

Impact of genotypic information on genetic evaluation accuracy for mastitis and footrot in the UK Texel Sheep



K. Kaseja, S. Mucha, E. Smith, J. Yates, G. Banos, J. Conington
Karolina.Kaseja@sruc.ac.uk



What are footrot and mastitis?

- Important endemic diseases affecting animal welfare
- Hard to measure health traits
- Impacting productivity – can cause significant losses for the industry



What are footrot and mastitis?

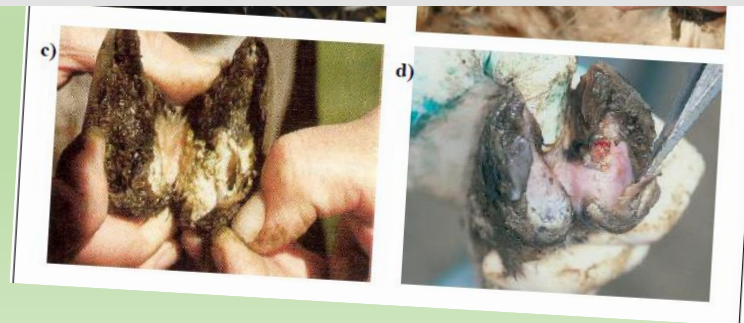
Losses:

- Imp
- Harc
- Imp indu
- **£3.60** per lamb loss in growth rate suckling from affected ewes with mastitis (unpublished results)
- **£8.40** per ewe if footrot prevalence was reduced by 10%

Conington, J., Cao, G., Stott, A., Bünger, L. (2008)

Breeding for resistance to mastitis in United Kingdom sheep – a review and economic appraisal. Veterinary Record 162: 369-376

March 22nd. DOI: 10.1136/vr.162.12.369



Collection of phenotypes



- 32 phenotype partner farms across the UK
- **Footrot (FR)**
 - Each hoof scored: range 0 to 4
 - Max total score 16
- **Mastitis** – proxy trait: California Mastitis Test (CMT)
 - correlated with SCC up to 0.98
 - Milk sample from each side of the udder scored: range 0 to 4
 - Max total score 8
- Both FR and CMT log transformed to normalise distribution

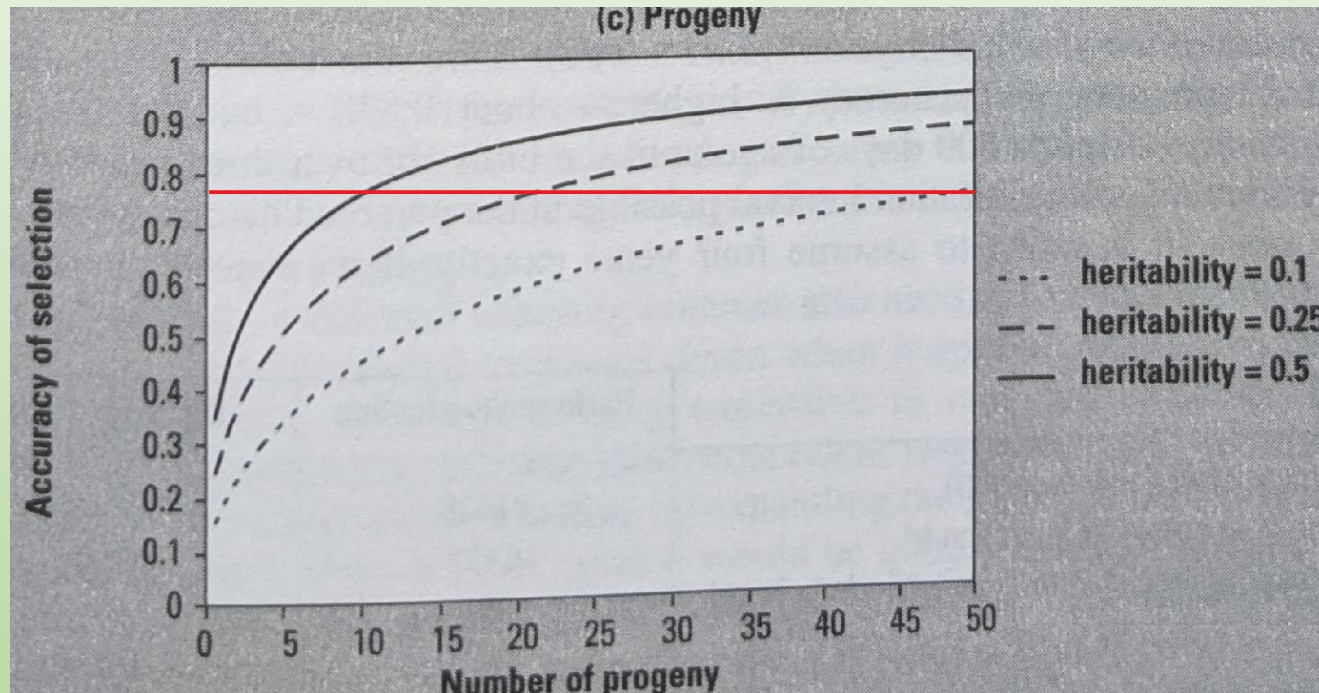


Is there potential for selection?

