Economic Development, Jobs, Transport and Resources

Genomic prediction for feed efficiency: a validation of accuracy and its impact on methane emissions of dairy cows

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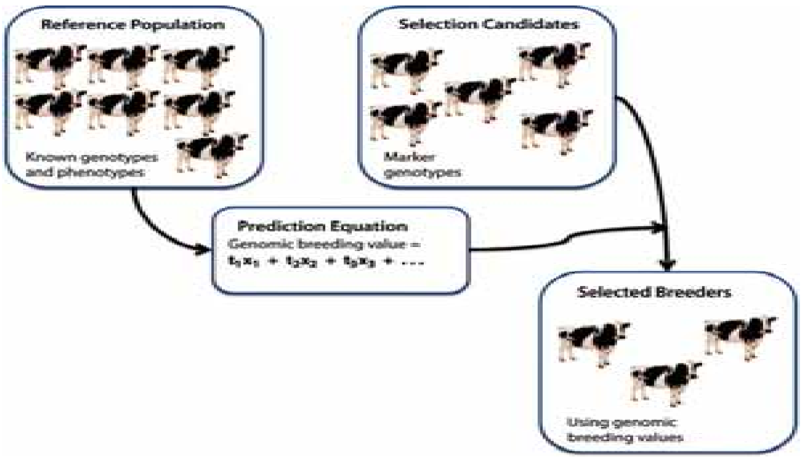
Introduction

- Feed efficiency is a major determinant of profitability and environmental impact of dairy production
  - ✓ Selection for feed efficiency is an important breeding objective in dairy industry
- But, it is a difficult and expensive to measure trait



Genomic prediction

Introduction

J. Dairy Sci. 98:7340–7350
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***Hot topic:* Definition and implementation of a breeding value for feed efficiency in dairy cows**

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Example Feed Saved ABVs

THE Good Bulls GUIDE

Holstein	BPI	FEED SAVED
BULL ID	BALANCED PERFORMANCE INDEX	FEED SAVED ABV
A	336	– 43
B	320	– 147
C	302	– 4
D	301	110
E	285	2
F	282	– 6
G	277	72
H	277	– 26
I	274	18
J	268	111
	$ profit/cow/year	kg feed saved /cow/year

DataGene
Solutions for Herd Development

It is essential to validate its accuracy and resulting (environmental) impact of selected cows using an independent data set

Objectives

- Validate the accuracy of the genomic estimated breeding values for residual feed intake (RFI): a major component of Feed Saved
- Compare methane emissions of low (efficient) and high RFI (inefficient) cows

Data

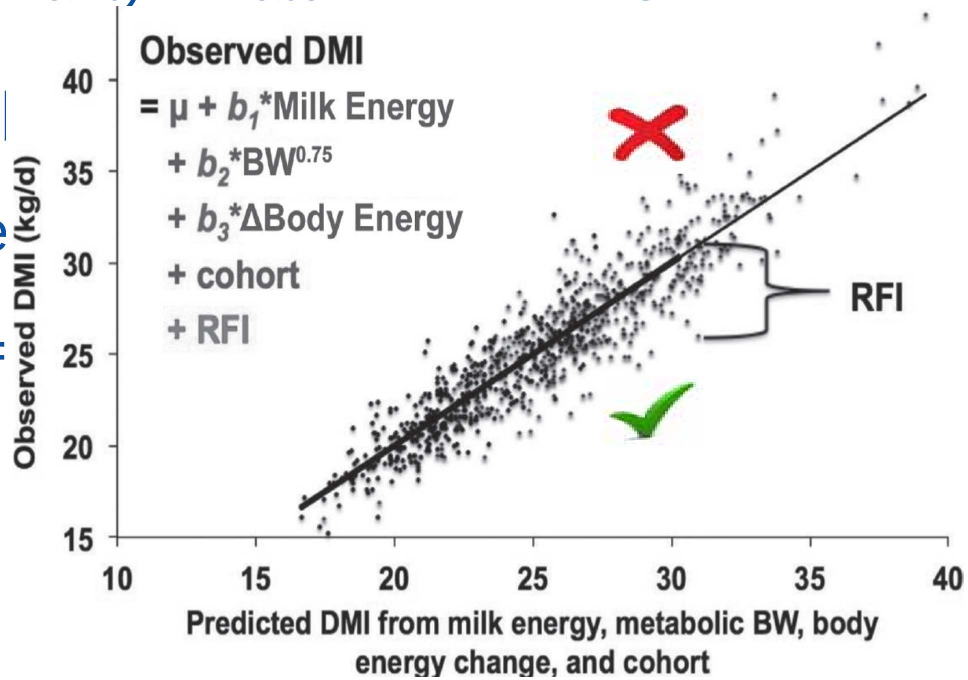
- 32-d experiments conducted on 160 cows at Ellinbank Dairy Research Centre (2015): 40 cows/batch
- Cows were fed with *Lucerne* cubes plus grain supplements
- Records include: milk yield, milk fat, milk protein, milk lactose, dry matter intake, body weight, body condition score.
- Methane emissions: modified SF6 tracer technique (*Deighton et al. 2014*)
- RFI GEBV were obtained from DataGene → 112 cows remained for analysis

Table 1. A summary of lactation performance, RFI and methane emissions of 112 cows

