

Animal health and GHG gas intensity: the paradox of periparturient parasitism

Jos Houdijk^{1,2}, Bert Tolkamp²,
John Rooke³ and Mike Hutchings²

¹Monogastric Science Research Centre, SRUC

²Disease Systems, SRUC

³Future Farming Systems, SRUC

Background

- Pathogen exposure reduces feed intake
 - Parasitism would reduce GHG output
 - Does parasitism affect GHG yield?
- Pathogen exposure reduces performance
 - Parasitism may increase nutrient input to obtain similar production output
- Here, we assessed the impact of ewe parasitism on GHG intensity for lamb production

Materials and Methods

- Experimental treatments (n=16)
 - Control
 - sham infection (water)
 - *ad libitum* fed pelleted lucerne throughout
 - Parasitised
 - *Teladorsagia circumcincta* (abomasal nematode)
 - trickle infection (10,000 L₃, Mon-Wed-Fri)
 - *ad libitum* fed pelleted lucerne throughout
 - Restricted
 - sham infection (water)
 - fed pelleted lucerne at 80% of control during lactation



Materials and Methods

- Periparturient observations (n=16)
 - From d_{-28} to d_{30} (d_0 is lambing)
 - Weekly body weight
 - Twice weekly feed refusals
 - Total tract digestibility (d_{28} to d_{30})
- Respiration chambers (n=8)
 - From d_{30} to d_{36}
 - 3 days adaptation
 - 3 days measurements
(last day used in calculations)



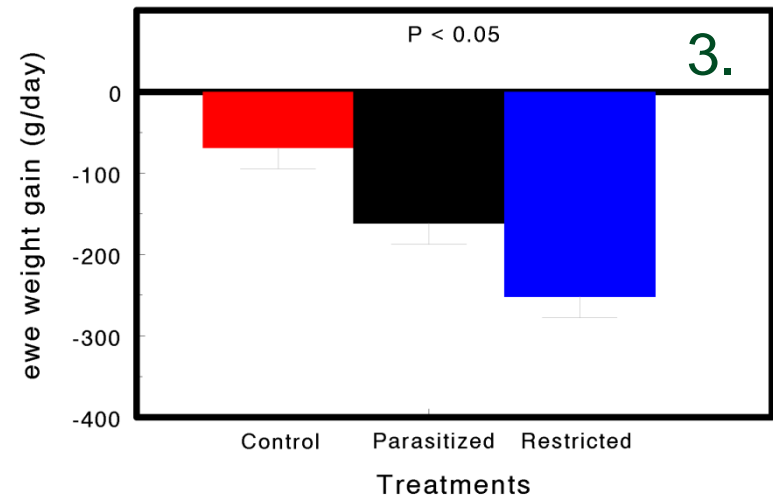
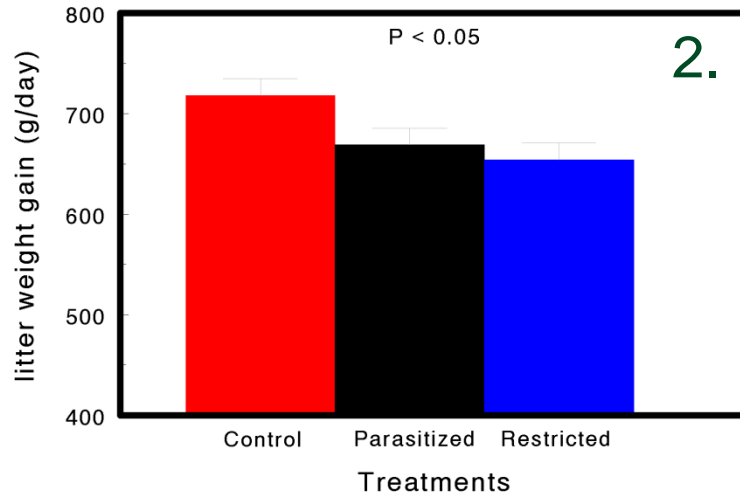
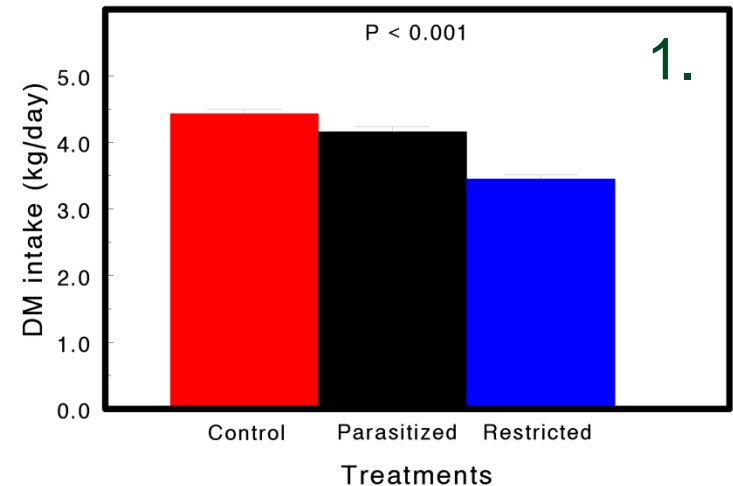
Materials and Methods

