Should *DMRT3* be used for estimation of breeding values in the French Trotter?

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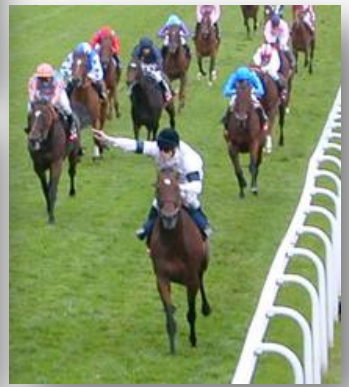
A mutation in *DMRT3* has a strong effect on gaits (Andersson *et al*. 2012). The fixed allele varies with the breeds:

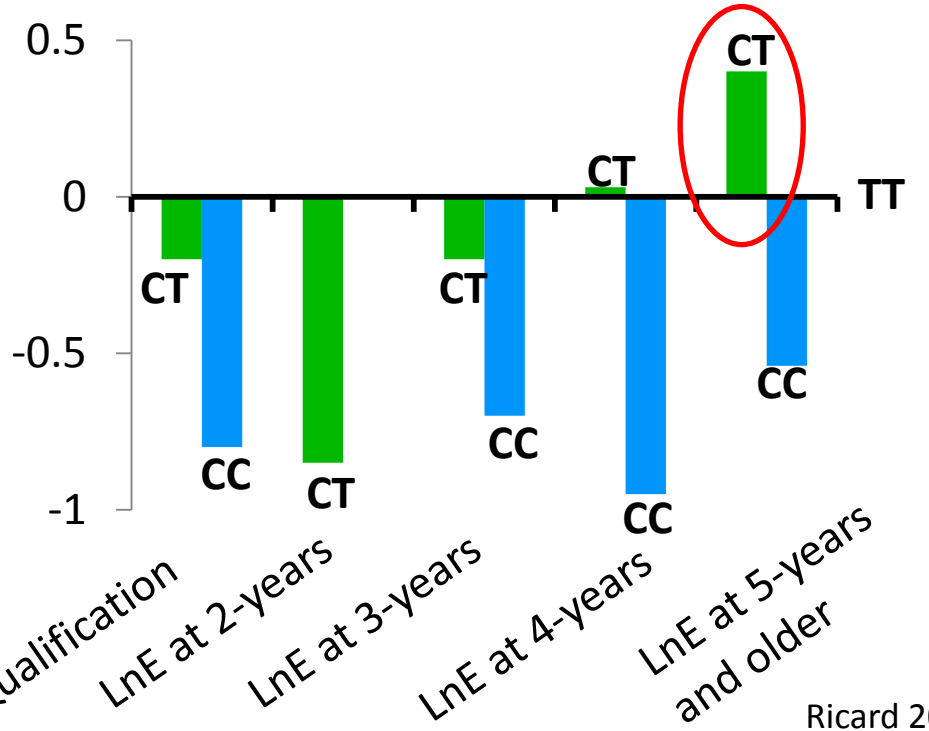
Wild-type allele C:



Mutant allele A:

Mutant allele frequency is 77% in French Trotters (FT) because of a positive effect of the wild-type allele on late performances

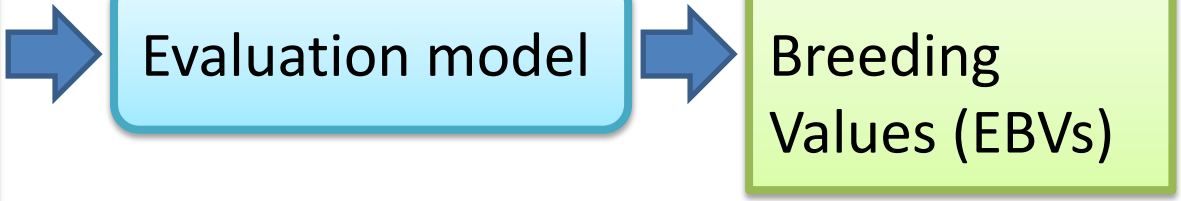
Effect of genotypes compared to **TT** (SNP *BIEC2-620109* linked to *DMRT3* (C-C, A-T))



Ricard 2015 (Genet. Sel. Evol., 47:10)

630 French Trotters were genotyped

- Pedigree: 5,699 horses
- 41,711 SNPs retained
- Own performances corrected for fixed effects



Multi-trait evaluation: account for genetic correlations between traits and horses who failed to qualify

Vector of ones and mean

Incidence matrices

Performances corrected for fixed effects

$$\boldsymbol{y}^* = \mathbf{1}\mu + \boldsymbol{Zg}\ (+\boldsymbol{W}\beta) + \boldsymbol{\varepsilon}$$

