farm, litter size at rearing (f), carcass wt / live wt (cov), days aging (cov - ShF only)

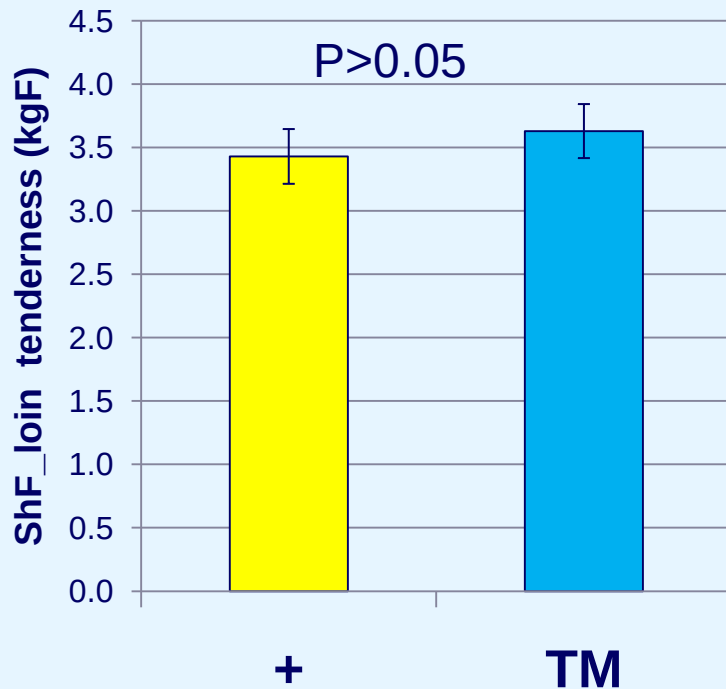
Results – direct effects on loin muscling



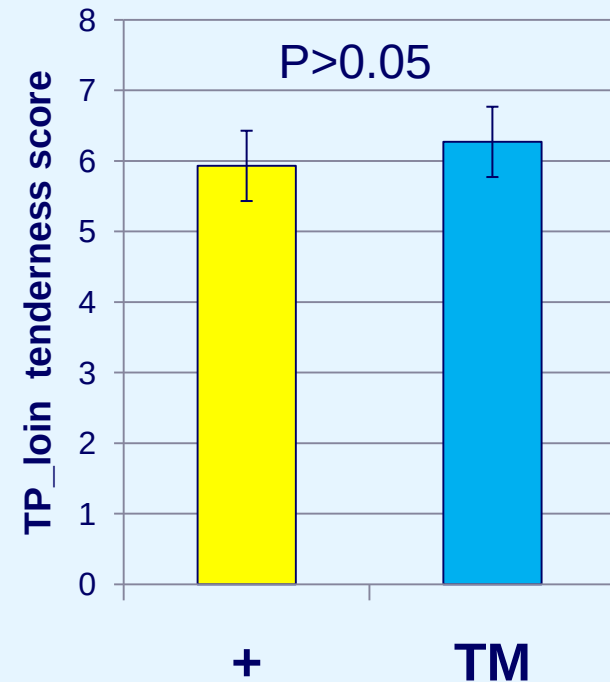
- TM-QTL carriers:
 - significantly deeper ultrasound muscle depth (0.8mm, 4%)
 - significantly heavier dissected loin muscle (19g, 5%)

