Effects of weighting schemes and base adjustment on US genomic validation

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Key findings from (Mota et al. 2023, 2024)

- Large breeds and highly heritable traits are most stable
- Small breeds and low-heritability traits are often unstable
- Failures are driven by a few candidate bulls rather than model issues
- TMACE provided more consistent validation

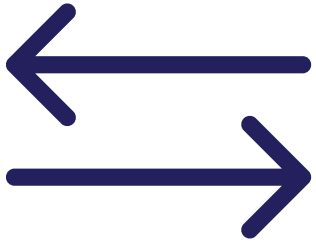
Why revisit genomic validation now?

GEBV are widely used to support early selection and marketing of young bulls.

- International semen marketing requires standardized and transparent genomic validation
- Increasing model complexity and trait expansion
- Limitations of traditional 4-year reference validation
- Persistent challenges for small breeds and low-heritability traits

Why compare validation scenarios?

1 GEBVtest outcomes influence international acceptance



2 Small methodological differences may alter regression statistics

3 Different scenarios may lead to different PASS/FAIL outcomes

Understanding scenario sensitivity is essential for robust genomic validation.

Validation Scenarios

Scenario	Target	Regression	Base Adjustment	Weight
1	dGEBV	ITB	No	Yes
2	dGEBV	ITB	Yes	Yes
3	dGEBV	LR	No	No
4	dGEBV	LR	Yes	No

Data and Breeds

August 2025 U.S. genomic evaluations

Breeds

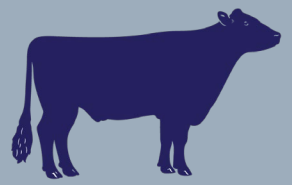
Holstein
Jersey
Brown Swiss
Ayrshire (RDC)
Guernsey

Traits

Production
milk, fat, pro

Function/Health
dlo, scs, mas

Fertility
hco, cc1, Int



Foreign bulls included only for small breeds

Validation Framework

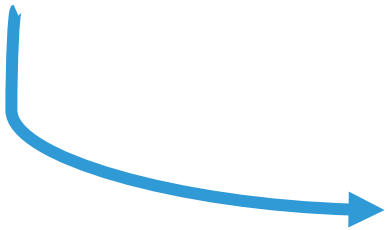
TMACE-based genomic validation

Full evaluation August 2025

- Domestic records
- MACE input

Truncated evaluation Domestic data ≤ 2021 + TMACE input

- Same pedigree
- Same UPGs



Validation Outcomes

- b_1 = Slope
- R^2 = R-square

Overall results

- All five breeds remained stable across scenarios
- Smaller breeds were mainly constrained by the number of validation bulls
- Some exceptions were observed depending on breed and trait





Validation group definition across scenarios

Tested bulls are defined by the regression method:
ITB (weighted) and LR (unweighted) use different sets of test bulls.

Scenario	Regression Method	Base Adjustment	Slope (b_1)	Validation Result
1	ITB	No	1.174	Pass
2	ITB	Yes	1.225	Fail
3	LR	No	1.1465	Pass
4	LR	Yes	1.1968	Pass

LR methods include additional candidate bulls, so the candidate group size is higher.

Key Observations

The number of tested bulls **are not the sole driver** of validation failures.

Validation outcomes are driven by **interactions among key methodological choices**, not a single factor.

What the Differences Tell Us

Validation behavior depends on the **interaction** among key methodological choices:

- Regression method (ITB vs. LR)
- Base adjustment (Yes vs. No)
- Validation group definition

Take Home Messages

Validation outcomes depend on configuration

Base adjustment and validation-group definition interact

Interpretation of GEBVtest requires caution

CDCB is transitioning to single-step evaluation with direct GEBV output, which may **improve scale consistency** and **validation performance**

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Thank you!

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