- Respiration chambers
 - Enteric GHG production
 - Methane
 - Carbon dioxide
- Total tract nutrient digestibility
 - Organic matter (dOMI)
 - Volatile solids
 - Manure methane
 - Nitrogen
 - N excretion
 - Manure nitrous oxide



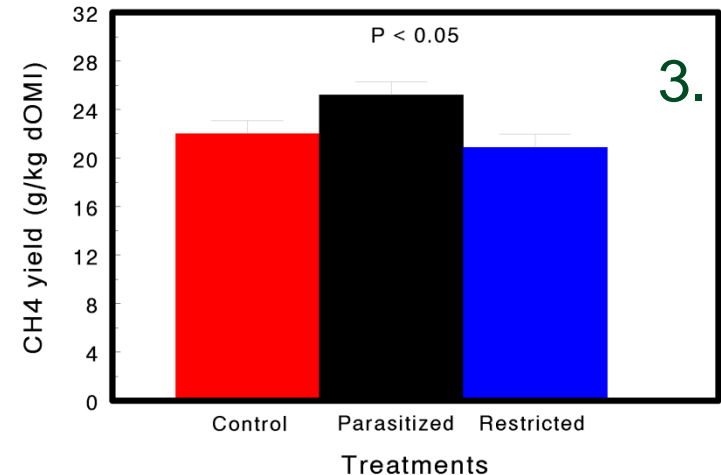
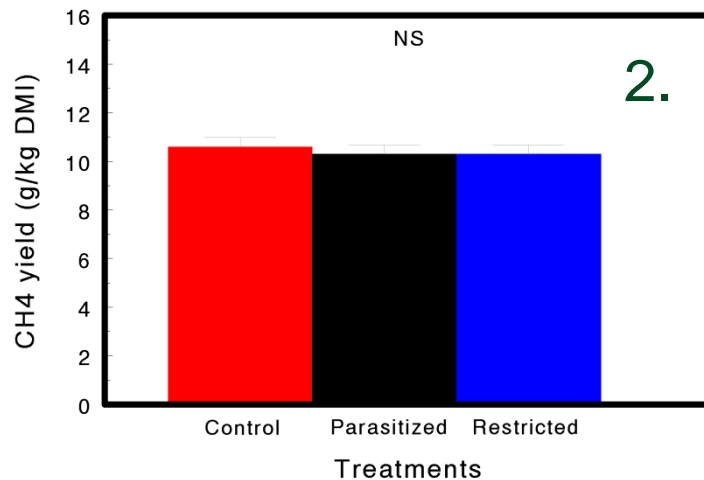
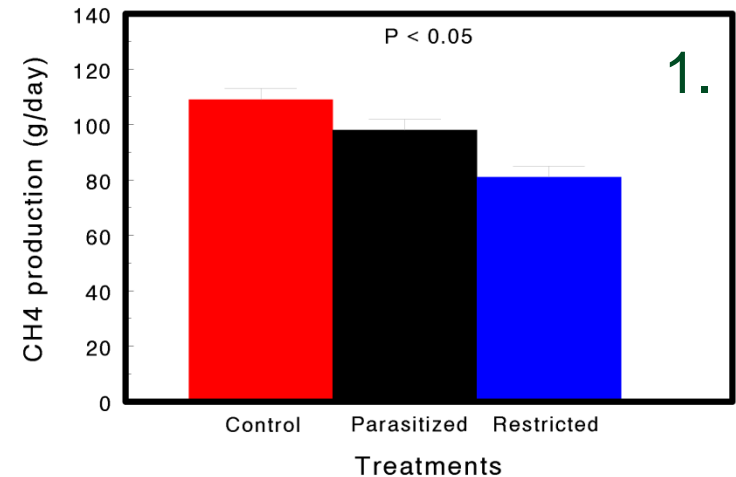
Ewe performance during lactation

