# Measuring Efficiencies in Beef Production

THE UNIVERSITY of ADELAIDE

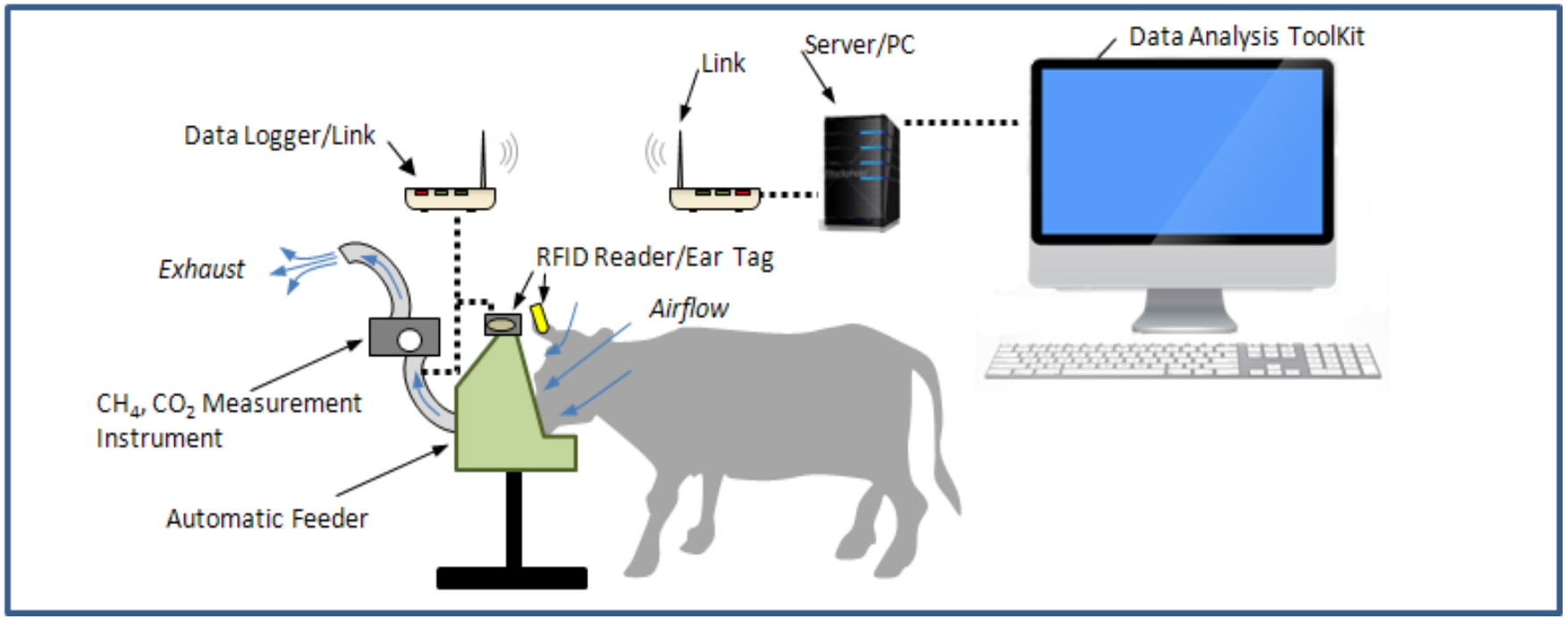
***Michael Wilkes***
***Research Associate***

