



GEORGIA



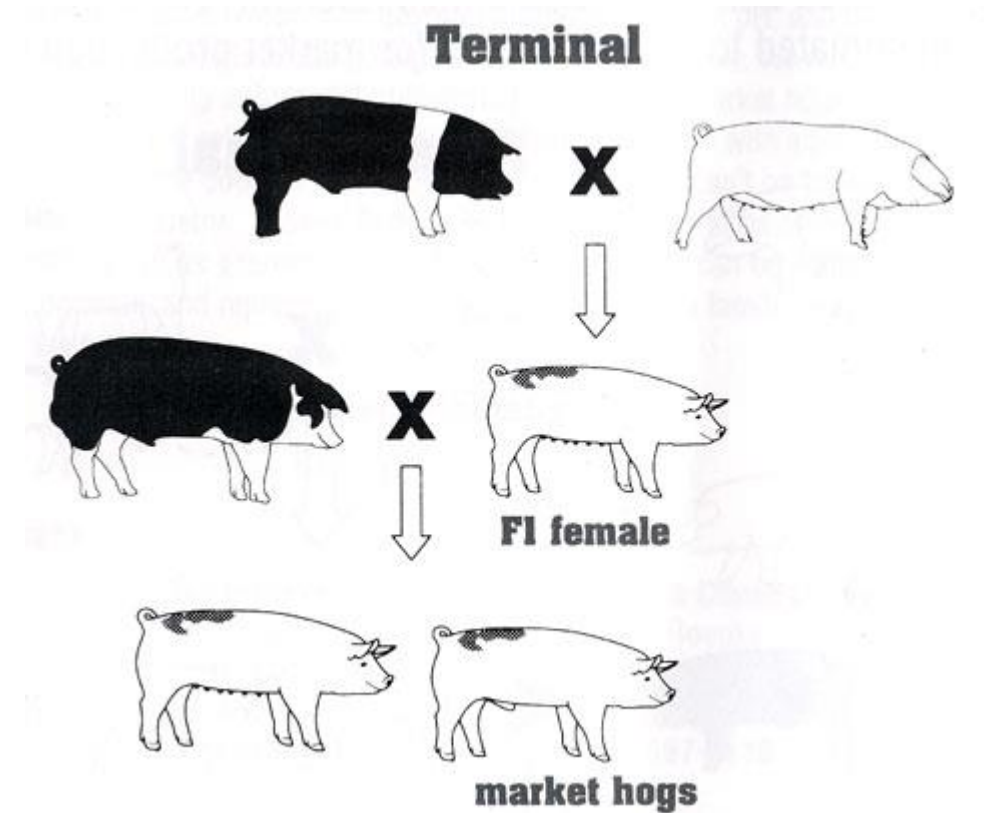
Predicting breeding values of purebred pigs for crossbred performance using crossbred phenotypes and genotypes

Natália Leite, Ching-Yi Chen, William Herring, Shogo Tsuruta, Daniela Lourenco



Introduction

- Genetic selection on purebred lines
- Performance on crossbred animals
- Breed complementarity and heterosis
- Challenges





Introduction

- How accurately select purebred animals for crossbred performance?
 - Increasing phenotyping
 - Expensive
 - Not always feasible (pedigree recording → pooled semen)
 - Increasing genotyping
 - Low cost
 - Low density SNP panels