- Phenotypes collected between 2015 and 2019:
 - Footrot: 9,123 records
 - CMT: 4,787 records

Estimated variance (SE)	direct	PE	residual	phenotypic	heritability
Footrot	0.04 (0.01)		0.28 (0.01)	0.32 (0.01)	0.12 (0.02)
California Mastitis Test	0.04 (0.01)	0.07 (0.02)	0.40 (0.02)	0.51 (0.01)	0.07 (0.03)

What accuracy can we expect?



G. Simm 'Genetic Improvement of Cattle and Sheep'

Conventional BLUP approach (pedigree + phenotypes):

- requires many phenotypes
- takes long time to achieve satisfactory (trustworthy) accuracy

Collection of genotypes



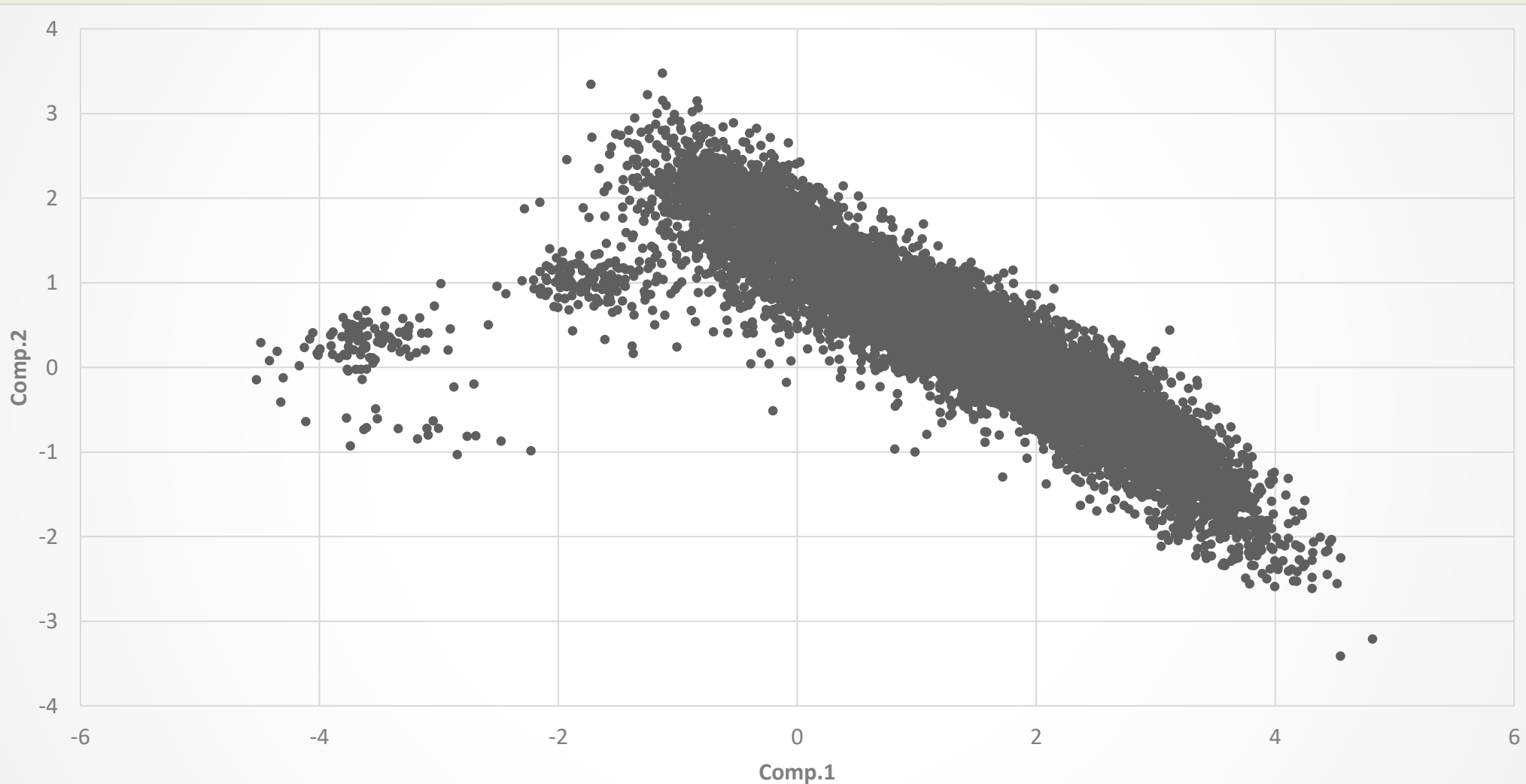
- Total of **10,193** Texel genotypes:
 - Illumina OvineHD BeadChip with 606,006 SNPs (HD)
 - Illumina OvineSNP50 with 54,241 SNPs (50K)
 - Illumina OvineLD BeadChip with 15,000 SNPs (LDv1)
 - Illumina OvineLD BeadChip with 16,560 SNPs (LDv2)
- Quality Control left **9,391** genotypes
- Reference population (genotyped + phenotyped)
 - Footrot: **3,779** ewes
 - CMT: **2,909** ewes