working together for a clean energy future

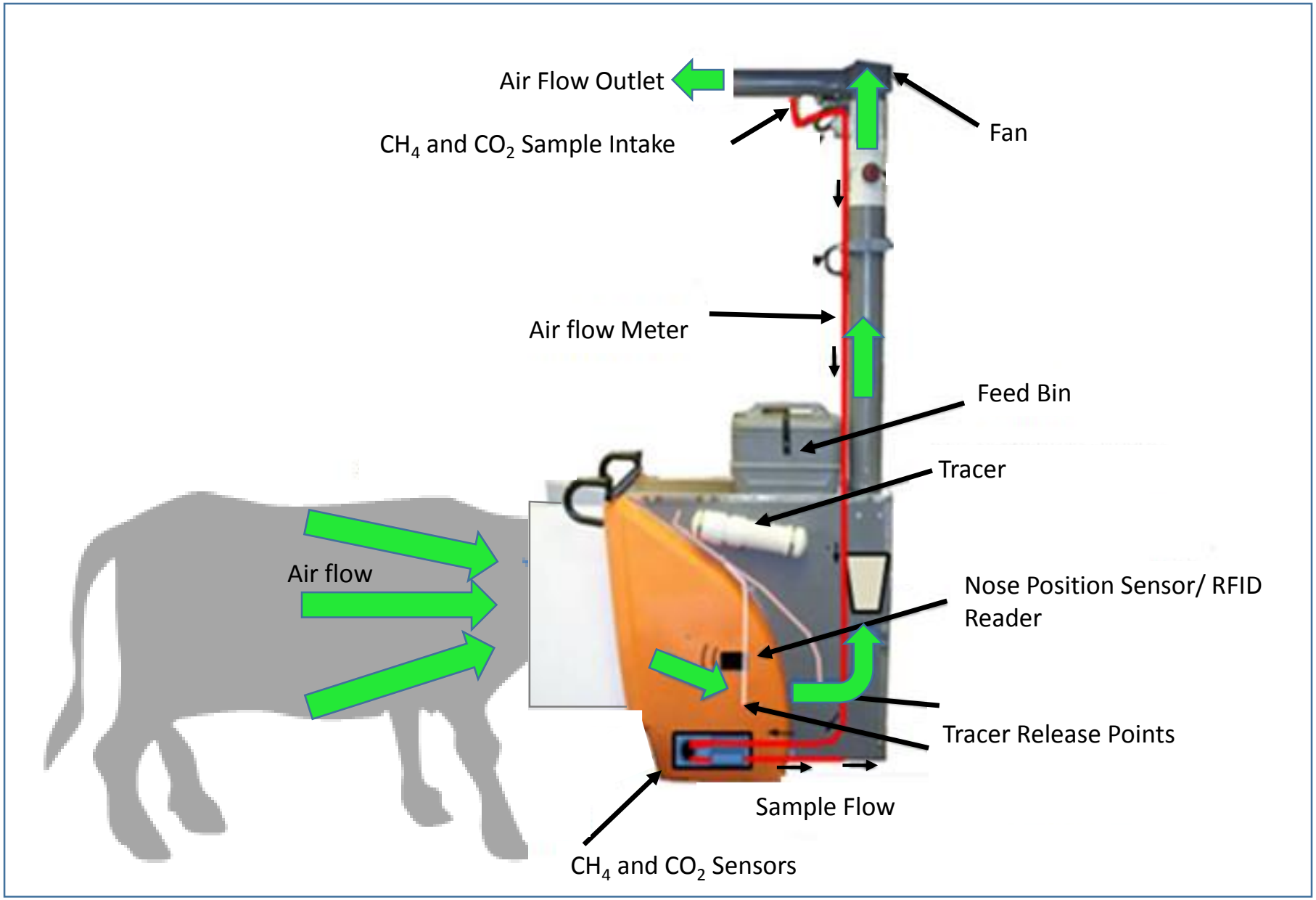
Australian Government
Department of Agriculture, Fisheries and Forestry

# What is GreenFeed?

- ✓ A *portable* *"baiting"* station that measures real-time $CO_2$ and $CH_4$
- ✓ It communicates real-time over the internet, anywhere in the world to authorized users



