Genomic evaluation on the French scale of Holstein bulls from a large Indian NGO reveals import history and potential directions of progress

Ducrocq V.[1], Cruz Hidalgo D.[1], Boussaha M.[1], Deshpande P.D.[2], Pande A.B.[2], Swaminathan M.[2]

[1] GABI, AgroParisTech, INRA, Université Paris-Saclay, 78350 Jouy-en-Josas, France
[2] Central Research Station, BAIF, Uruli Kanchan, Maharashtra, India

Context

- **BAIF** Development Research Foundation (*http://www.baif.org.in*) is the largest Indian NGO in agriculture. BAIF runs a bull stud which produced **12.5 million doses** in 2016 from ***bos taurus*** bulls (Holstein (HF) and Jersey used to produce F1 crossbred cows), ***bos indicus,* crossbred bulls** as well as **buffaloes**.
- **55 HF bulls** from the bull stud and **22 HF cows** from the bull dam nucleus herd (founded in the late 70' from Canadian HF and Danish Friesian) were genotyped (among others) with the Bovine SNP50 Beadchip®.

Objectives

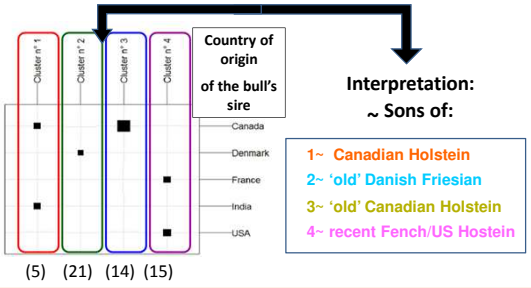
- To study the **genetic structure of pure HF animals at BAIF**.
- As the development of an Indian genomic evaluation based on a local reference population is still in progress, to **genomically evaluate these animals on the French scale** (as if born in France), acknowledging the existence of GxE (*i.e., best in France ≠ best in India*)

Conclusion

- **4 subsets of bulls identified**, reflecting the initial procurements and past mating strategies (in « lines »).
- With no real bull dam selection at BAIF, French GEBV reflect these « lines »: **the older the bulls'sires, the lower the GEBV on traits that were heavily selected in North America / Europe** (production, type traits).
- GEBV of BAIF bulls show **high GEBV on traits with negative trends in North America/Europe** until recently (Fertility, Clinical Mastitis).

Cluster analysis

cluster option of the R package "*adegenet*" (without any prior knowledge) applied to bull genotypes ➔ 4 clusters

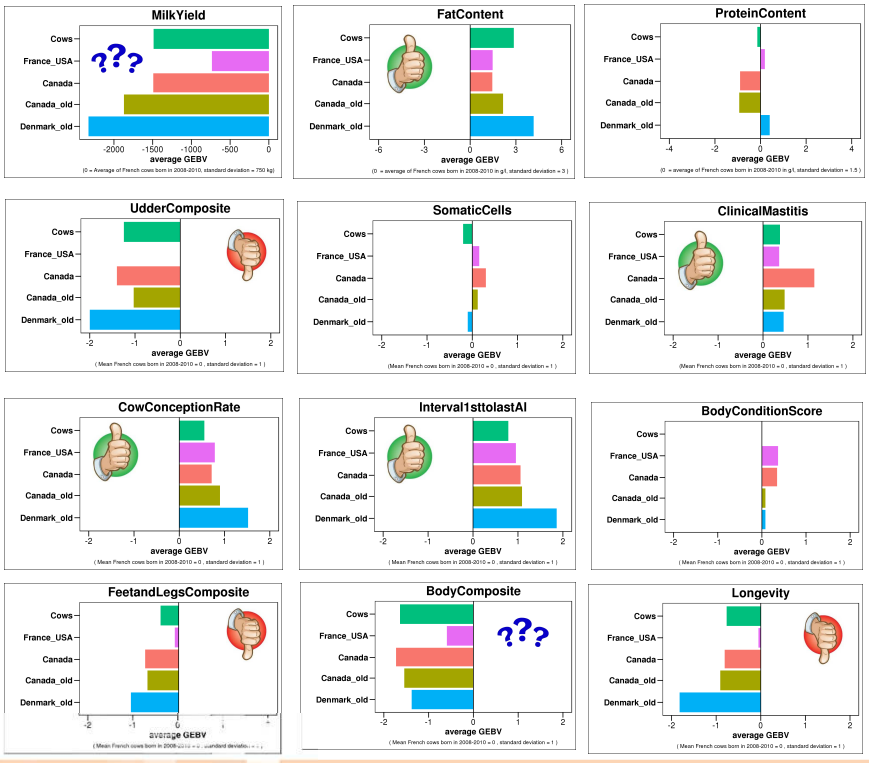


(5) (21) (14) (15)

Perspectives

- GEBV on the French scale brings valuable information especially on numerous traits not recorded in India
- Similar results found on Australian scale (Gibson, UNE)
- **Even though G x E interactions are huge, a HF bull with poor GEBV on fitness traits in Europe is unlikely to perform well in India ➔ Use these GEBV for screening of bulls and bull dams at BAIF**

Genomic evaluation on French scale (44 traits)



- average genetic merit (AGM) of bulls from « old » clusters are very low for yields (***maybe better for Indian conditions?***) but high for fat contents
- Poor AGM for udders (except for recent sires) ⇔ strong positive genetic trends in HF populations over last 30 years
- correct AGM for Somatic cells and good for clinical mastitis (compared to French population)
- Good AGM for fertility traits ⇔ to negative genetic trends in all HF populations until recently (compared to French population)
- Poor AGM for feet and legs
- Poor AGM on body traits due to strong selection (***maybe good for Indian conditions?***)
- Poor AGM for longevity ⇔ Poor udders feet and legs?

GIMIC Joint Lab
(Genetic IMprovement of Indian Cattle and buffaloes)