PRIFYSGOL ABERYSTWYTH UNIVERSITY | CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD | BBSRC | IBERS

Athrofa y Gwyddorau Biolegol, Amgylcheddol a Gwledig
Institute of Biological, Environmental and Rural Sciences

Future Forages: Assessing forage of today for climate change conditions of the future

E.H. HART[1], S. CHRISTOFIDES[2], C.T. MÜLLER[2], H. RODGERS[2] and A.H. KINGSTON-SMITH[1]
[1]IBERS, Aberystwyth University, Penglais, Aberystwyth, Ceredigion, SY23 3FL, UK.
[2]School of Biosciences, Cardiff University, Museum Avenue, Cardiff, CF10 3AX, UK.

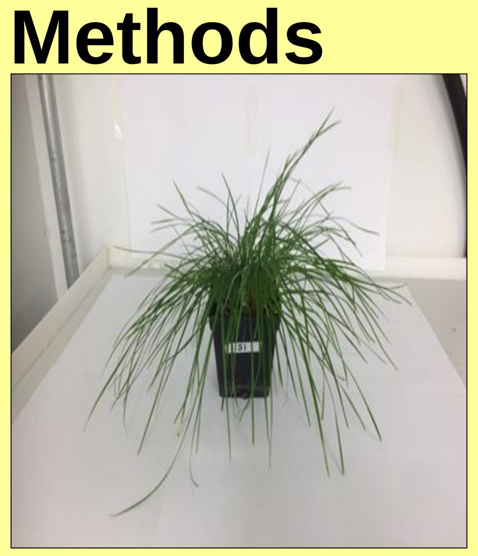
Objective: To determine the effect of future climate conditions on *in vitro* rumen fermentation parameters of three current forage grass varieties

Introduction



Human population growth is predicted to be 9.7 billion by 2050, leading an increase in demand for animal products with a co-incident pressure to decrease environmental pollutants. Ruminant livestock can convert low quality forage feed into high quality products for human consumption. Increases in ruminant production has been achieved to date by continual improvement of forage feed germplasm, therefore the development of potential new forage varieties for livestock production is essential to keep up with future demands. Here we consider the potential effect of climate change effects on quality and utilisation patterns of forage feeds.

Methods



Climate scenario 1: Control 2020 (400 ppm CO_2, 16/18°C, watered)

Climate scenario 2: Control 2050 (500 ppm CO_2, 21/23°C, watered)

Climate scenario 3: Drought (500 ppm CO_2, 21/23°C, no water last wk)

Grass varieties Aber Zeus, Barolex and Premium were grown in triplicate for 3 months in each climate scenario. Grass was then harvested and incubated anaerobically at 39°C with 10% rumen fluid inoculum for 86 hours where total gas and methane were recorded to assess the extent of fermentation (Theodorou *et al*., 1994).

Results and Discussion

Table 1

Variety (V)	Aber Zeus			Barolex			Premium			Significance		
Climate (C)	1	2	3	1	2	3	1	2	3	V	C	Int
Total gas, ml/gDM	107	170	141	95	182	182	145	134	145	*	**	***
Total CH_4, ml/gDM	2.0	7.0	2.6	1.9	9.2	6.8	2.8	4.2	3.7	*	**	ns

There was a variety x climate scenario interaction observed for total gas due to scenario 2 having the highest gas production from Aber Zeus and Barolex varieties and the lowest total gas from Premium (Table 1). Methane production was highest in Barolex with similar values observed for Aber Zeus and Premium. Additionally, total methane production was highest in scenario 2 and lowest in scenario 1. Discriminant functional analysis (DFA) scores from FTIR of the 86 h incubated grass residue (Aber Zeus – AZ, Barolex – B, Premium – P) resulted in grouping of grass varieties from 2020 and 2050 climate scenarios together and those from the drought (D) scenario grouping separately with Premium (P) grown in the 2050 climate, grouping with grasses grown in drought conditions (Figure 1). These results suggest that Premium is the most consistent grass variety across the climate scenarios in terms of *in vitro* gas production. However, we have shown that climate scenario has the potential to play a key role in plant response within the rumen environment. Therefore, future climate should be a consideration for the development of forage breeding programmes for sustainable livestock production.

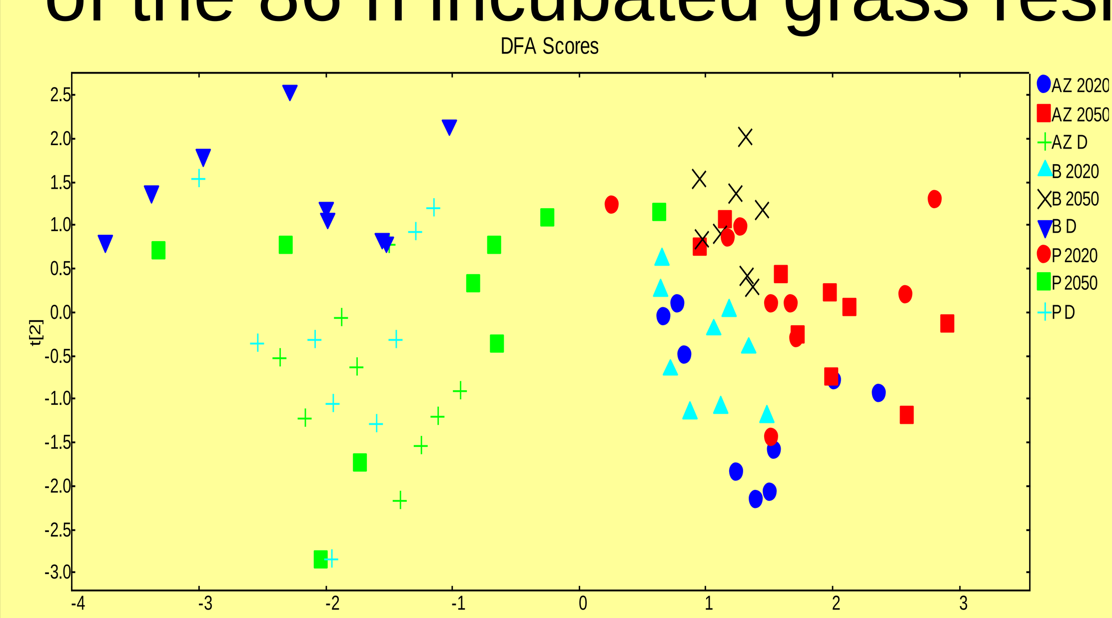
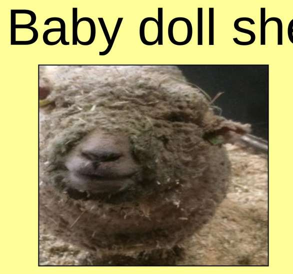


Figure 1

Next Steps

- Animal trials
- Baby doll sheep



Acknowledgements

The authors thank BBSRC for grant funding for this project (BB/R019185/1).

Reference

Theodorou, M.K., Williams, B.A., Dhanoa, M.S., McAllan, A.B and France, J. (1994). A simple gas production method using a pressure transducer to determine the fermentation kinetics of rumen feeds. Animal Feed Science and Technology, 48, 185-197.

Contact

Elizabeth Hart
elh18@aber.ac.uk