



Tools to breed sheep with lower methane emissions

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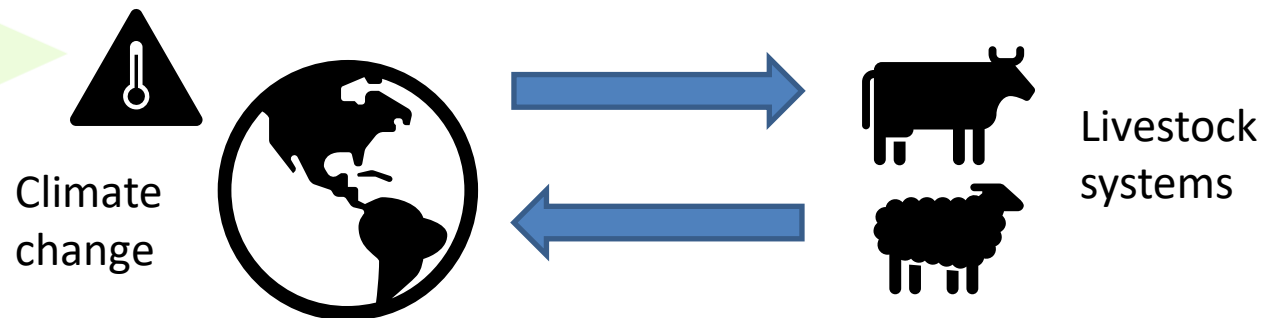
A. McLaren, K. McLean, J. Gordon, H. Wishart and J. Conington

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

Genetic strategies - methane mitigation

Genetic solutions:

- a) Breeding for improved productivity / reduced waste
- b) Breeding for feed efficiency
- c) Breeding for direct reductions in methane emissions
 - Measuring methane directly
 - Proxy measures – to accurately predict methane / rank animals



Some phenotypes under research in sheep:



- Individual feed efficiency
 - Indoor - automated feeders, individual pens
 - Outdoor - n-alkanes, sensors/ bite meters, faecal NIR...
- Methane emissions
 - Respiration chambers
 - Shorter-term methane measures:
 - Portable accumulation chambers, extraction hoods, sniffers, laser detectors ...
 - Proxy measurements linked to rumen function:
 - Rumen volumes, rumen microbiome, rumen metabolites ...