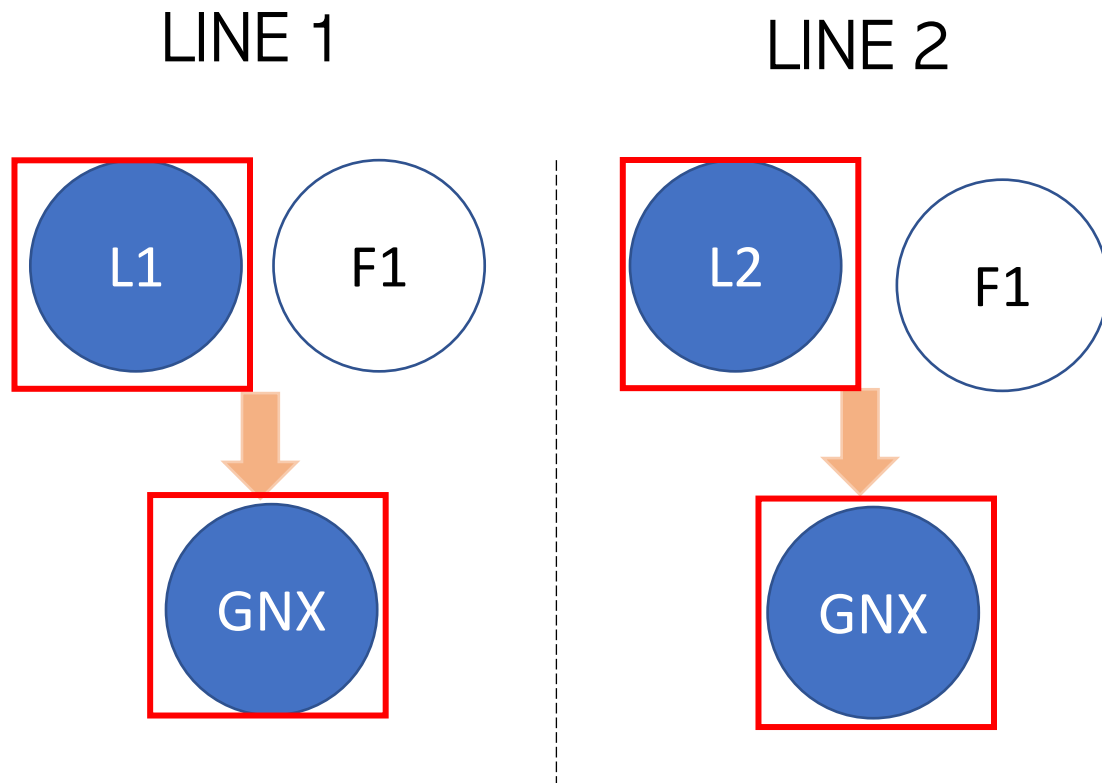


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Objective

To Investigate the benefit of including crossbred genotypes on the accuracy of GEBV of purebred animals for crossbred performance

Material and Methods



Purebred traits: GP, BFP

Crossbred traits: GX, BFX

		Line 1	Line 2
Pedigree		151,625	246,699
Phenotypes	Purerbred	137,707	207,569
	Crossbred	10,622	32,893
Genotypes	Purebred	46,760	13,8026
	Crossbred	10,622*	32,893*

* Imputed genotypes

50K SNP and Imputed

Material and Methods

Genomic sets:

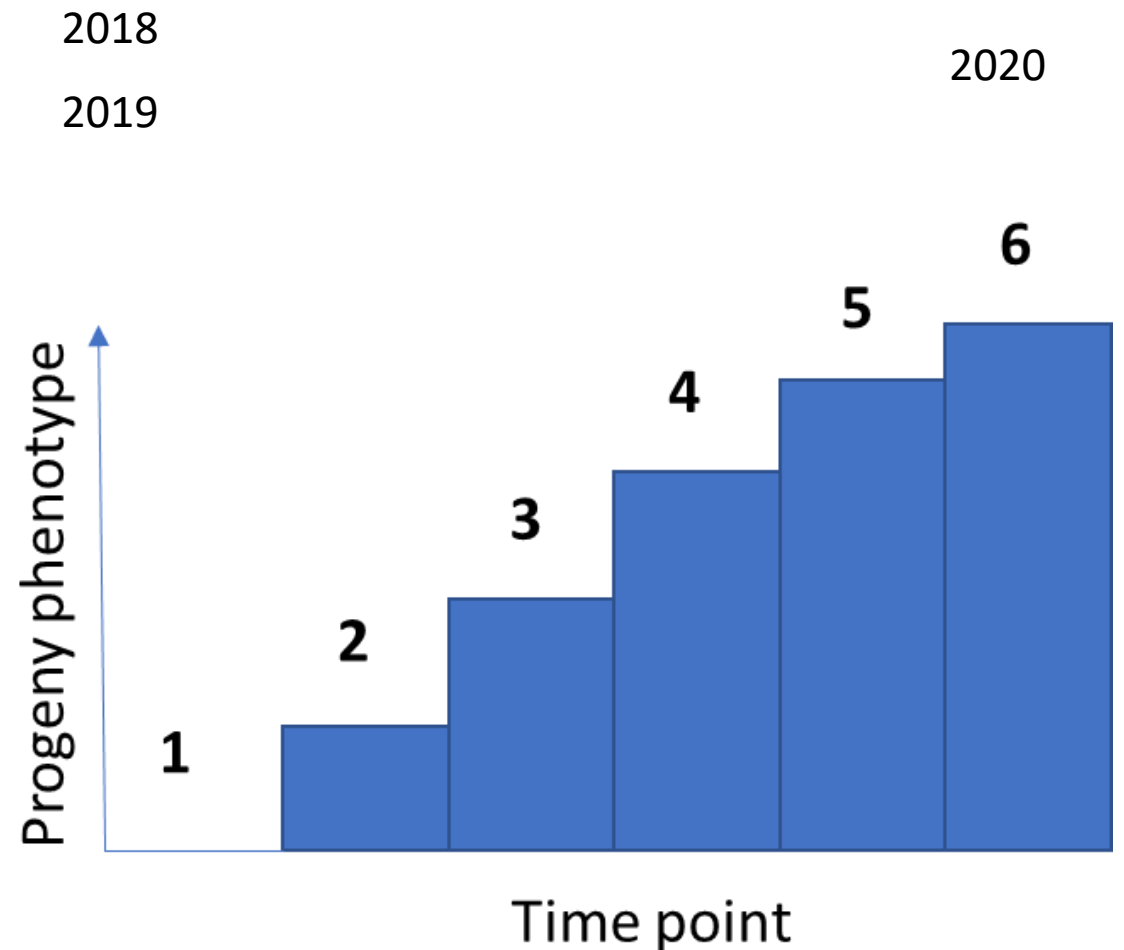
PURE: only purebred genotypes

PURE_GNX: pure and crossbred genotypes

Validation sires (average N progeny):

