Evaluation of models to predict feed intake in dairy cows

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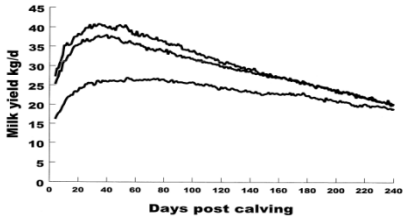
Introduction

- Mathematical modelling have been used to predict different variables in animal production
  - Milk Yield

$$dY / dt = a\{\exp[-\exp(G_0 - bt)]\} [\exp(-ct)]$$



  - Feed intake

DMI = 0.076+0.404 CDMI + 0.013 BW - 0.129 WOL + 4.12log10(WOL) + 0.14MY

Friggens et al (1999) and Vadiveloo and Holmes (1979).

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Introduction

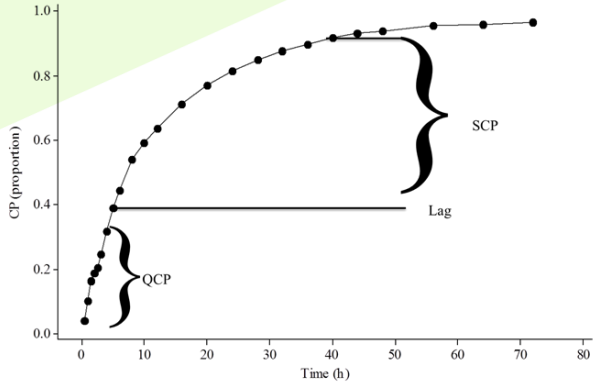
- Feed intake is paramount in the performance of livestock and have been of interest when creating such models
  - Feeding costs
  - Nutrition
  - Health

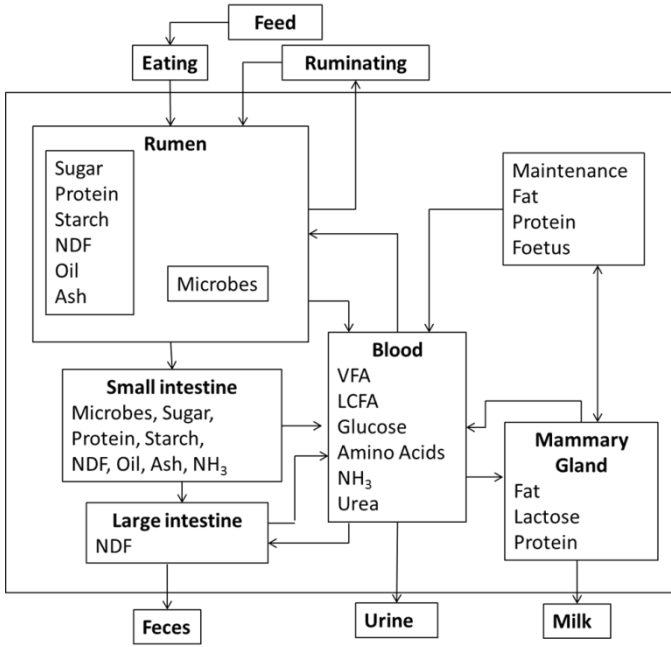
Introduction

- FI prediction models
  - Regression equation models that include animal characteristics *e.g.* body weight, milk yield and characteristics and feed characteristics
    - Cornell Net Carbohydrate and Protein system (CNCPS (Fox et al., 2004))
    - Nutrient Requirements of Dairy Cattle National Research Council (NRC, 2001)
    - Vadiveloo and Holmes (1979)

Introduction

- FI prediction models
  - Dynamic mechanistic whole animal model
    - BSM-Milk (BioSimetrics Ltd.)
    - (Ambriz-Vilchis et al. 2015)





Aims

- To evaluate four models in their predictions of feed intake in dairy cows fed total mixed rations (TMR).

Materials and Methods

- Trial
  - SRUC's Dairy Research Centre
  - Holstein Dairy cows consuming two contrasting TMR diets
  - Electronic feeders to record FI

Ingredient	Forage (g/kg/DM)	Concentrate (g/kg/DM)
Grass silage	0.40	
Maize silage	0.23	
Crimped wheat	0.11	
Beans	0.25	
Minerals	0.01	0.01
Wholecrop		0.40
Megalac		0.02
Whey		0.08
Concentrate		0.50

