



# Could rumen volumes measured by CT scanning help to breed sheep with lower methane emissions?

N. R. Lambe, A. McLaren, K. McLean,  
J. Gordon and J. Conington

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

# Background: rumen volume vs CH<sub>4</sub>



## Low vs high methane emission lines

- Goopy et al, 2014 – Australia
- Bain et al. 2014; Elmes *et al.* 2014; Waite *et al.* 2018 - NZ

## Progeny of sires divergent for methane emissions

- Bond *et al.* 2019; Oddy *et al.* 2019

Bigger rumen  
= more methane

## Rumen-canulated sheep

- Pinares-Patino *et al.* 2003

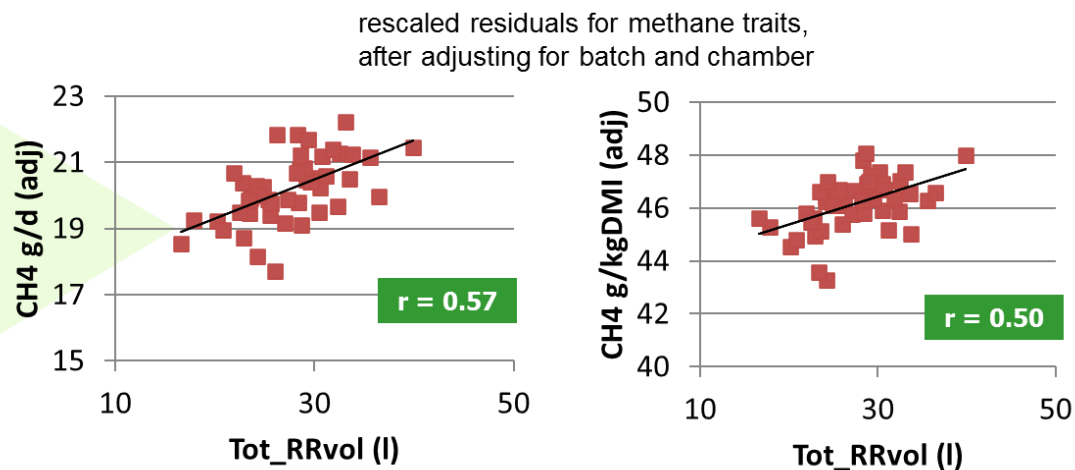
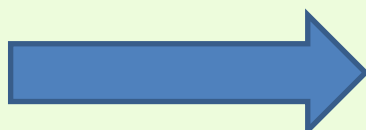
- longer rumen retention =
- larger rumen fill =
- higher methane yields

## Maternal selection lines

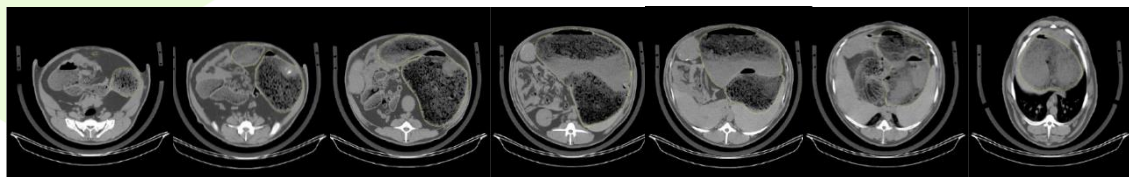
- Lambe et al. 2019

# Rumen volume vs CH<sub>4</sub>

Lambe, Miller, McLean, Gordon and Dewhurst 2019.  
Prediction of methane emissions in sheep using  
computed tomography (CT) measurements of rumen  
volume. British Society of Animal Science.