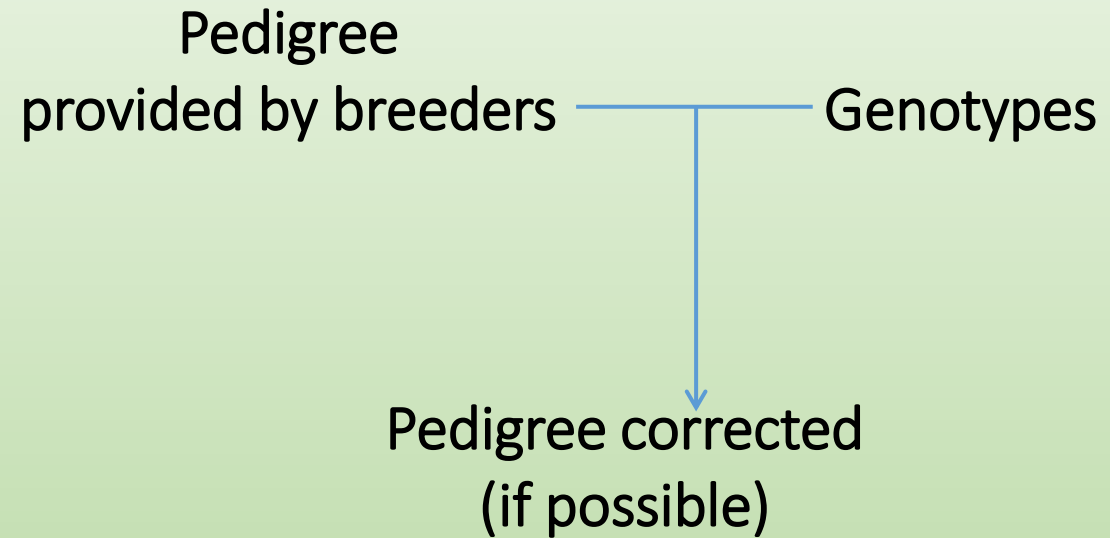
Population structure



14.8% and 4.7%
of variation
explained by first
and second
component



What we have done



What we have done

Phenotypes