Results – indirect effects on tenderness

Mechanical
loin tenderness

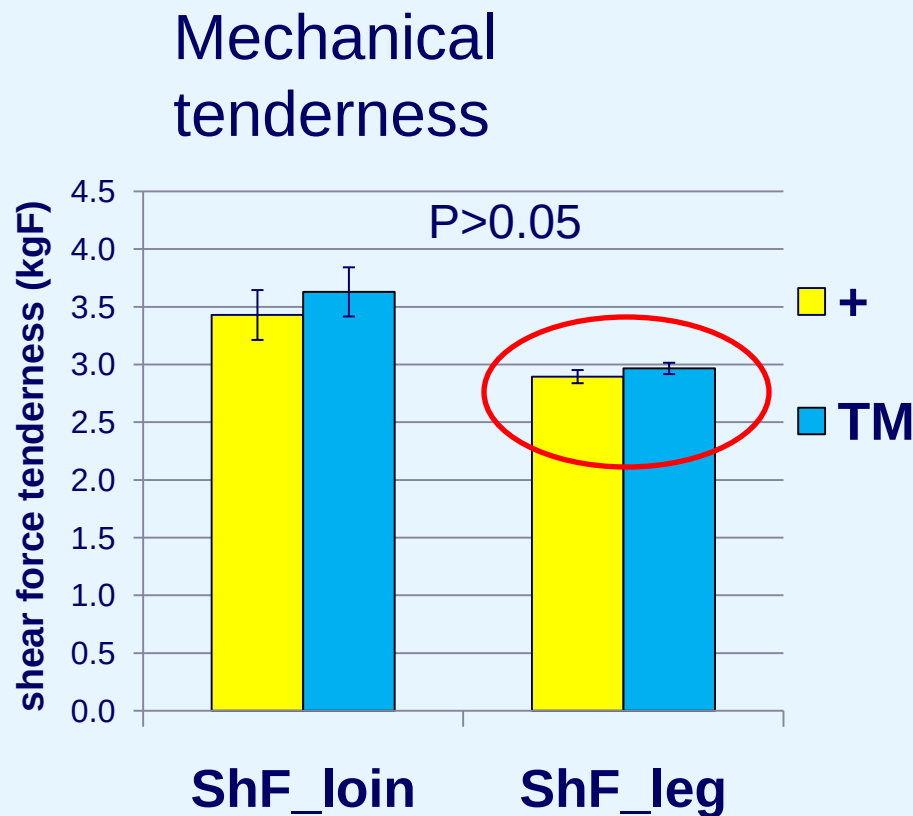


Taste panel
loin tenderness



- No sig. differences between genotypes in *loin* tenderness

Results – indirect effects on tenderness



- No sig. differences between genotypes in *leg* tenderness

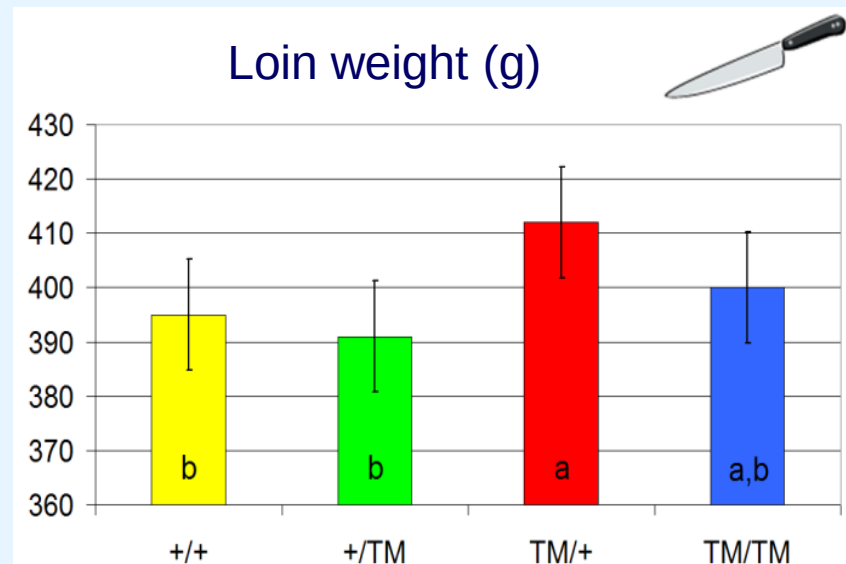
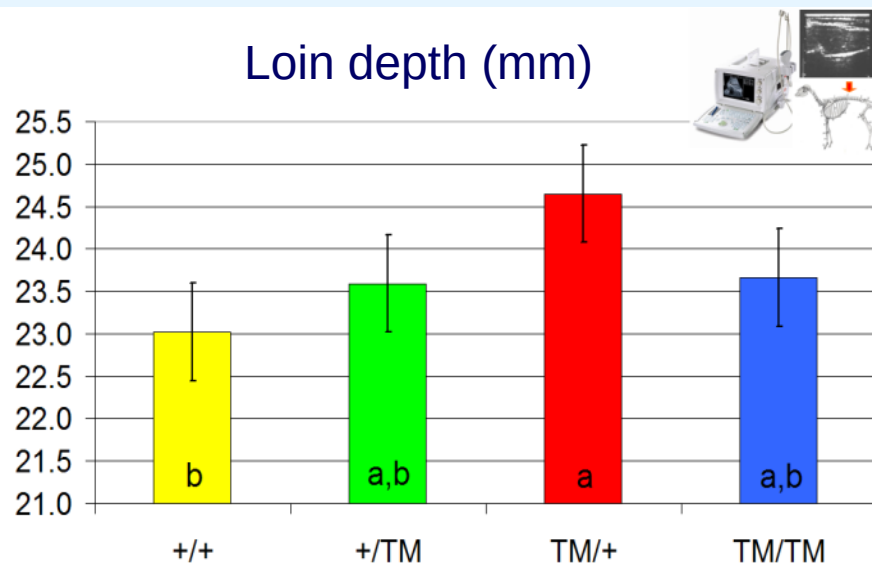
Further analyses