CT reticulo-rumen (RR) volume  
related to CH<sub>4</sub> emissions

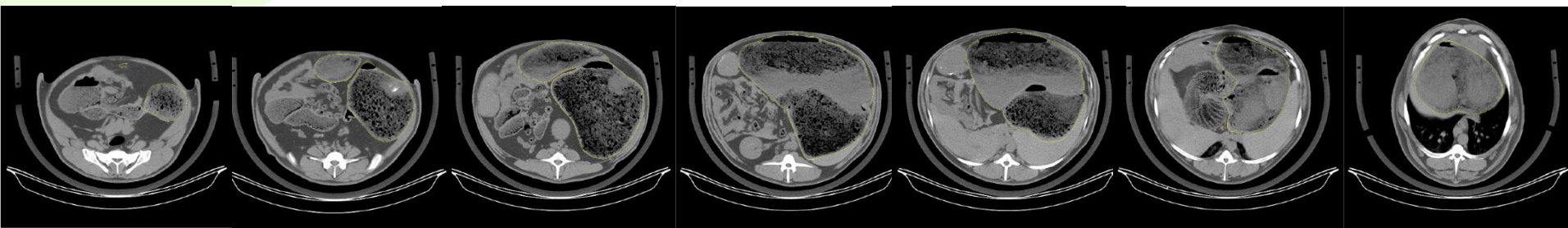


# Methods: CT image analysis

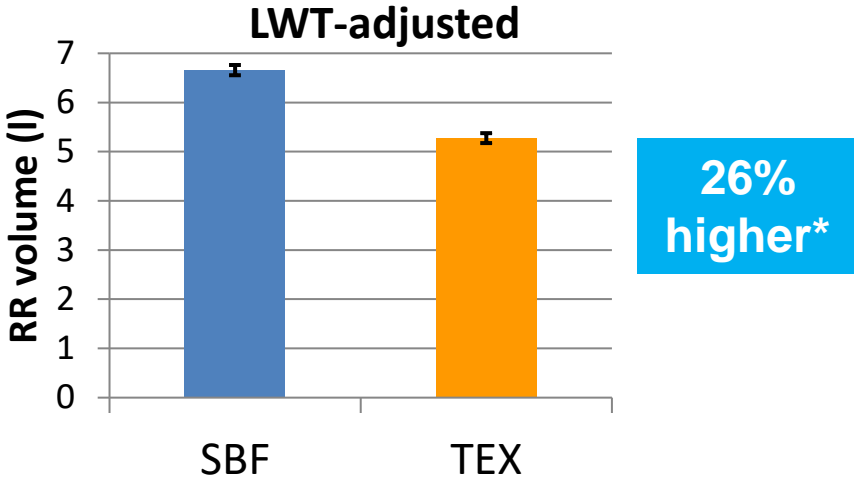
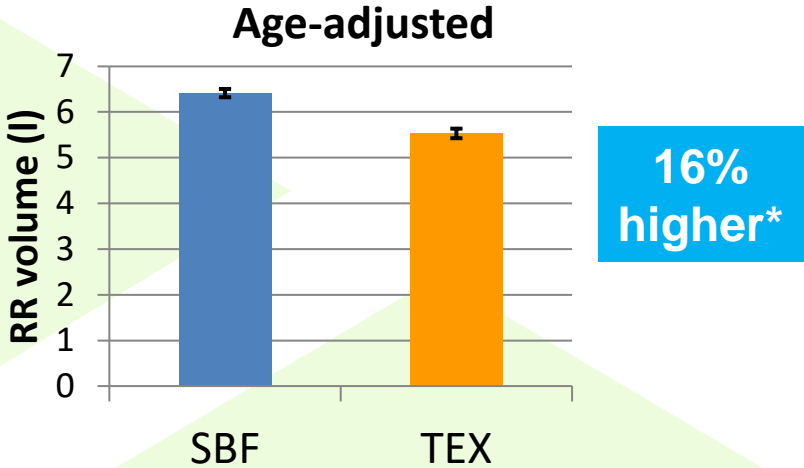


## *CT image analysis*

- Methods refined on 50 lambs
    - mixed breed & sex
  - Cross-sectional images every 8mm
    - measure areas every 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup> image:  $\Sigma(\text{area} \times \text{thickness})$
    - 6<sup>th</sup> image (48mm apart),  $R^2 = 0.99$  with 16mm
    - average 8 images vs 22 images
- Reticulo-rumen volume (RRvol)



