



International issues in dairy cattle genetics

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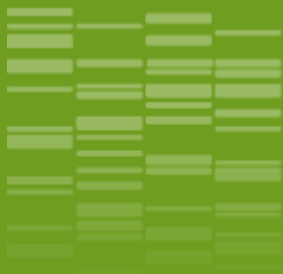
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International issues in dairy cattle genetics

Vincent Ducrocq

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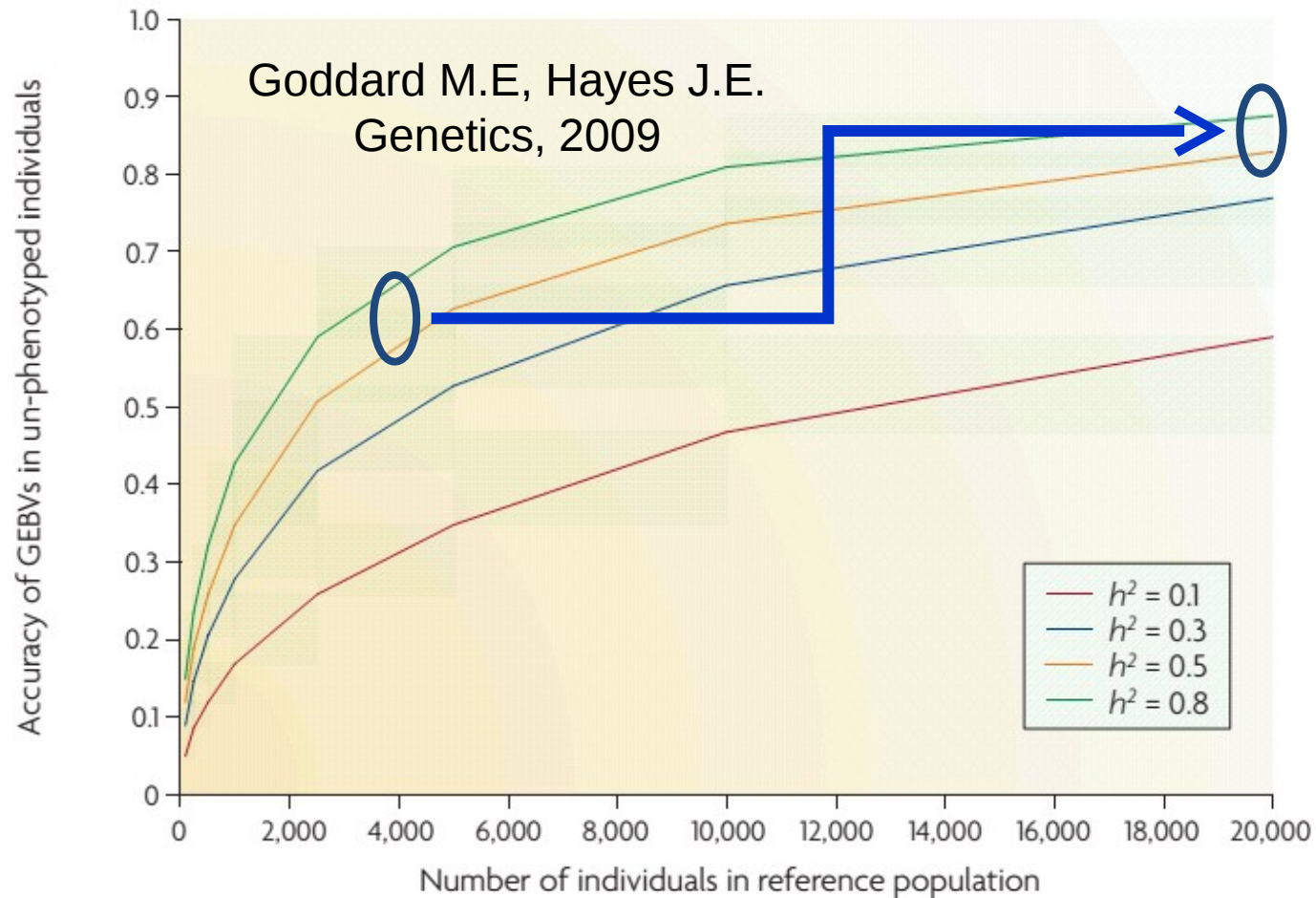
Outline