Line 1: 66 (108)

Line 2: 163 (142)



Material and Methods

Four-trait model:

$$y = X\beta + Z_1u_a + Z_2u_{li} + e$$

BLUP90iod2OMP1 (Misztal et al., 2014)

Approximated accuracies:

ACCF90GS (Misztal et al., 2014)

Single-step method:

$$\begin{bmatrix} X'X & X'Z \\ Z'X & Z'Z + H^{-1}\lambda \end{bmatrix} \begin{bmatrix} \hat{\beta} \\ \hat{u} \end{bmatrix} = \begin{bmatrix} X'y \\ Z'y \end{bmatrix}$$

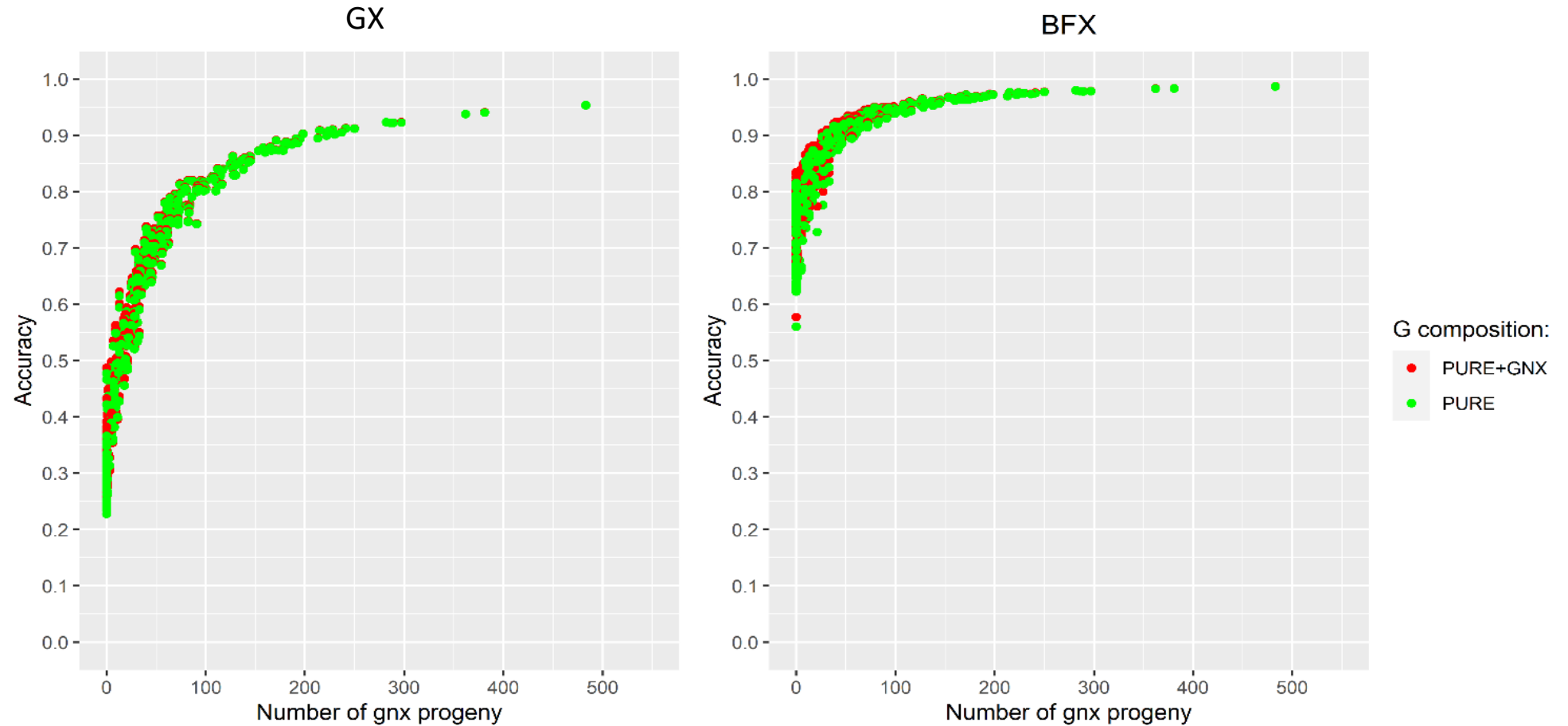


$$H^{-1} = A^{-1} + \begin{bmatrix} 0 & 0 \\ 0 & G^{-1} - A_{22}^{-1} \end{bmatrix}$$



