Effect of residual feed intake in beef suckler cows

P. Lawrence[1], D. Kenny[1], B. Earley[1], M. McGee[2]

[1]Animal and Bioscience Research Department, Animal & Grassland Research and Innovation Centre, Teagasc, Grange, Dunsany, Co. Meath, Ireland, [2]Livestock Systems, Research Department, Animal & Grassland Research and Innovation Centre, Teagasc, Grange, Dunsany, Co. Meath, Ireland

Session No. 22

Abstract No. 14744

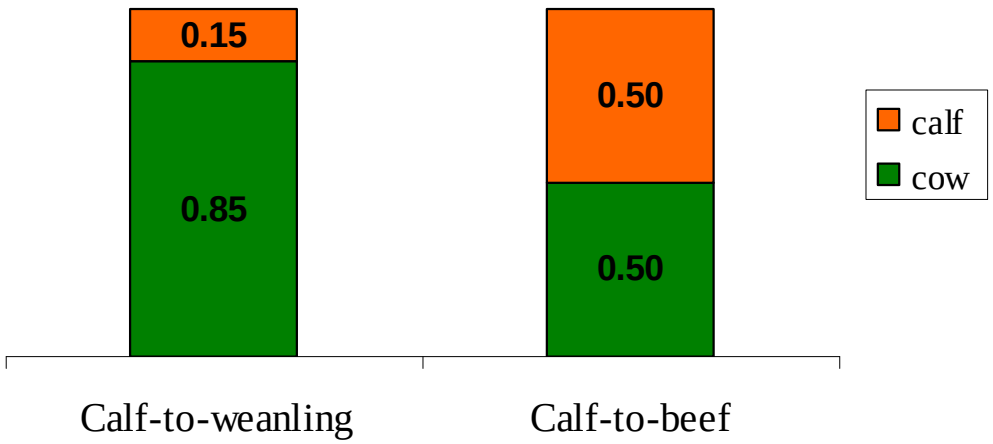
Peter.lawrence@teagasc.ie

Presentation Outline

- Introduction
- Materials & Methods
- Results
- Summary

Introduction

- Feed accounts for ~75% of total variable costs



- ~75% of total dietary energy consumed is used for maintenance energy requirements
- High maternal cost to suckler beef production
- Improving feed efficiency = reduce production costs + increase profitability (€)

"Conversion of feed to product"

Feed Efficiency

- Traditionally, a gross measure of feed efficiency:

FCR = feed intake : weight gain

BUT → increase mature size + maintenance requirements

- Alternative measure, independent of growth & body size

Residual Feed Intake (RFI)
or
Net Feed Efficiency

Residual Feed Intake

RFI = **Actual intake** – **Predicted intake**

-RFI = more efficient

+RFI = less efficient

- Moderately heritable trait (0.45)
- Selecting herd replacements from low RFI animals should

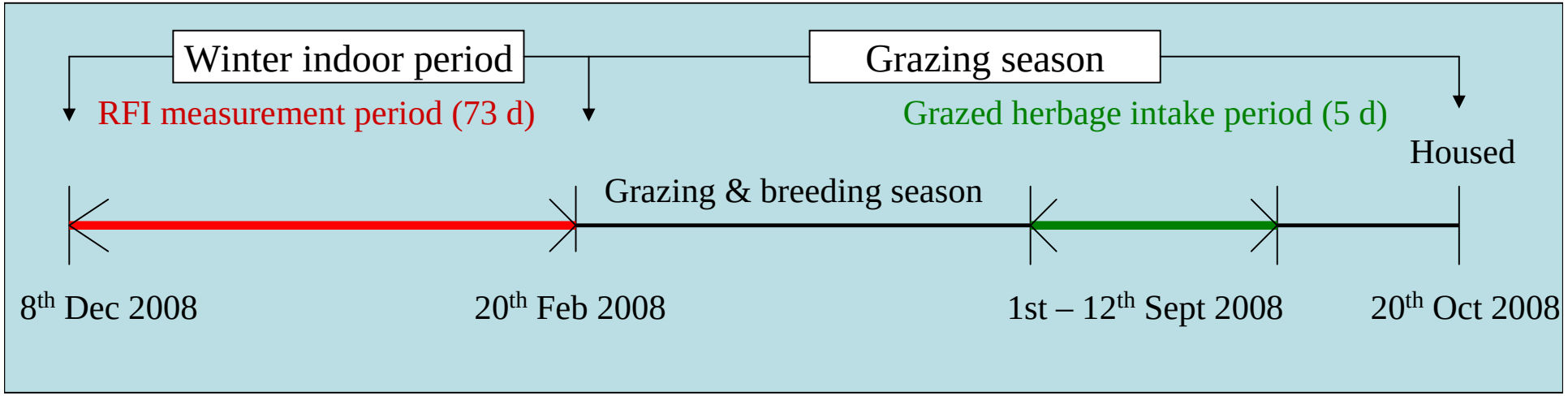
  → energy efficient beef suckler cows & progeny

Objectives

1.Quantify the phenotypic variation in RFI and productivity of beef suckler cows offered a grass silage-based diet during pregnancy

2. Determine the effect of RFI classification on herbage intake during lactation

Materials and Methods



RFI Measurement Period

- 39 beef cows (33 purebred & 6 Crossbred)
- Mean age: 1026 (SD = 53)
- Initial mean weight: 605 kg
- Gestation day: 179 d (SD = 30)
- Diet: Grass silage *ad libitum*

Grass Herbage Intake Period

- Mean lactation day: 159 d (SD = 31)
- Mean weight: 582 kg
- Diet: Grass herbage