	Batch 1	Batch 2	Batch 3	Batch 4
Number of cows	28	33	31	20
Days in milk	79 ± 4	91 ± 7	80 ± 6	63 ± 22
Residual feed intake (kg/d)	-0.03 ± 0.9	0.05 ± 0.8	-0.005 ± 0.9	0.02 ± 0.5
Dry matter intake (kgDM/d)	22.0 ± 3.2	24.8 ± 2.9	23.1 ± 2.9	24.3 ± 2.2
Milk yield (kg/d)	22.5 ± 4.0	25.6 ± 4.6	23.2 ± 3.8	29.7 ± 4.2
Body weight (kg)	511 ± 73	544 ± 70	523 ± 51	569 ± 59
Methane production (g/d)	454 ± 60	450 ± 65	495 ± 66	543 ± 38
Methane yield (g/kgDMI)	19.5 ± 2.5	16.4 ± 1.9	20.5 ± 2.3	18.3 ± 1.4
Methane intensity (g/kgMY)	20.1 ± 3.6	21.5 ± 3.9	21.9 ± 3.4	20.8 ± 2.7

Statistical Analysis

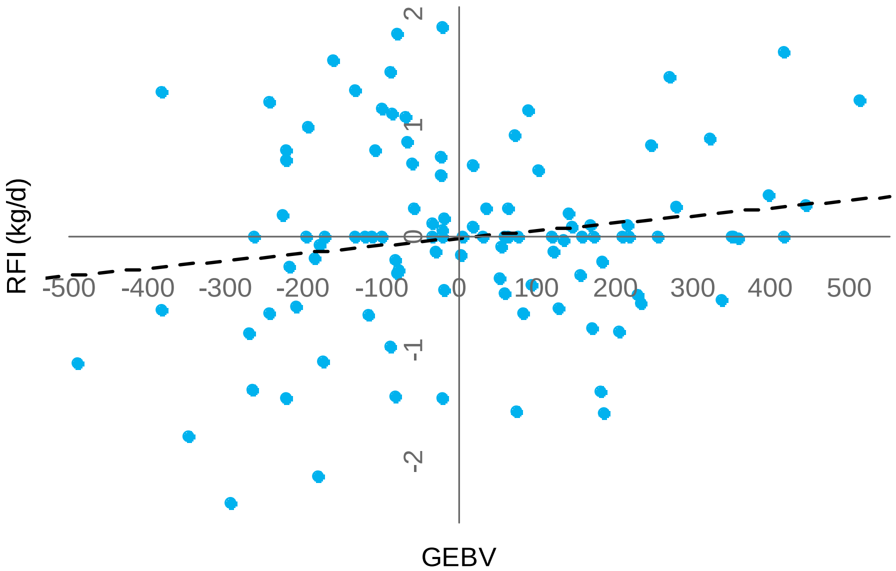
- Residual feed intake:
  - ✓ *DMI = μ + Parity + Batch + DIM + ECM + BW + △BW + **RFI***
- Rank cows ... op and bottom 30
  - ✓ Methane e...
- Accuracy of ... EBV,RFI)/h



VandeHaar et al (2016)

Results

r = 0.35



~ r = 0.37 of Pryce et al (2015) on 78 cows

Figure 1. Scatter plot of GEBV and RFI phenotype of 112 cows

The accuracy of the current RFI GEBV is low

Results

Table 2. Performance and methane emissions (mean ± SD) of low and high residual feed intake (RFI) cows

	Low RFI	High RFI	P-value
Number of cows	30	30	
Milk yield (kg/d)	23.9 ± 4.6	24.2 ± 4.7	NS
Dry matter intake (kgDM/d)	21.9 ± 2.5	24.5 ± 2.9	***
Body weight (kg)	520 ± 65	529 ± 60	NS
Residual feed intake (kg/d)	-1.0 ± 0.6	1.0 ± 0.4	***
Methane production (g/d)	471 ± 55	503 ± 67	*
Methane yield (g/kgDMI)	19.3 ± 2.6	18.6 ± 2.8	NS
Methane intensity (g/kgMY)	20.4 ± 3.3	21.4 ± 3.3	NS
Feed Saved (kg/year)	35.9 ± 92.3	15.3 ± 74.6	NS
RFI GEBV (kg/lifetime)	-51.6 ± 220.0	20.4 ± 230.2	NS

Results

Table 3. Performance and methane emissions (mean ± SD) of low and high residual feed intake (RFI) cows [Ranked by RFI GEBV)

	Low RFI GEBV	High RFI GEBV	P-value
Number of cows	30	30	
Milk yield (kg/d)	24.1 ± 4.9	24.9 ± 4.5	NS
Dry matter intake (kgDM/d)	23.1 ± 3.3	23.1 ± 2.5	NS
Body weight (kg)	530 ± 67	521 ± 64	NS
Residual feed intake (kg/d)	-0.2 ± 1.1	0.004 ± 0.7	NS
Methane production (g/d)	477 ± 73 <	488± 62	NS
Methane yield (g/kgDMI)	18.3 ± 2.5	18.2 ± 2.8	NS
Methane intensity (g/kgMY)	21.1 ± 3.5	20.8 ± 3.4	NS
Feed Saved (kg/year)	88.4 ± 61.7	-49.5 ± 65.7	***
RFI GEBV (kg/lifetime)	-277 ± 168	279± 133	***

Conclusions

- Accuracy of the current genomic prediction of feed efficiency is low and thus more data is required for an improvement
- Low RFI cows produced significantly less methane than high RFI cows

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"Improving farm profitability by demonstrating the value of genetics and herd improvement"

THANK YOU FOR YOUR ATTENTION!