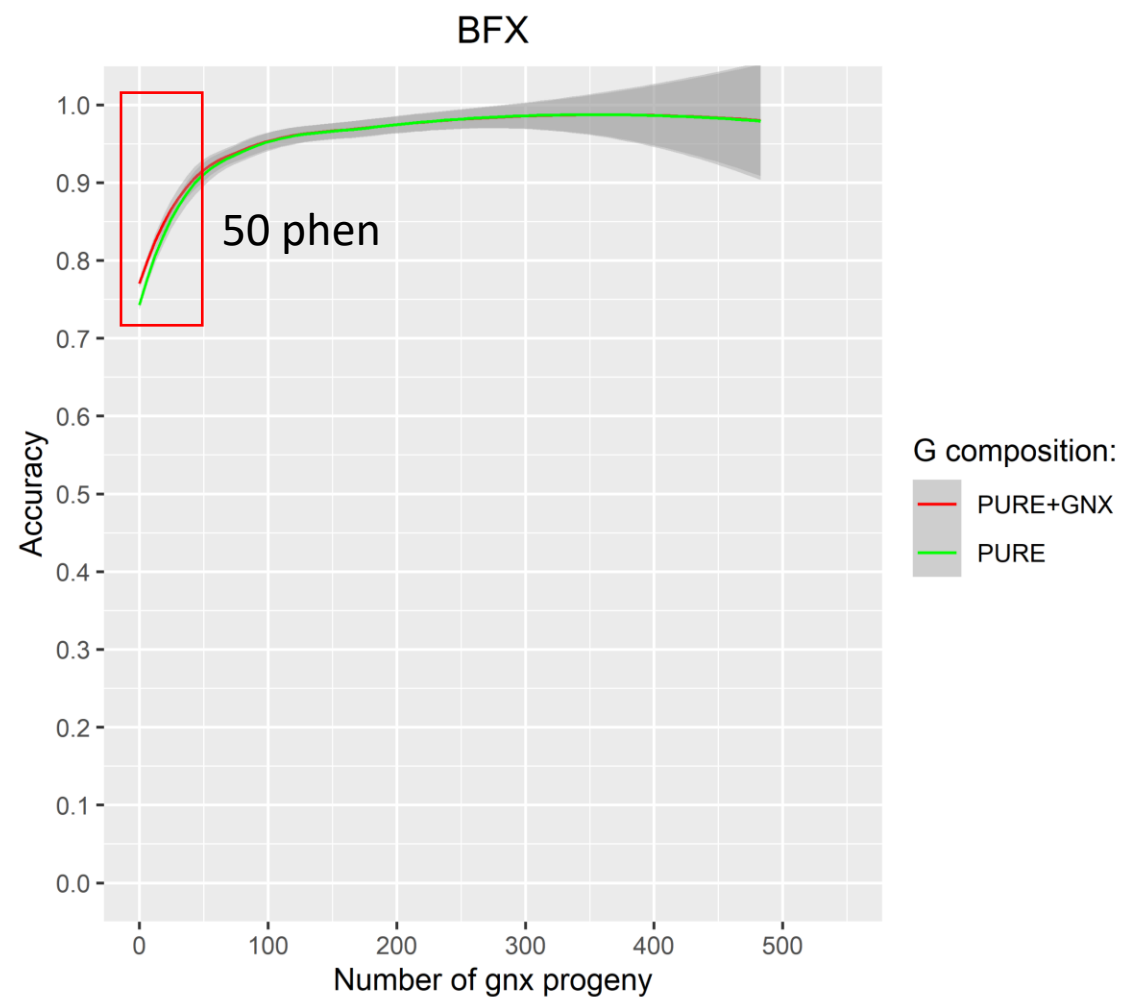
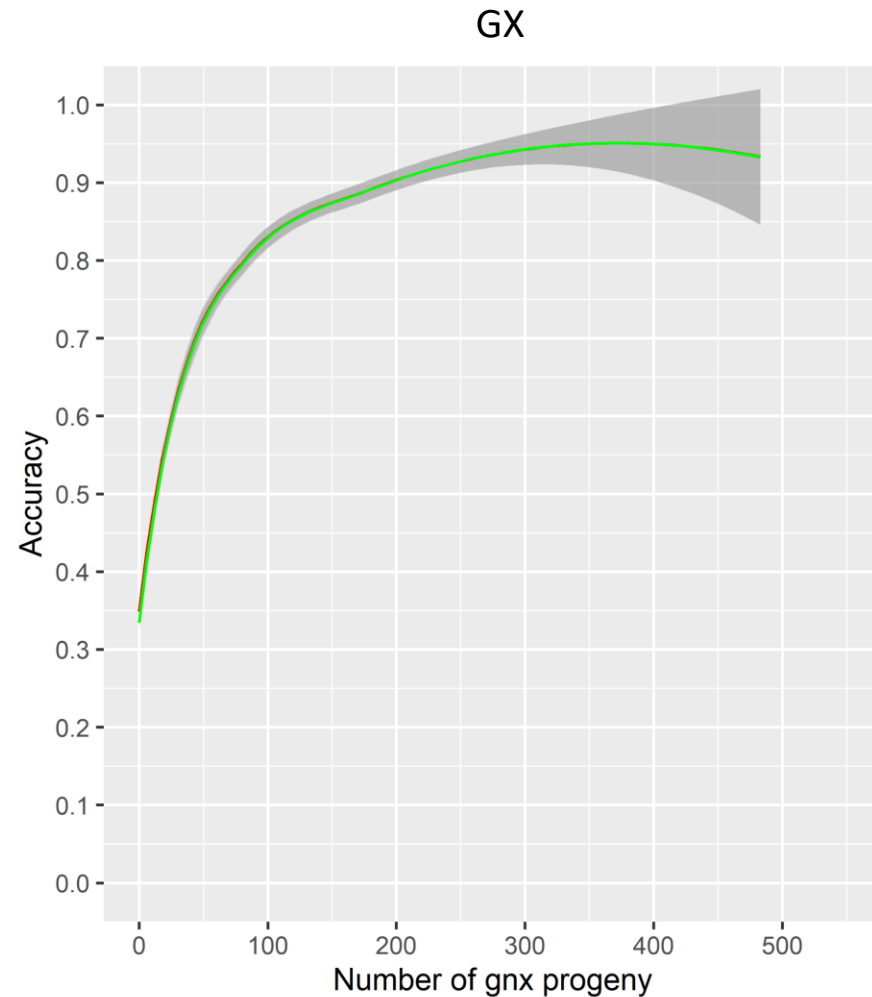
Results