- Identification of haplotypes inherited from sire & dam
- Investigate genotypic effects of TM-QTL:
 - 4 genotype groups considered:
 - homozygous non-carrier (+/+)
 - heterozygote inheriting TM-QTL from dam (+/TM)
 - heterozygote inheriting TM-QTL from sire (TM/+)
 - homozygous carrier (TM/TM)

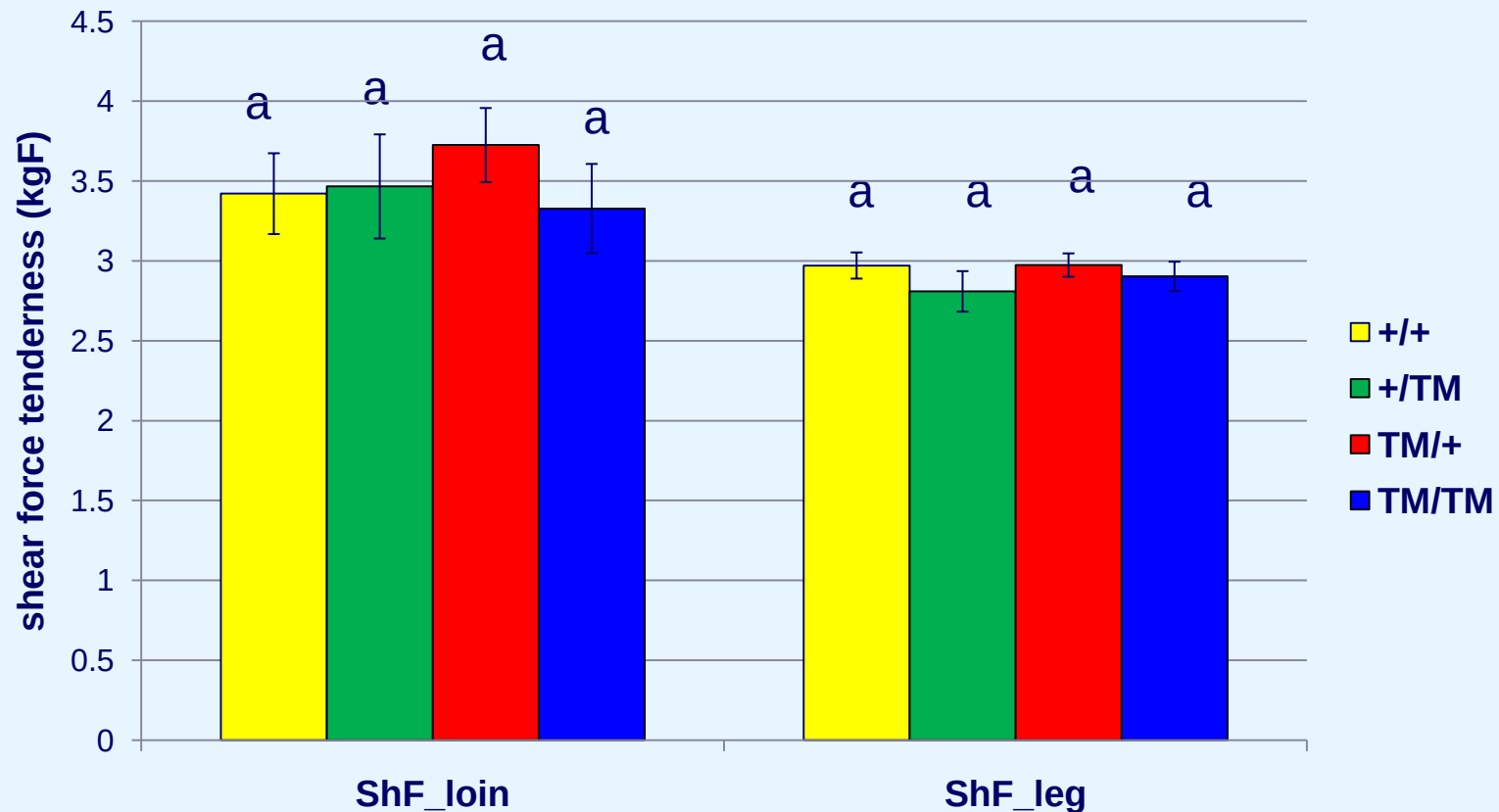
Number of records per genotype						
	+/+	+/TM	TM/+	TM/TM	?	Total
ShF	40	17	53	34	65	209
TP	13			18	(9)	40

