Implementation of genomic selection in UK dairy goats

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Goat milk

- Increasing popularity of goat milk
- 90,000 dairy goats
  - 1/3 on few large commercial farms
    - Produce majority of milk
  - Small scale industry - ‘Niche’ market
Breeding value

- Routine breeding value estimation
  - France, Canada, US, Norway, UK
- Genomic breeding values
  - France, UK

- Specific structure of reference population
  - Low number of animals
  - Mixture of males and females
  - Limited exchange of genotypes
Goat genomics

- 50K SNP caprine chip
  - Introduced in December 2011
  - 12000 chips sold world-wide
    - 7000 in UK
Breed composition

- Crossbred goat population
  - Saanen
  - Toggenburg
  - Alpine

http://www.allgoats.com
Population stratification
Animals

- 2 dairy goat farms
- 19,790 goats
- Lactation 1 – 6
- Years 1987 – 2016
Pedigree

- 38,273 individuals
- 16 generations
- 2,799 founders
- 386 sires & 16,112 dams
Phenotypes

- 1,337,653 milk yield records
- 123,611 milk composition records
  - 11,741 goats
- 6,723 conformation scores
- 11,844 mastitis records
Initial genotyped population

- Training: 1,474 ♀ & 64 ♂
- Validation: 305 ♀ & 3 ♂
- Young: 123 ♀ & 67 ♂
- TOTAL: 1,902

- Illumina Caprine 50K BeadChip
- 47,306 SNP after QA
Current genotyped population

- Training: 3,793 ♀ 3,675 ♂ 118 ♂
- Validation: 1,419 ♀ 1,407 ♂ 12 ♂
- Young: 3,764 ♀ 3,521 ♂ 243 ♂
- TOTAL: 8,976

- Illumina Caprine 50K BeadChip
- 44,670 SNP after QA
Accuracy of milk yd GEBVs

- PBLUP: 0.58
- HBLUP: 0.61
Conformation scoring

- 9 traits
- Linear scale (1 – 9)
- Similar to CAPGENES
- 2 scorers
Conformation traits

- **Udder Depth (UD)**
- **Teat Shape (TS)**
- **Udder Furrow (UF)**
- **Teat Angle (TA)**
- **Udder Attachment (UA)**
- **Teat Placement (TP)**
- **Back Legs (BL)**
- **Front Feet (FF) and Back Feet (BF)**
Heritability

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Genotyped population

- UF
- UD
- UA
- TS
- TA
- TP
- BL
- FF
- BF

Training and Validation
Accuracy

Accuracy

0.23 0.39 0.26 0.18 0.39 0.48 0.21 0.55 0.04
Sub-clinical & clinical mastitis

- Frequency: 4.96%
- Heritability: 0.05 ± 0.01
- Accuracy: 0.30
Future plans

• Genomics of new traits
  – Out of season breeding
  – Longevity
  – Feed efficiency
  – Parentage panel
  – Sequence analysis
  – ...

[Image of goats in a pen]
Acknowledgement
Thank you for your attention
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