



A HOLISTIC APPROACH FOR MONITORING THE ENVIRONMENTAL SUSTAINABILITY OF THE ITALIAN HOLSTEIN POPULATION



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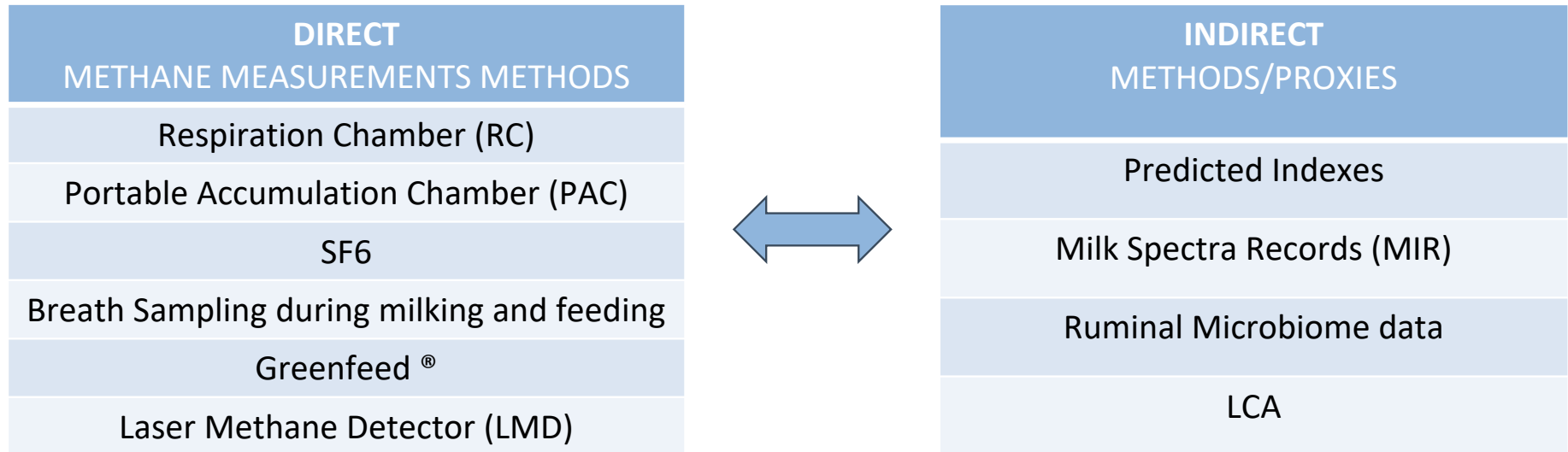




INTRODUCTION

- Dairy cattle is known to be impactful on greenhouse gases (GHG) emissions for **over 10%** of livestock sector emission globally (*Gerber et. Al., 2013*);
- Methane (CH₄) and carbon dioxide (CO₂) emissions have been shown to be **heritable**, providing the basis for applying genetic selection for their reduction (*Cassandro et al., 2010*);
- **National breeding programs** and the genetic improvement can provide relevant contribution to reduce GHG emissions;
- Many Universities, Research Centers, Associations and Private Companies have started **collecting phenotypes**.