Further results – effects on loin muscling

- TM-QTL mode of inheritance (Macfarlane et al., 2010)
 - polar overdominance
 - imprinted (paternally expressed)
 - increases loin muscle only if single copy inherited from sire (TM/+ had 4 - 11% greater loin muscling than +/+)



Results - mechanical tenderness



- No significant differences between genotypes in tenderness

Summary and discussion

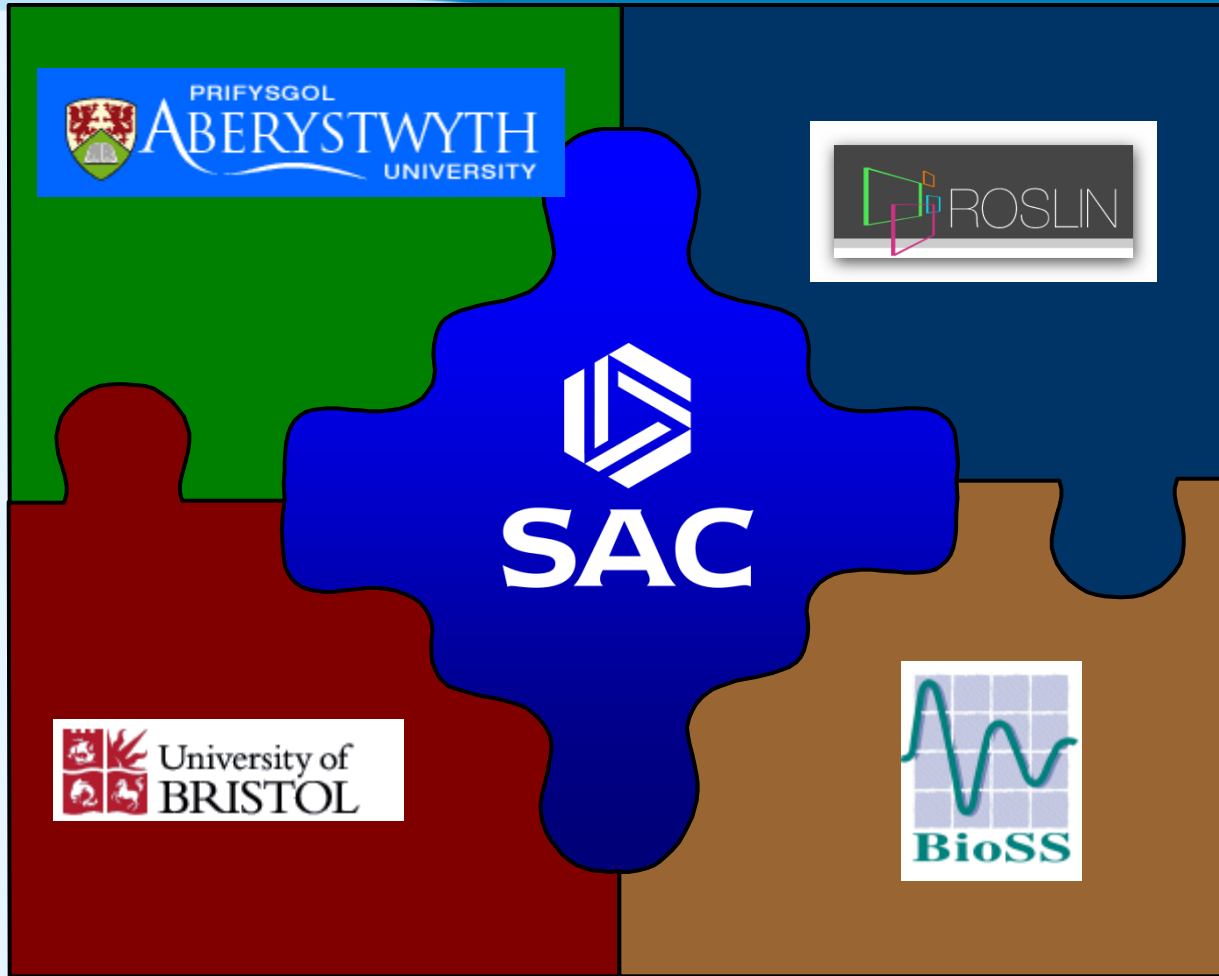
- Lambs inheriting TM-QTL from only their sire had significantly greater loin muscling than non-carriers
- Lambs inheriting TM-QTL were not significantly different in tenderness to non-carriers
 - after 7 – 9 d aging