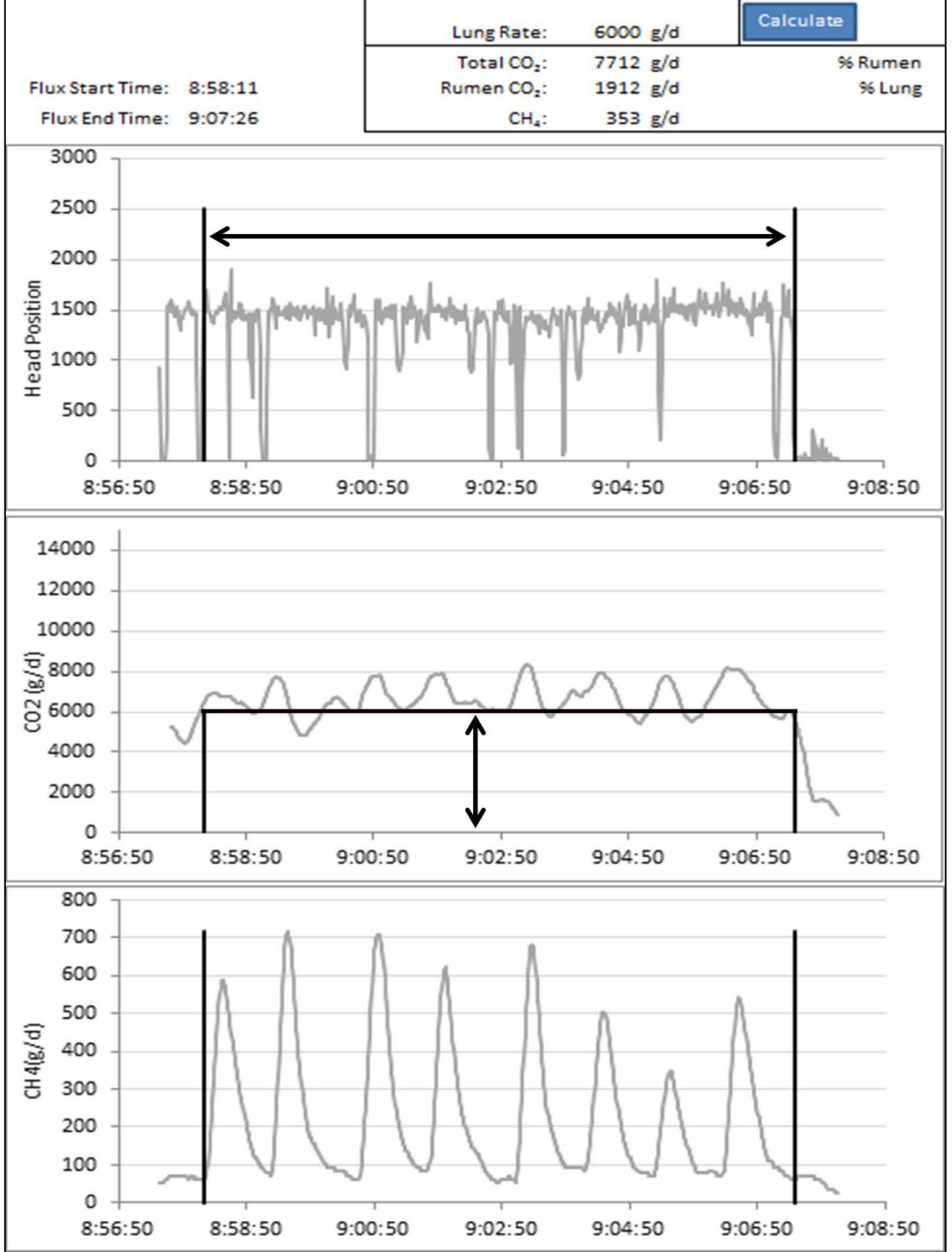
# GreenFeed System



Head position

$CO_2$, g/d

$CH_4$, g/d



**Rumen $CO_2$** total quantity of FERMENTABLE MATERIAL DIGESTED daily in the rumen

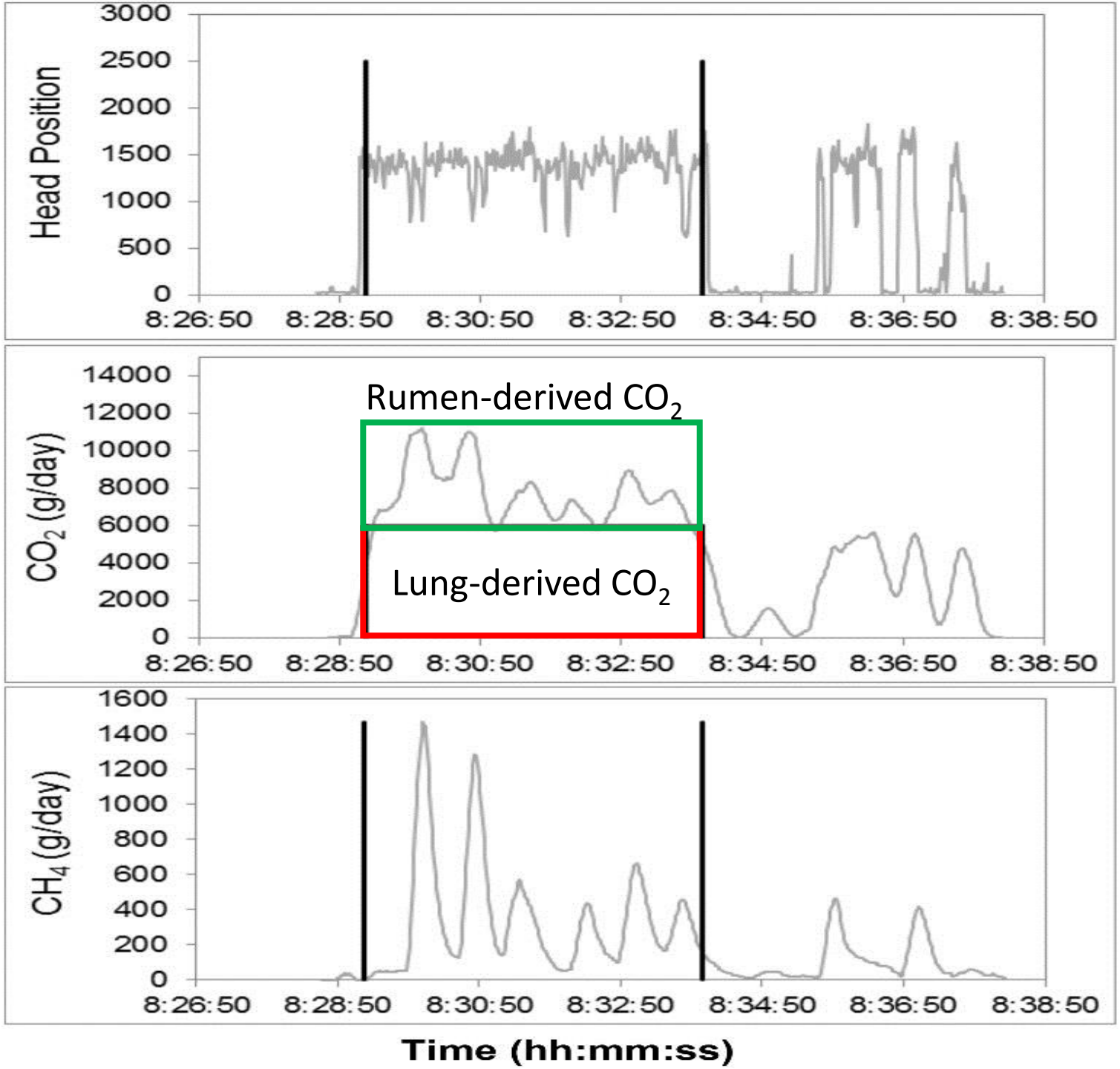
**Lung $CO_2$** Quantify total ENERGY EXPENDITURE by the animal

