

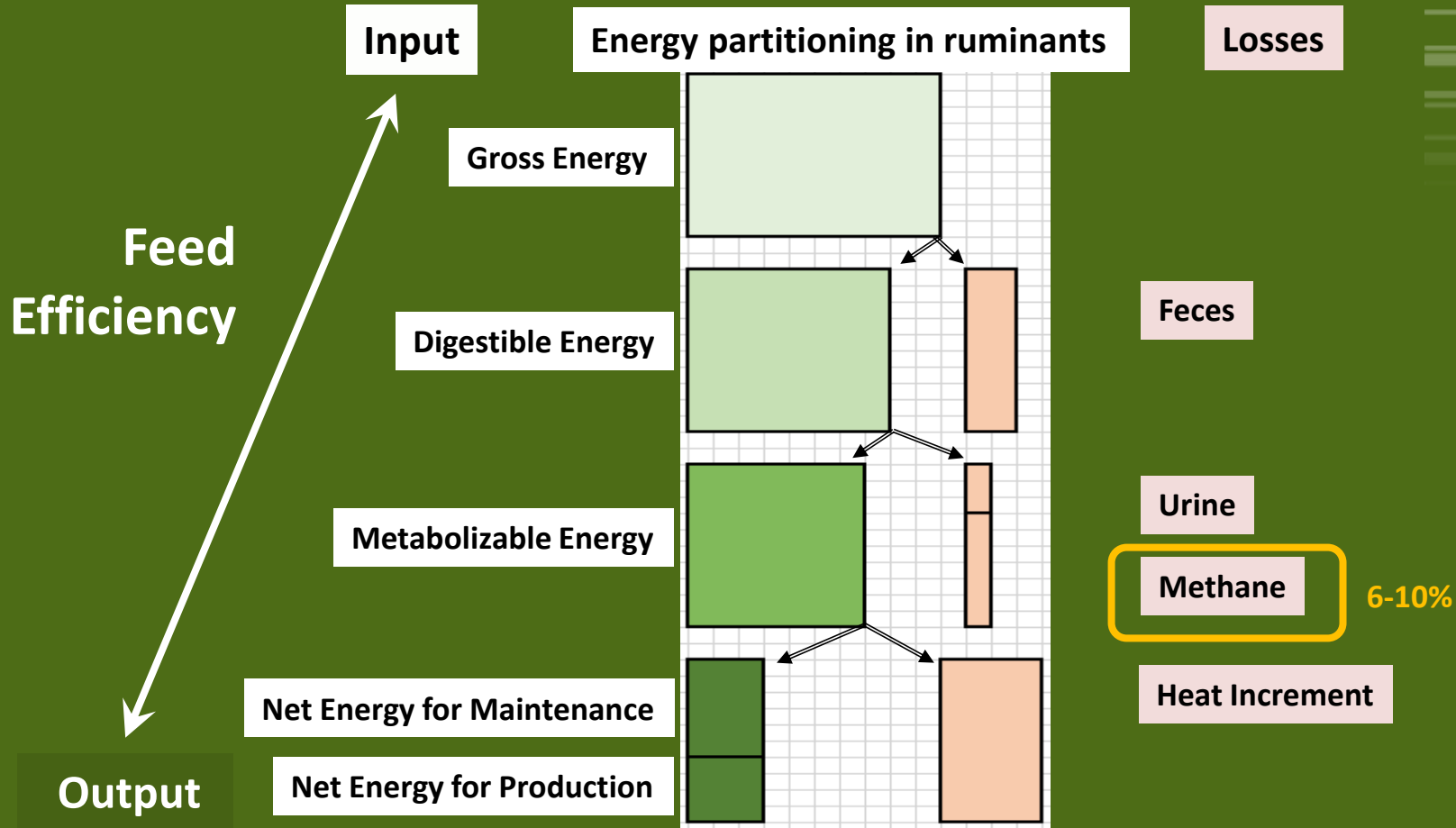
Methane production rate in relation with Feed Efficiency traits of beef heifers fed roughage diets.