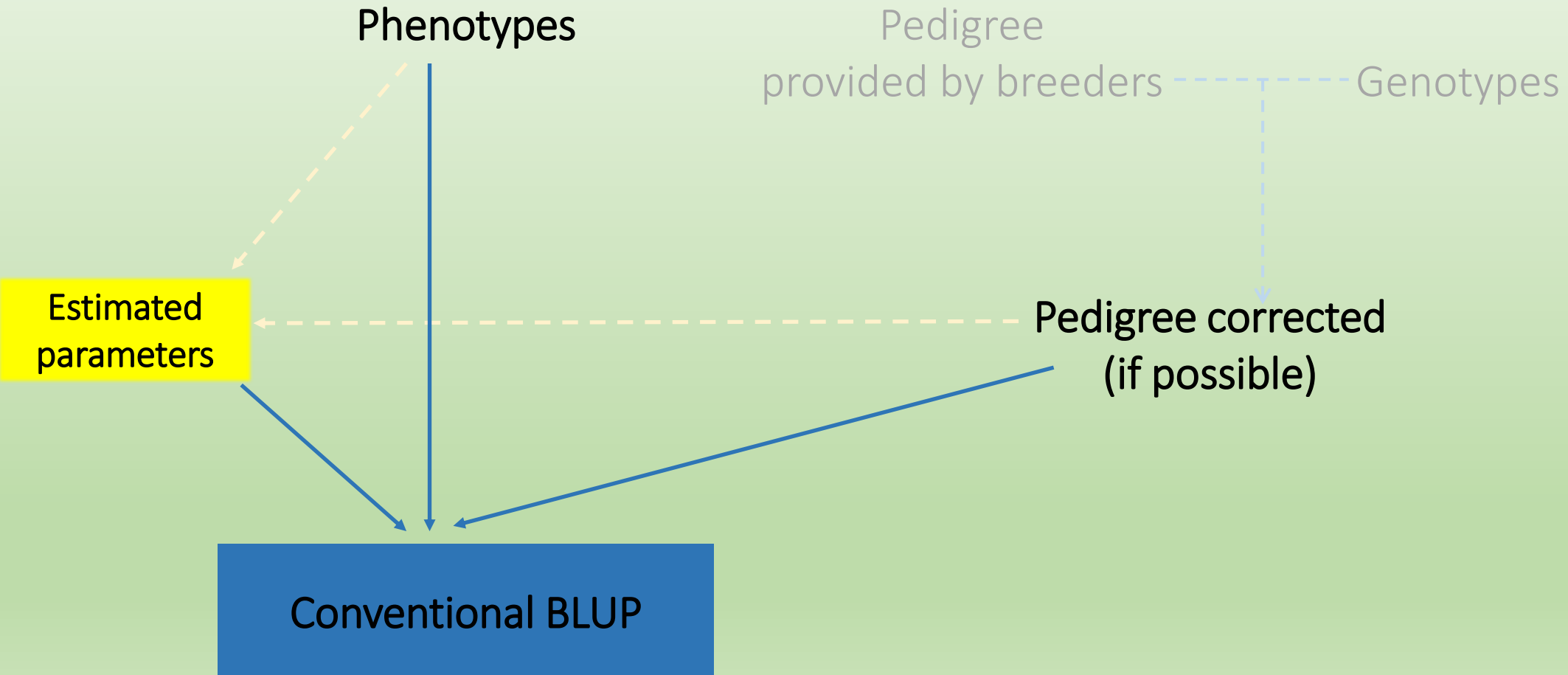
Pedigree
provided by breeders

Genotypes

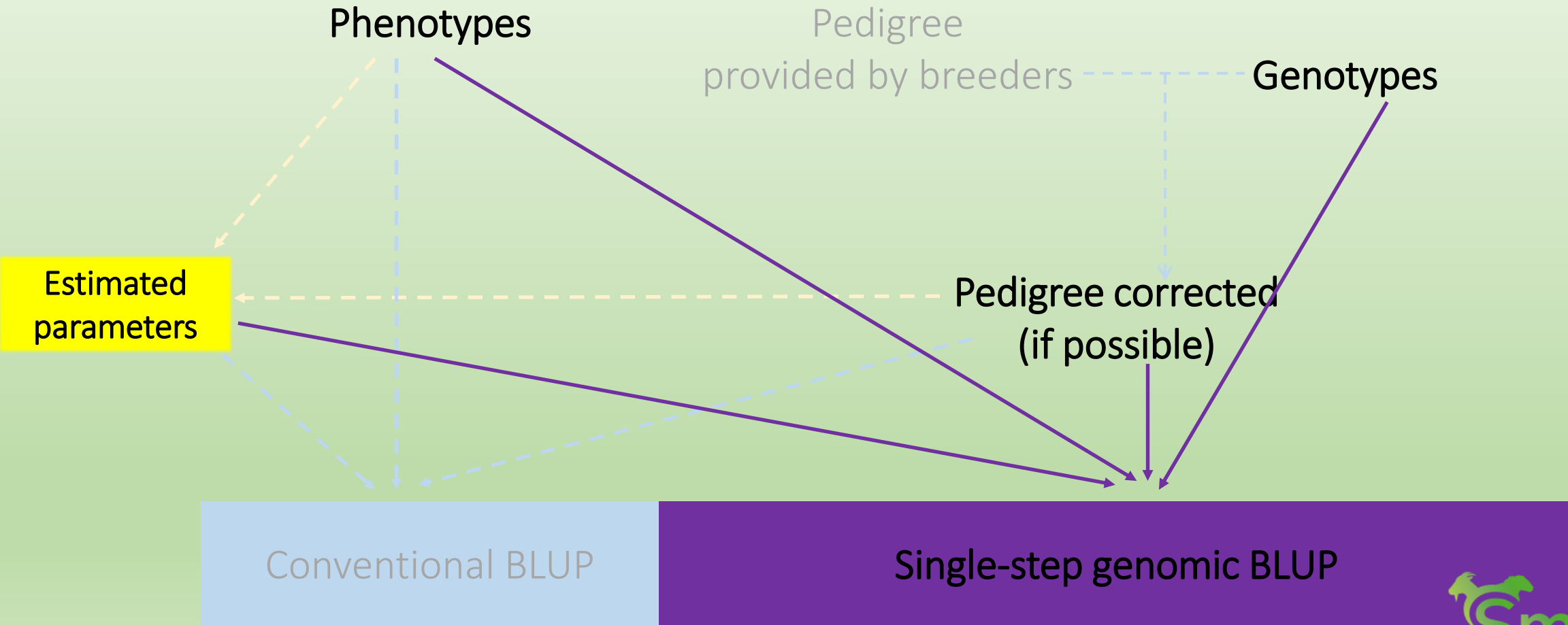
Estimated
parameters

Pedigree corrected
(if possible)