- Parasitism reduced performance
 - Anorexia
 - Reduced litter weight gain
 - Increased body weight loss



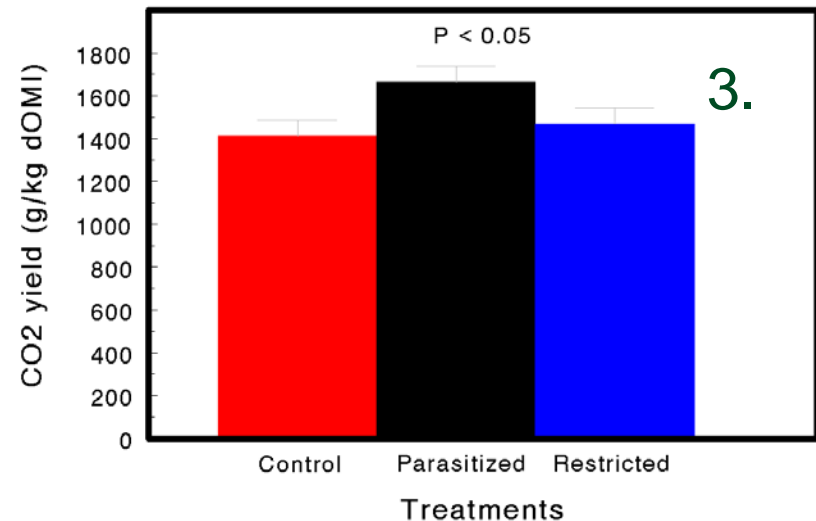
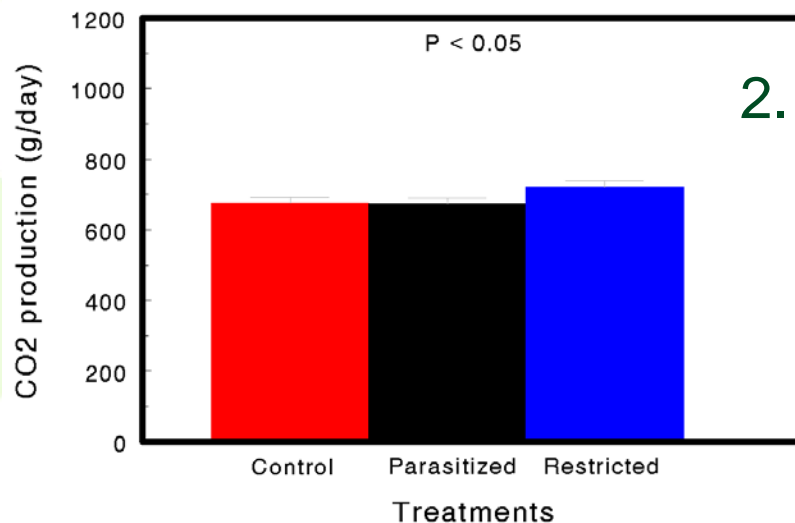
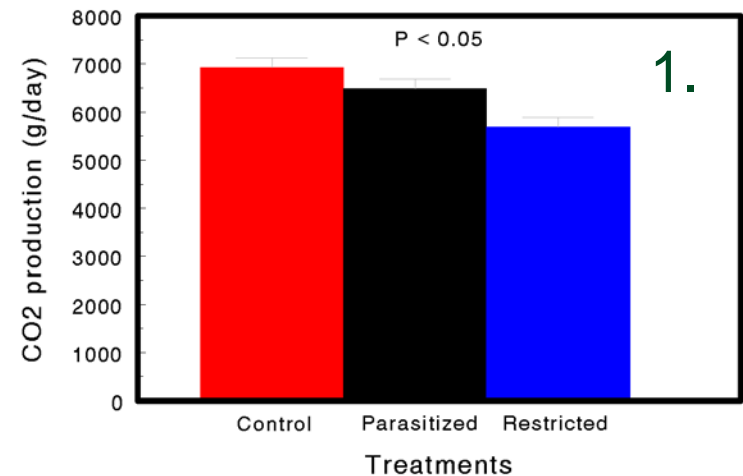
Enteric Methane