- New context: **genomic era**
- Principles of **international genetic evaluations / Interbull**
- How do farmers get access to the best bulls with genetic
or genomic evaluations
 - *from countries which are Interbull members*
 - *from the others (with/without genetic or genomic evaluations)*
- Key messages

Genomic selection: very fast adoption

- **Reference population** = genotyped progeny-tested bulls
 - from which estimates of the effect of tiny chromosome segments are computed
- Reference population size = key parameter of accuracy of genomic selection

Importance of reference population size

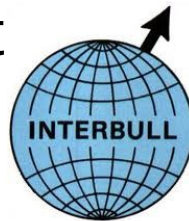


Genomic selection: very fast adoption

- ach year
- Organized progeny testing: decreased or abandoned
- **Market share of semen from young bulls: 40 to 75%**

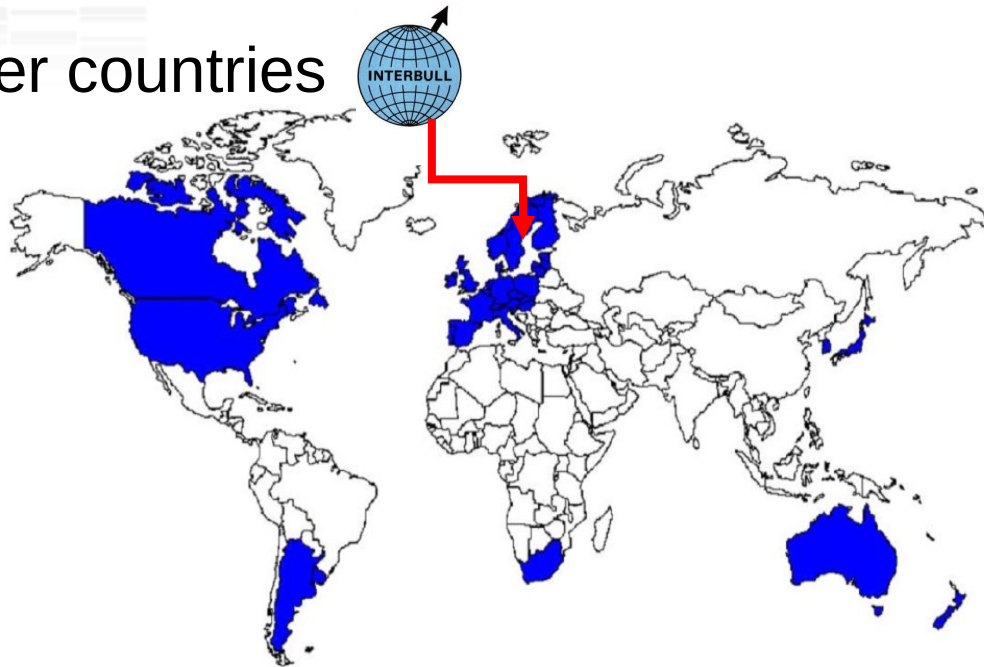
International Genetic Evaluations

- National evaluations are not directly comparable (different traits, different production system and environments, different recording systems, different models of analysis)
- For the past 30 years, **Interbull** has made such comparisons possible (+ has contributed to the international recognition of national evaluations (harmonization, validation