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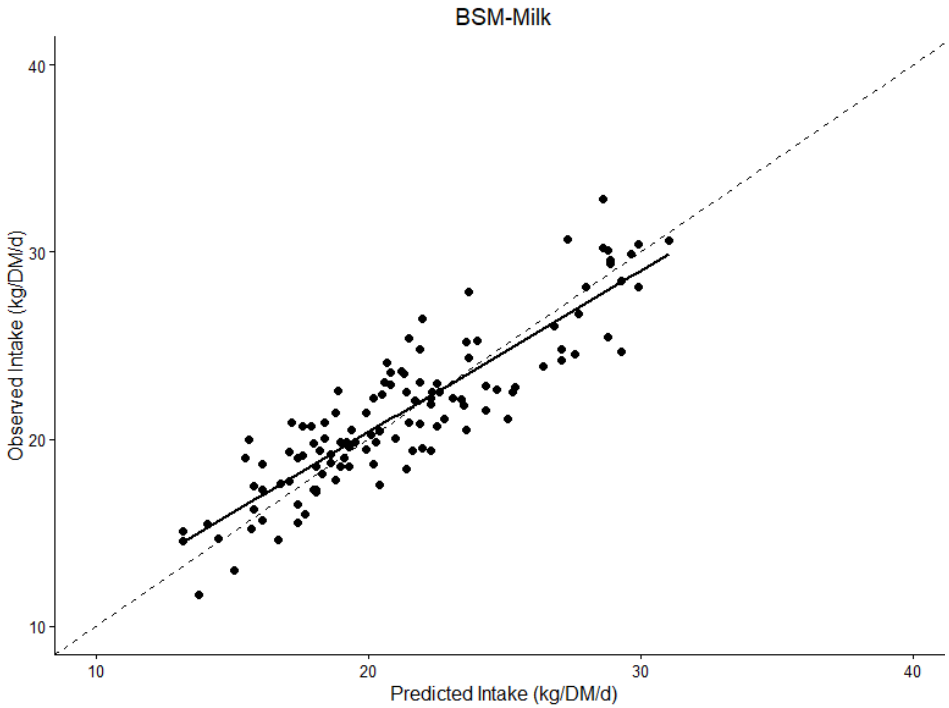
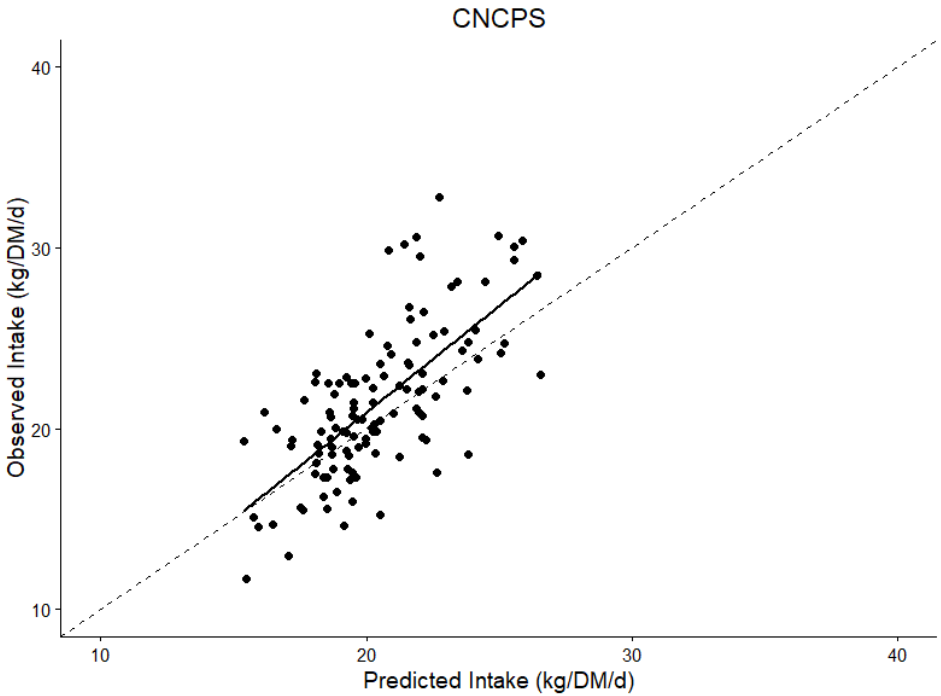
Materials and Methods

- Details of:
  - Animals: BCS, BW, WOL, DIM, MY (characteristics)
  - Diets: chemical and degradation characteristics
- Were used as inputs to run the models
- The predictions were evaluated using regression analysis, limits of agreement method and the concordance correlation coefficient.