- Taste panel testing did not identify a genotypic effect on sensory tenderness
 - small number of lambs
 - only homozygotes tested
 - no comparisons with TM/+ lambs

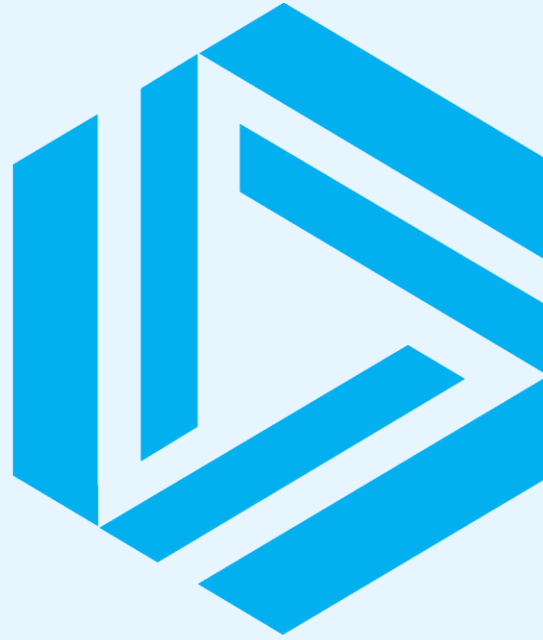


Conclusions

- Breeding programmes designed to produce lambs with 1 copy of TM-QTL, inherited from sire:
 - will increase loin muscling
 - without effects on tenderness (when meat aged ≥ 7 days)
- Indirect effects of TM-QTL on ewe and lamb health and welfare traits are being studied
- Combined results will assess whether TM-QTL should be recommended for UK sheep industry

Acknowledgements





SAC

S✓**ccess** through **Knowledge**