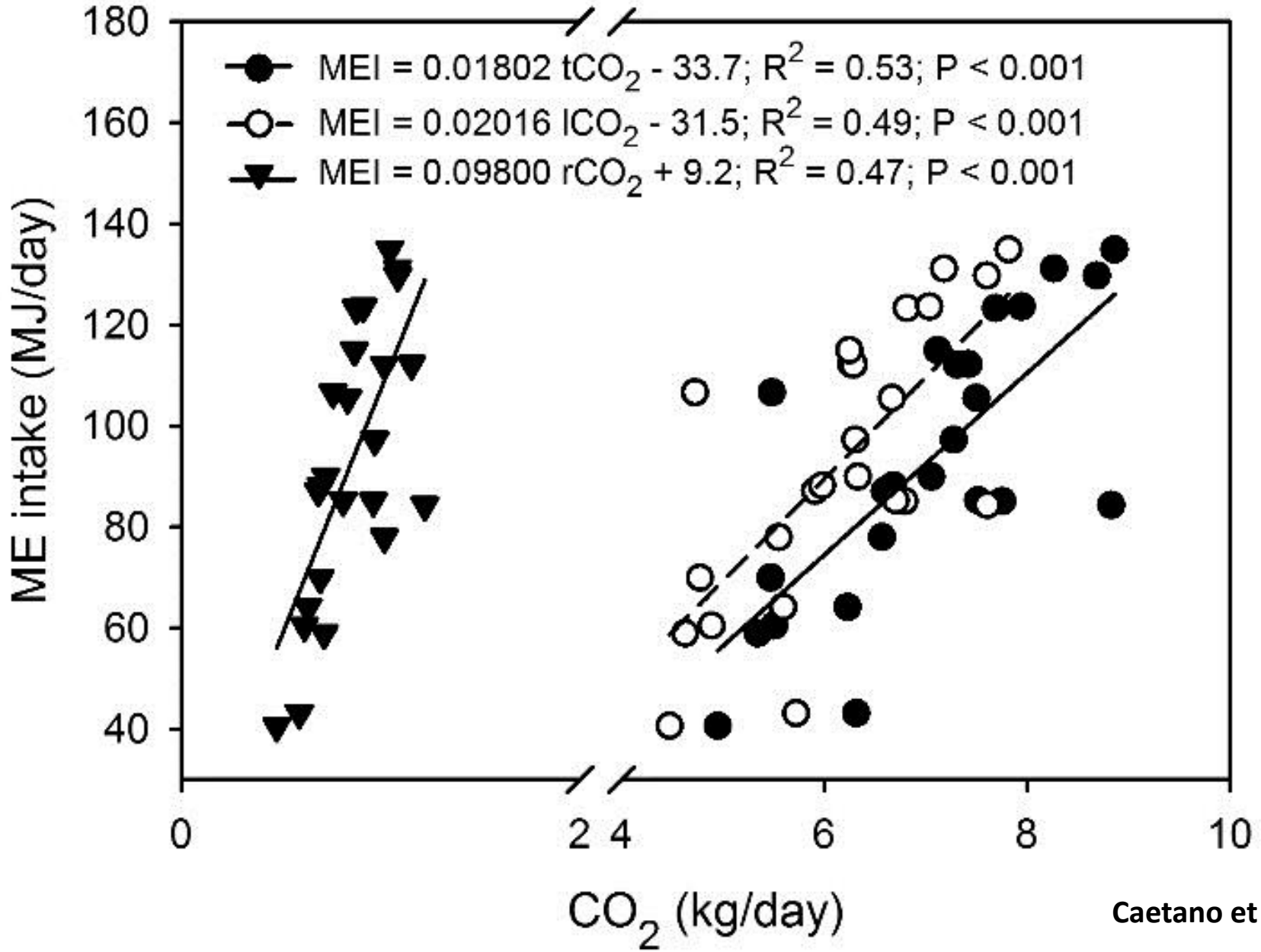
Junghans et al. (2007); Madsen et al. (2010)

