26/08/2013: 2nd Symposium on SUSTAINABLE ANIMAL PRODUCTION IN THE TROPICS (SAPT2) and high constraint areas

INRA
SCIENCE & IMPACT

Genetic evaluations for crossbred Holstein x bos indicus cattle in India

Use of a test day model

Patry C.[1], Gokhale S.[2], Ducrocq V.[1],

INRA, 78350 Jouy-en-Josas, France, [2]BAIF CRS, 412202 Uruli Kanchan, India

Content

- **BAIF and INRA collaboration**
- **Interest of the project**
- **How to predict breeding values for milk yield?**
- **Strategies for data analyses**
- **The data**
- **Results and benefits**
- **Conclusions**

The GENOSOUTH project

- A 2 years project (September 2012 – September 2014) of international coordination
- Aiming at developing collaborations on methodological and applied aspects of genomic selection in cattle
- 4 targeted countries: **India, Brazil, South Africa and Kazakhstan,** with contrasted advances regarding methods for genetic evaluations and strategies of genetic improvement

clotilde.patry@jouy.inra.fr

Partnership in India

- BAIF = Bharatiya Agro Industries Foundation
  - An NGO founded in 1967, aiming at developping and improving livestock activities in India
  - Based on a Holstein/Jersey x zebu breeding program
  - BAIF activities (Central Research station):
    - ✓ Semen production
    - ✓ Insemination
    - ✓ Milk recording
    - ✓ Progeny testing program => *Estimation of the sire breeding value*
    - ✓ Research

⇒ **A large database (pedigree and phenotypes) in Holstein crossbred cattle**

clotilde.patry@jouy.inra.fr

INRA – BAIF Collaboration

- A global topic: development of genomic tools for the improvement of crossbred dairy cattle under harsh environment
- 3 sub-topics:
  - *More robust and diversified genetic analyses of BAIF field performances*
  - *Detection of large genome areas (QTL) responsible for fat quantity in milk*
  - *Determination of the breed composition among crossbreds*

clotilde.patry@jouy.inra.fr

Interest of the project

“More robust and diversified genetic analyses of BAIF field performances” :

- More confidence in the breeding value estimation, with impact on breeding schemes

Observed performances (milk yield)

*= **sire breeding value** + environmental effects + residuals*

- Considering country specific constraints:
  - ✓ Very diverse management and production systems
  - ✓ Stressful and changing environment along the lactation (temperature, hygrometry, diseases, parasites, etc…)
  - ✓ Limited number of data:
    - ✓ Few pedigree information
    - ✓ Few animals / herd (to characterize the environment)
    - ✓ Number of observations / costs for milk recording

Interest of the project

“More robust and diversified genetic analyses of BAIF field performances” :

- More confidence in the breeding value estimation, with impact on breeding schemes

Observed performances (milk yield)

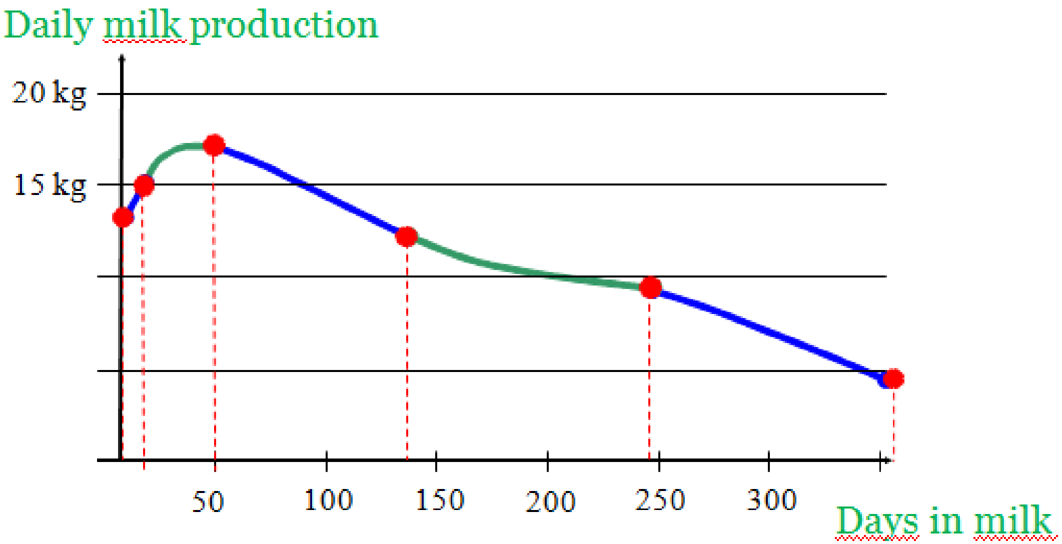
Choose the most appropriate model for milk yield prediction and optimisation of the data recording

- ✓ Limited number of data:
  - ✓ Few pedigree information
  - ✓ Few animals / herd (to characterize the environment)
  - ✓ Number of observations / costs for milk recording

clotilde.patry@jouy.inra.fr

How to predict breeding values for milk yield?