INTRODUCTION



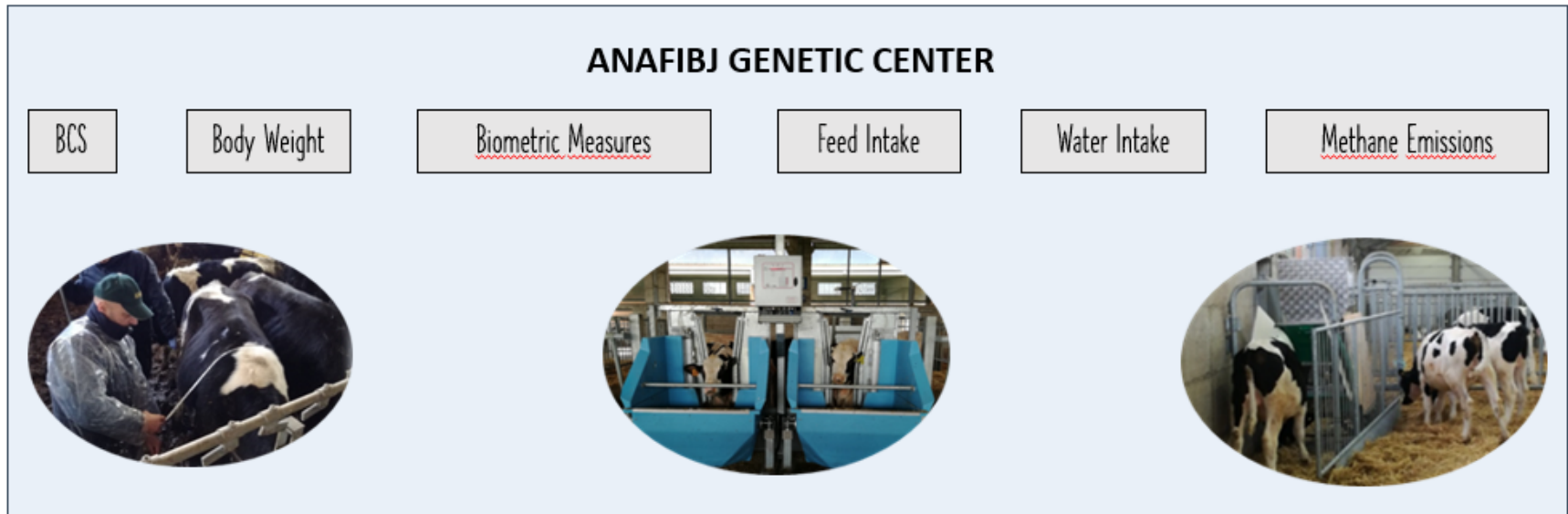
OBJECTIVES

- **Collect GHG emissions data using different methods:**
 - Greenfeed ®
 - Moologger ®
- **Collect innovative traits data:**
 - Milk Spectra Records (MIR)
 - Ruminal Microbiome data
- **Validate proxies;**
- **Develop tools, certifications and services** that meet community and farmers need of mitigation climate change;
- Set-up a **genetic evaluation** also including innovative traits.

MATERIALS AND METHODS

STEP 1 (2019)

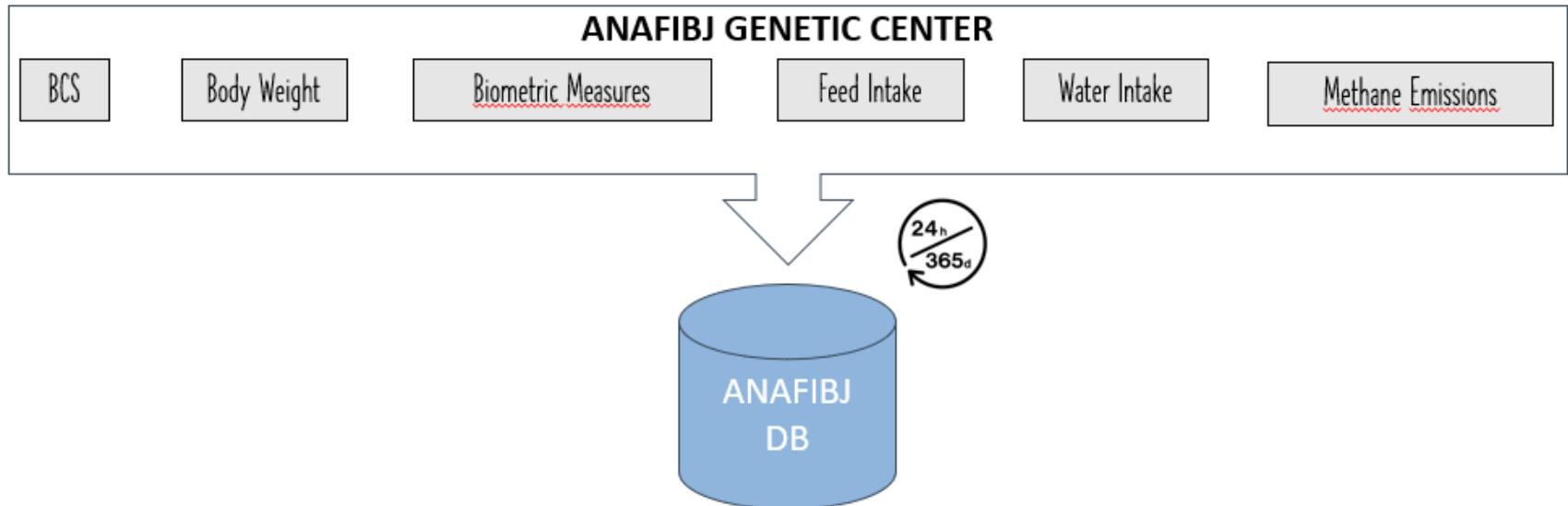
Collection of methane, carbon dioxide emissions, feed intake and water intake data in ANAFIBJ Genetic Center on **Italian Holstein young bulls** candidates to AI in Italy.