# GreenFeed

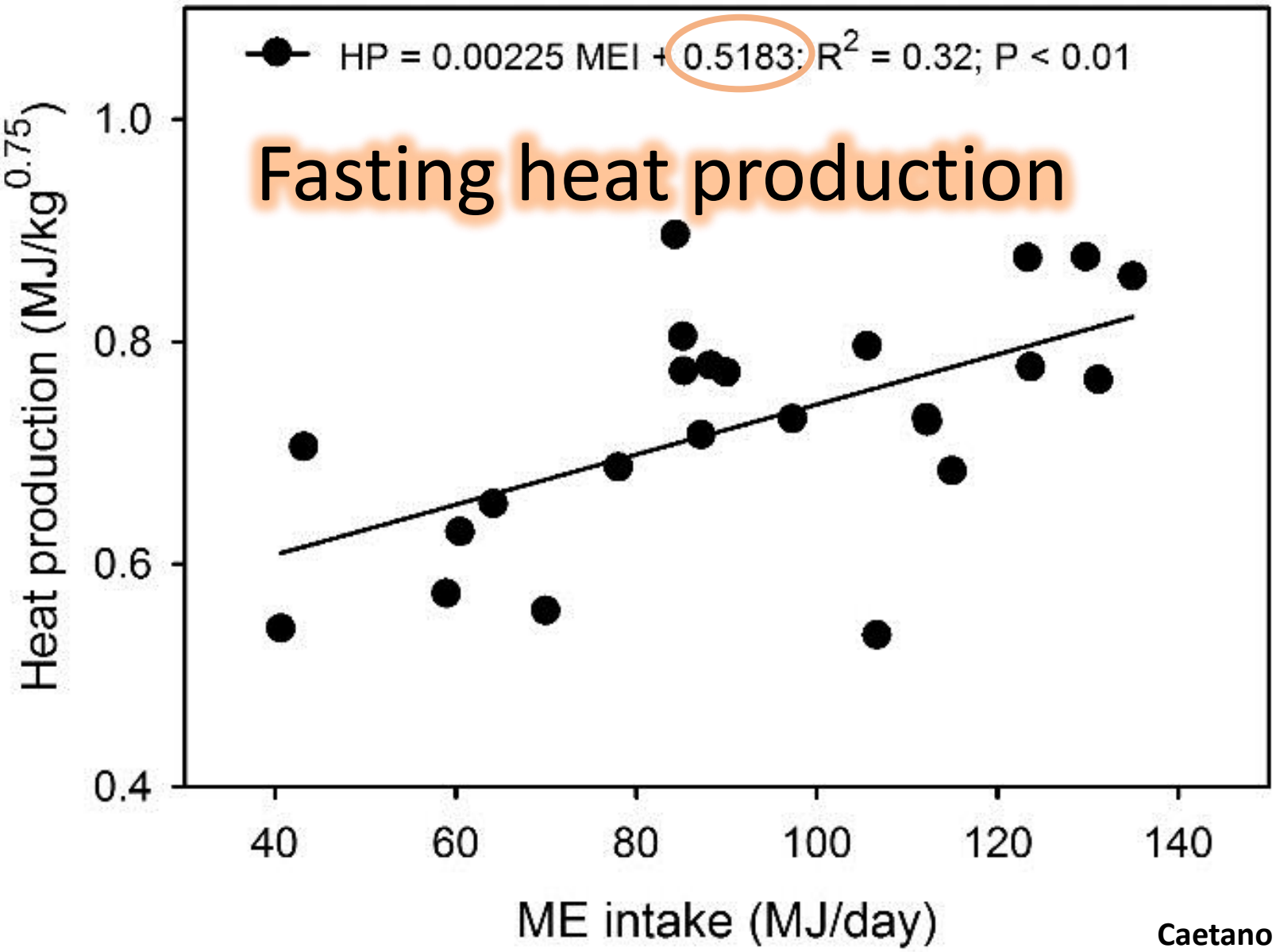
Quantify energy intake

energy expenditure


Head Position
3000
2500
2000
1500
1000
500
0
8:26:50
8:28:50
8:30:50
8:32:50
8:34:50
8:36:50
8:38:50
CO2 (g/day)
14000
12000
10000
8000
6000
4000
2000
0
Rumen-derived CO2
Lung-derived CO2
CH4 (g/day)
1600
1400
1200
1000
800
600
400
200
0
Time (hh:mm:ss)