1. Modeling the lactation curve from the discrete milk yield observations (milk recording)



2. Removing appropriately the environmental effects: *lactation model, multi-trait model,* ***test-day model***

⇒for one lactation, each milk record is considered as a separate observation of each individual animal

The strategy chosen for data analyses

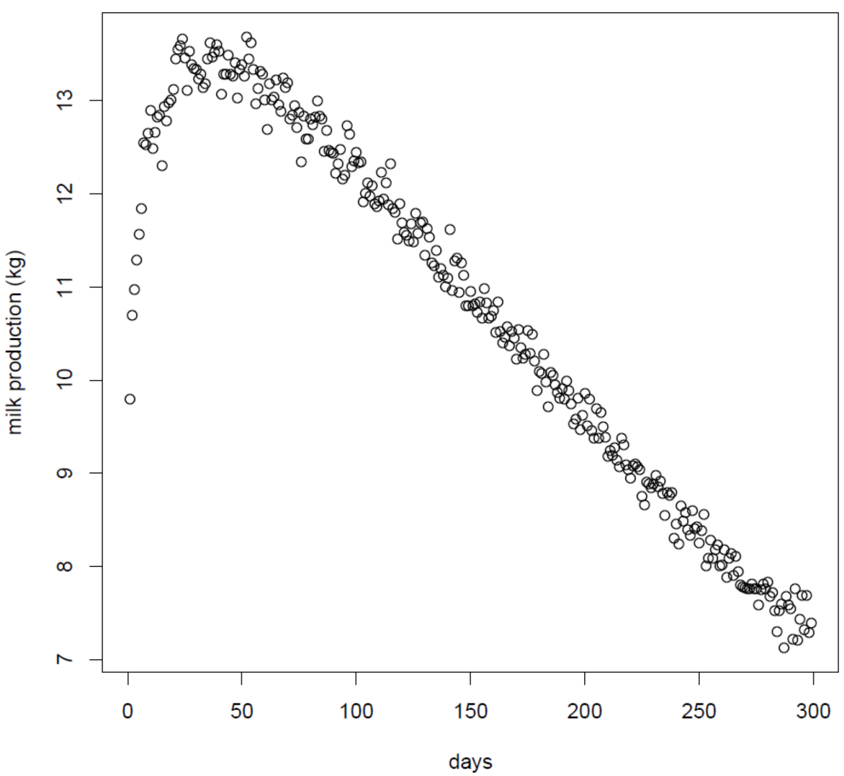
- For flexibility: **semi-parametric model**
  - lactation curve partitioned into 10 lactation stages, described using splines
- To account for environmental effects through the entire lactation: **test day model**
  - model accounting for repeated observation / animal (accounting for time)

  ⇒ Changing h^2 across the lactation length : more accurate
- To account for the lack of pedigree information: **a 2 step analysis**
  - Estimate the environmental effects (including the permanent one / lactation rank) based on all records available
  - Estimate the breeding values ONLY based on cows with pedigree information

clotilde.patry@jouy.inra.fr

Data available

Average milk production per day



Mean = 10.5 kg / day
Range: from 1 to 34 kg / day

- BAIF field data (milk recording, editing)
- **(STEP 1)** Performances for <u>6,675 crossbred cows</u>
  - ✓ Recorded from 1994 to 2010
  - ✓ >120,000 observations
  - ✓ Up to the 6th lactation rank (mostly1st or 2nd lactation)
- **(STEP 2)** Data set reduced: ~2, 000 cows:
  - ✓ 38,000 adjusted performances
  - ✓ from cows with known sires
  - ✓ at least 5 recorded daughters

Results and benefits

- WOMBAT software (Karin Meyer)

⇒ Free of costs, friendly using

- Breeding values for 193 bulls and 2404 cows

⇒ ranking the sires of interest

⇒ ranking the dams to better benefit from the local genetic diversity in their crossbreeding scheme

- Genetic parameters: $h^2 = 0.12$ on the whole lactation

⇒ Low level explained by tiny herds, missing information

⇒ Study the impact of less records / sire or less accurate records to mimick a simplified recording scheme (Duclos et al., 2008)

Conclusions and perspectives

- India, crossbreds: limited number of data with complex factors to consider (data structure, changing environment): *Specific model & tools*
- Improvement of the genetic evaluation model, with perspective
  - for additional traits (e.g., fertility)
  - of including molecular data
- Improvement of the **recording** design:
  - ✓ AI technician
  - ✓ Smartphone: less data lost, centralized data base
  - ⇒ *More data for R&D & Evaluations for a larger number of animals: genetic trend*
- Genetic improvement is a long-term process, where recording is a key: **even if genomic selection tend to speed up breeding improvement programs, it is still a slow process**

clotilde.patry@jouy.inra.fr

26/08/2013: 2nd Symposium on SUSTAINABLE ANIMAL PRODUCTION IN THE TROPICS (SAPT2) and high constraint areas

THANK YOU !

Patry C.[1], Gokhale S.[2], Ducrocq V.[1],

INRA, 78350 Jouy-en-Josas, France, [2]BAIF CRS, 412202 Uruli Kanchan, India