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Feed intake recording



water crates

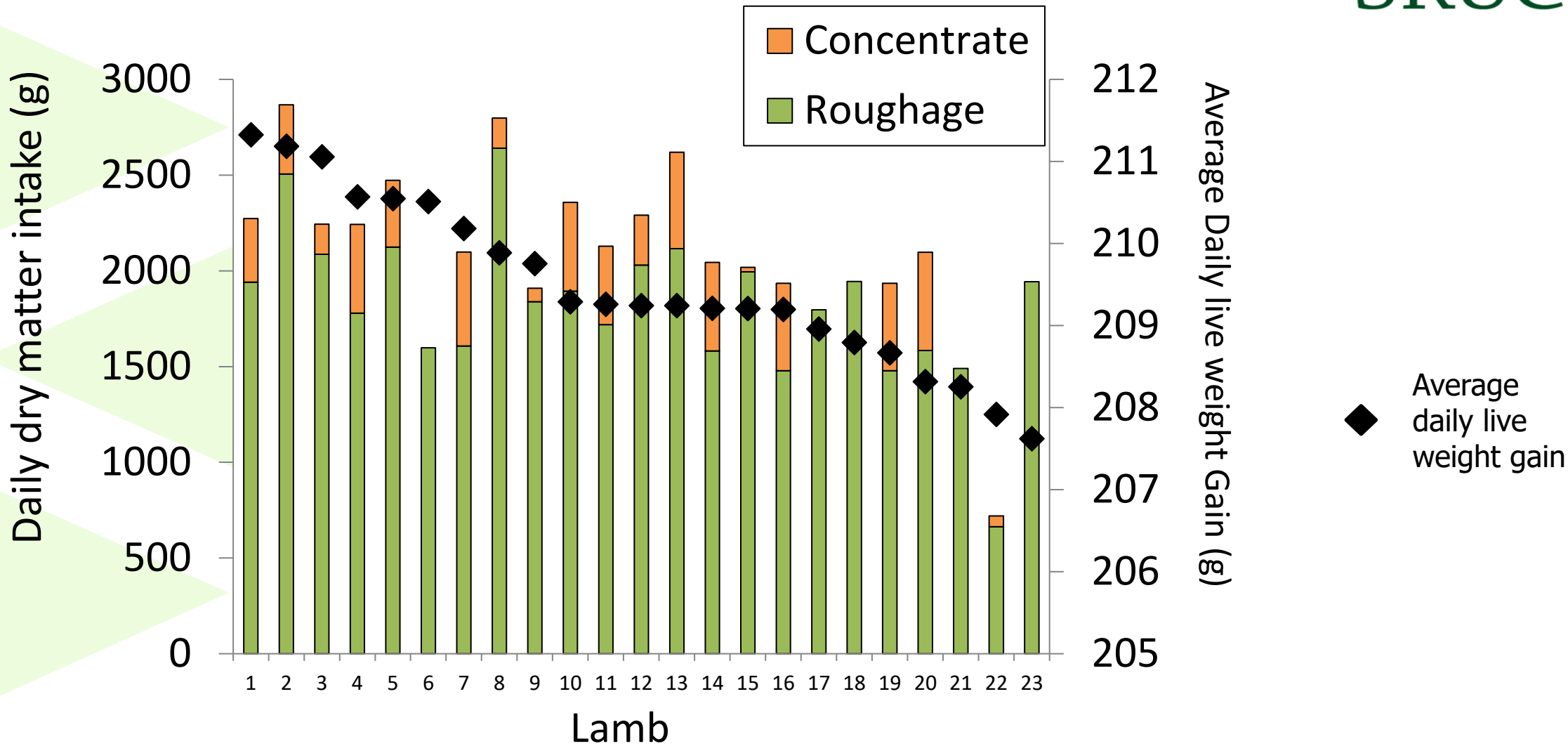


Concentrate crates

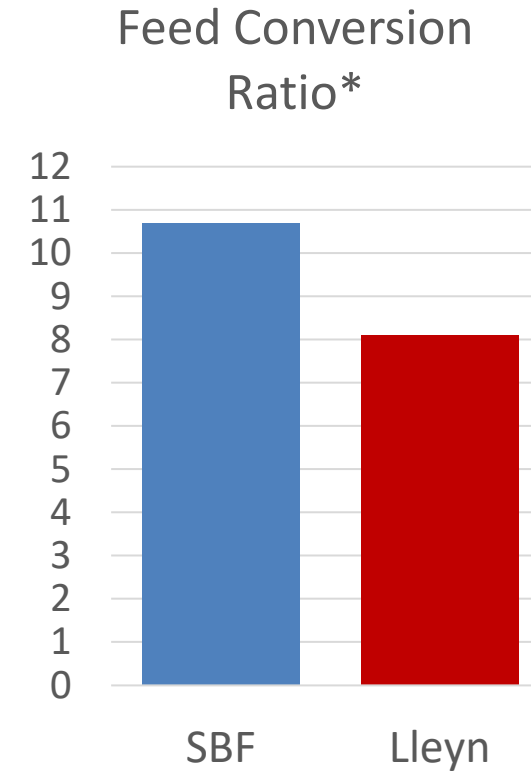
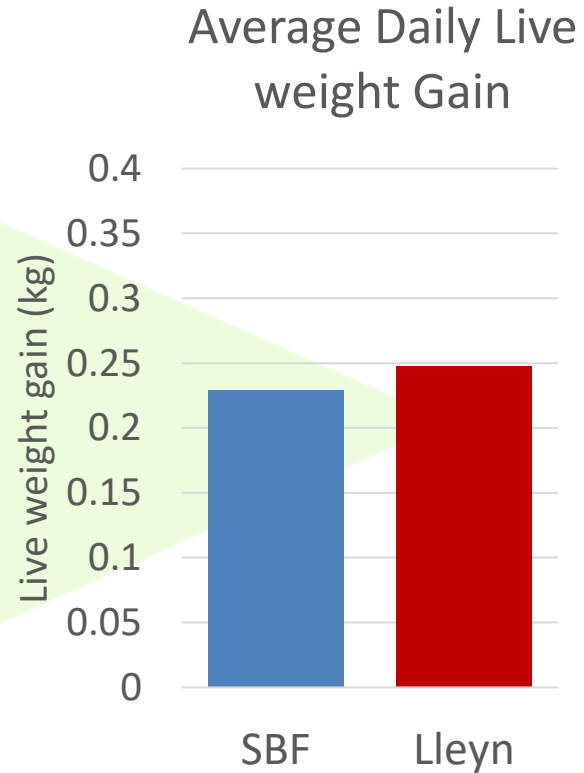
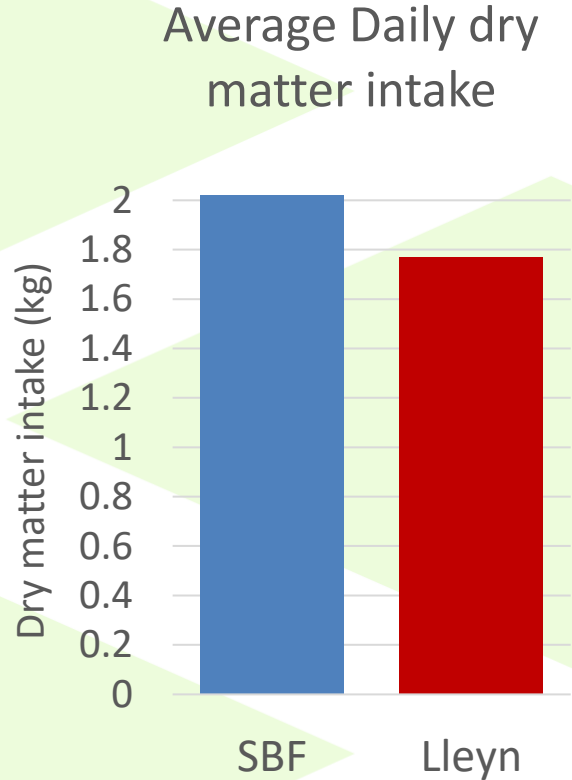
16x roughage troughs
Grass nuts
Ad lib



