



IT-Solutions for
Animal Production

Breeding on polled genetics in Holsteins - chances and limitations

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Ethical aspects of breeding

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Background

- Ethical considerations about removing cattle horns after birth
 - Painful for animals

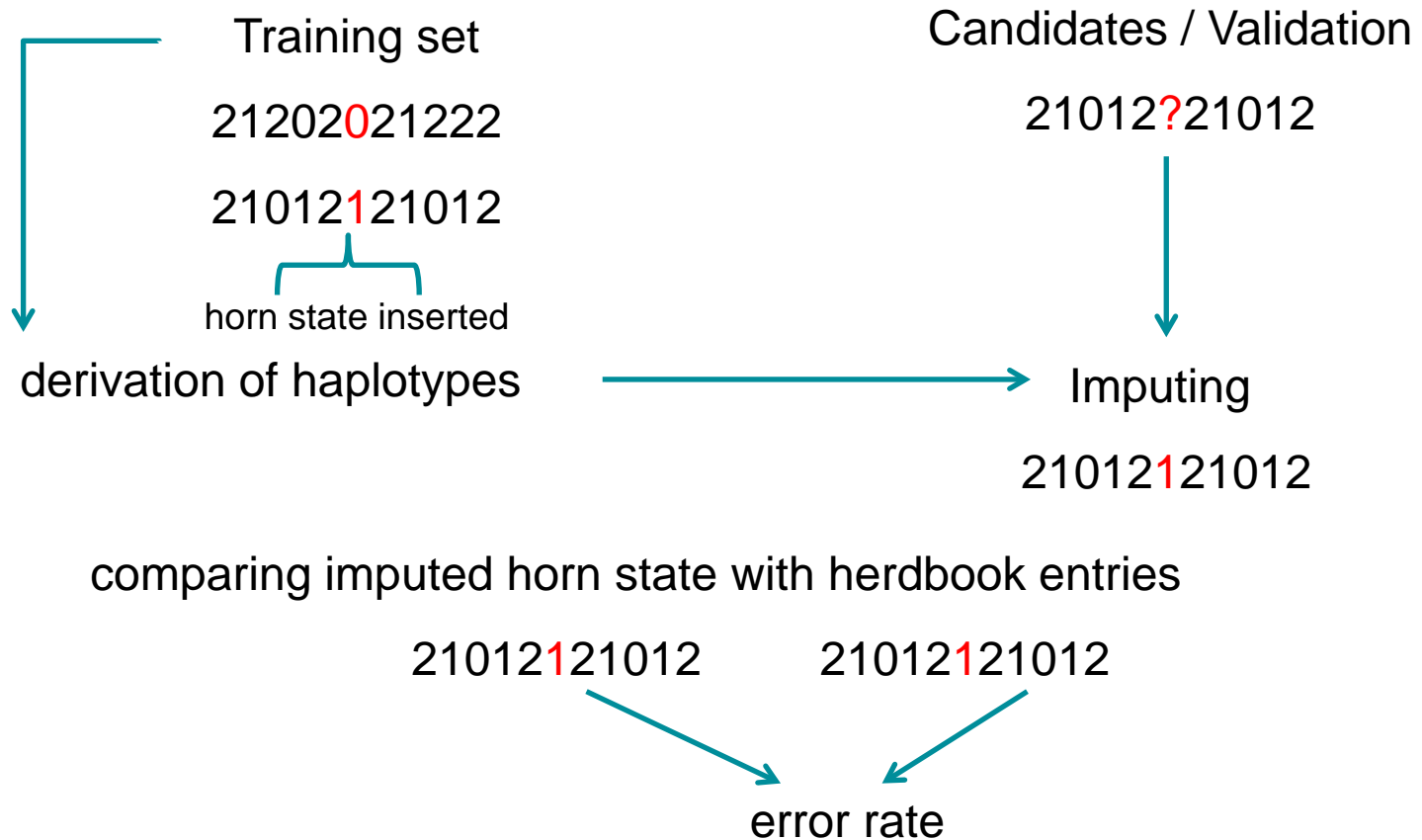
- Chance: Breeding on polled animals helps to solve ethical conflict on the long term

- Limitation: Only two polled sires and their offspring with high breeding values
 - Identification of polled Holstein animals in herdbook (Size of genetic base)
 - Increased inbreeding
 - Increased recessive alleles

- *Objective:* To investigate chances and limitations of breeding for polled cattle

Materials and Methods (1)

- Imputing procedure of horn state:
 - **Beagle**, Version 3.3 (Browning and Browning, 2010)