- Parasitism and enteric CH₄
 - Reduced production
 - No effect on yield per kg DMI
 - Increased yield per kg dOMI



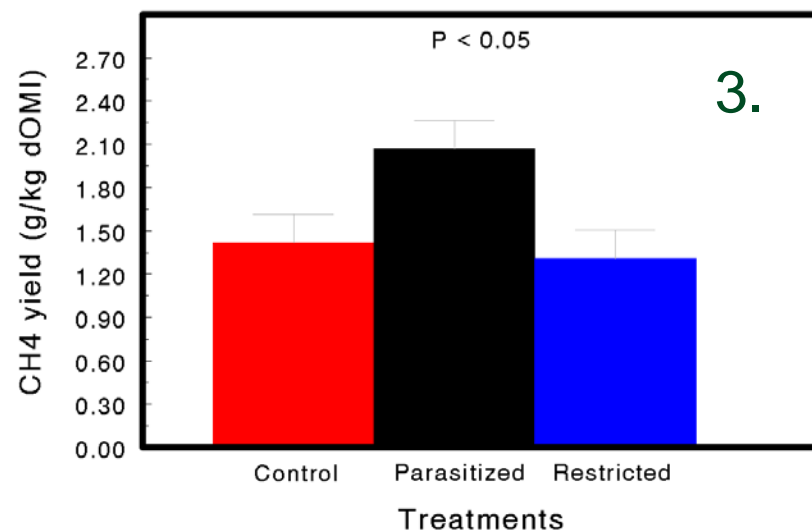
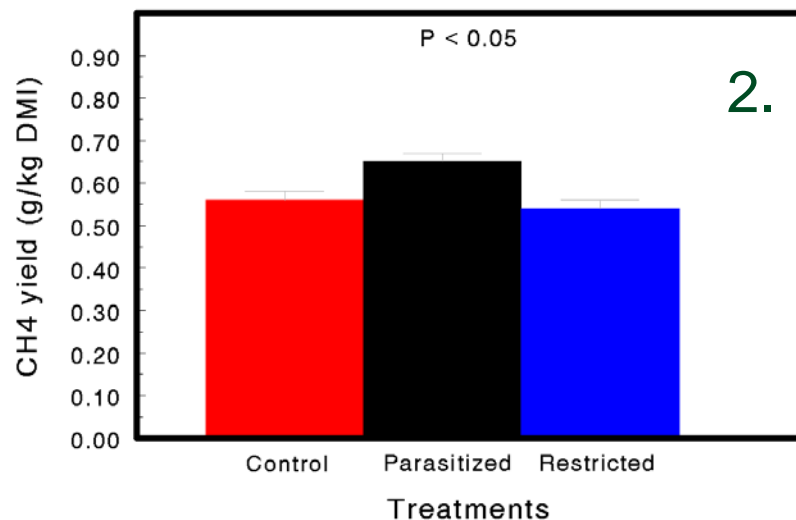
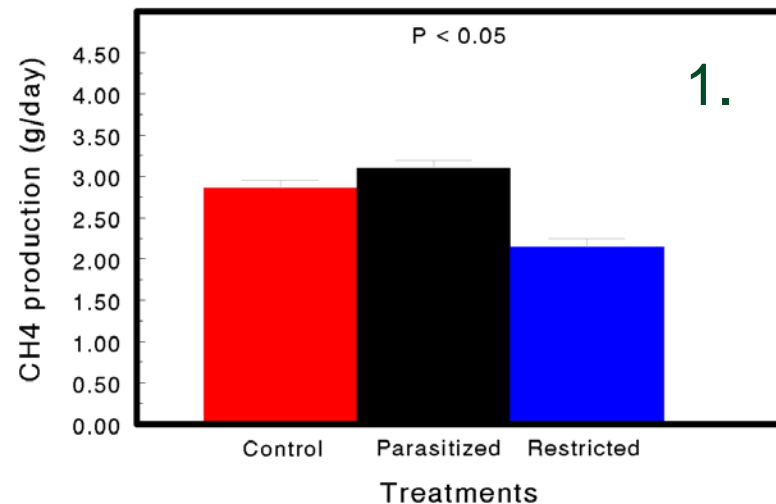
Enteric Carbon dioxide

- Parasitism and enteric CO₂
 - Reduced production (trend)
 - No effect on yield per kg DMI
 - Increased yield per kg dOMI