Materials and Methods

Animal Measurements

- DMI
  - Indoors (silage)
  - Outdoors (herbage)
- Live weight
- Growth (ADG)
- Body condition score (BCS)
- Calving difficulty
- Calf birth weight
- Calf weaning weight
- Ultrasonic fat thickness and muscle depth
- Skeletal measurements
- Blood variables
- Rumen pH and fermentation
- Total tract digestibility

Animal RFI classification

Cow BW & ADG adjusted for conceptus weight (NRC 2000)

Expected DMI:

- Regressed average daily DMI on conceptus adjusted ADG and conceptus adjusted mean $BW^{0.75}$

RFI for each animal was calculated:

- Actual DMI – Predicted DMI from the regression
- Within breed, animals ranked into Low, Medium and High RFI groups

Statistical Analysis

- High RFI vs Medium RFI vs Low RFI
- MIXED Procedure (SAS)
- Model:
    - RFI group
    - Breed
    - RFI group ×Breed
    - Calving date
    - Parity
    - Pen

Plasma metabolites – Repeated measures ANOVA

Results: Indoor winter period

Traits	High RFI	Medium RFI	Low RFI	SE	Sig
Silage DMI, kg DM/d	10.27[a]	9.28[b]	8.00[c]	0.229	***
RFI, kg/d	1.02[a]	0.01[b]	-1.02[c]	0.184	***
FCR, kg DM/ kg gain	26.4	27.3	24.5	14.01	NS
Initial BW, kg	600	615	576	19.5	NS
Conceptus adjusted Initial BW, kg	580	596	559	19.4	NS
ADG	0.73	0.55	0.60	0.083	NS
Conceptus adjusted ADG, kg	0.30	0.14	0.21	0.089	NS
Calf birth weight, kg	44.5	43.8	40.7	2.37	NS
Calving difficulty score, (1-5)	1.56	1.13	1.08	0.250	NS

[a,b,c] **Means differ at $P < 0.05$**

- Low RFI animals consumed **14%** and **22% less feed** than animals with medium and high RFI respectively

Results: Indoor winter period

Trait	High RFI	Medium RFI	Low RFI	SE	Sig
Body condition score, (0-5)					
Initial pre-partum	**2.09^{a}**	**2.28^{b}**	**2.14^{a}**	**0.064**	*
Change pre-partum	**0.05**	**-0.03**	**0.06**	**0.039**	NS
Post-partum	**2.25**	**2.25**	**2.21**	**0.066**	NS
Ultrasound measurement, mm					
Initial fat thickness	**1.31**	**2.03**	**1.71**	**0.767**	NS
Fat thickness change	**0.15**	**0.16**	**0.22**	**0.129**	NS
Initial muscle depth	**56.6^{ab}**	**60.8^{a}**	**54.9^{b}**	**1.84**	*
End muscle depth	**62.7**	**60.6**	**58.1**	**1.91**	NS
Muscularity score, (1-15)					
Round	**4.4**	**4.7**	**4.2**	**0.28**	NS
Rump	**5.4**	**5.7**	**5.2**	**0.34**	NS
Loin	**5.7**	**6.0**	**5.6**	**0.35**	NS

Results: Indoor winter period

Trait	High RFI	Medium RFI	Low RFI	SE	Sig
Initial height at withers, mm	1350	1347	1322	11.5	NS
End height at wither, mm	1326	1334	1307	10.8	NS
Initial back length, mm	1265[a]	1234[ab]	1212[b]	14.4	*
End back length, mm	1343[a]	1328[ab]	1301[b]	12.6	*
Initial depth of chest, mm	733	737	730	8.6	NS
End depth of chest, mm	760	762	740	9.9	NS
Initial chest circumference, mm	1988	1992	1961	26.9	NS
End chest circumference, mm	2023	2041	1997	27.3	NS
Initial pelvic width, mm	524	550	517	13.3	NS
End pelvic width, mm	576	559	556	11.7	NS

[a,b,c] **Means differ at $P < 0.05$**

Results: Outdoor grazing period

Traits	High RFI	Medium RFI	Low RFI	SE	Sig
Herbage DMI, kg DM/d	**9.93**	**9.99**	**9.72**	**0.686**	**NS**
Onset of grazing season BW, kg	**580**	**585**	**553**	**23.4**	**NS**
Grazed herbage intake period BW, kg	**585**	**590**	**552**	**20.3**	**NS**
End of grazing season BW, kg	**592**	**592**	**555**	**23.0**	**NS**
Milk yield, kg/day	**8.1**	**7.1**	**8.0**	**0.92**	**NS**
Calf pre-weaning ADG, kg	**1.00**	**0.97**	**0.93**	**0.040**	**NS**

- Low RFI animals consumed **2% ($P > 0.05$) less grass herbage** than high RFI animals, respectively
- **No difference** in cow ADG, BW, & calf pre-weaning ADG between the RFI groups

Results

Plasma metabolites

- **Triglyceride** concentration tended ($P < 0.06$) to be higher for high RFI cows than medium or low
- RFI groups did not differ during grazing period

Haematology variables

- **No difference during**
  - RFI measurement period
  - Parturition

Total Tract Digestibility

- **No difference** ($P > 0.05$) between RFI groups

Summary

- **Indoor period:** Low RFI cows consumed less feed than Medium & High RFI cows
- **Grazing period:** Consumed similar amounts of herbage
- No compromise in growth, body composition or calf performance
- 14% difference annual feed cost between Low vs High RFI = ~€55

Conclusion

- RFI in beef suckler cows is independent of growth and body size
- No obvious negative effects between RFI and other important economically important traits measured
- Increasing cow feed efficiency, while maintaining levels of performance should improve producer profitability

Acknowledgements

Teagasc

Department of Agriculture, Food and the Marine

University College Dublin

Thank You!