What we have done



What we have done



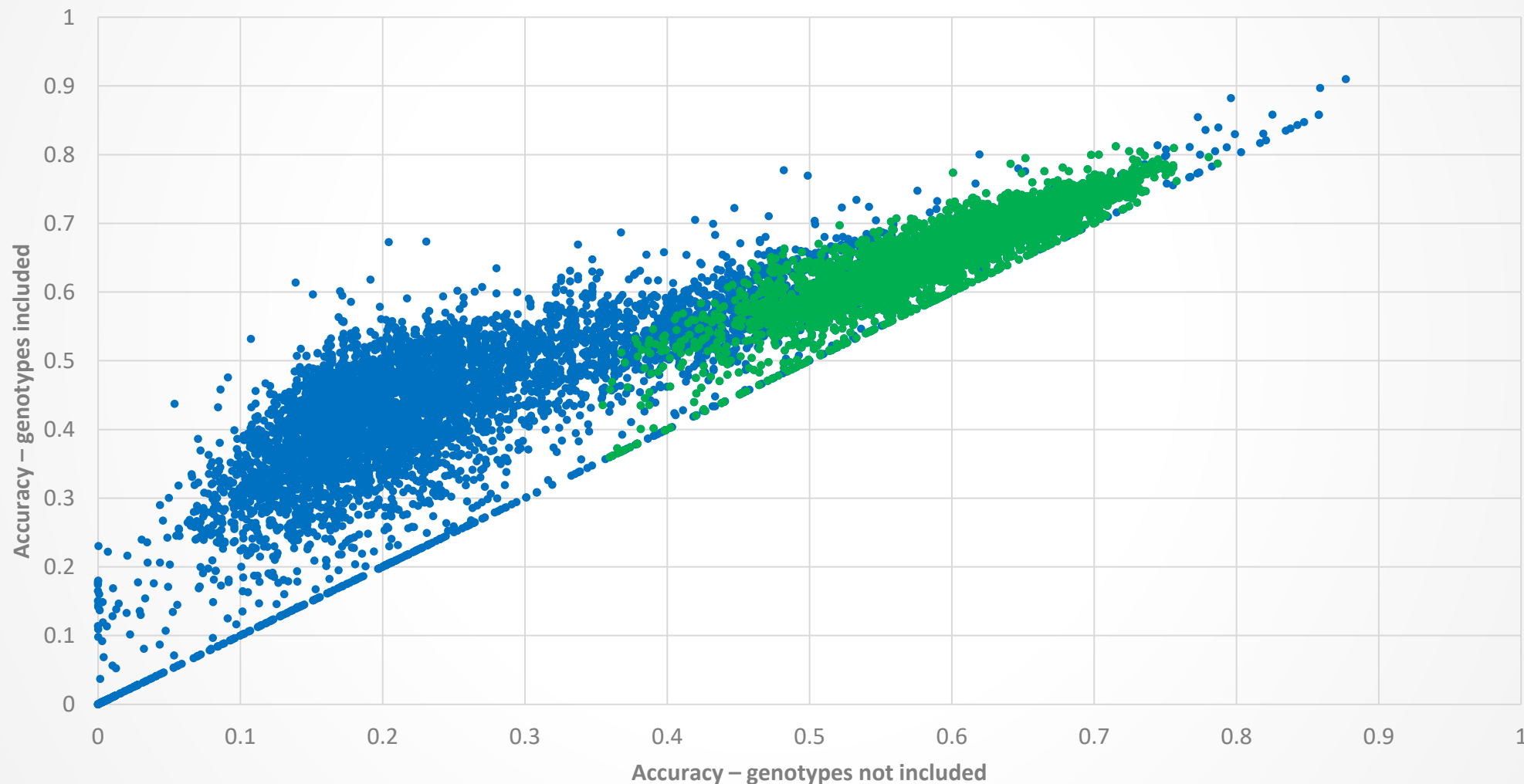
Heritability 12%

Max change:

- +0.18 with phenotype
- +0.47 no phenotype

FOOTROT

• no phenotype • phenotype available

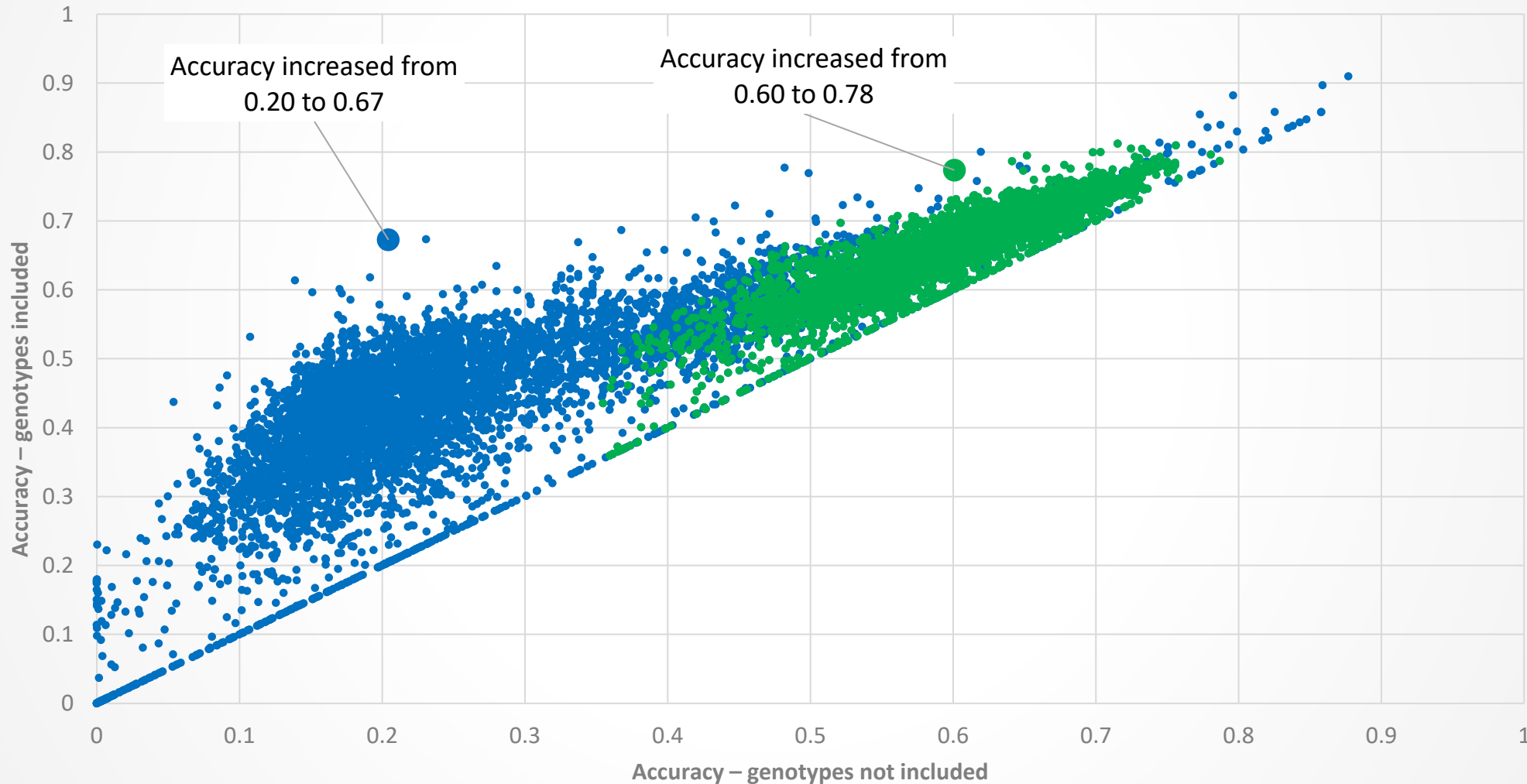


Heritability 12%

- Max change:
- +0.18 with phenotype
 - +0.47 no phenotype