Caetano et al. 2017




Caetano et al. 2017

# *THE APPLICATIONS ARE ENDLESS!*

*GreenFeed machines can be used to estimate*

*Energy Intake,*

*Energy Expenditure,*

*identifying cows with greater FEED EFFICIENCY*

# Using Grape Marc to Overcome Feed Gaps in Pasture Production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# GRAPE MARC

## Condensed tannins

- ✓ Protect amino acids from ruminal microbes
- ✓ Reduce methane emissions
- ✓ Bloat control
- ✓ Anthelmintic effects
- ✓ Antioxidants
- ✓ Reproduction

## Essential oils

- ✓ Performance
- ✓ Reproduction

# GRAPE MARC

Ensiled crimped grape marc (ECGM)

- Performance
- $CH_4$ emissions

# *Effect of grape marc on energy intake and performance*


20 Angus steers
41 days


**90% Chaff pellet**
**10% Oaten chaff**
ME = 9.5 MJ/kg of DM
Protein = 7.7%

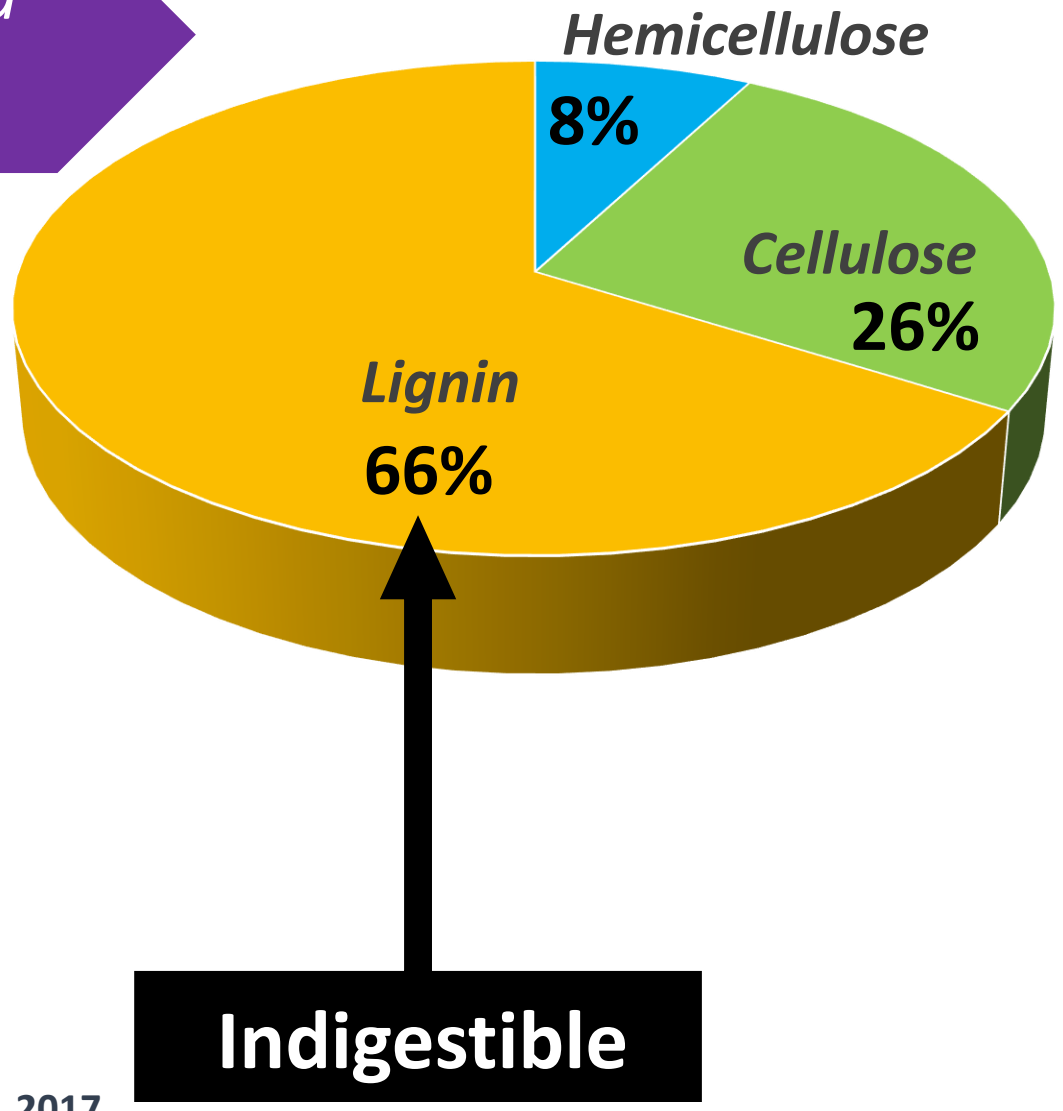
**60% Chaff pellet**
**10% Oaten chaff**
**30% Grape Marc**