Pilot 1 - Intake and gain by lamb



Pilot 2 – Breed comparison @ finishing



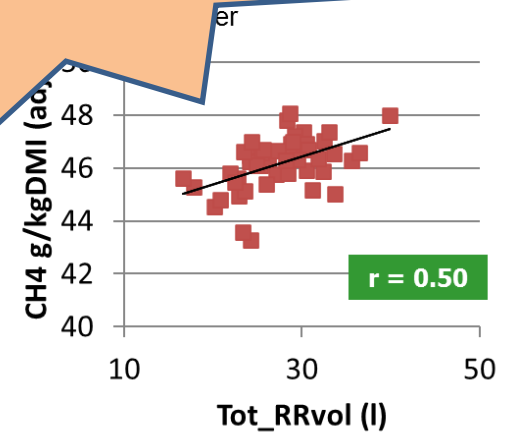
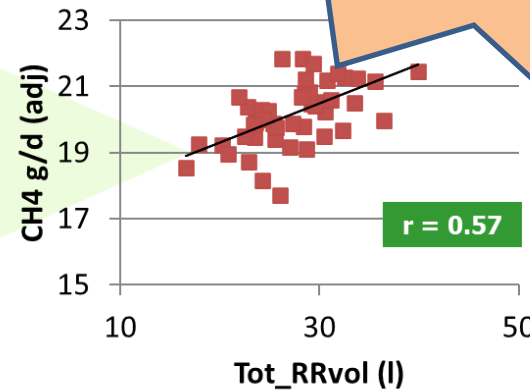
*kg feed per kg live weight gain

