Trait definitions for methane production in Australian beef cattle

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First results from the Southern Low Methane Beef project

- Recording and analysing emission records from Southern Australian beef cattle

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mla MEAT & LIVESTOCK AUSTRALIA DONOR COMPANY

Angus Enhancing & Promoting the value of Angus

NSW GOVERNMENT Department of Primary Industries

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une University of New England

Aims

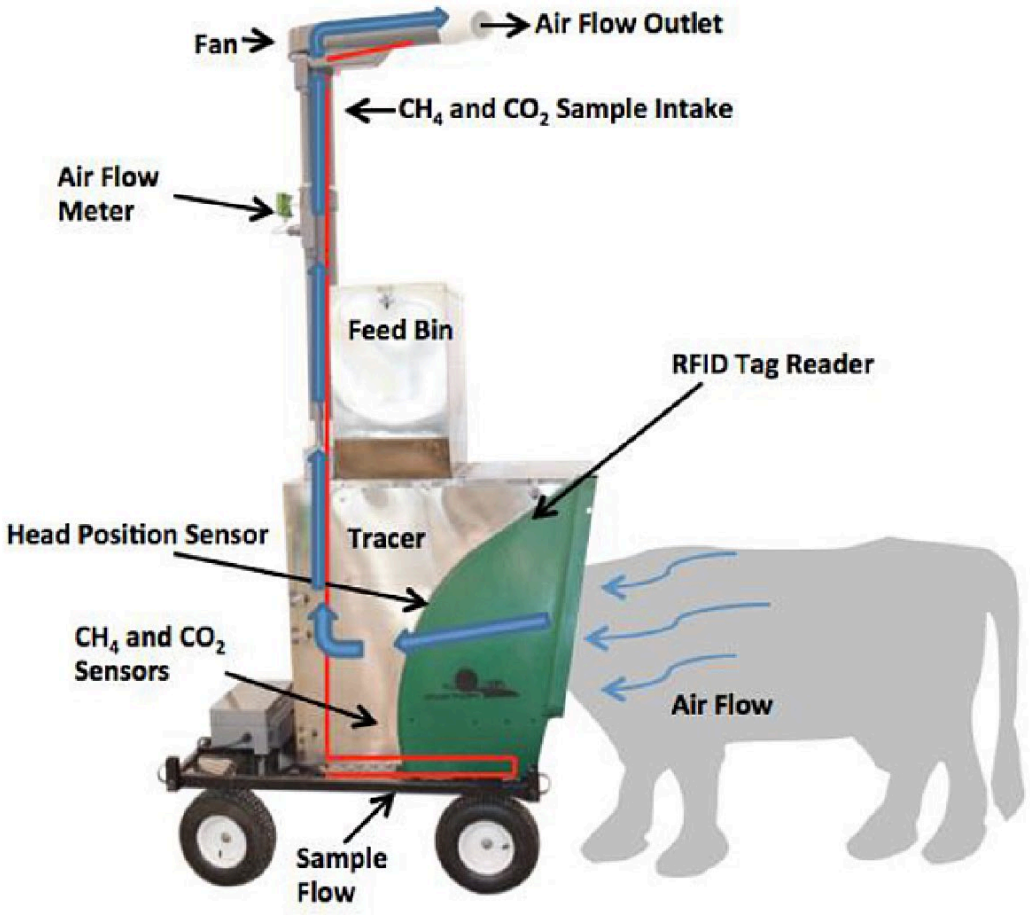
Estimating

1) Variance components of emission production traits
2) Correlations between emission production traits and production traits

in Australian beef cattle steers* using trial average emission traits

*only Bos Taurus cattle

Recording – Emission traits



Recording – Production traits

70-day feed efficiency trial

- Weight recorded every ~14 days
- Feed intake recorded using Vytalle feed bunks
- Much more

Animals and records

Origin	Records	Animals
Southern MultiBreed	57746	1101
Angus Sire Benchmarking Project	32917	491
Both	90663	1592

Records from animals with less than 5 records were excluded

Origin	Records	Animals
Southern MultiBreed	57592	1030
Angus Sire Benchmarking Project	32885	477
Both	**90477**	**1507**

Pre-correction of raw emission phenotypes

Apply a correction:

$$y = mID + SMT \times Hour + e$$

where:

y = raw CH_4 or CO_2 emission

mID = machine ID

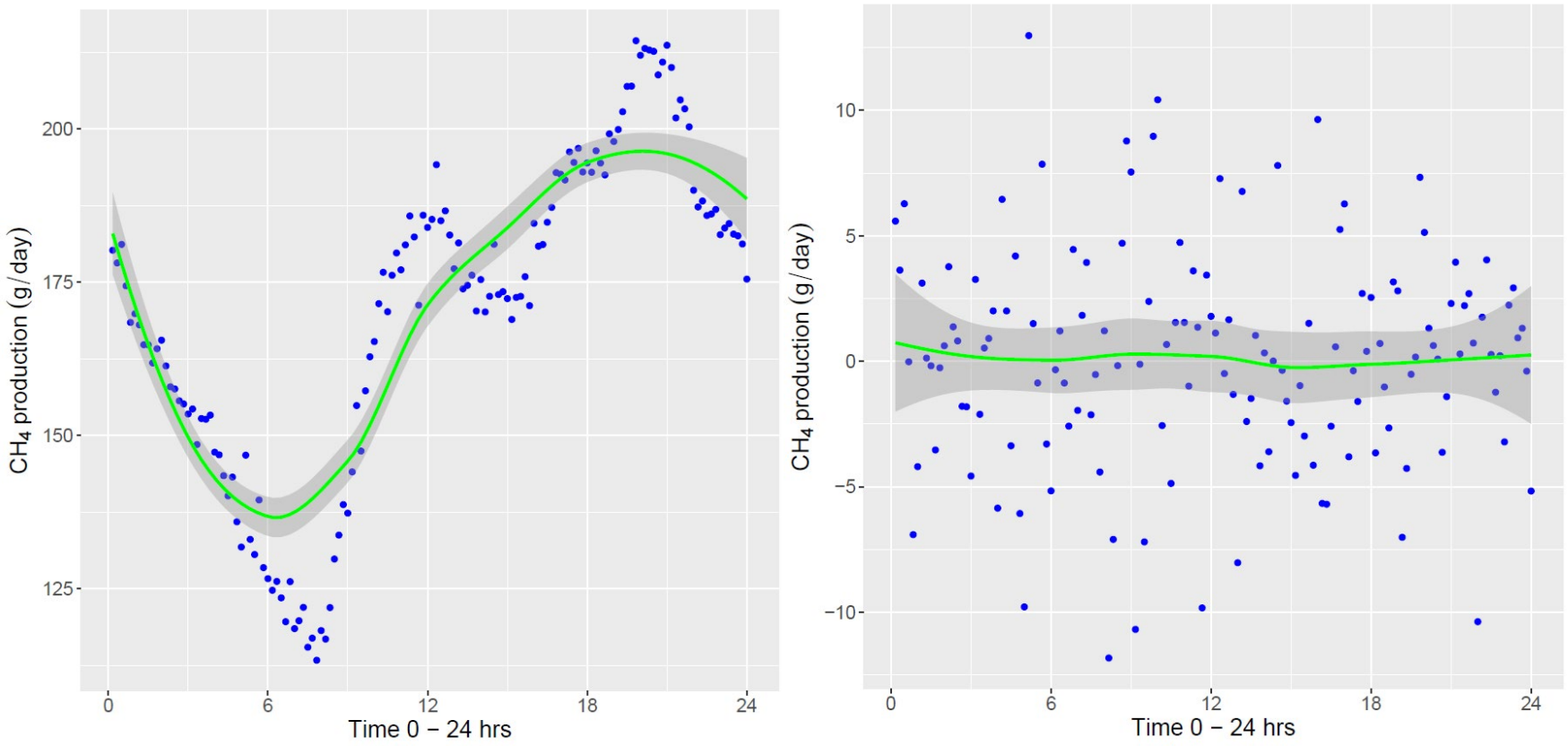
SMT = Start month of trial

Hour = Hour of recording

e = residual = corrected phenotype

Diurnal pattern

The peaks and valleys of emissions across the day



Traits

Methane Production (MP, g/day)

Carbon dioxide Production (CP, kg/day)

Trial weight (TWT, kg)

Average daily gain (ADG, g/day)

Average daily feed intake (DFI, kg/day)

Analysis

Model: $\mathbf{y} = \mathbf{Xb} + \mathbf{Za} + \mathbf{e}$

Fixed effects/covariates:

- Breed using the first 4 principal components
- Contemporary group
- Age
- Age of Dam for TWT

} All traits

Fitted as a 5-trait model with both genetic (using GRM) and residual covariances.

GRM with 3394 animals and 49087 SNPs

Heritability and genetic correlations

	MP	CP	TWT	ADG	DFI
MP	0.40 (0.06)				
CP	0.61 (0.07)	0.41 (0.05)			
TWT	0.57 (0.09)	0.82 (0.06)	0.51 (0.05)		
ADG	0.45 (0.12)	0.66 (0.10)	0.40 (0.12)	0.26 (0.05)	
DFI	0.57 (0.09)	0.88 (0.05)	0.69 (0.06)	0.83 (0.07)	0.46 (0.05)

MP=Methane Production
CP=Carbon dioxide Production
TWT=Trial weight
ADG=Average daily gain
DFI=Average daily feed intake

Conclusion

Trial average CH_4 and CO_2 production is moderately heritable and moderately correlated

Trial average CH_4 production is genetically moderately positively correlated to growth and feed intake traits

Trial average CO_2 production is genetically highly positively correlated to growth and feed intake traits

Thank you