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Feed Efficiency vs Methane production rate



Methods used to study this relationship

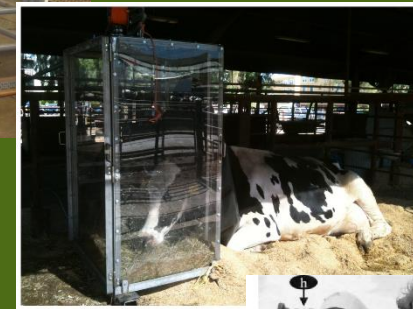
Feed Efficiency test

70-120 days

Feed Efficiency test

Methane emission measure:
Respiratory Chambers, Head Hoods or SF6

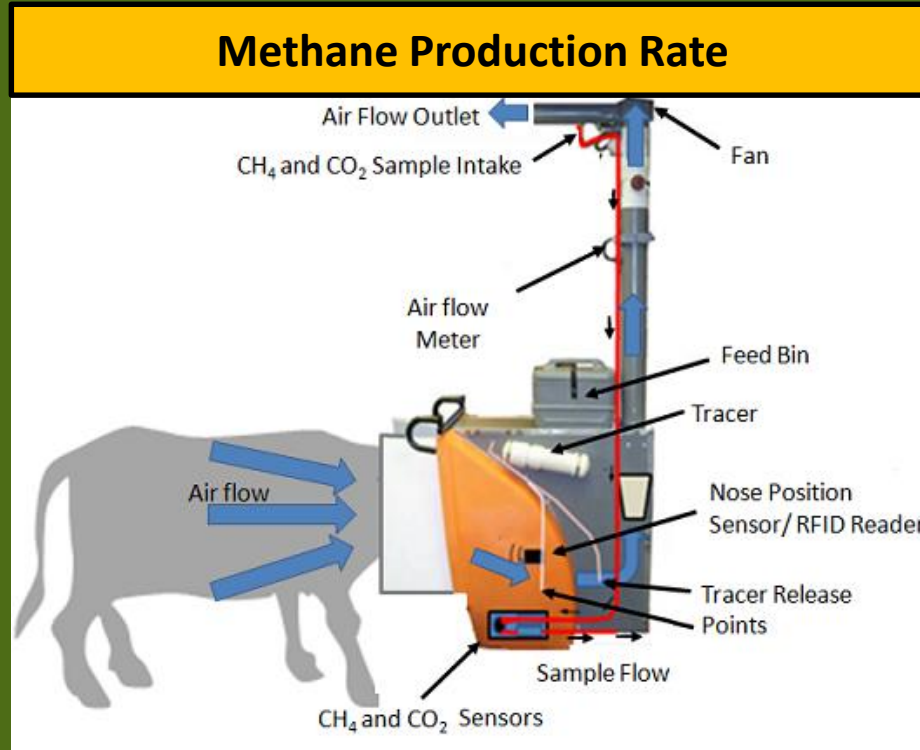
2 to 5 days



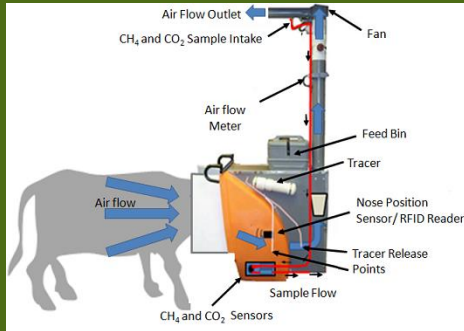
Selection
RFI- RFI+

Feed Efficiency test

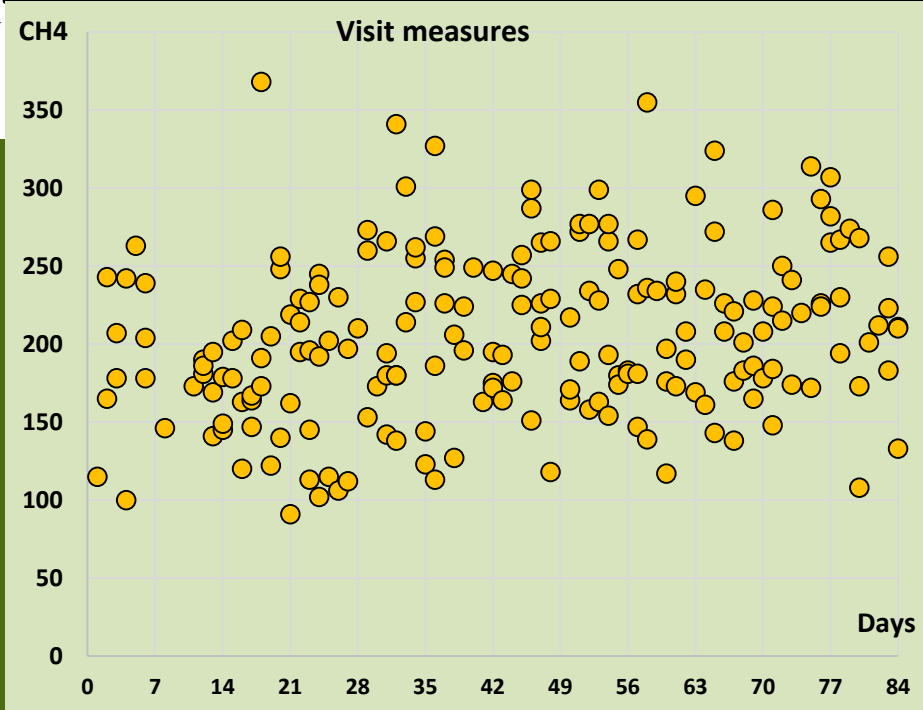
Long term measure of CH₄ with GreenFeed



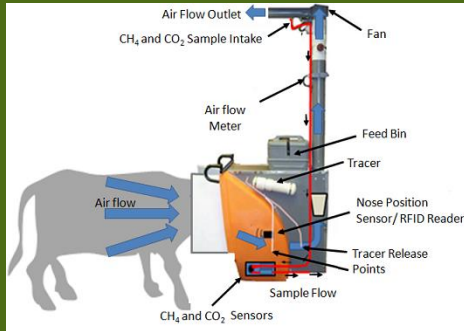
Long term measure of CH₄ with GreenFeed



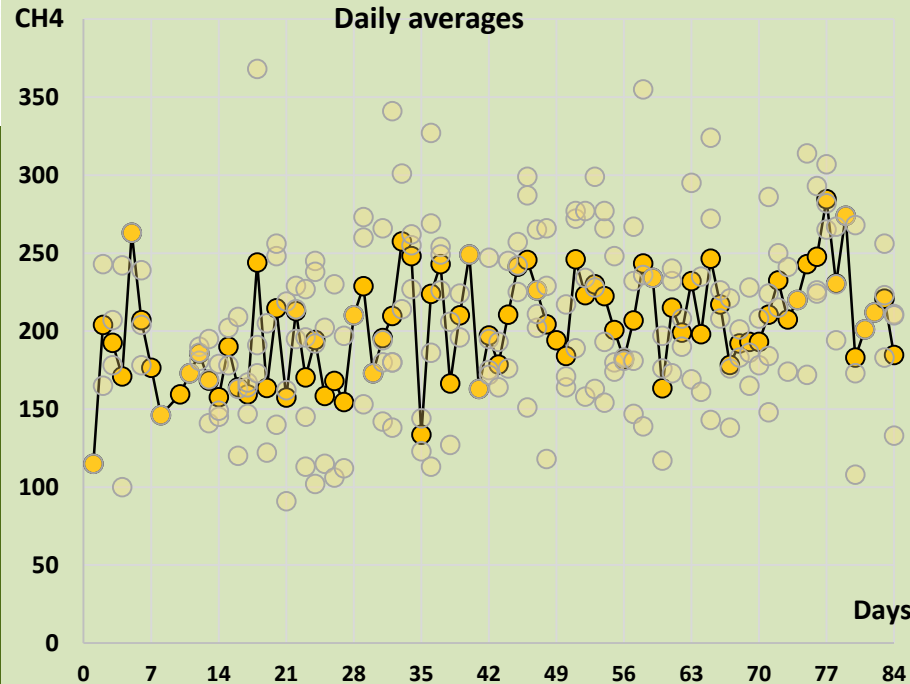
Methane Production Rate



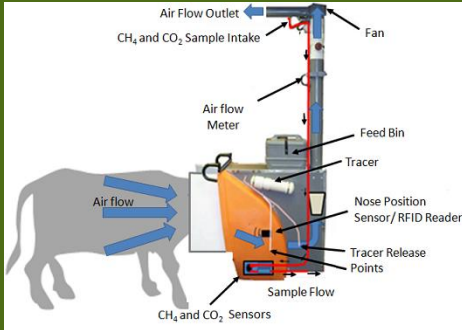
Long term measure of CH₄ with GreenFeed



Methane Production Rate

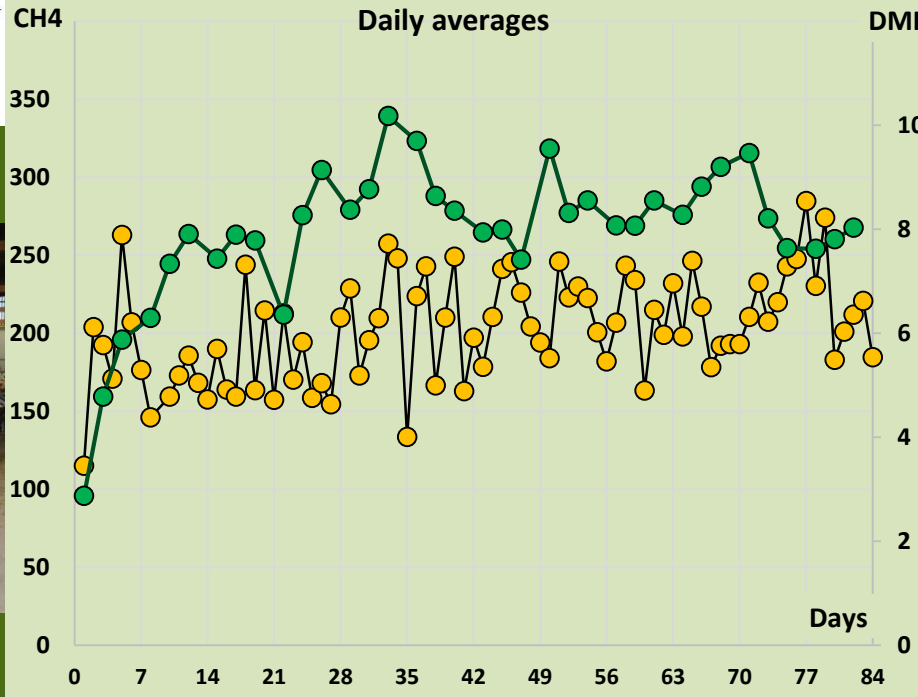


