HOW CAN WE GET PEOPLE TO EAT MORE LAMB?

- Improve quality and consistency of the finished product
  - Better customer experience
  - Better returns for producers
THE CHALLENGE

- For the UK sheep industry to continue as a major producer and exporter of lamb
  - Maximise sustainability, competitiveness and market focus across the supply chain
- ~ 58% of UK lambs meet market spec
  - 5.9m prime lambs not optimised sale values
- This can be improved by
  - Modern breeding methods and technologies
  - Accurate carcass and meat quality information
**HOW / WHY CAN TEXELS CONTRIBUTE?**

- Leading terminal sire breed in the UK
  - 30% of ewes mated to Texels and their crosses [in 2012]

- Texel-cross ewes represent over 10% of the national flock [in 2012]

- In a unique position to significantly influence maternal and terminal sire traits of the national flock
PHENOTYPE FARM NETWORK

- Now in it’s third year
- Underpins Society’s research
- Network of 26 pedigree flocks
  - England | Scotland | Wales
- Hard-to-measure maternal trait data
  - Mastitis
  - Footrot
- Phenotyped ewes are genotyped
  - Towards genomic breeding values

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SUPPLY CHAIN

10 %

30 %

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SUPPLY CHAIN

Hard-to-measure maternal traits

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SUPPLY CHAIN

Performance recording

30%

Hard-to-measure maternal traits

10%

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SUPPLY CHAIN

Performance recording

Meat quality

30 %

Hard-to-measure maternal traits

10 %

Carcass quality

30 %
Texel Society Research Projects

- Two major industry-focused research projects
  - Carcase quality
  - Meat quality
  - Disease traits (live animal scoring)

- We’re working with
  - Breeders
  - Commercial lamb producers
  - Processors
 Texel Society Research Projects

- Aim is to produce
  - Crossbred lambs that meet processor / retailer requirements
  - Novel commercially-relevant breeding values for Texel rams for meat and carcase quality
- ...and develop
  - a novel and sustainable phenotyping strategy
    - Network of hard-to-measure data collection farms
  - a producer group, producing Texel-cross lambs
VIDEO IMAGE ANALYSIS (VIA) PROJECT

- Three-year carcass quality project
- Builds on, and maintains, hard-to-measure data collection
- Also crosses Texel tups with Lleyn ewes
- Producing ~3,500 crossbred slaughter lambs over 2 years
  - Genotyped
  - VIA scanned
  - EUROP graded
VIDEO IMAGE ANALYSIS (VIA) PROJECT

- To match VIA predictions to genomic regions
  - Identify sheep genotypes that produce economically important improvements in carcass yield traits
  - Breeding values for economically important carcass traits
VIDEO IMAGE ANALYSIS (VIA) PROJECT

- Working with four commercial producers
  - ~1,100 ewes
- Over 40 natural and AI sires from 13 flocks
- Mating program underway
- Posters on display
TASTE VERSUS WASTE (TvW) PROJECT

- Meat quality study
  - Two phases
    - Suffolk sires
    - Texel sires
- Overall aims remain the same
  - Identify rams that produce optimal carcass characteristics and tastier meat
- First phase results published
  - Neil will talk more about these shortly
TASTE VERSUS WASTE (TvW) PROJECT

- > 1,100 lambs for slaughter this year

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- > 75 % in spec
TASTE VERSUS WASTE (TvW) PROJECT

- All loins weighed, NIR and CT scanned
- Subset of loins retained for further meat quality and taste analyses
TASTE VERSUS WASTE (TvW) PROJECT

- Starting the second year of Texel involvement
- Four Scotch mule flocks
  - > 1,200 ewes
- > 30 natural and AI sires
- Mating program underway
COLLECTIVELY THESE PROJECTS

- Breed-specific central progeny test
- Supported by a network of pedigree farms
COMBINED RAM MOVEMENTS

- Farm providing rams
- Commercial partner flock

→ Ram movements

Huge thanks to all involved!
COLLECTIVELY THESE PROJECTS

- Breed-specific central progeny test
- Supported by a network of pedigree farms

- Provide large amounts of data
  - When combined with data from pedigree services will provide the ability to influence industry further
RESEARCH PROJECTS IN NUMBERS

- 1 terminal sire breed
- 2 maternal breeds
- 8 commercial partner flocks
- 26 phenotyping farms
- 76 natural service and AI rams
- 2,300+ commercial ewes
- 5,500+ animals genotyped (10,000+ by 2019)
- £3,000,000+ invested in R & D to 2020
- £23,000,000 / yr: est. benefit to industry
- 885,086,898 SNPs (1 billion datapoints by 2019)
Texels leading sheep industry development in the areas of post-mortem traits and genomics

Adding value to the breed and UK R&D

RESEARCH PROJECTS IN NUMBERS

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Carcass trait phenotype feedback for genomic selection in sheep

Making Today’s best tomorrows average!!