# Results: Breed effect on RR volume

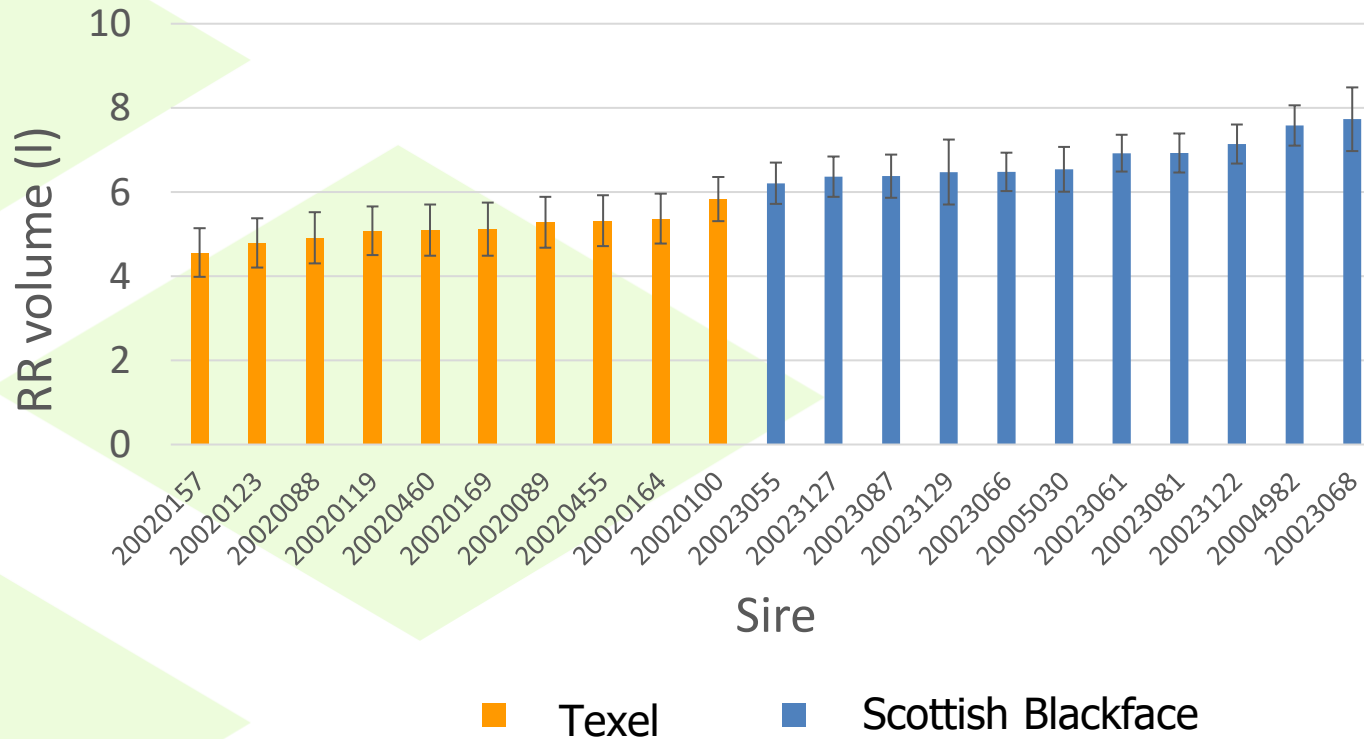


\* P<0.001

# Results: Sire effect on RR volume



Adjusted means for RR volume (LWT adjusted)



n=220 lambs

- Significant sire differences, even within breed ( $P < 0.05$ )

# Results: Genetic effects on RR volume



- Reticulo-rumen volume measured from routine CT images
  - Moderately heritable in Texel lambs ( $h^2 = 0.52$ )
  - Potential for genetic selection within-breed?
- 
- Effects on other traits?
    - Favourable RR volume vs carcass traits (muscle wt, carcass wt)
    - Favourable  $CH_4$  vs carcass traits (lean yield, dressing %, Elmes et al., 2014)
    - Animals inefficient at digesting fibre produce less  $CH_4$  (Cabezas-Garcia et al., 2017)
    - Different priorities in different production systems?



# Acknowledgements



Scottish Government  
Riaghaltas na h-Alba  
gov.scot