Results





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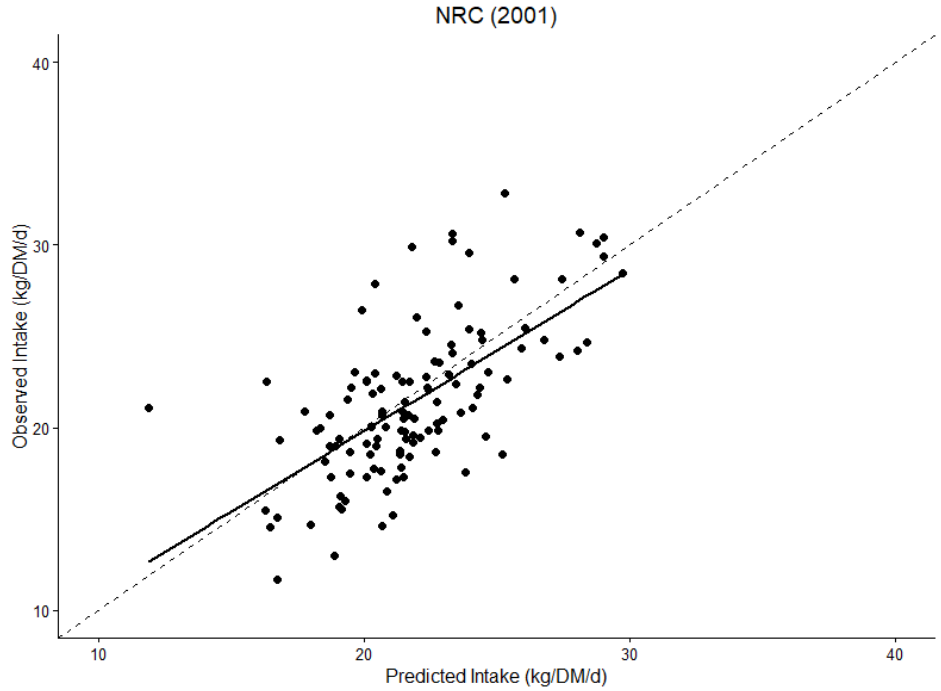
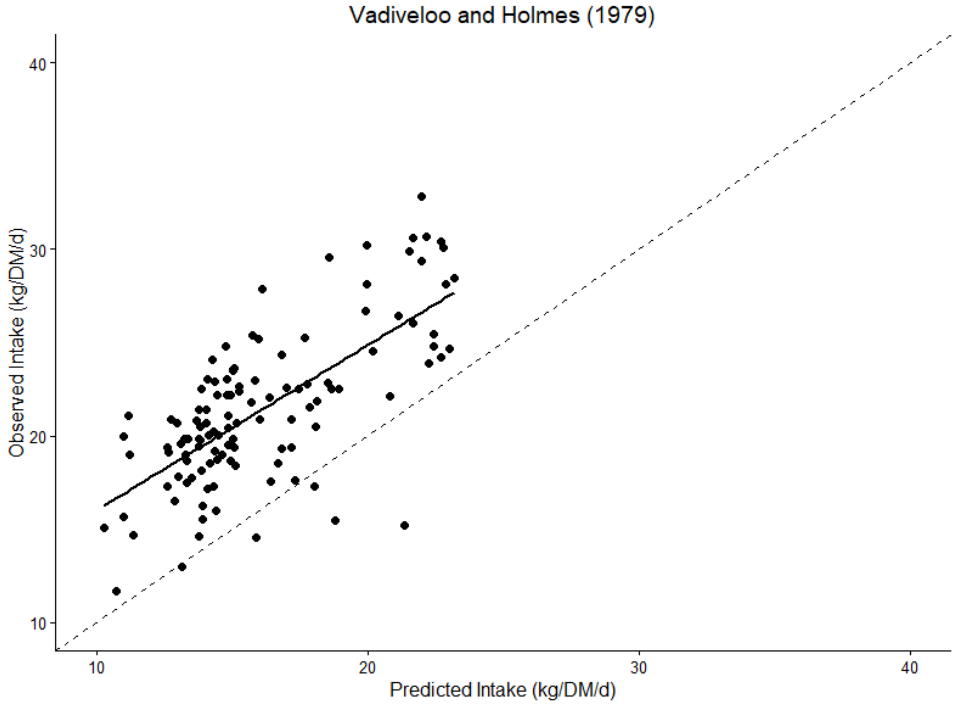
Results