Residual

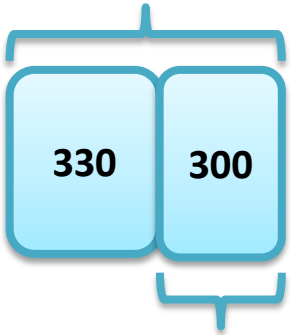
Additive genetic breeding values

BLUP : $V(g) = \boldsymbol{A}\sigma_g^2$, **GBLUP** : $V(g) = \boldsymbol{G}\sigma_g^2$

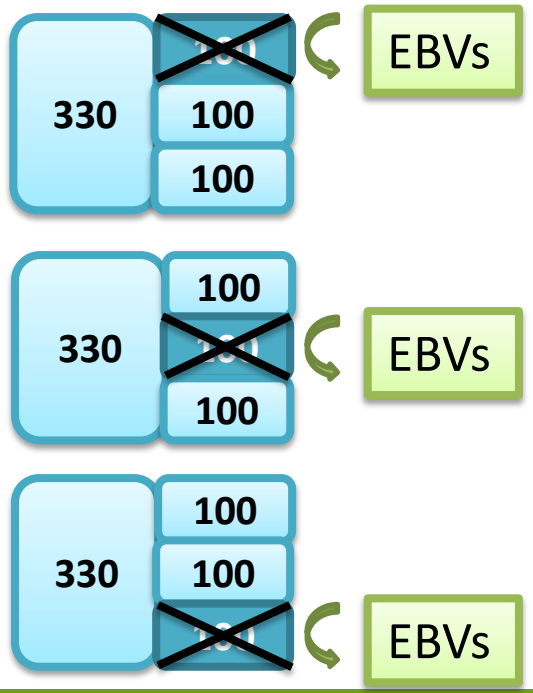
Fixed effect of genotype at SNP *BIEC2-620109*

Cross-validation on 3 disjoint groups of candidates → 530 horses in the reference population