Materials and Methods (1)

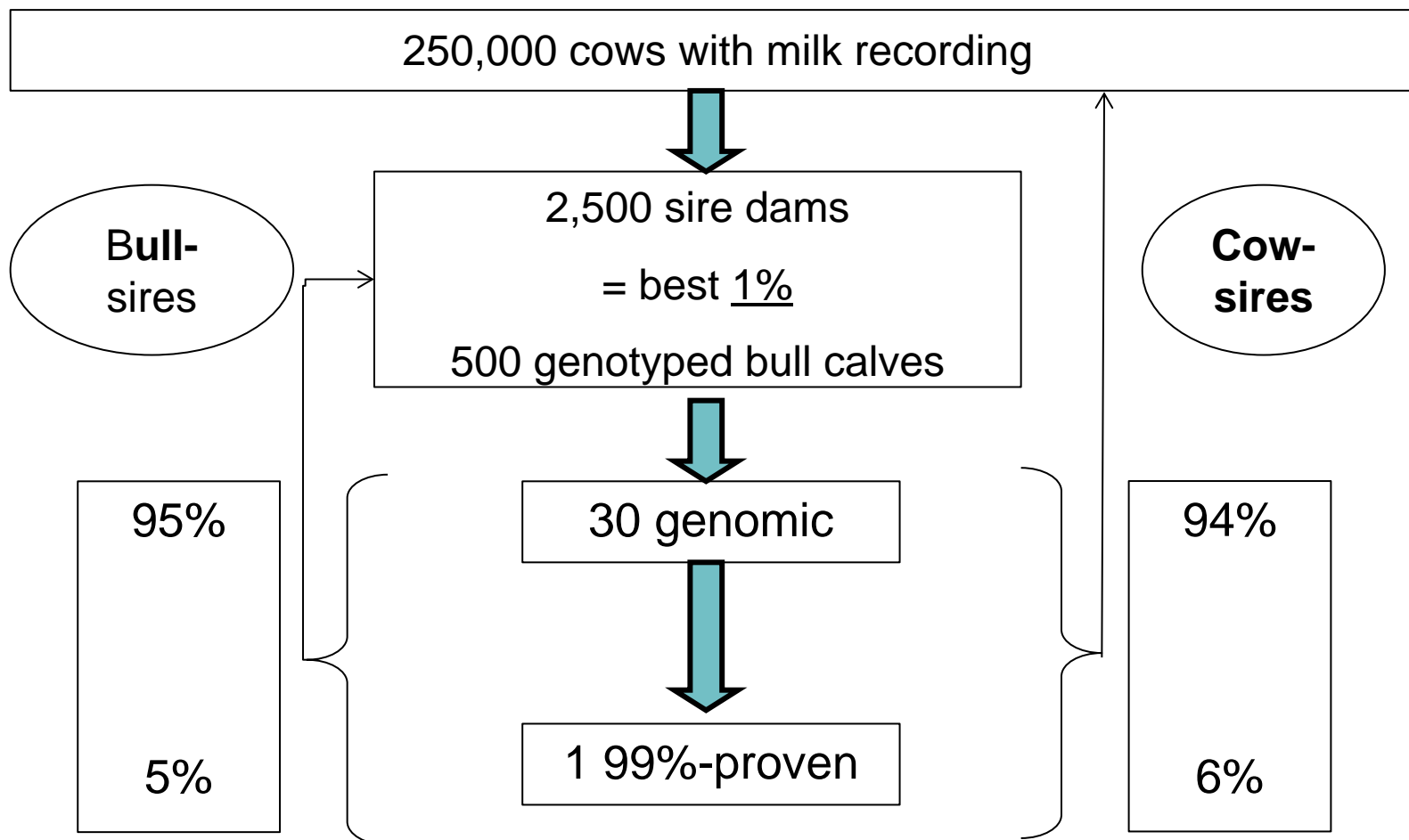
- Data Set for imputing horn state
- Localisation Chromosome 1
 - 78 SNPs from 54k-Chip

- Genotypes: 60.368 animals (54K Chip), **aug 2012**

- Animals with known horn state and genotypes (SNP):
 - 22.834 horned animals (pp), identified by pedigree information
 - 417 heterozygote polled animals (Pp), because of herdbook entry
 - 20 homozygote polled animals (PP), because of herdbook entry

Materials and Methods (2)

Genomic breeding program for polled



Materials and Methods (2)

Breeding scenario for polled:

- **A**: Selection due to breeding values – assortative mating 500 bull-dams
- **A+BM**: Selection additional 100 polled bull-dams
- **G**: Selection only polled bull-dams (mostly PP)
- **G+A**: Selection within polled-bull dams due to breeding value
- **P**: Selection due to phenotype polled state

Results (1)

Comparison of herdbook entries and imputation results of validation animals

Herdbook entries	Imputed pp	Imputed Pp	Imputed PP
5.555 pp*	5.554	1	-
184 Pp	5	176	3
9 PP	-	-	9
68 P	3	65	-

■ Genotype error rate: 0.2%

*) Because of pedigree- information

Results (1)

Results of prediction for candidates

# reference animals	23.271
# validation animals	37.097
Imputed PP	18
Imputed Pp	545
Imputed pp	36.534

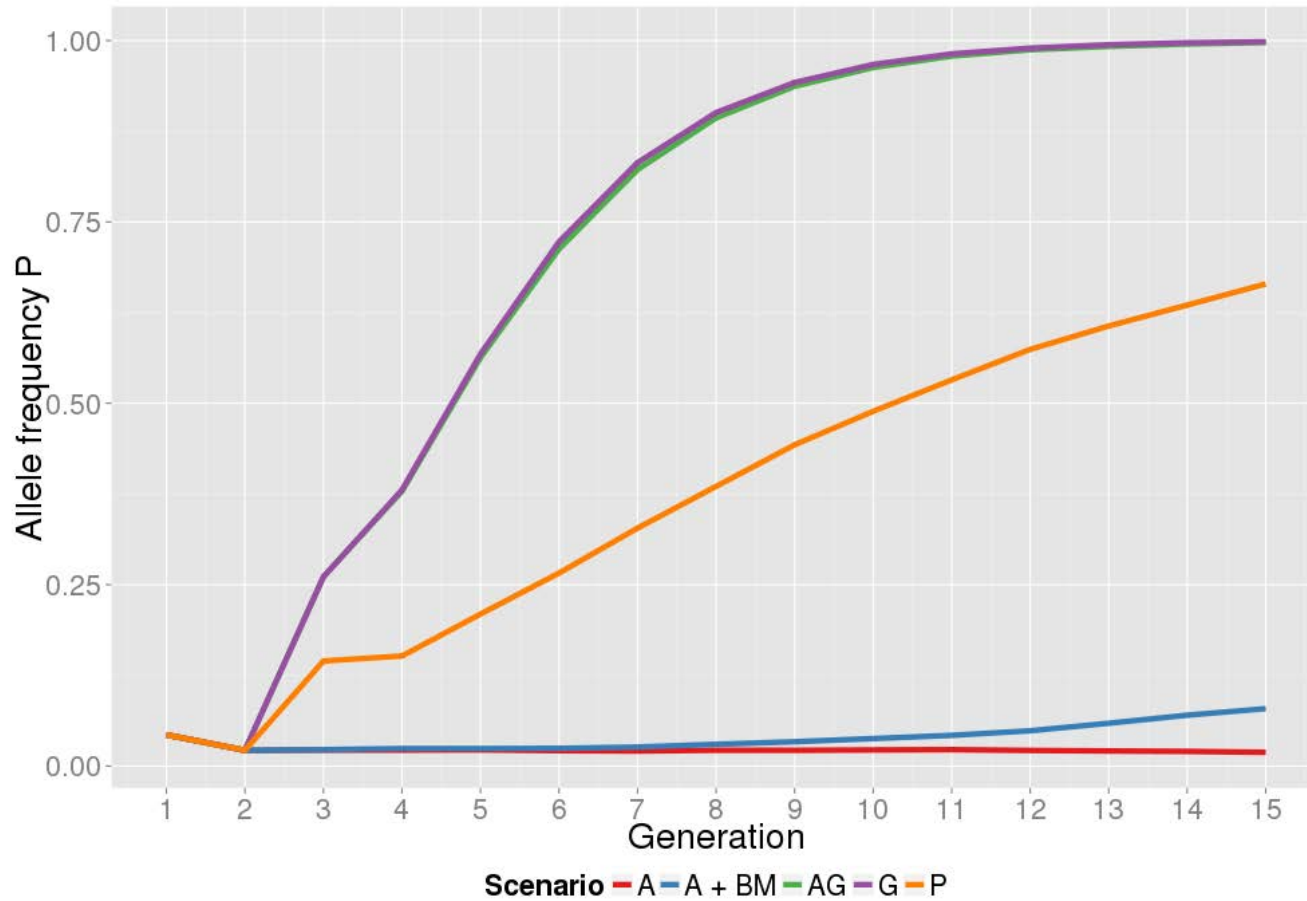
Results (1)