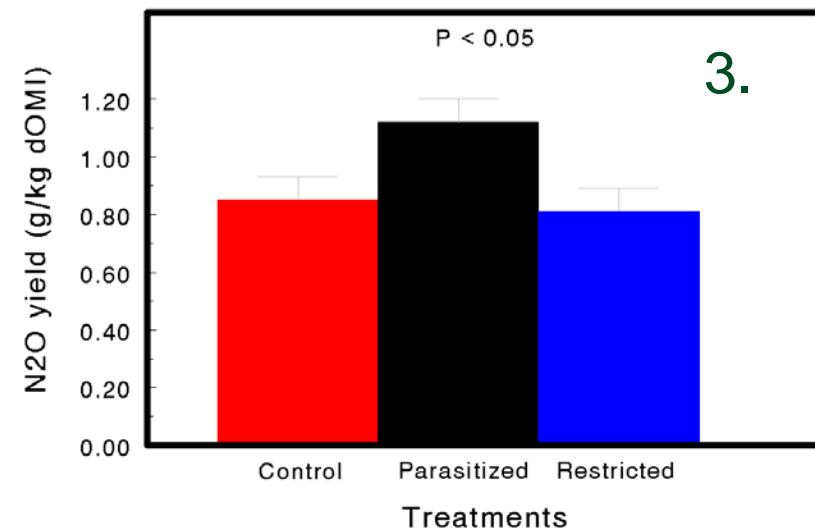
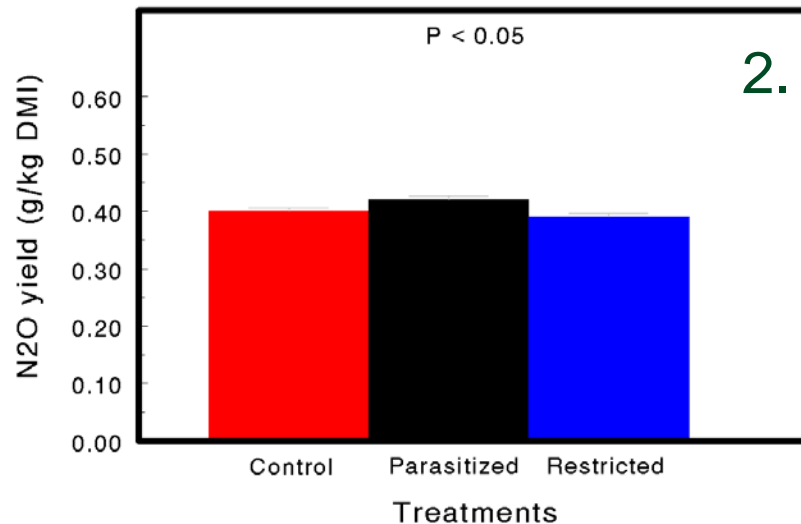
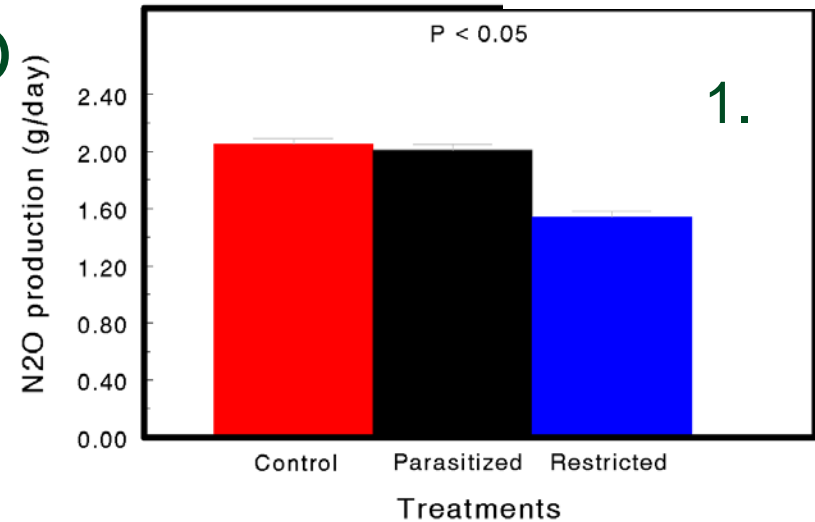
Manure Methane