630 genotyped FT with own performances

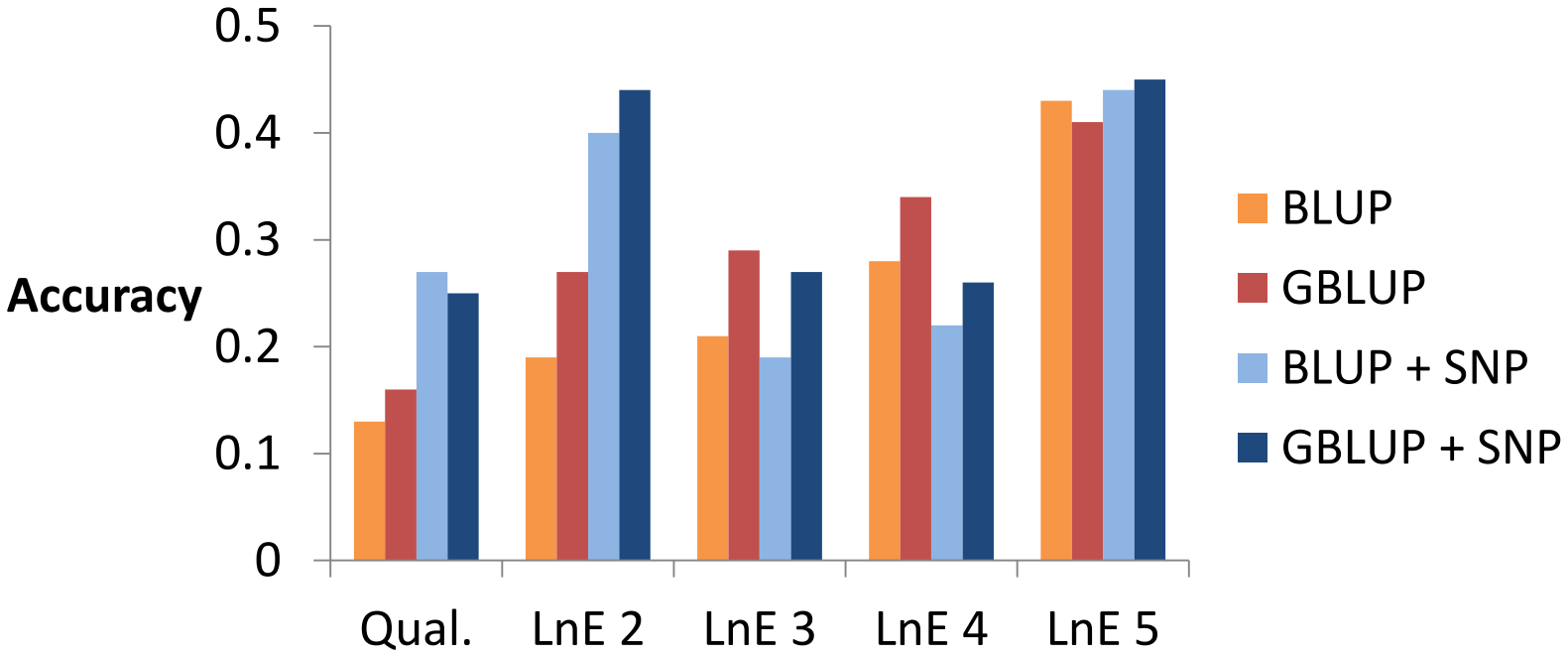


300 FT with their sire genotyped

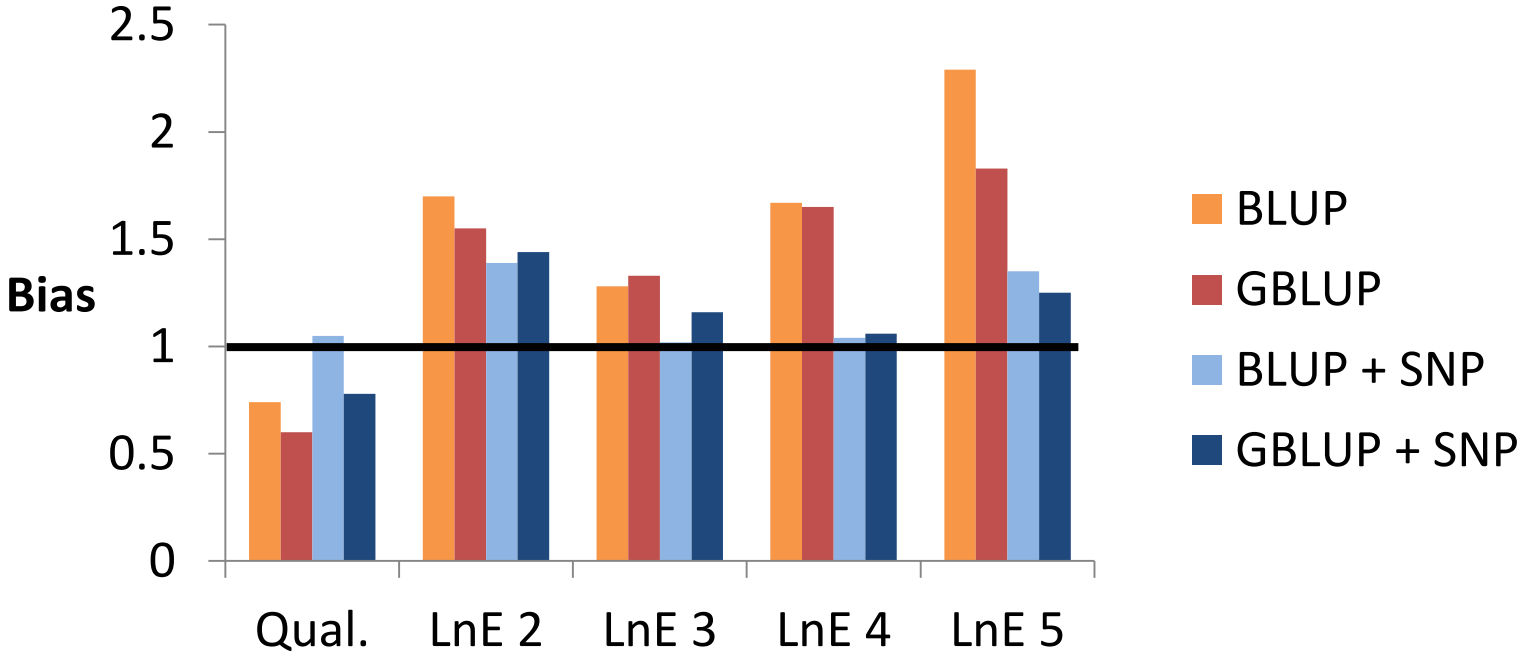


Accuracy and bias computed on the 300 candidates

Accuracy was improved with the SNP *BIEC2-620109* in the model for qualification and early earnings



Bias was reduced for all traits when the SNP *BIEC2-620109* was in the model



Using the SNP *BIEC2-620109* as a fixed effect in a genomic evaluation has two advantages:

- EBVs accuracy improved for qualification and early earnings
- EBVs bias reduced for all traits

→ Different strategies for breeders:

- Breed trotters easy to qualify (TT)
- Breed trotters harder to qualify but with higher earnings in late career (CT)

Frequency of allele C in the population

Thank you for your attention

More details in Journal of Animal Science: doi: 10.2527/jas2015-9224