Cattle Trial

*The inclusion of 30% grape marc reduced the energy availability*

| | Control | Grape marc |
|---|---|---|
| Final BW (kg) | 443.5 | 424.0 |
| ADG (kg) | 1.758 | 1.600 |
| DM intake (kg/day) | 11.81 | 12.29 |
| Feed:Gain ratio | 6.81 | 7.88 |
| Digestibility of DM (%) | 55.18 | 48.59 |
| ME intake (MJ/day) | 104.0 | 100.3 |
| $CH_4$ (g/day) | 236.9 | 204.2 |
| $CH_4$ (g/kg ADG) | 130.63 | 135.03 |

## Fibre Composition of Grape Marc




Caetano et al. 2017

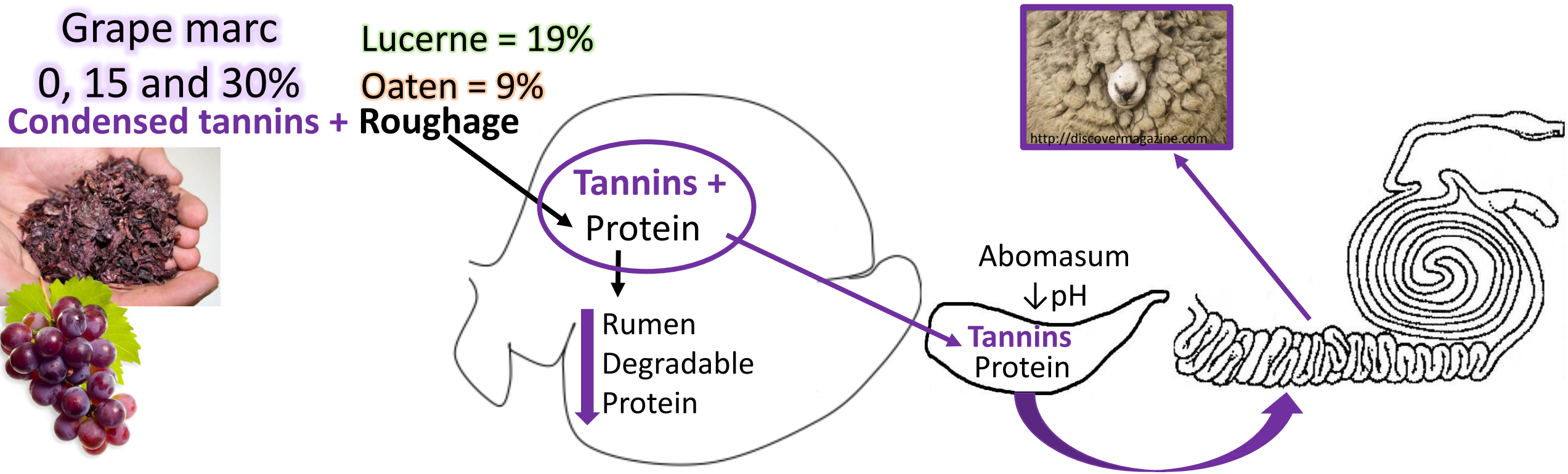
# *Effect of condensed tannins in grape marc to increase protein availability to the animal*