- Parasitism and manure CH₄
 - No effect on production
 - Increased yield per kg DMI
 - Increased yield per kg dOMI



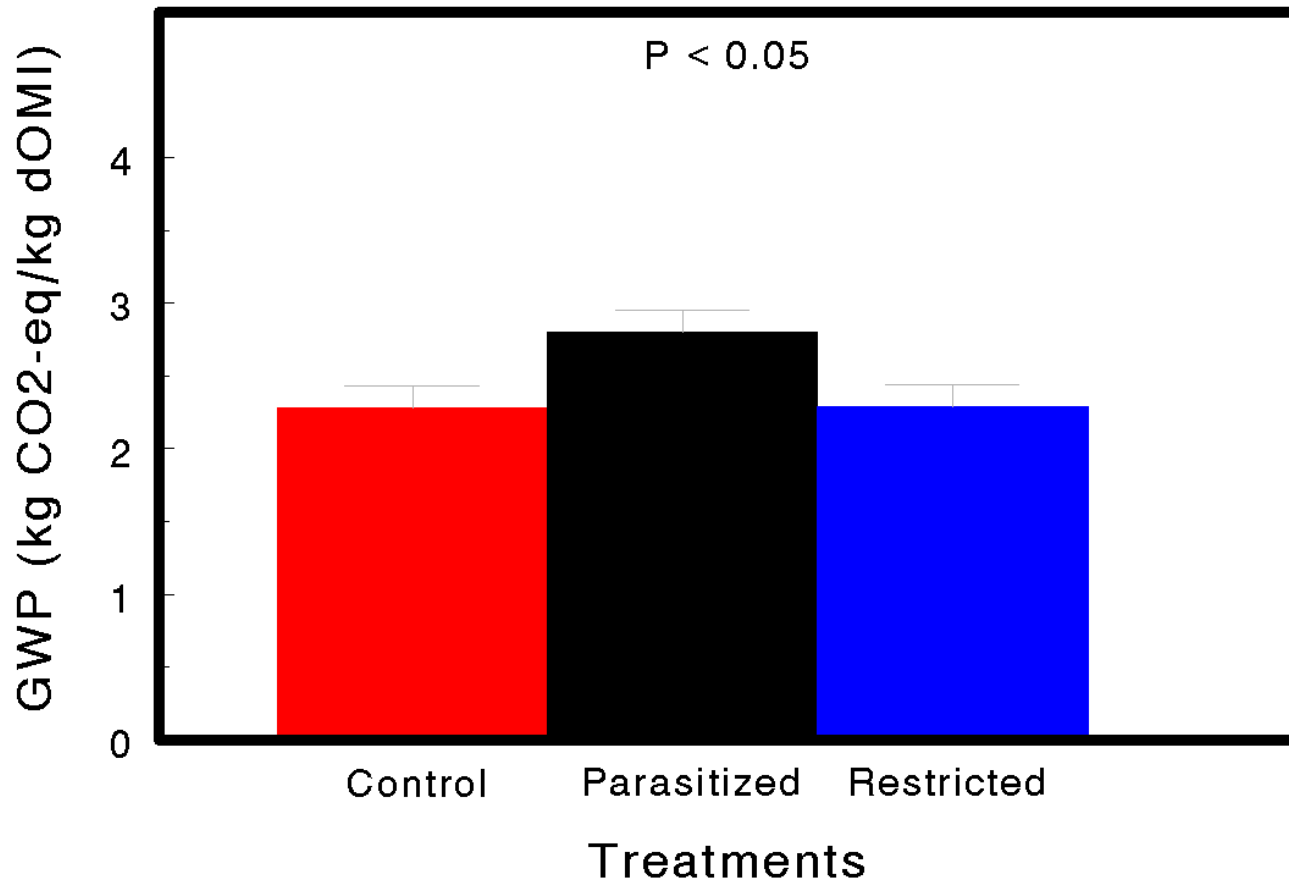
Manure Nitrous oxide

- Parasitism and manure N_2O
 - No effect on production
 - Increased yield per kg DMI
 - Increased yield per kg dOMI