Dr. Neil Clelland
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Introduction

- Around 50% of UK-produced lambs meet target EUROP specifications

- No financial incentives
  - Saleable meat yield
  - Higher value cuts

- No connection between commercial and purebred flocks
  - Performance and carcass data
Main Aims

- Improve quality and efficiency of primary lamb production
- Objective feedback from processor to farmer
  - Carcass ‘quality’
- Informing selection decisions in the purebred sector
- Collection of genomic and phenotypic data
  - Abattoir derived disease and condemnation traits
  - New carcass quality data using VIA and CT
  - Genotyping
Main Aims

• ~3,500 sheep genotyped and phenotyped (Texel & Crossbred)

• VIA validated by CT (n=220 crossbred lamb carcasses)

• Genotyped on Illumina LD chip (16k)
  – Imputation from 16k to 50k
  – Deliver GEBV’s for new, hard to measure carcass quality traits

• Implementation of genomic ‘pipeline’
  – Receipt of genotype
  – Imputation
  – Delivery of GEBV’s
Main Aims

VIA Carcass traits
- Saleable meat yield
- Primal yield
- High value cuts

Pedigree breeders (Texel)

Commercial Farms (Lleyn)

Commercial Slaughter Lambs (Texel x Lleyn)
Genomic selection in sheep breeding programmes
Routine commercial implementation

New, untested animal

Prediction Equation SNP key

gEBV

Genomically enhanced breeding value
BREEDING FOR MORE TASTE AND LESS WASTE

Making Today’s best tomorrows average!!

Dr. Neil Clelland
SRUC

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Leading the way in Agriculture and Rural Research, Education and Consulting
Introduction

• Meat eating quality - tenderness, juiciness, flavour
  – Known to be linked to fat levels
  – Due to positive associations with IMF

• Genetic selection for MQ is rare
  – Limitations in measurement (non-invasive)

• Non-invasive methods investigated
  – CT/NIR/in-vivo/post-mortem
  – Scope for inclusion into UK sheep breeding programmes
Main Aims

• Investigate accuracy of CT/NIR in the prediction of MQ/MEQ traits

• Establish a UK-relevant window of acceptability (IMF)

• Establish method to predict meat quality routinely

• Incorporate carcass and MQ data into breeding program
  – Crossbred EBV’s for carcass and MQ traits
  – Derive terminal selection index and optimal breeding programme
Results from WP1
(Calibration and proof of concept)

CT and NIR of *loin cuts* predicted:

- IMF with moderate accuracy ($r = 0.6$), refinements planned
- Shear force and sensory traits with low accuracy ($r < 0.3$)
Results from WP1
(Calibration and proof of concept)

IMF affects meat eating quality traits

- Less discrimination by CT
- Significant differences identified

<table>
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<tr>
<th>IMF band (chemical)</th>
<th>Texture</th>
<th>Flavour</th>
<th>Juiciness</th>
<th>Liking</th>
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<td>&lt;1%</td>
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<tr>
<td>4-5%</td>
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<td>&gt;5%</td>
<td>5.0</td>
<td>5.8</td>
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</tbody>
</table>

Effect of CT-predicted intramuscular fat (CT-IMF) on meat eating quality

- <3% CT-IMF
- >3% CT-IMF
Conclusions WP1 *(post-mortem)*

- CT parameters predict IMF with moderate accuracy
- Cannot accurately predict mechanical tenderness
  - Or sensory traits
- Sensory traits are significantly influenced by IMF
  - Texture, Flavour, Juiciness, Overall liking
  - Juiciness and flavour increases linearly with IMF
- Optimum level of IMF 4-5% (>3%)
  - UK trained taste panel
• Project has produced:
  – high accuracy live phenotypes for IMF
  – moderate accuracy post-mortem phenotypes for IMF
  – BioBank/data set to develop SNP-keys for genomic selection

• A combination of *in-vivo, post-mortem* and genomic predictors could be used to develop a sustainable breeding programme including lamb meat quality traits
WP2 – Breeding for more taste, less waste

Terminal sire rams
CT scanned

Mated to Mule ewes

N= 5000 crossbred lambs

MQ info/NIR/CT

N= 5000 crossbred lambs

EBVs based on meat and carcass quality of crossbred lambs

N= 5000 crossbred lambs

Nasal/Tissue sampling
Acknowledgements
ACKNOWLEDGEMENTS

- Texel Society
  - John Yates
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  - Gil Burton
  - Will Sawday
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  - Peter Lee

- Phenotype farms

- Commercial flocks

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  - Ann McLaren
  - Karolina Kaseja
  - Kirsty McLean
  - John Gordon

- ABP
  - James Draper
  - Mark Eastwood
  - David Wharton
  - Paula Lobb
  - Guy Bartle
  - Karl Hughes

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Innovate UK

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SRUC – CIEL

Mobile - CT scanner/Sensory/MQ lab/Feed Intake
Leading the way in Agriculture and Rural Research, Education and Consulting
Leading the way in Agriculture and Rural Research, Education and Consulting
What CT already tells us

- Currently a two-stage selection method (US and CT scanning) is used in UK terminal sire breeding programmes
  - Improve growth, carcass composition; overall fatness, muscularity
  - Lambs US scanned at 21 weeks, selection candidates are then CT scanned within 2 weeks
What CT already tells us

- Predicted carcass tissue weights (Muscle/Fat/Bone)
- Killing out %
- Muscle to Bone ratio
- Muscle to Fat ratio
- Gigot shape
- Eye muscle Area (Width/Depth)
- % Muscle in Leg/Loin/Chest (High value cuts)
- Current EBVs
  - CT fat/lean weight, Gigot shape (muscularity)
How it is measured (IMF)

- X-Ray Computed Tomography (CT)
  - Separate carcass from non-carcass tissues
  - Pixels allocated to fat, muscle or bone

94 Models
Accuracies
- IMF >65%
- Shear force ~ 14%
How it is measured (IMF)

- Heritability estimates for CT-predicted IMF similar to chemical IMF in previous studies ($h^2 = 0.32-0.48$)
  - Indicative of the CT prediction accuracy in CT IMF

- CT IMF is heritable and partially under different genetic control from fat weight

- Potential to select for ‘correlation breakers’
  - More taste less waste
‘Correlation breakers’

CT IMF vs. CT Carcass fat

n = 1,971
r = 0.71