Line 1



Theoretical accuracies

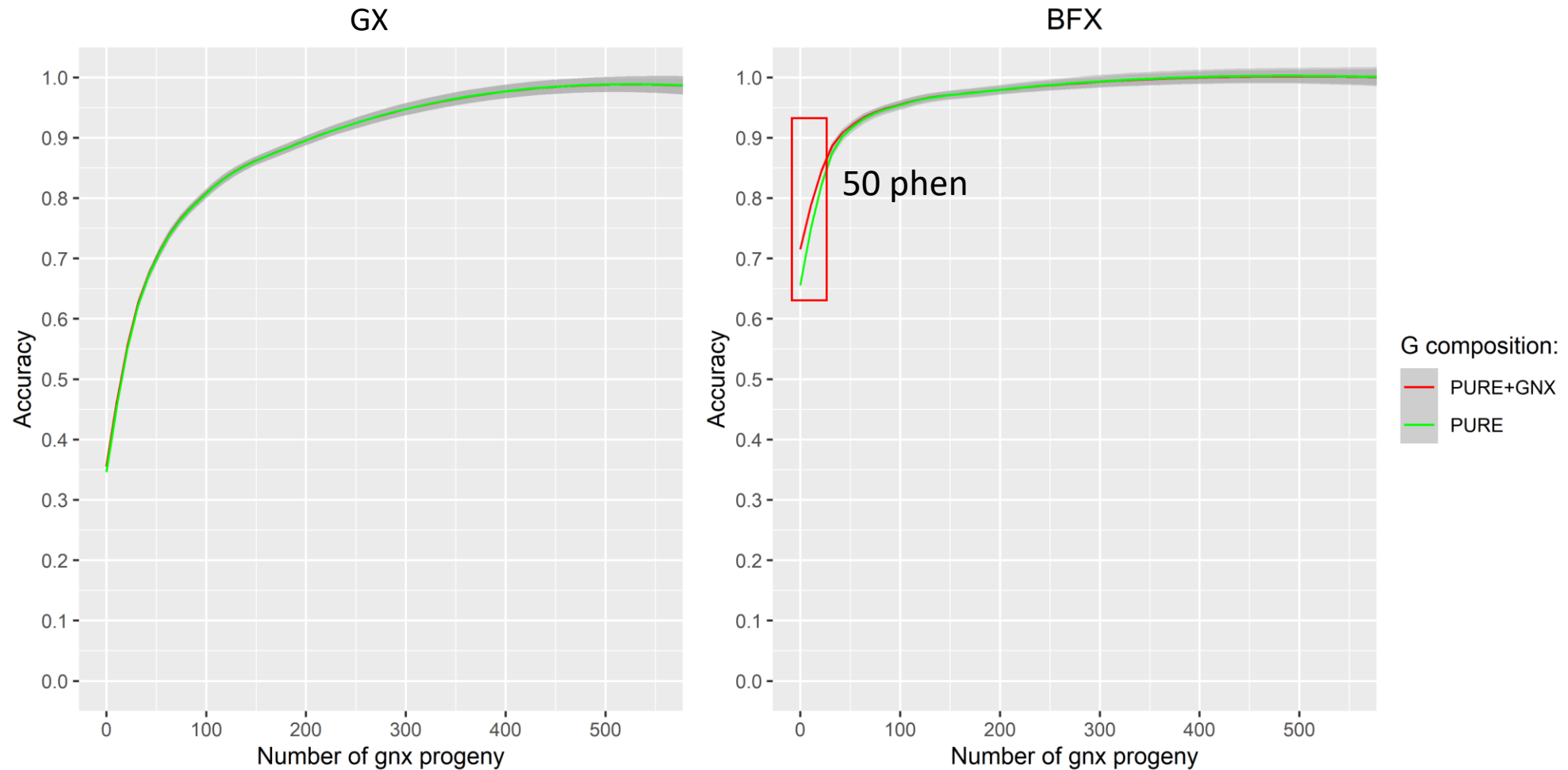
Line 1