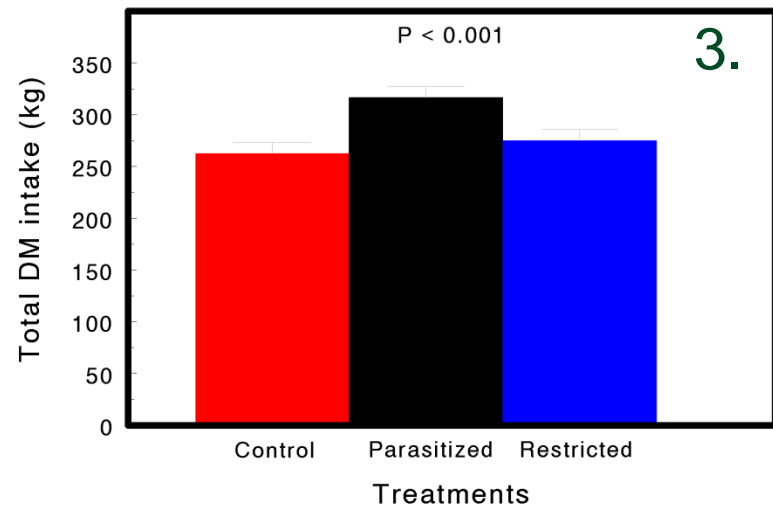
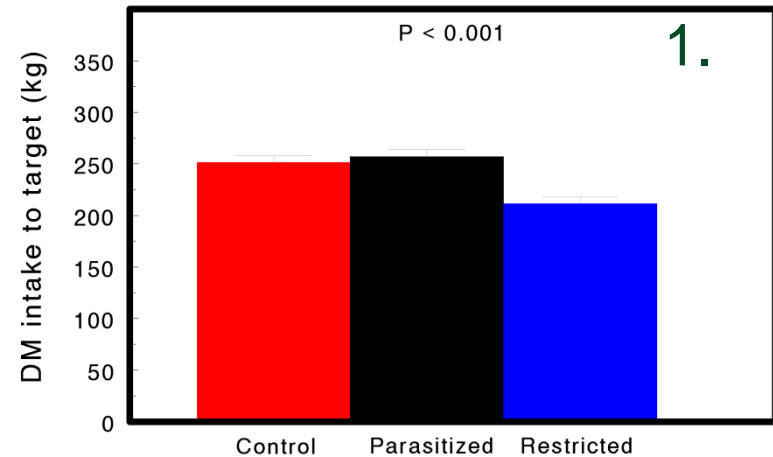
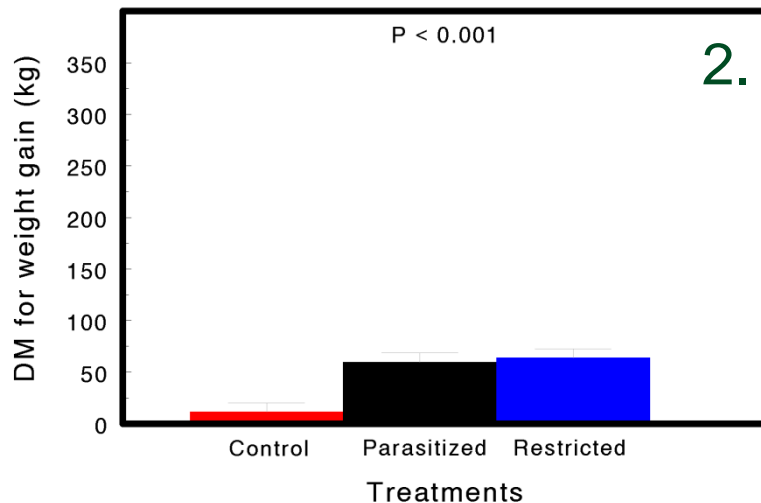
GHG combined