MATERIALS AND METHODS

STEP 2 (2021)

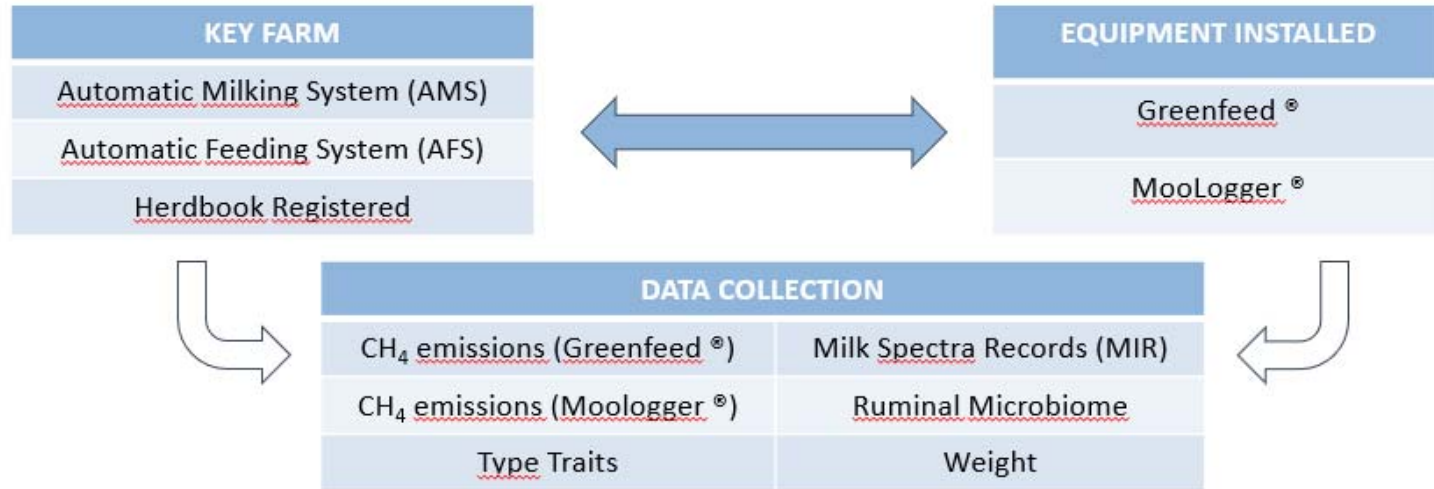
Creation of a **daily automatic data pipeline** to incorporate these new traits into the routine database maintained by ANAFIBJ.



MATERIALS AND METHODS

STEP 3 (2023)