Interbull

- 32 member countries



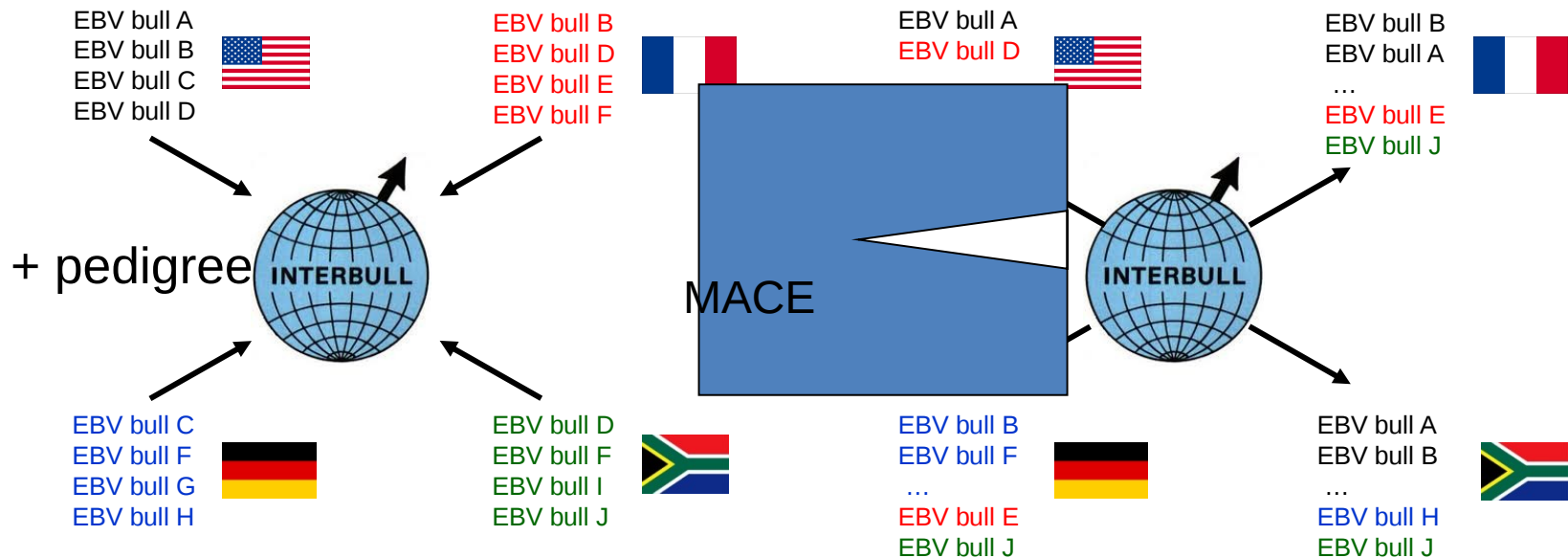
- 6 (groups of) breeds: Holstein, Simmental (including Montbéliarde) Brown Swiss, “Red” Dairy cattle, Jersey, Guernsey.
- Traits: Production, Type, Udder Health, Fertility, Longevity,

Workability, Calving traits

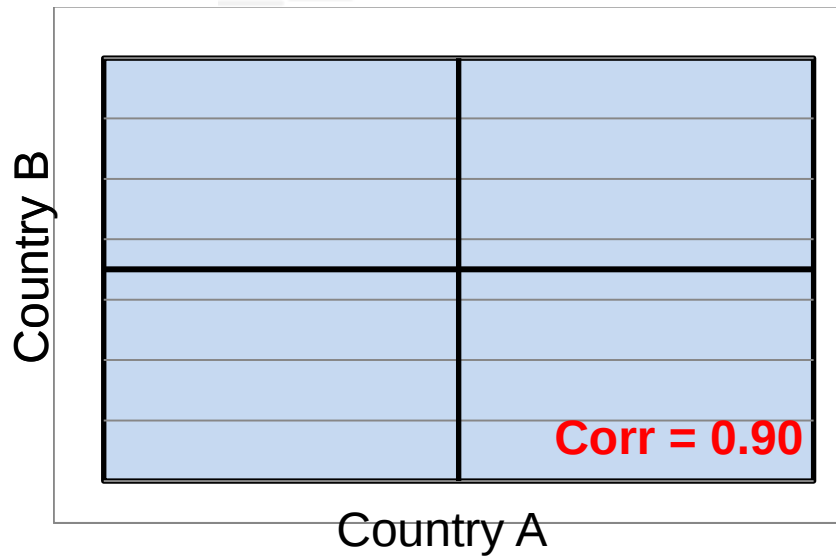
International genetic evaluations

- Meta-analyses of national results of bulls

MACE = Multiple Across Country Evaluation



How much reranking ?