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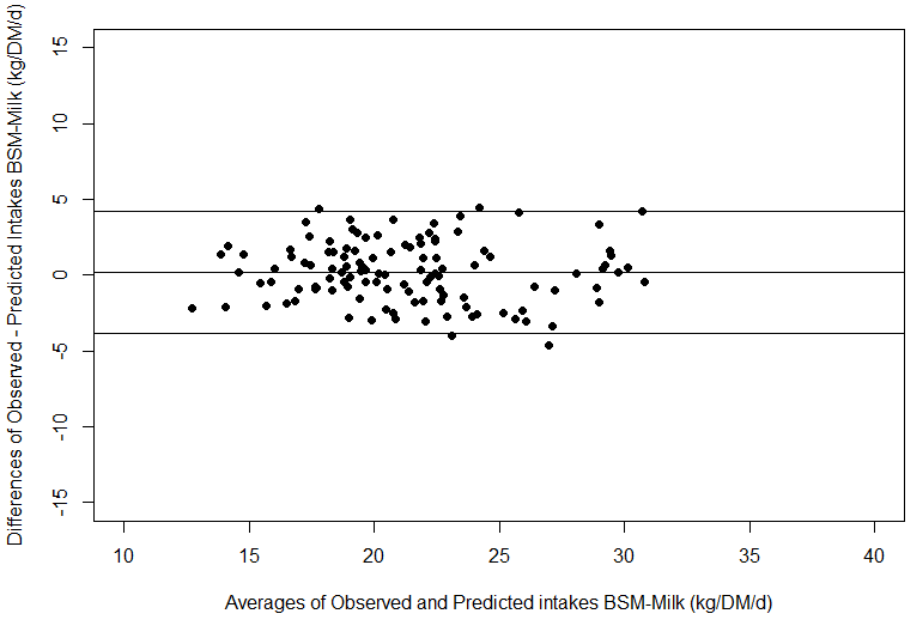
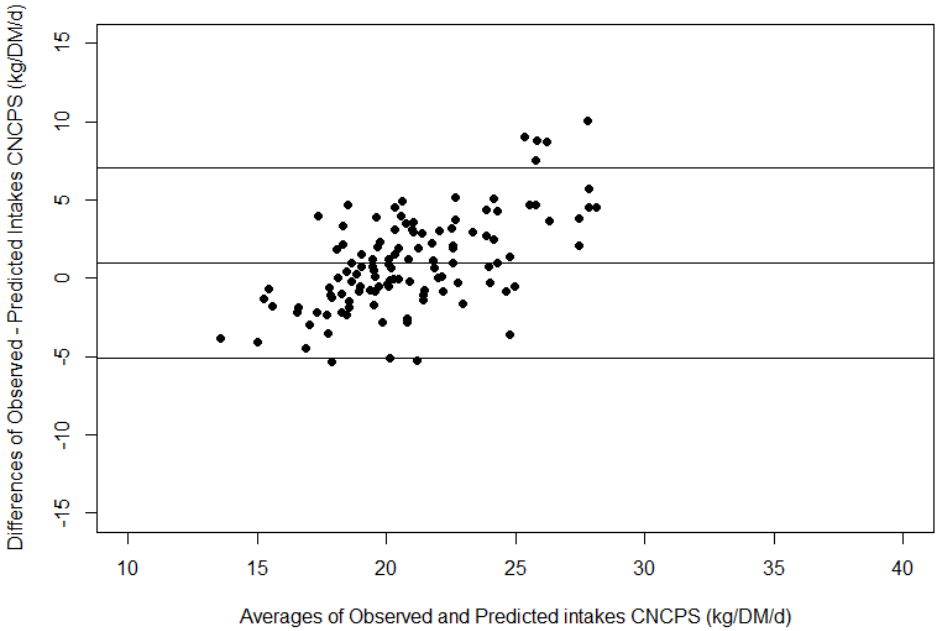
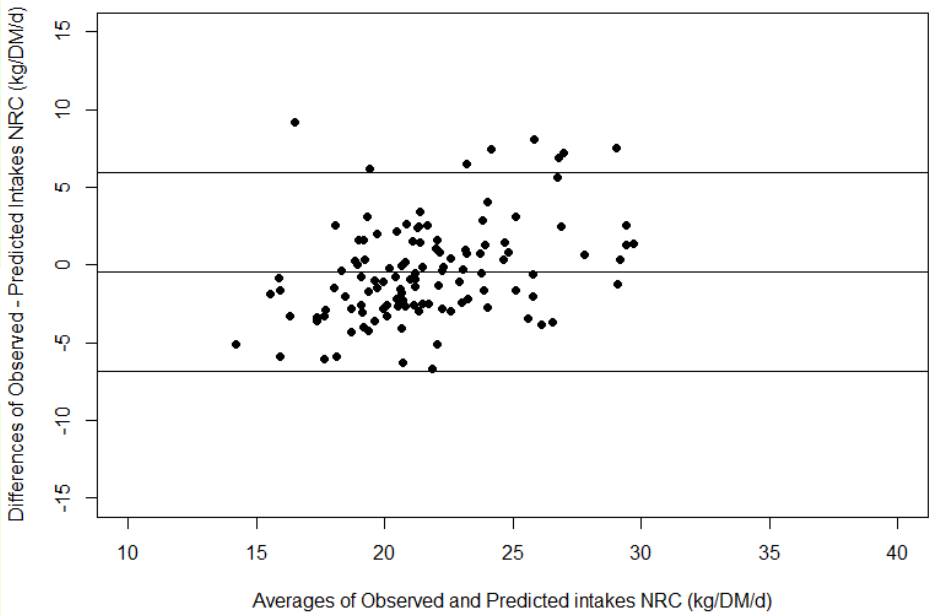
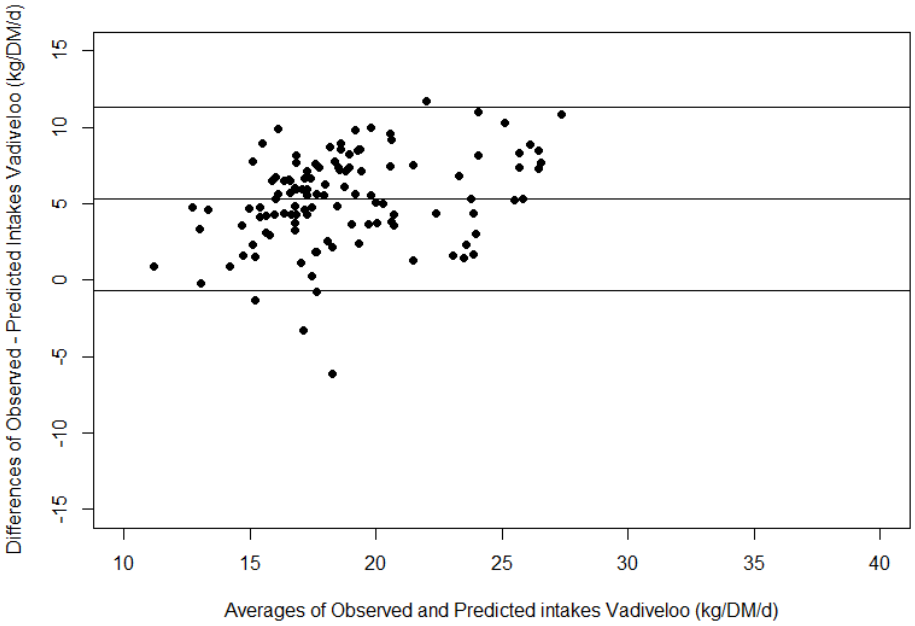
Results