Theoretical accuracies

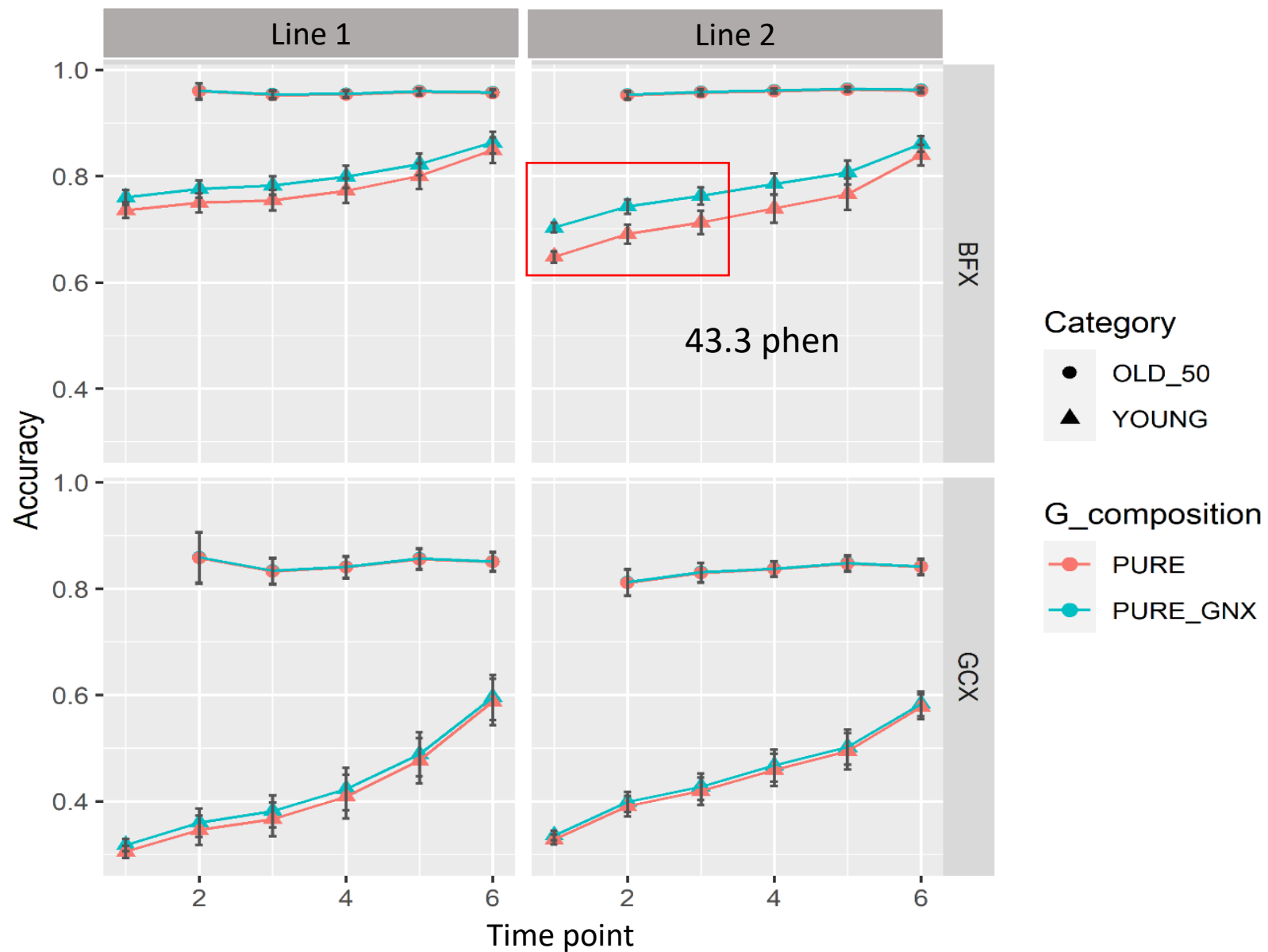
Line 2



Two sire groups:

OLD: >50 GNX phen

YOUNG: ≤ 50 GNX phen





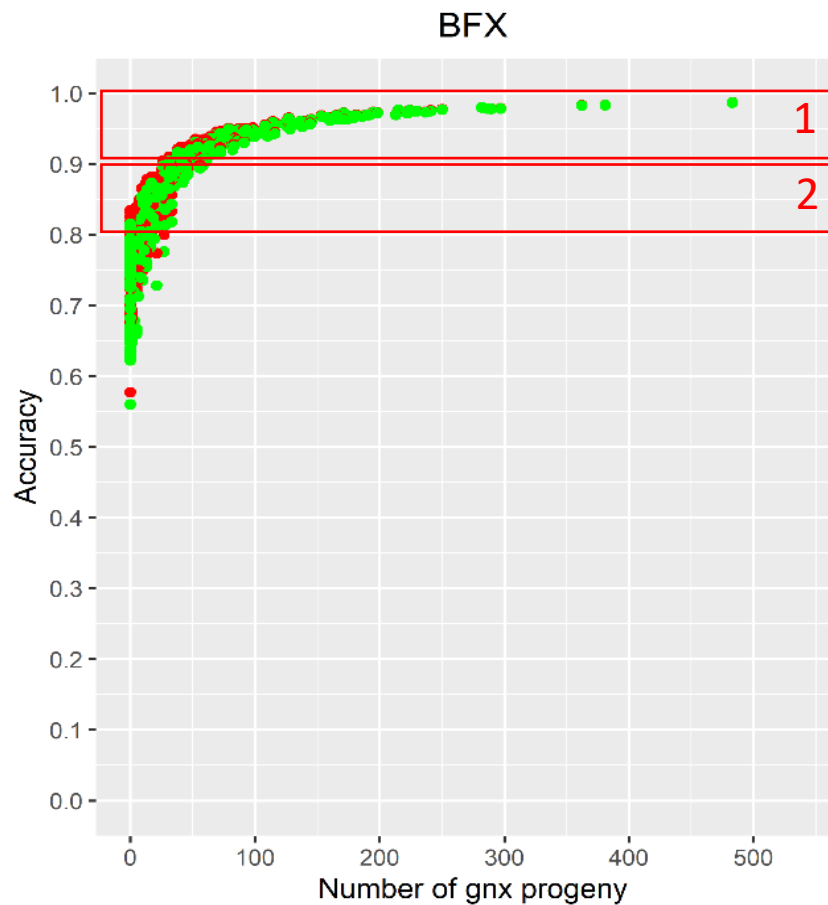
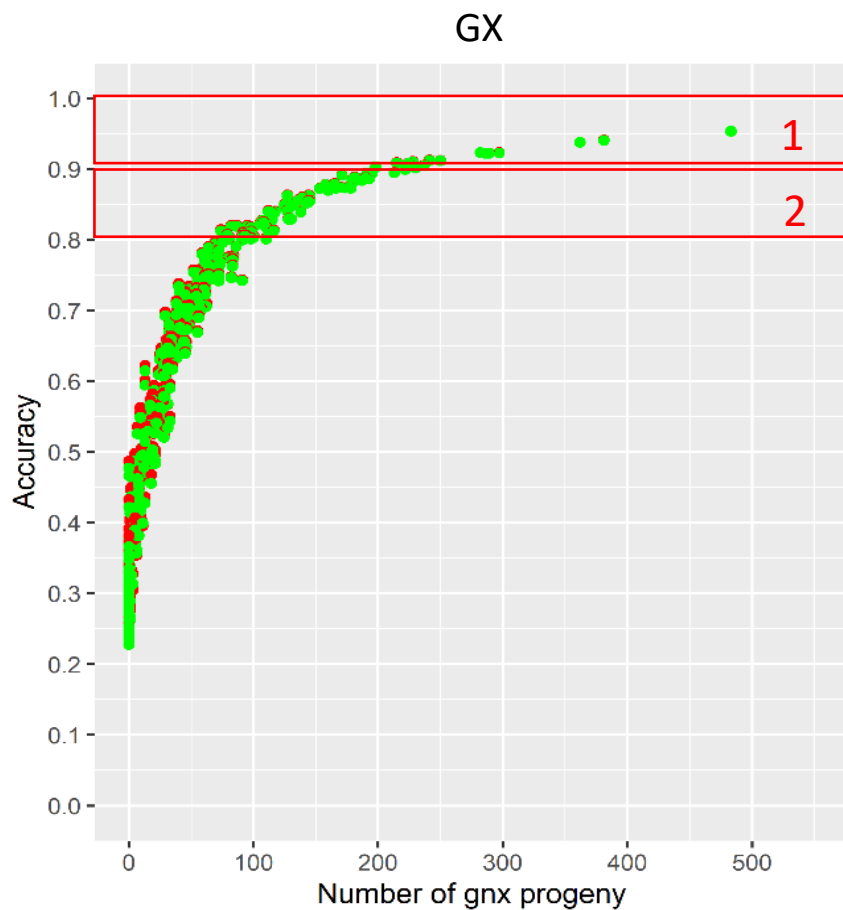
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Can we trade off GNX phenotypes for GNX genotypes for
young sires to become proven?