**Haylee A. Clifford**

Grape marc
0, 15 and 30%

Lucerne = 19%
Oaten = 9%
**Condensed tannins + Roughage**







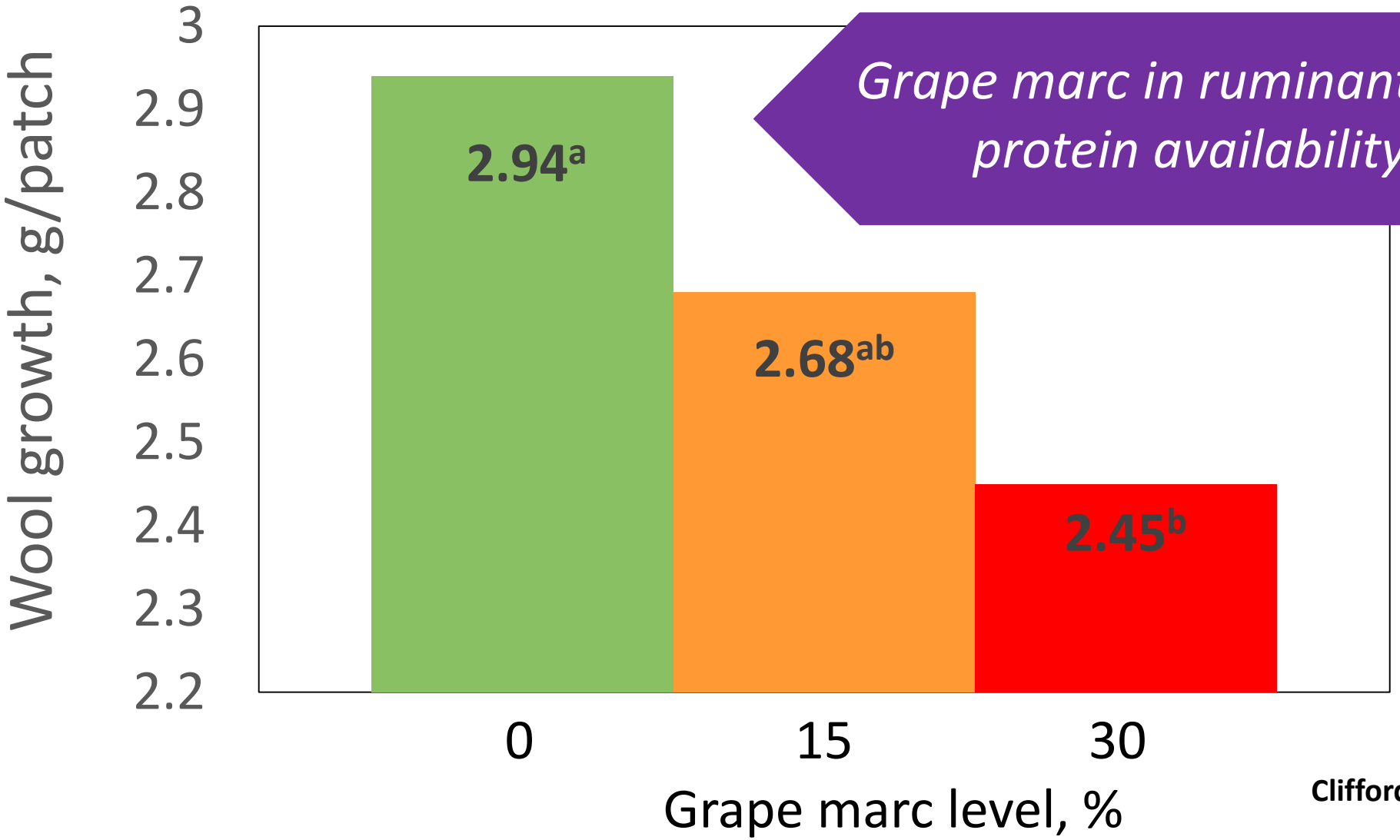


42 Merino ewes
90 days

*Student scholarship:*
Australian Wool Education Trust
John Ridley memorial

**Clifford, Caetano and Hynd 2017**
*Journal of Animal Science*
under review

Sheep Trial




*Grape marc in ruminant diets reduces protein availability to the animal*

**Clifford, Caetano and Hynd 2017**
*Journal of Animal Science*
under review

# *Effect of grape marc on growth performance of Steers*

| | GRAPE MARC LEVELS | | | |
|---|---|---|---|---|
| | LOW | MEDIUM | MEDIUM+B | HIGH |
| Straw (%) | 17.0 | 17.0 | 15.0 | 15.0 |
| **Grape marc** (%) | **7.5** | **30.0** | **30.0** | **70.0** |
| Barley, whole (%) | 57.2 | 38.7 | 38.7 | 7.7 |
| Lupins, whole (%) | 15.0 | 12.5 | 12.5 | 5.5 |
| Minerals + Rumensin (%) | 0.5 | 0.5 | 0.5 | 0.5 |
| Urea (%) | 1.3 | 1.3 | 1.3 | 1.3 |
| Oil (%) | 1.5 | - | - | - |
| Bentonite (%) | - | - | 2.0 | - |

Cattle Trial

60 Angus steers
56 days

*Inclusions up to 30% grape marc in a well formulated diet can provide cost-effective growth rates*

| | GRAPE MARC LEVELS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | LOW | | MEDIUM | | MEDIUM+B | | HIGH | |
| **Initial BW (kg)** | 324 | | 318 | | 333 | | 335 | |
| **Final BW (kg)** | 401 | = | 401 | = | 407 | > | **376** | |
| **ADG (kg)** | 1.45 | = | 1.54 | = | 1.34 | > | **0.68** | |
| **CH4 (g/day)** | 233 | = | 246 | = | 342 | > | **171** | |
| **CH4/ME intake (g/MJ)** | 2.32 | < | 2.49 | = | 3.03 | = | **2.97** | |

# Using Grape Marc as a feed source

- Analysis of total ration quality, and in particular protein is a must
  - Significant risk in low protein diets of tannins binding to protein.
- Spoilage during storage a risk to animal health and performance
  - Ensiling is the best cure (but does add handling cost)
- Methane emissions per unit intake unaltered
- Up to 30% inclusion in cattle rations will not alter growth performance.
- Is it cost effective??


Maximize Efficiency
Min
Max


# Thank you for your attention!