Use of phenotypes from research herds to develop genomic selection for scarcely recorded traits like feed efficiency

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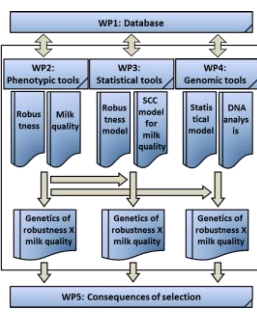
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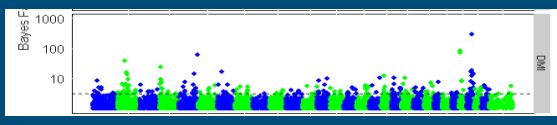
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Introduction

- Valuable recording new traits in research herds
  - feed intake, progesterone for fertility, disease resistance ...

- Any use pooling data across research herds for genomic selection?
  - Different populations
  - Different nutrition and management(-groups)
  - Different recording strategies

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Inroduction: SNP effects DMI

Chromosome	SNP name	Position	Post. Prob.	Bayes factor	SNP variance (kg²)	% total genetic variance
27	Hapmap40631-BTA-103396	31461111	0.081	295.4	0.00303	**0.40%**
26	BTB-01078268	7846224	0.024	83.3	0.00068	**0.09%**
26	BTB-01078331	7900988	0.021	72.5	0.00063	**0.08%**
5	ARS-BFGL-NGS-14632	118501191	0.018	59.9	0.00048	**0.06%**
2	Hapmap59844-rs29025329	44947955	0.011	37.9	0.00035	**0.05%**

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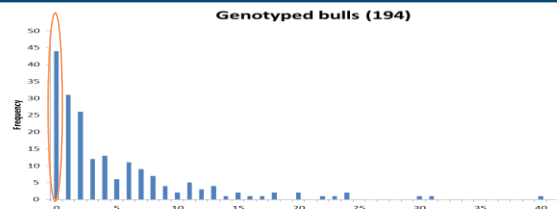

Introduction

- Objective:
  Test the accuracy of DGV from data pooled across 4 research herds (UK, SW, NL, IE), with the progeny test EBV in the UK, IE and NL.

- Steps:
  - Combine genotypes & phenotypes across herds
  - Estimate SNP key and DGVs
  - Correlate with progeny breeding values for national traits

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Data:

Trait	UK	SW	IE	NL	N
Yield	x	x	X	x	1629
DMI	x			x	970
BCS	x				564
LW	x		x	x	1416

	# bulls progeny EBV	
	All	Rel. >0.9
NL	177	140
IE	189	143
UK	144	110

Methods

1) Random regression model with random animal effect across DIM, to adjust for fixed effects and predict full lactation curves for each animal

2) BSSVS (Calus et al., 2008) model: Gibbs sampling, 50,000 cycles, 5 chains.

3) DGV: polygenic plus SNP effects average of 5 chains, i.e. no parent average in there.

4) Correlation DGV and EBV ≈ accuracy DGV

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Accuracy RobustMilk DGV

Progeny EBV	Correlation with RobustMilk DGV (194 bulls)		
	NL	IE	UK
Milk (kg)	0.51	0.42	0.57
Fat (kg)	0.57	0.51	0.58
Protein (kg)	0.46	0.40	0.56
Fat (%)	0.78		0.76
Protein (%)	0.71		0.70

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Accuracy RobustMilk DGV

	Correlation with RobustMilk DGV		
	LW (kg)	BCS (1-5)	DMI (kg/d)
Progeny EBV NL			
Angularity	-0.30	-0.30	
Body condition score	0.40	0.36	0.17
Chest width	0.41	0.28	0.29
Dairy strength	0.37	0.26	0.20

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Expected versus observed accuracy

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Accuracy: 44 bulls with no RobustMilk daughters

	Accuracy RobustMilk DGV (44 bulls)			(194 bulls)
	NL	IE	UK	NL
Milk(kg)	0.36	0.24	0.48	0.51
Fat(kg)	0.38	0.51	0.31	0.57
Protein(kg)	0.24	0.23	0.35	0.46
Fat(%)	0.79		0.79	0.78
Protein (%)	0.73		0.70	0.71

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Conclusion

- Relatively high accuracy even with
  - Differences in recording and populations
  - Most bulls less than 5 daughters
  - No blending with accurate sire/mgs EBV

- Lower when no daughters in reference

- Sharing data from research herds might make selection for new traits possible (and effective)!

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