Results

Line 1



0.0

0.9 (ns)

8.0 (ns)

12.6 (*)

G composition:

- PURE+GNX
- PURE



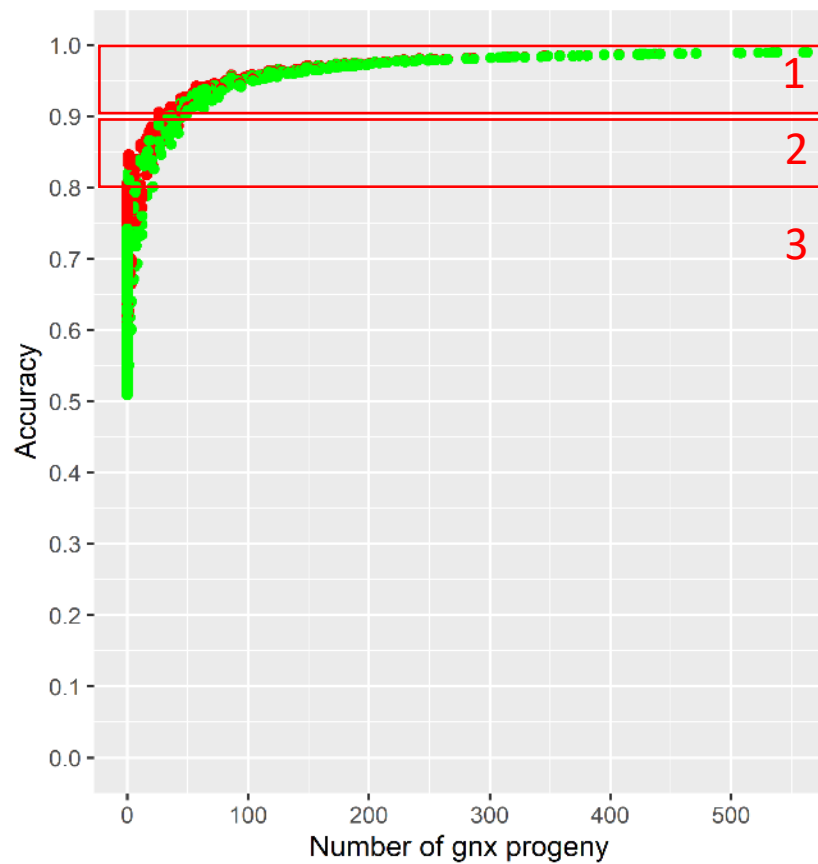
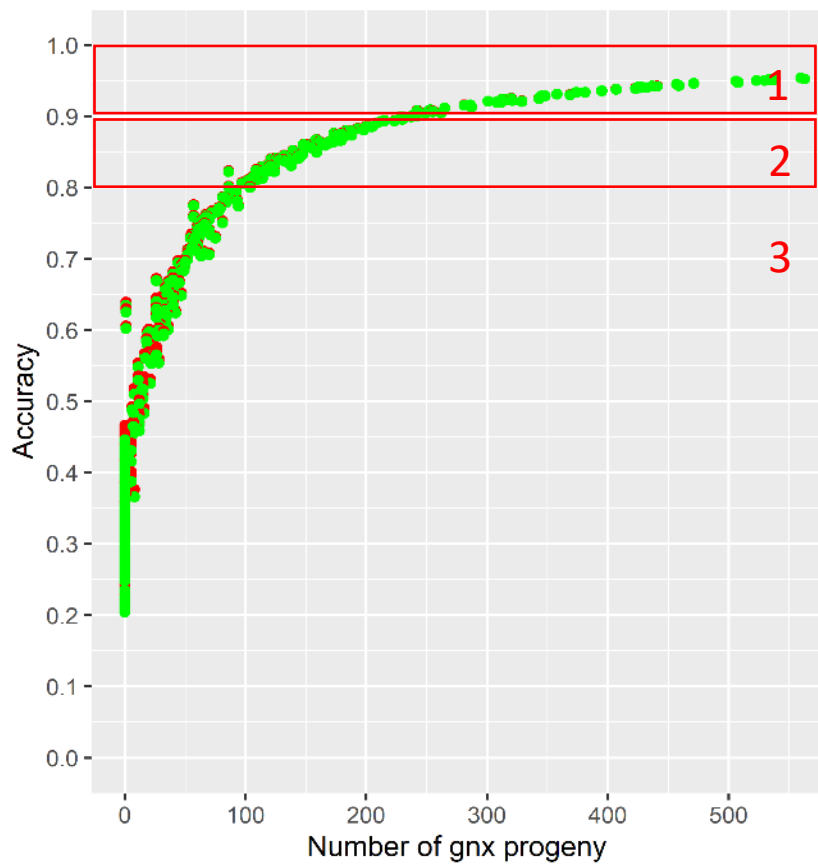
Results

Line 2

GX

BFX

0.0
0.0



9.1 (ns)
4.7 (*)

G composition:

- PURE+GNX
- PURE

Further steps

- The impact of including crossbred genotypes:
 - On the predictability, bias and dispersion of GEBV of purebred sires on crossbred traits
 - On genomic analysis using the algorithm for proven and young (APY)

Take home message

- The inclusion of crossbred genotypes does not significantly affect the accuracy of **GX** for purebred animals
- For **BFX**, the inclusion of crossbred genotypes significantly increases individual accuracies for young sires, which might result in, on average, up to 12.6 fewer progeny phenotypes required for sires to become proven
- Given the cost of genotyping crossbred animals is small, its inclusion in genetic evaluations might bring small benefits

Acknowledgements

nataliagaloro@uga.edu