Depends on **genetic correlation**

between countries

(= a measure of Genotype x Environment interaction)

Within Europe or North America
(for production traits)

How much reranking ?

Country B

Corr = 0.90

Country A

Corr = 0.50

Corr = 0.75

Corr = 0

Ho

[illegible][illegible]

Farmers /breeding organisations: Consequences

- **Strongly depends on the country situation**
 - ✓ Is it an Interbull member? (access to international ranking on **own national scale**)
- **Even more complex with genomic evaluations**
 - ✓ Access to a (inter)national reference population ?

Interbull members

Top 10 LIST:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



Top 10 LIST:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



Top 10 LIST:

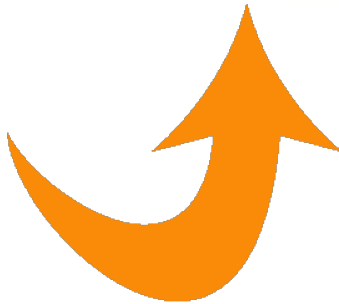
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



100
TOP

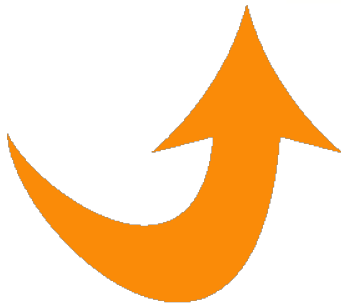
Top 10 LIST:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



Non members

- ✓ Europe? too many scales !!!
which one to choose ?



US scale

	Net merit (NM\$) (2010)	
(Milk)+Fat+Protein	35	
Longevity (PL)	22	
Somatic cells	-10	48
Fertility (DPR)	11	
Calving diff./ Stillbirth	-5	
Type composite		
Udder composite	7	
Feet/legs composite	4	17
Body size	-6	



Source 1: Net merit as a measure of lifetime profit: 2010 revision *J. B. Cole et al.*, AIPL, ARS-USDA

US scales

	Net merit (NM\$) (2010)	TPI (2011)
(Milk)+Fat+Protein	35	43
Longevity (PL)	22	10
Somatic cells	-10	-5
Fertility (DPR)	11	11
Calving diff./ Stillbirth	-5	-3
Type composite		10
Udder composite	7	12
Feet/legs composite	4	6
Body size	-6	

Source 1: Net merit as a measure of lifetime profit: 2010 revision J. B. Cole et al., AIPL, ARS-USDA

Source 2: http://www.holsteinusa.com/genetic_evaluations/ss_tpi_formula.html

TPI: the worst possible choice for many countries

- Very strong emphasis on type: the big “show” cow
- Not adapted to suboptimal environments !



- Most American farmers don't use it !

Alternatives do exist !