Differences of Observed - Predicted Intakes BSM-Milk (kg/DM/d)
15
10
5
0
-5
-10
-15
10
15
20
25
30
35
40
Averages of Observed and Predicted intakes BSM-Milk (kg/DM/d)


Differences of Observed - Predicted Intakes CNCPS (kg/DM/d)
15
10
5
0
-5
-10
-15
10
15
20
25
30
35
40
Averages of Observed and Predicted intakes CNCPS (kg/DM/d)

Results


Differences of Observed - Predicted Intakes NRC (kg/DM/d)
15
10
5
0
-5
-10
-15
10
15
20
25
30
35
40
Averages of Observed and Predicted intakes NRC (kg/DM/d)


Differences of Observed - Predicted Intakes Vadiveloo (kg/DM/d)
15
10
5
0
-5
-10
-15
10
15
20
25
30
35
40
Averages of Observed and Predicted intakes Vadiveloo (kg/DM/d)

Results

			Limits of Agreement		
	R^2	CCC	Lower	Mean	Upper
BSM-Milk	0.78	0.88	-3.80	0.19	4.19
CNCPS	0.48	0.58	-5.06	0.98	7.03
NRC	0.42	0.61	-6.80	-0.41	5.98
VH	0.48	0.34	-0.70	5.31	11.31

Conclusion

- Feed intake values were obtained on-farm and compared to those obtained with four models
- All models were able to predict feed intake with information gathered on-farm

Conclusion

- The BSM-Milk was the model with the best performance when compared with the rest of the evaluated models (R^2 = 0.78, CCC = 0.88)
- Future work will compare BSM-Milk predictions to those obtained with other dynamic mechanistic models

Thank you

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Knowledge Transfer Network

Biosciences

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