SBF = Scottish Blackface

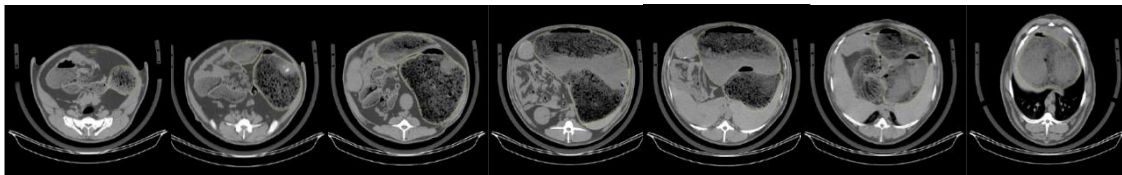
Rumen volume vs methane



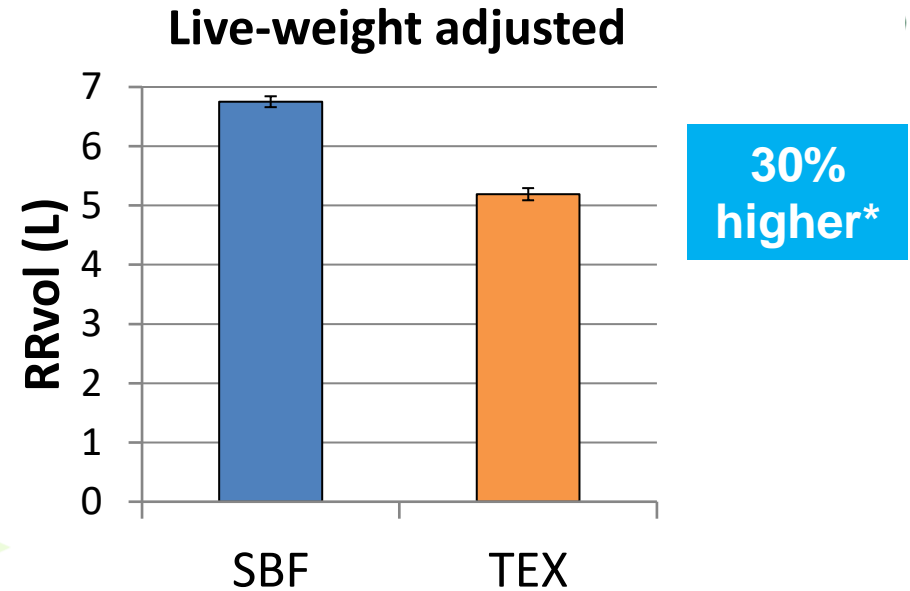
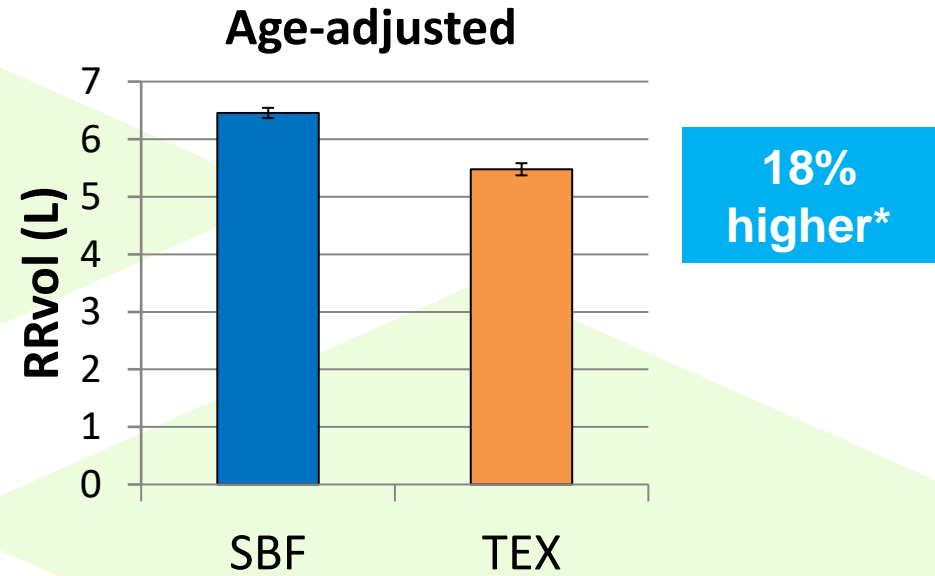
Bigger rumen
= more methane



CT reticulo-rumen (RR) volume
related to CH₄ emissions



Breed effect on rumen volume (RRvol)