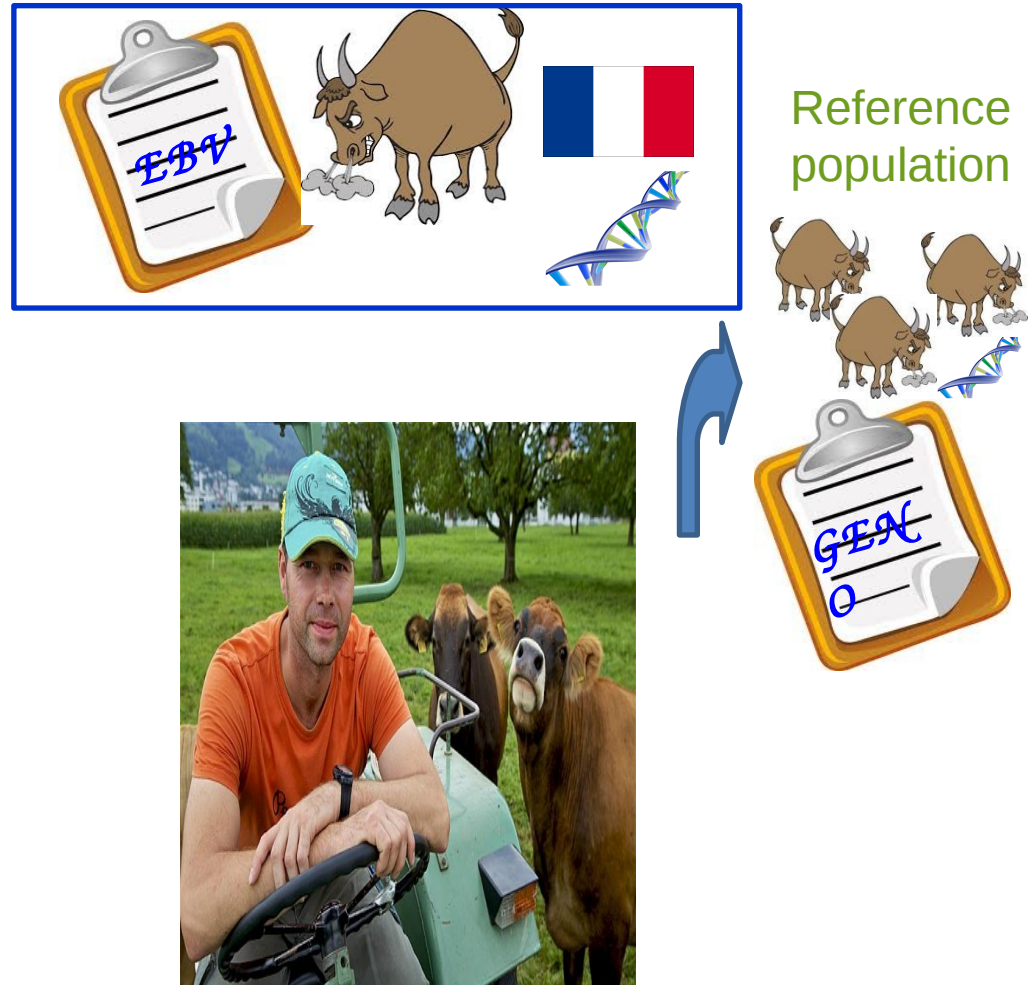
- Use Net Merit \$!
- Use Interbull results on a more adequate Interbull scale (New-Zealand, Ireland, South Africa, Argentina ...)
- For low input environments: choose a more sustainable Total Merit Index combining Interbull information

30% Fertility, 30% Health, 20% Longevity, 10% Production, 10% Feet and legs ?

- ☐ A much larger choice of (cheaper) bulls
- ☐ genetic level may still be (too) high for production