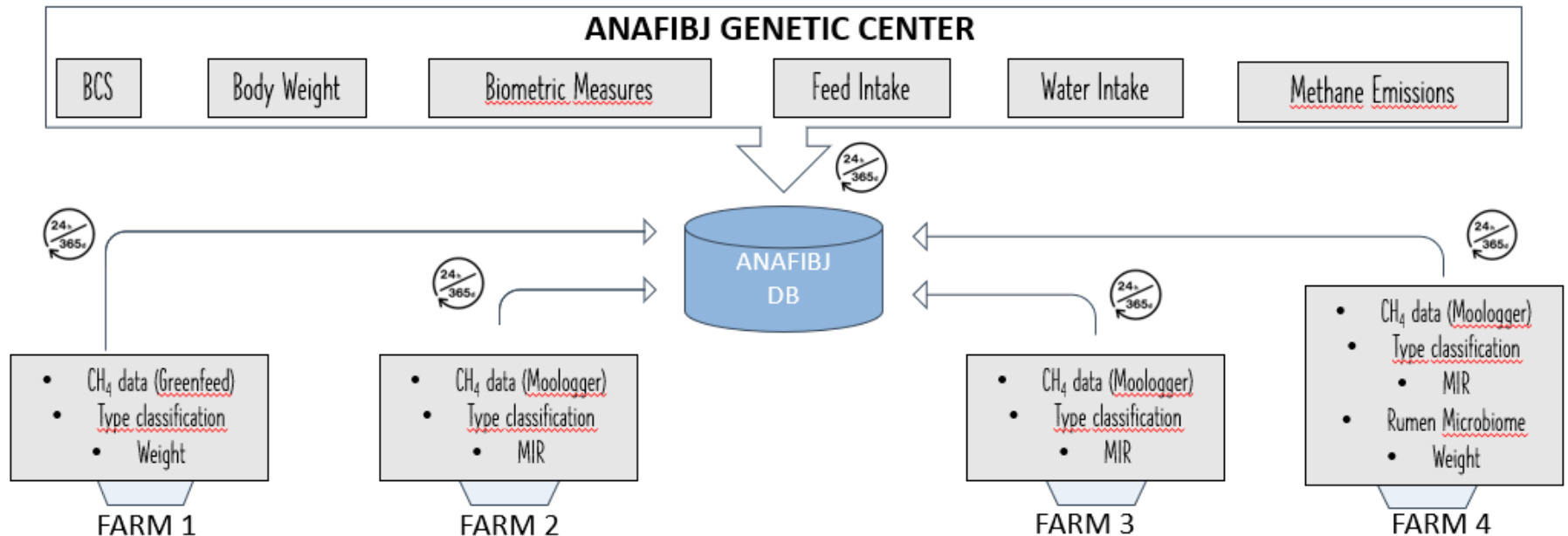
Creation of a **ISC (Italian Sustainability Consortium)** including University, Experimental Farms, Research Centers and Private Companies.



MATERIALS AND METHODS

STEP 4 (2024)

Creation of **ISC (Italian Sustainability Consortium)** data pipeline to incorporate Consortium traits into the routine database maintained by ANAFIBJ.





RESULTS

ITALIAN HOLSTEIN YOUNG BULLS

- 35,653 CH₄ records (Greenfeed[®])
- 559,800 feed intake records
- 6,491 water intake records
- 2,181 BCS records
- 6,543 biometric measures records
- 2,315 weight records

272 Italian
Holstein
young bulls

RESULTS

ITALIAN HOLSTEIN YOUNG BULLS GREEN PASSPORT

ANAFIBJ Associazione Nazionale Allevatori della Razza Frisone, Bruna e Jersey Italiana

Bull Functionality and Environmental Impact Report

- REPORT DATE: 09/05/2024
- MATRICOLA:
- DATE OF BIRTH: 20/01/2022
- GENETIC CENTER NUMBER: 1681
- CFA: 9900834

Methane Emissions:

- Mean Daily Production: 232.46 (g/day)
- Average daily for the population: 237.45 (g/day)

Feed Intake:

- Mean Daily Production: 6.79 (kg/day)
- Average daily for the population: 8.81 (kg/day)

Water Intake:

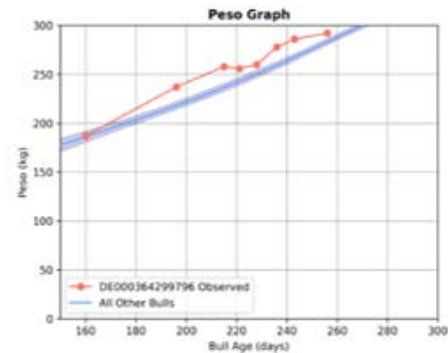
- Mean Daily Production: 16.05 (kg/day)
- Average daily for the population: 20.44 (kg/day)

ANAFIBJ Associazione Nazionale Allevatori della Razza Frisone, Bruna e Jersey Italiana

Growth Report- Weight

Matricola: I Genetic Center Number: 1681

| Data pesata | Eta toro (giorni) | Peso (kg) | Peso stimato (kg) | ADG (kg/giorno) |
|-------------|-------------------|-----------|-------------------|-----------------|
| 03-10-2022 | 256 | 292.0 | 237.65 | 0.46 |
| 20-09-2022 | 243 | 286.0 | 228.12 | 1.14 |
| 13-09-2022 | 236 | 278.0 | 222.99 | 2.25 |
| 05-09-2022 | 228 | 260.0 | 217.12 | 0.57 |
| 23-08-2022 | 215 | 258.0 | 207.6 | 1.11 |
| 04-08-2022 | 196 | 237.0 | 193.67 | 1.39 |
| 29-06-2022 | 160 | 187.0 | 167.28 | - |