* P<0.001



- Texel
- Scottish Blackface

Sire

Genetic effects on rumen volume

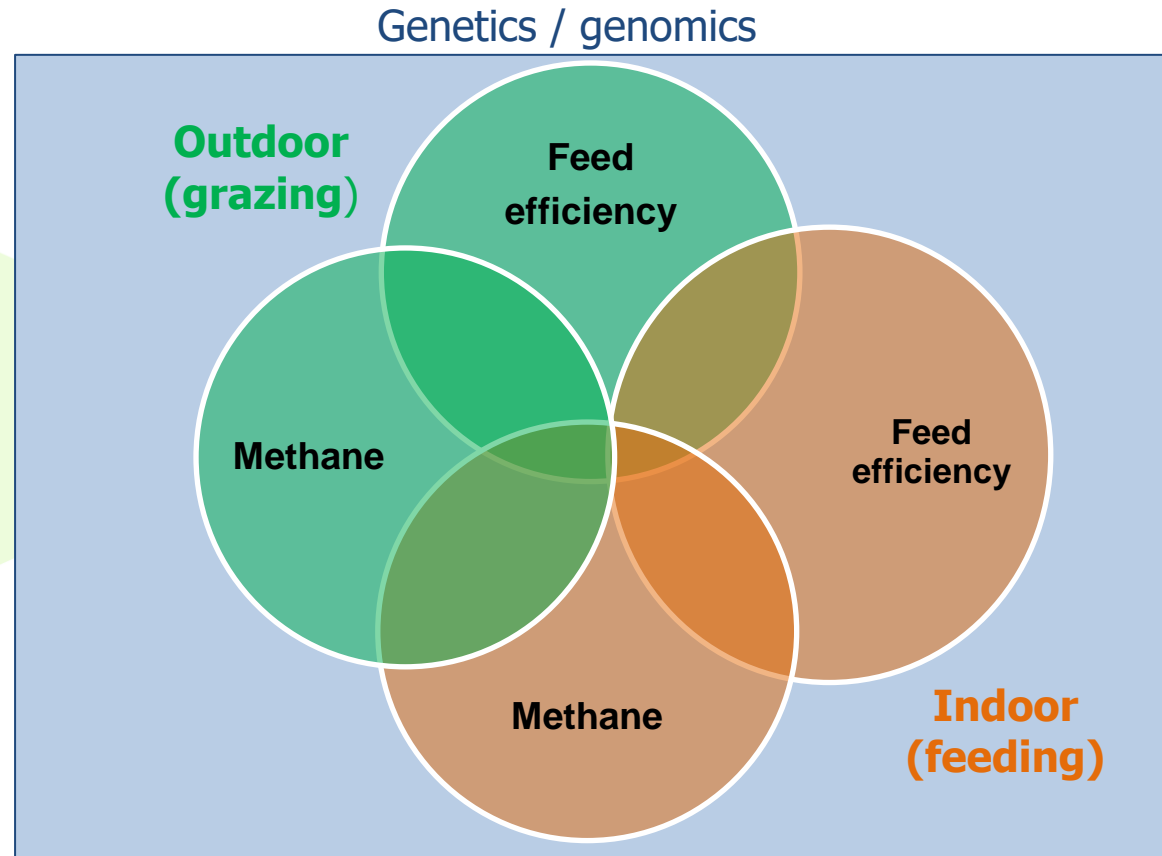


- Rumen volume measured from routine CT images
- Moderately heritable in Texel lambs ($h^2 = 0.45$)
 - potential for genetic selection within-breed?
- Genetic relationships with other economic / environmental traits?
 - Favourable CH_4 vs carcass traits (lean yield, dressing %)
 - Animals inefficient at digesting fibre produce less CH_4 (Cabezas-Garcia et al., 2017)
 - Different priorities in different production systems?



Grass to Gas project (2019-2023)

- Strategies to mitigate GHG emissions from pasture-based sheep systems





SMALL RuminanTs breeding for Efficiency and Resilience

WP1. Novel traits to improve resource use efficiency

Identify novel phenotypes related to resource use efficiency:

- feed efficiency
- body tissue mobilisation
- methane emissions

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Portable Accumulation chambers (PAC)



Conclusions



- Promising tools are being developed to measure traits related to GHG emissions from sheep
- Enabling genetic selection for reduced methane emissions
- International collaboration is key:
 - Avoids duplication of research effort / funding
 - Pools expertise
 - Accelerates industry implementation
 - Global problem requires global solution
 - SRUC: SG-funded research informing larger international projects



Acknowledgements



Thanks for your attention!