for exporting countries: larger range of bulls

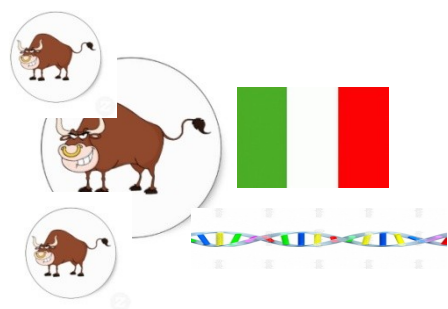
Genomic era: Interbull members



Interbull members : the ideal situation



Interbull members : the ideal situation



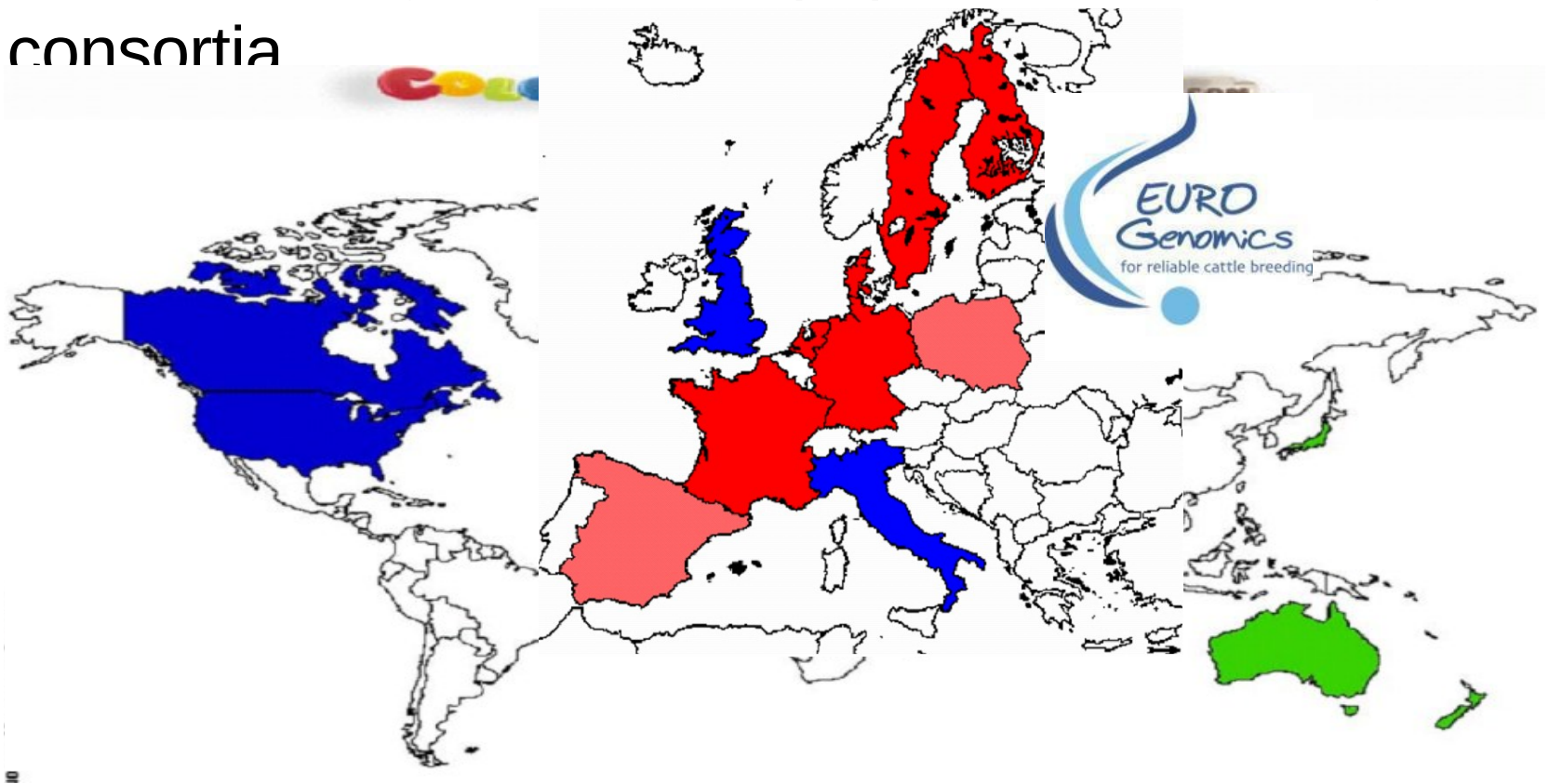
TOP
10
LIST

Reference populations



The Holstein situation

- favors the largest (groups of) countries able to jointly assemble large reference populations □ 2 large consortia



Issues for countries with genomic evaluations

- Each country has its own genomic evaluation with its own particularities and its own scale
- Interbull **does not** have access to (Holstein) genotypes
- ✓ How to insure fair across country GEBV comparison?
- ✓ Interbull is developing a GMACE (extension of MACE) but faces technical + political problems

Issues for countries with genomic evaluations

- Interbull **genetic** evaluations are extremely important
 - ✓ **Only way** to combine reference populations from different countries !
 - ✓ BUT resulting **genomic** evaluations are **better** (G x E free) !