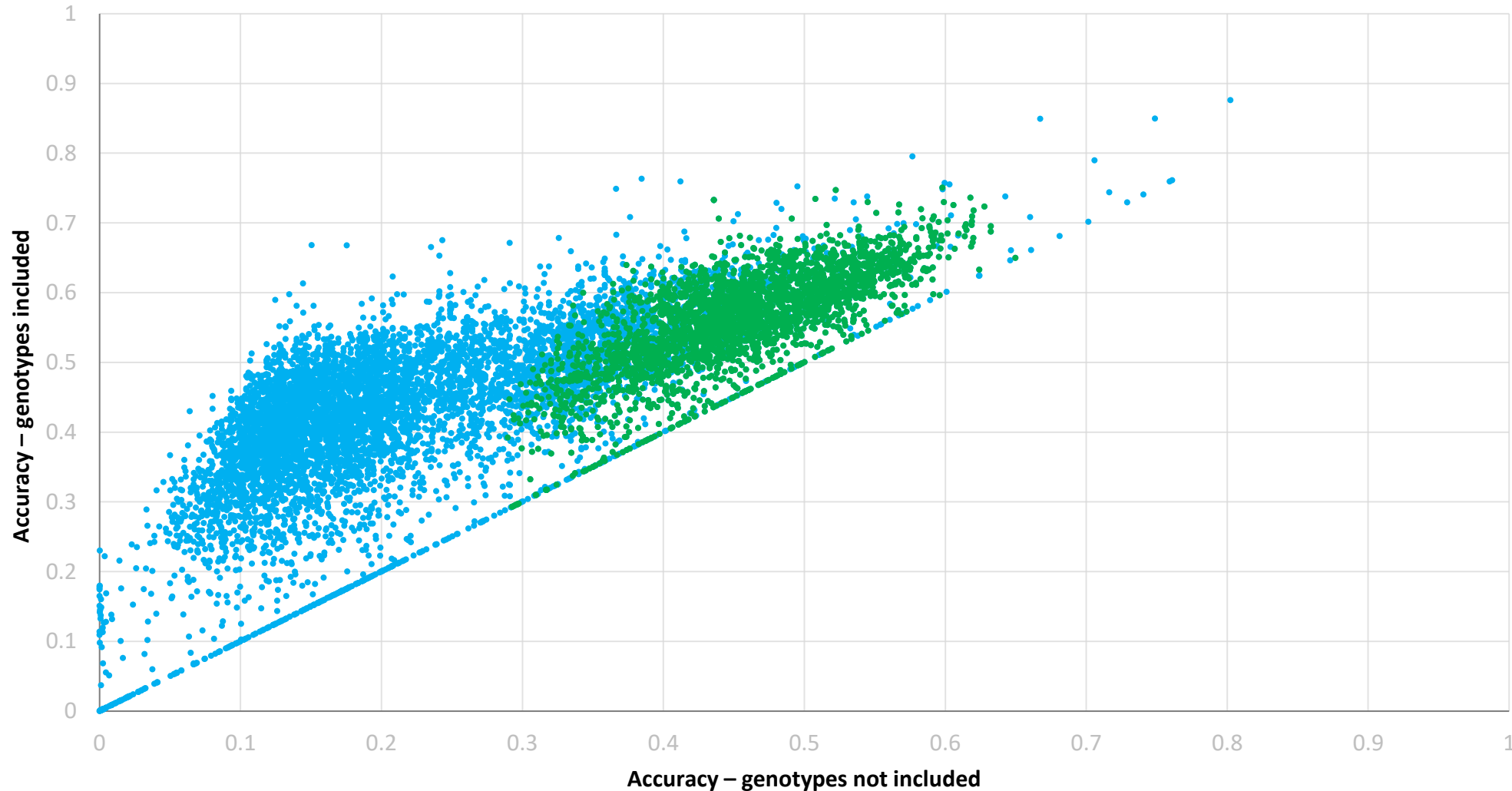
FOOTROT

• no phenotype • phenotype available



CALIFORNIA MASTITIS TEST

• no phenotype • phenotype available



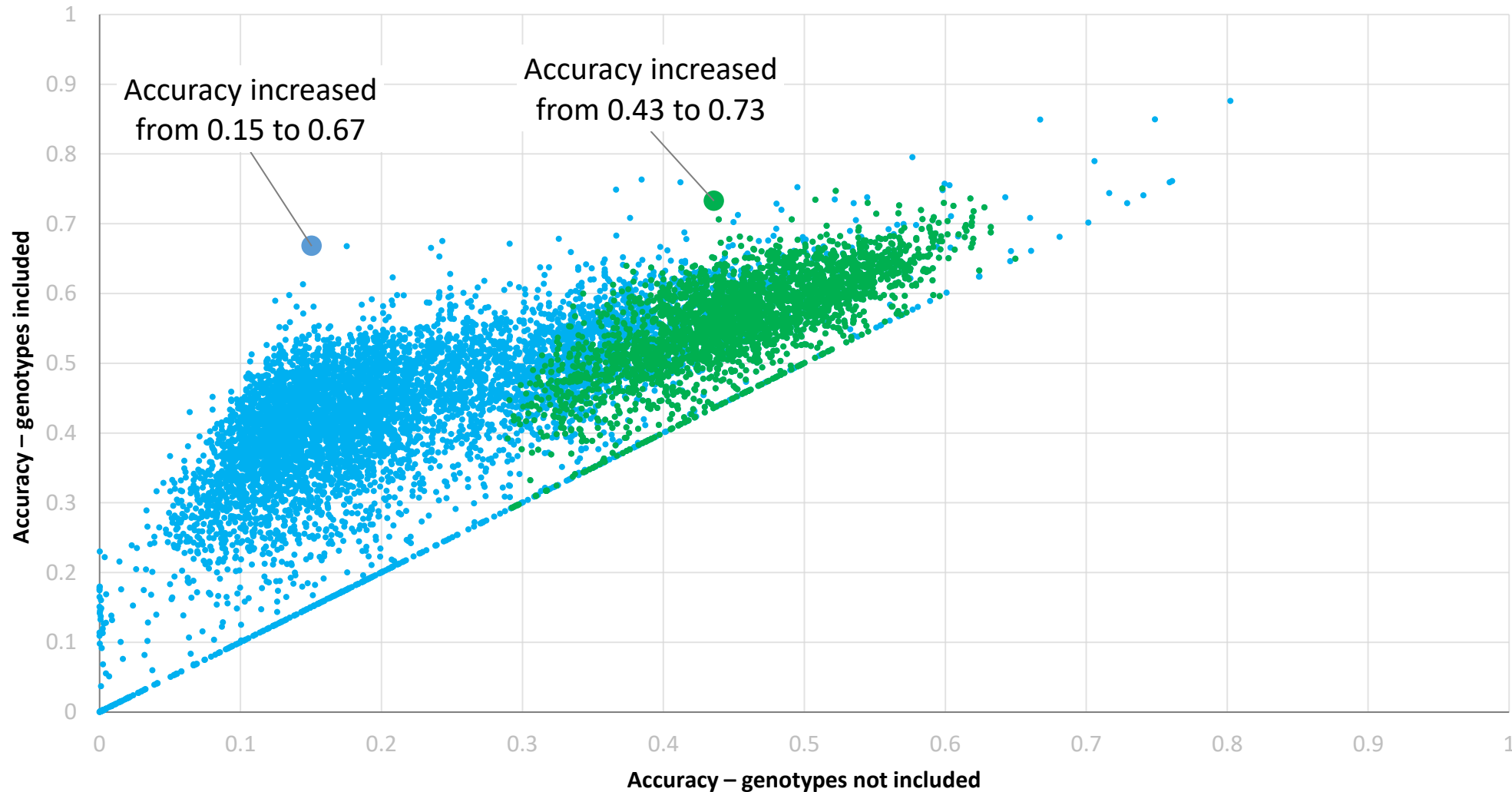
Heritability 7%

Max change:

- +0.30 with phenotype
- +0.52 no phenotype

CALIFORNIA MASTITIS TEST

• no phenotype • phenotype available



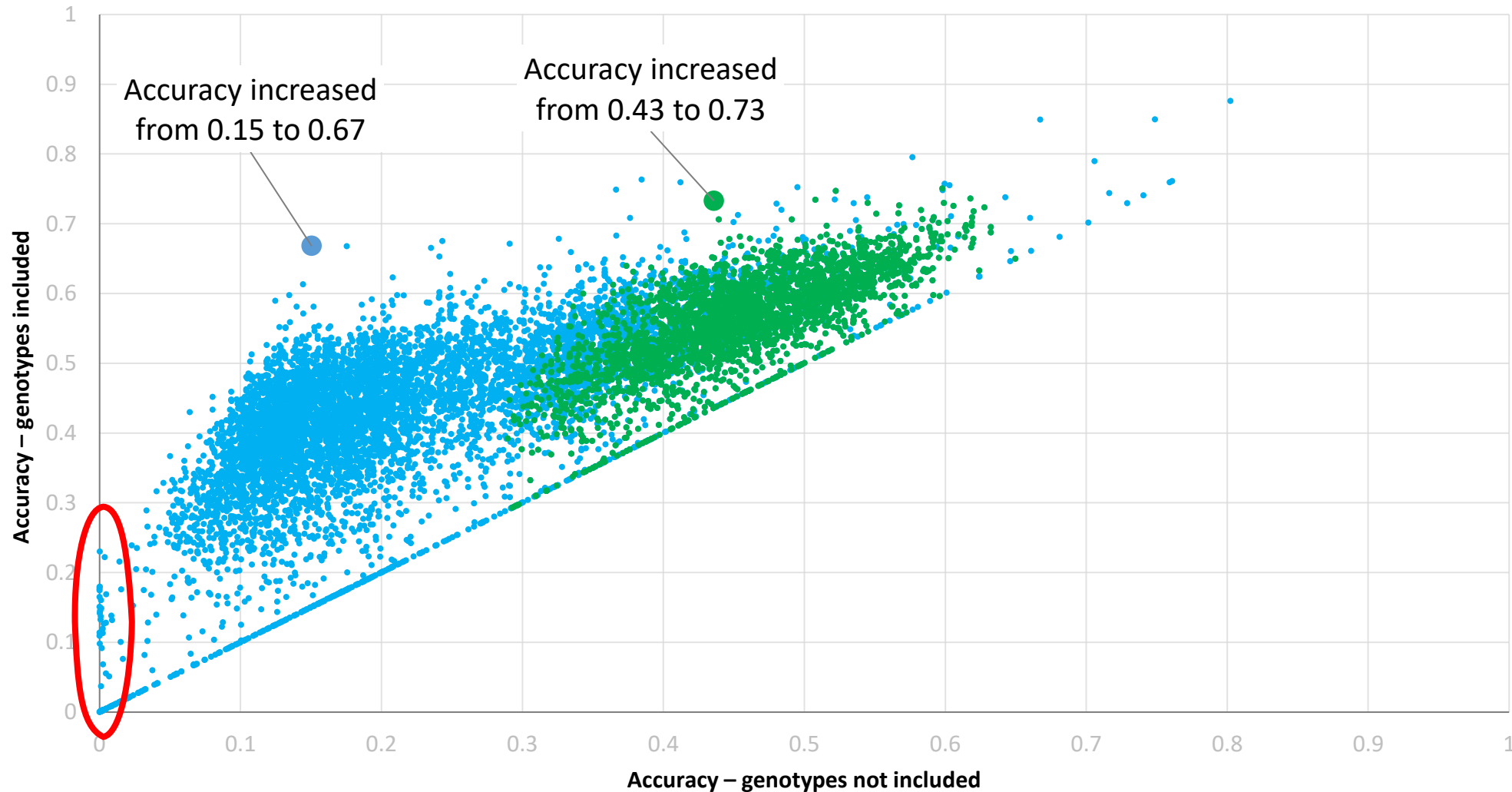
Heritability 7%

Max change:

- +0.30 with phenotype
- +0.52 no phenotype

CALIFORNIA MASTITIS TEST

• no phenotype • phenotype available



Heritability 7%

Max change:

- +0.30 with phenotype
- +0.52 no phenotype

Conclusions



- With a properly designed reference population, the use of genomic information is beneficial for non-phenotyped animals
- Improving both genotyping and phenotyping would enhance the accuracy of genetic evaluations for footrot and mastitis, which means Estimated Breeding Values (EBVs) for these traits could be published for more animals



World Congress on
Genetics Applied
to Livestock Production



Rotterdam | The Netherlands
3 - 8 July 2022



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 772787 (SMARTER), InnovateUK project ID 102646 (BBSRC project no. BB M02833X/1) and InnovateUK project ID 131791.



SMALL RuminanTs breeding
for Efficiency and Resilience



Innovate UK



SRUC



The Scottish
Government
Riaghaltas na h-Alba