Long term measure of CH₄ and Feed Intake

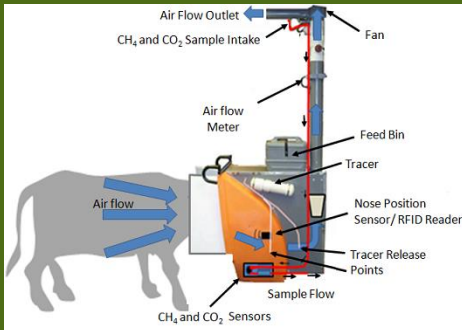


DMI

Methane Production Rate

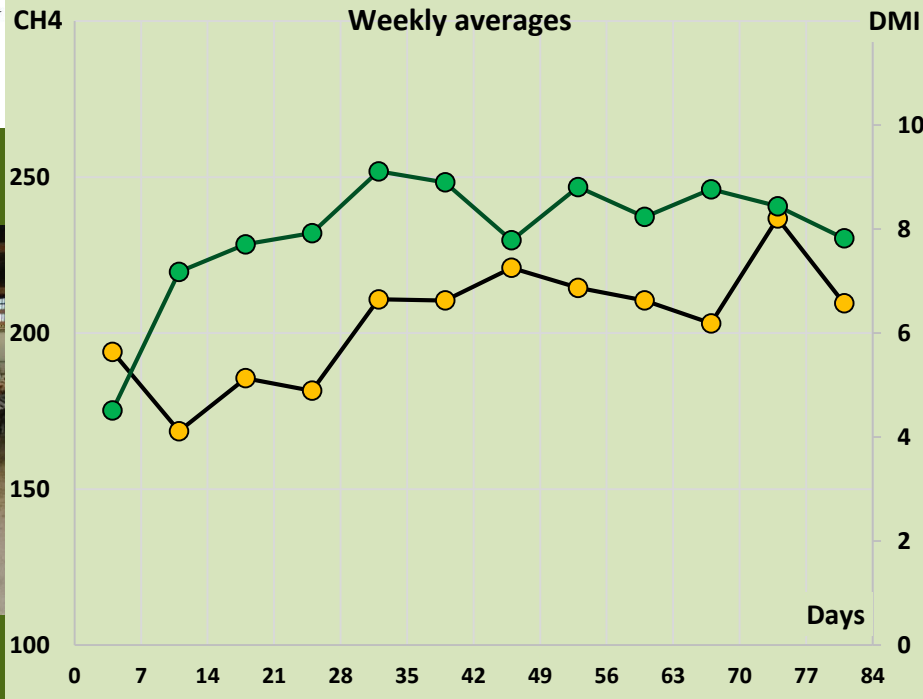


Long term measure of CH₄ and Feed Intake

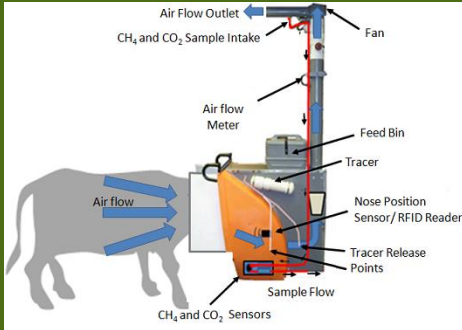


DMI

Methane Production Rate

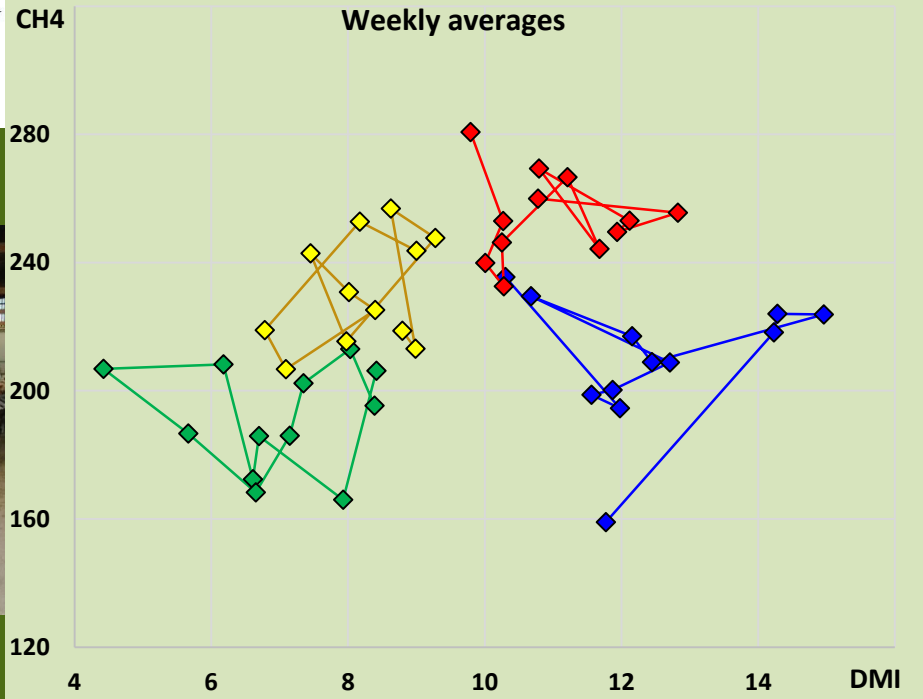


Long term measure of CH₄ and Feed Intake



DMI

Methane Production Rate



Experiment with Charolais heifers and 2 {diet*farm}

| Traits | | Grass Silage | Hay |
|-----------------------|------|--------------|--------|
| N heifers / N batches | | 252 / 8 | 74 / 2 |
| Start age | d | 678 | 665 |
| Start weight | kg | 499 | 496 |
| Test duration | d | 76 | 75 |
| DMI | kg/d | 8.75 | 7.92 |
| ADG | g/d | 932 | 360 |
| ADG/DMI | g/kg | 109 | 45 |
| Mid Test Weight | kg | 534 | 509 |