... for countries **without** genomic evaluations

- ✓ How to create a national reference population large enough?
- ✓ How to join a consortium (and which one?)
- ✓ How to compare foreign GEBV from different countries ?
- ✓ Rely on GMACE ? Just starting (trust?)
- ✓ Not comparable scales  Currently the most popular is

GTPI !

e.g., on tweeter:

  @HolsteinUSA
Official Top 5 GTPI Young Bulls 5: #1
NUMERO UNO(+2604); #2
SUPERSIRE(+2581); #3
MCCUTCHEN(+2547); #4
HEADLINER(+2496); #5 MOGUL(+2493)

Répondre

Retweeter

Favori

Plus



A longer term, more **sustainable** alternative

recordings

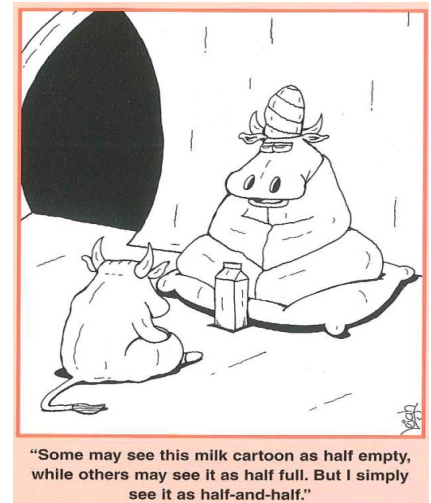
- ✓ **to join Interbull**
- ✓ **and to benefit from existing reference populations**

... in order to develop genomic evaluations adapted to the local conditions and to import the best young bulls worldwide for

- ^{the local needs} e.g., INRA program GENOSOUTH with South Africa, Brazil and India

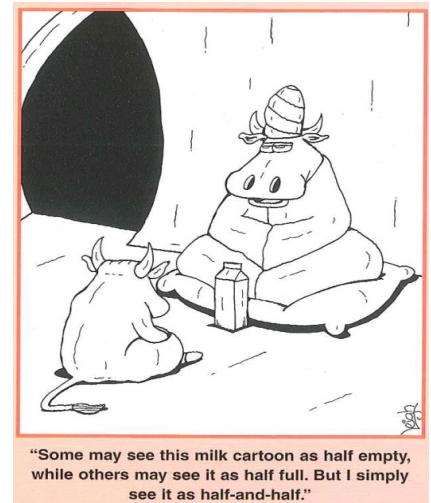
Key messages

- Genomic selection is characterized both by intense international **collaboration** and strong economic **competition**, in particular in Holstein
- Even for large exporting countries, collaborations are still needed
 - use of sequence data: 1000 genome projects
 - phenotyping of new traits (feed efficiency, methane emission)
- The gap between leading countries and the others is widening fast, to such an extent that « **collaborative spirit** » is **declining**



Key messages

- Fair across-country comparisons are (and will remain) a necessity
- **Interbull plays (and will play) a central role**
- For importing countries without own genetic/genomic evaluation: **a proper choice of scale is essential** and the (G)TPI is certainly NOT the most sustainable one
- For (large) importing countries, **becoming an Interbull member and developing an own genomic evaluation is strategic**
- A unique (€) scale for genetic evaluations would make



Europe stronger on the international market

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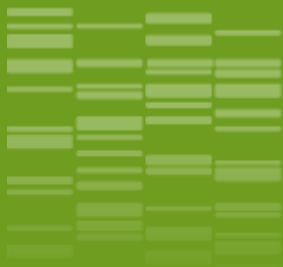
X. David

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LABOGENA

Thank you





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