- *Distribution of polled status, allele frequencies of the recessive allele p and Hardy-Weinberg-equilibrium by breed and sex*

	PP animals	Pp animals	pp animals	Allele frequency p	Sub - population HWE
Male HOL	11	313	41.781	0.996	No
Female HOL	7	124	11.724	0.994	No
Male RHF	10	372	4.620	0.960	Yes
Female RHF	8	145	981	0.929	Yes

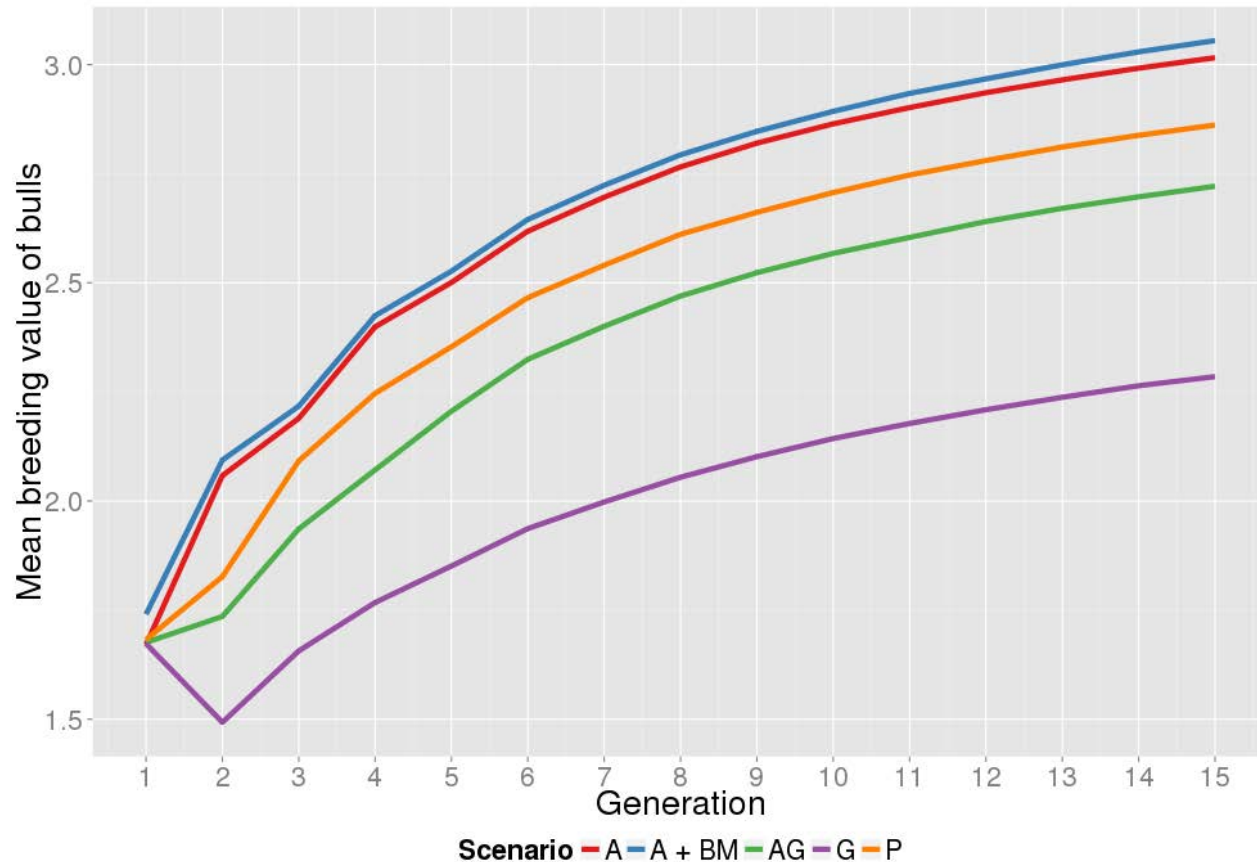
Results (2)

Development of allele frequency of P in the whole population for the 5 scenarios over 15 generations



Results (2)

Increase of mean breeding values of bulls over the investigated 15 generations and 5 scenarios



Conclusions

- Imputing powerful tool to identify more polled animals
 - Low error rate
 - Helps to check herdbook entries

- Selection on homozygote polled genotype for already SNP-genotyped animals is most effective way to increase polled allele & genetic gain in population

- Non-SNP-genotyped animals selection on their phenotype is sufficient

- Genotyping of the polled state is not mandatory



Acknowledgements

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Thank you for attendance !