- Parasitism increases combined GHG yield per kg dOMI



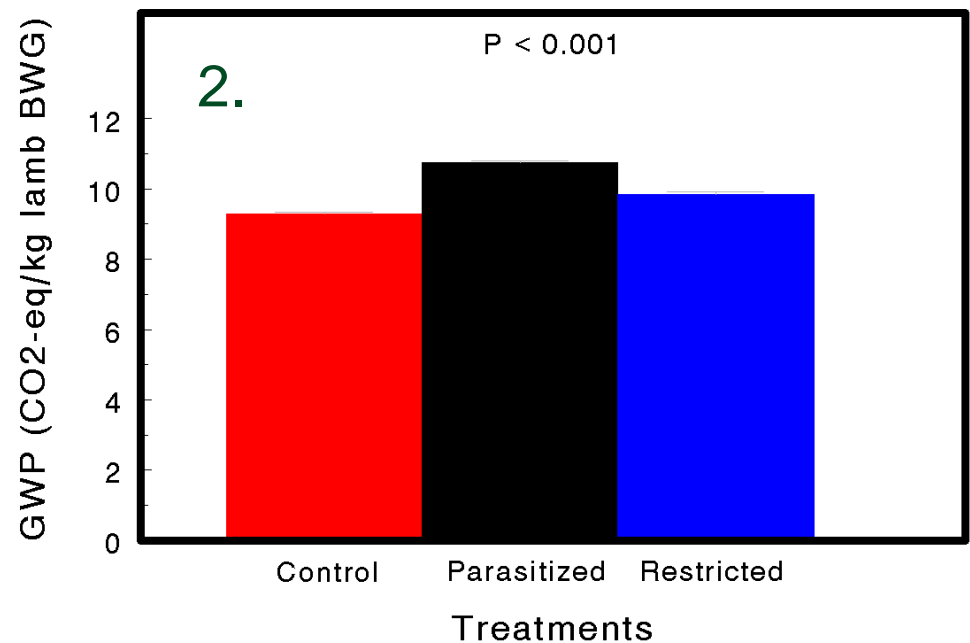
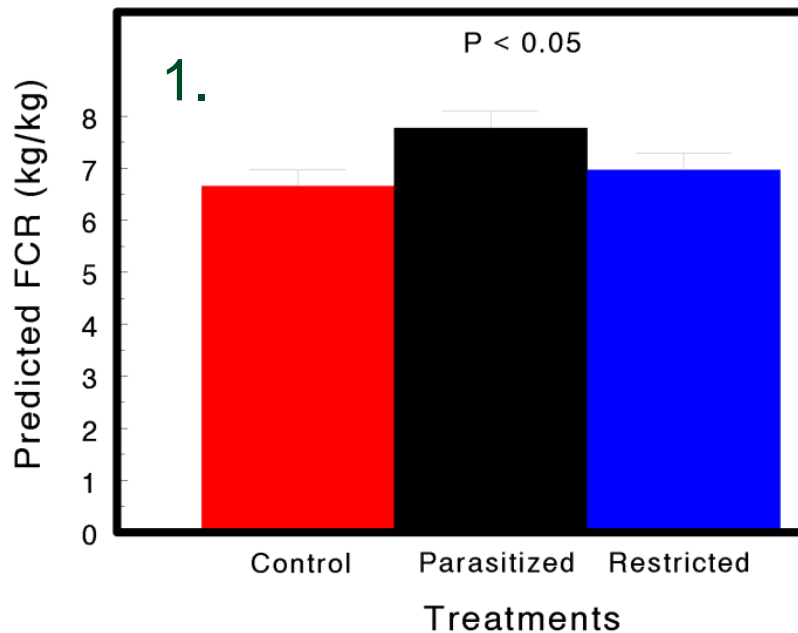
Feed need to wean lambs at 25 kg

- Parasitism and feed need to target
 1. Similar to weaning
 2. Greater to restore BW
 3. Total feed need drives GHG intensity for lamb production



Feed conversion ratio and GWP

- Ewe parasitism
 1. Increased FCR
 2. Increased GWP/kg lamb weight gain



Discussion

- Parasitism reduces productivity
 - ewes will require **longer** feeding to reach **similar weaning lamb body weight** and **compensate** for higher rate of **maternal weight loss**
 - this increased feed requirement will increase total GHG output during production cycle
- Parasitism reduces feed value
 - ewes will require **longer** feeding and rely on **body reserves** to reach **similar dOM intake** (proxy for metabolizable energy intake)
 - increased GHG from extra feed requirements: ~16%
 - increased GHG yield per kg dOMI: ~22%

Conclusion

- Periparturient parasitism increases methane intensity for lamb production
 - Increased feed conversion ratio
 - Anorexia
 - Reduction in nutritional value
- Animal health impacts on GHG intensity
 - Quantify impacts through feed conversion ratio
 - Consider additional direct effects

Acknowledgements

- Funding
 - Scottish Government
- Technical assistance
 - Dave Anderson, Terry McHale, Jo Donbavand
 - Ross McGinn, Dave Ross, Lesley Deans
- GHG intensity calculations
 - Michael Macleod, Eileen Wall



**The Scottish
Government**
Riaghaltas na h-Alba