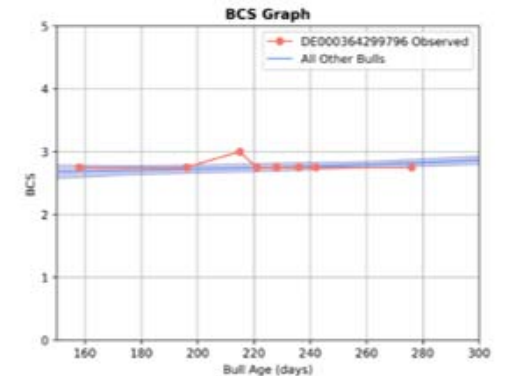


ANAFIBJ Associazione Nazionale Allevatori della Razza Frisone, Bruna e Jersey Italiana

Growth Report- BCS

Matricola: I Genetic Center Number: 1681

| Entry Date | Eta toro (giorni) | BCS |
|------------|-------------------|------|
| 23-10-2022 | 276 | 2.75 |
| 19-09-2022 | 242 | 2.75 |
| 13-09-2022 | 236 | 2.75 |
| 05-09-2022 | 228 | 2.75 |
| 29-08-2022 | 221 | 2.75 |
| 23-08-2022 | 215 | 3.0 |
| 04-08-2022 | 196 | 2.75 |
| 27-06-2022 | 158 | 2.75 |



RESULTS

ITALIAN HOLSTEIN COWS

- 40,400 CH₄ records (Moologger[®])
 - ~ 500 CH₄ records/day

In addition, from University Farms:

- Weight
- Rumen Microbiome

For each cow enrolled:

- BCS data (1st lactation)
- Type classification
- Milk Spectra data (MIR)

> 300 Italian Holstein cows continuously recorded.

RESULTS

Environmental Sustainability Evaluation using LCA approach

- Average **Predicted** Methane Emission Index → **Direct** data

| | | Parametri | Default | Simulazione |
|--|--|---|----------|------------------------------------|
| Total UAA (Utilised agricultural area) | <input type="text" value="0"/> | | | |
| Biogas | <input type="radio"/> Si <input checked="" type="radio"/> No | Reference year | 2024 | |
| Organic Farm | <input type="radio"/> Si <input checked="" type="radio"/> No | Daily milk yield of current cows (kg/d) | 35,62 | <input type="text" value="40,00"/> |
| Amount of hay in the ration (kg/d) | <input type="text" value="12,3"/> | Estimated annual herd milk production (q/year) | 78007,80 | 87600,00 |
| Amount of soybean meal in the ration (kg/d) | <input type="text" value="3"/> | Fat (%) | 3,72 | |
| Total feed quantity (kg/d) | <input type="text"/> | Protein (%) | 3,40 | |
| Amount of protein concentrate in the ration (kg/d) | <input type="text"/> | Cows (lactation + dry) (n) | 600 | <input type="text"/> |
| Total dry matter intake per day | <input type="text" value="27"/> | Heifers > 12 mo (n) | 246 | <input type="text" value="300"/> |
| <input type="button" value="Elabora"/> <input type="button" value="Chiudi"/> | | Heifers between 12 and 6 mo (n) | 184 | <input type="text" value="200"/> |
| | | Female calves < 6 mo (n) | 110 | <input type="text" value="150"/> |
| | | Age at first calving (mo) | 23,49 | <input type="text"/> |
| | | Average IES (Economic Sustainability Index) (Average of last 5 years) | 325 | |
| | | Average Predicted Methane Emission Index | 101 | |
| | | Herd milk yield sold/LU (livestock units) | 8200,99 | 8588,24 |
| | | Pregnant cows at 120 d (%) | 65 | <input type="text" value="70"/> |
| | | Herd environmental impact (CO2/milk kg) | 1,76 | 1,70 |

CONCLUSIONS

- **Data collection** on key-farms is crucial to create a **national inventory** about sustainability traits (direct and proxies) and to **set up a genetic evaluation**;
- **Data collection** in commercial farms is going to be **enhanced**;
- **LCA** is a key-tool to perform high-quality **technical assistance** using an holistic approach (nutritional, genetic, agronomic...).



Thanks!



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