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Genomic predictions based on a joint reference population for Scandinavian red breeds

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Joint reference population for Scandinavian red breeds

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● > 7,000 progeny tested bulls

  – 2,843 Norwegian Red

  – 4,422 bulls from DFS (Swedish Red, Finnish Ayrshire and Danish Red)

Aim

- Examine whether reliability of genomic predictions improve when using a joint reference population

- Validation studies for Norwegian Red and DFS to compare joint and separate reference populations

Material and methods

- **Response variables:** Deregressed proofs (DRP) derived from Interbull EBVs

- **SNP data:** After editing, 46,512 SNP markers used in genomic analyses
  - 54K and 25K – imputed

- Bulls born after 2001 were used as **validation data**
  - 1,035 bulls for DFS
  - 281 for Norway

Material and methods

- Genomic breeding values were predicted using **GBLUP**

- **Reliability** of genomic predictions: The squared correlation between genomic predictions and DRP divided by average reliability of DRP for bulls in the test datasets

Validation DFS

- **Number of bulls in reference** for DFS only (REF_{DFS}) and joint referance population (REF_{ALL})

	Number of bulls		
	REF_{DFS}	REF_{ALL}	Validation
Min (feet & legs)	2847	3677	966
Max (fertility)	3593	5884	1023
Mean	3313	5316	1035

+ 60%

Validation DFS

Trait	r^2_{DGV}		
	REF_{DFS}	REF_{ALL}	Δr^2_{DGV}
Milk	0.367	0.399	0.032
Fat	0.461	0.481	0.020
Protein	0.355	0.381	0.026
Fertility	0.289	0.282	-0.007
Birth	0.218	0.244	0.025
Calving	0.161	0.179	0.018
Udder-health	0.241	0.254	0.013
Leg-feet	0.274	0.283	0.009
Udder-conform.	0.328	0.342	0.014
Milking-ability	0.299	0.321	0.023
Temperament	0.303	0.313	0.010
Yield	0.370	0.393	0.023
Mean	**0.305**	**0.323**	**0.018**

max   min

Validation Norwegian Red

Number of bulls in reference

- Norway only :   2563

- Joint reference population: 5840

    – More than double

Validation Norwegian Red

Trait	r^2_{DGV}		
	REF_{NOR}	REF_{ALL}	Δr^2_{DGV}
Milk yield	0,36	0,38	0,02
Protein yield	0,28	0,39	0,11
Fat yield	0,38	0,45	0,07
SCC	0,37	0,40	0,03
Mastitis	0,26	0,23	-0,03
NR56 heifers	0,16	0,10	-0,06
NR56 cows	0,17	0,14	-0,03
CFI	0,11	0,10	-0,01
Calving interval	0,15	0,10	-0,05
Mean	**0.247**	**0.254**	**0.007**

Max   Min

Joint reference population for Scandinavian Red

- Number of bulls in reference population

    + 60 % for DFS

    > Double for Norwegian Red

- Gain in reliability relatively small

    – Similar results for DFS and Norwegian Red

    – Largest increase in reliability for production traits

    – Reliability decreased for fertility traits

Interpretation

- Smaller gain in reliability than joint reference populations for Holsteins (e.g. EuroGenomics)

  - Relationship among the Scandinavian red breeds lower than among Holstein populations

  - Larger effective population size

    for each population and jointly

  - Different traits and trait definitions

    many health and fertility traits with low heritability

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