| CH4 | g/d | 205 | 206 |
| CH4/DMI | g/kg | 24 | 26 |

Correlations between CH4 and Intake or Growth traits

| Traits | | Grass Silage | Hay |
|--------|-----------------|------------------------|------------------------|
| CH4 | DMI | Corr = 0.36 *** | Corr = 0.48 *** |
| CH4 | ADG | Corr = 0.44 *** | Corr = 0.26 * |
| CH4 | Mid Test Weight | Corr = 0.68 *** | Corr = 0.70 *** |

Model of CH4 regressed on Intake and Growth traits

| Effect | significant | |
|--------------------------|-------------|---------|
| Batch | *** | P<.0001 |
| Diet | ns | P=0.19 |
| BW ^{.75} | *** | P<.0001 |
| BW ^{.75} (Diet) | ns | P=0.44 |

| Effect | significant | |
|------------|-------------|---------|
| DMI | ns | P=0.28 |
| DMI (Diet) | ns | P=0.56 |
| ADG | *** | P<.0001 |
| ADG (Diet) | ns | P=0.52 |

Whatever the diet, one single equation

$$\text{CH4 (g/d)} = - 36 + 1.51^{***} \text{BW}^{.75} + 1.33 \text{ DMI} + 18.9^{***} \text{ADG}$$

Definition of Feed Efficiency traits

ADG/DMI : Feed Efficiency

$$DMI = \alpha_0 + \alpha_1 BW^{.75} + \alpha_2 ADG + \underline{RDMI}_{WG} : RFI$$

$$ADG = \beta_0 + \beta_1 BW^{.75} + \beta_2 DMI + \underline{RADG}_{WI} : RGain$$

Definition of Feed Efficiency traits and CH4 production traits

ADG/DMI : Feed Efficiency

CH4/DMI : CH4y

$$\text{DMI} = \alpha_0 + \alpha_1 \text{BW}^{.75} + \alpha_2 \text{ADG} + \underline{\text{RDMI}}_{\text{WG}} : \text{RFI}$$

$$\text{CH4} = \gamma_0 + \gamma_1 \text{BW}^{.75} + \gamma_2 \text{ADG} + \underline{\text{RCH4}}_{\text{WG}}$$

$$\text{ADG} = \beta_0 + \beta_1 \text{BW}^{.75} + \beta_2 \text{DMI} + \underline{\text{RADG}}_{\text{WI}} : \text{RGain}$$


$$\text{CH4} = \delta_0 + \delta_1 \text{BW}^{.75} + \delta_2 \text{DMI} + \underline{\text{RCH4}}_{\text{WI}}$$


Correlations between Feed Efficiency and CH4 production traits

| Traits | | Grass Silage | Hay |
|--------------------|----------------------------|------------------------|----------------------|
| CH4/DMI = CH4y | ADG/DMI | Corr = 0.57 *** | Corr = 0.07 ns |
| RCH4 _{WG} | RDMI _{WG} = RFI | Corr = 0.05 ns | Corr = 0.12 ns |
| RCH4 _{WI} | RADG _{WI} = RGain | Corr = 0.23 *** | Corr = 0.22 * |

CH₄ emission rate in relation to feed efficiency traits

CONCLUSION

 CH₄ production is not related with RFI, while it is positively related with RGain

 More efficient heifers (*Low RFI or High RGain*) cannot be considered as low CH₄ emitting cattle

Feed Efficiency vs Methane production rate

