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

L. Benzoni, *R. Finocchiaro, G. Visentin, M. Dorigo, F. Tiezzi, M. Marusi, J. Layton, A. Bracchi, G. Bonacina, M. Zucali, G. Gislon, M. Cassandro*

your **COW**
our **FUTURE**

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 (CH_4) and carbon dioxide (CO_2) 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

DIRECT METHANE MEASUREMENTS METHODS
Respiration Chamber (RC)
Portable Accumulation Chamber (PAC)
SF6
Breath Sampling during milking and feeding
Greenfeed ®
Laser Methane Detector (LMD)

INDIRECT METHODS/PROXIES
Predicted Indexes
Milk Spectra Records (MIR)
Ruminal Microbiome data
LCA

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.

ANAFIBJ GENETIC CENTER

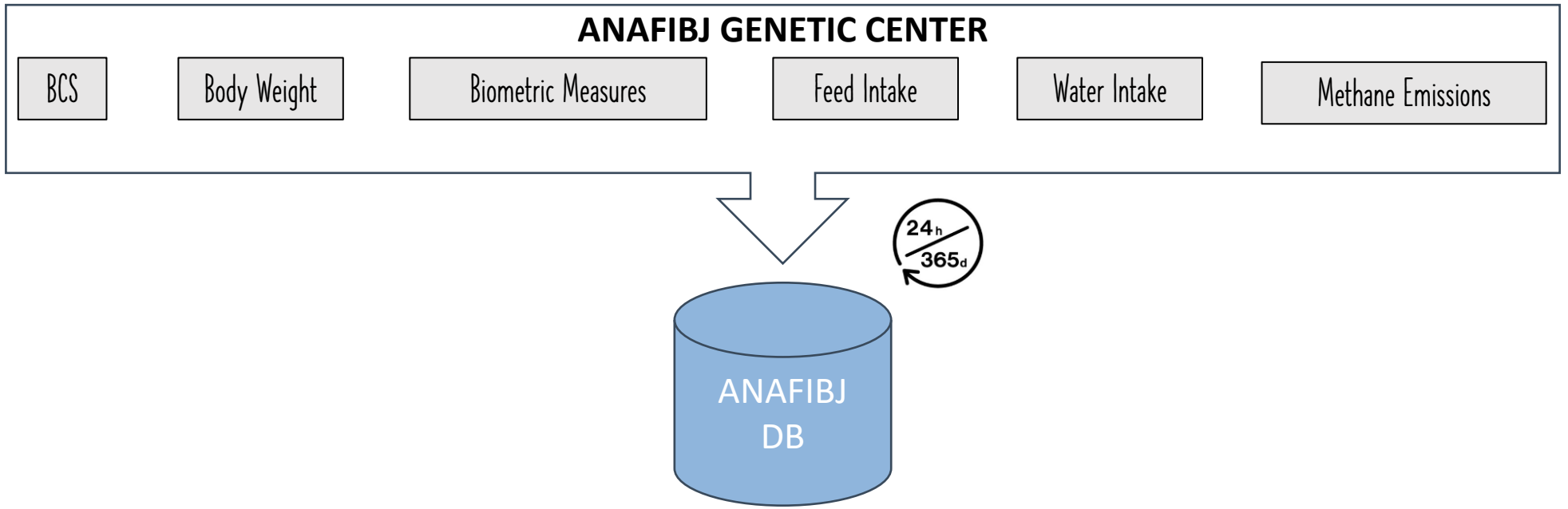
BCS | Body Weight | Biometric Measures | Feed Intake | Water Intake | Methane Emissions

your **COW**
our **FUTURE**

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.



your COW
our FUTURE

MATERIALS AND METHODS

STEP 3 (2023)

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

KEY FARM
Automatic Milking System (AMS)
Automatic Feeding System (AFS)
Herdbook Registered

EQUIPMENT INSTALLED
Greenfeed ®
MooLogger ®

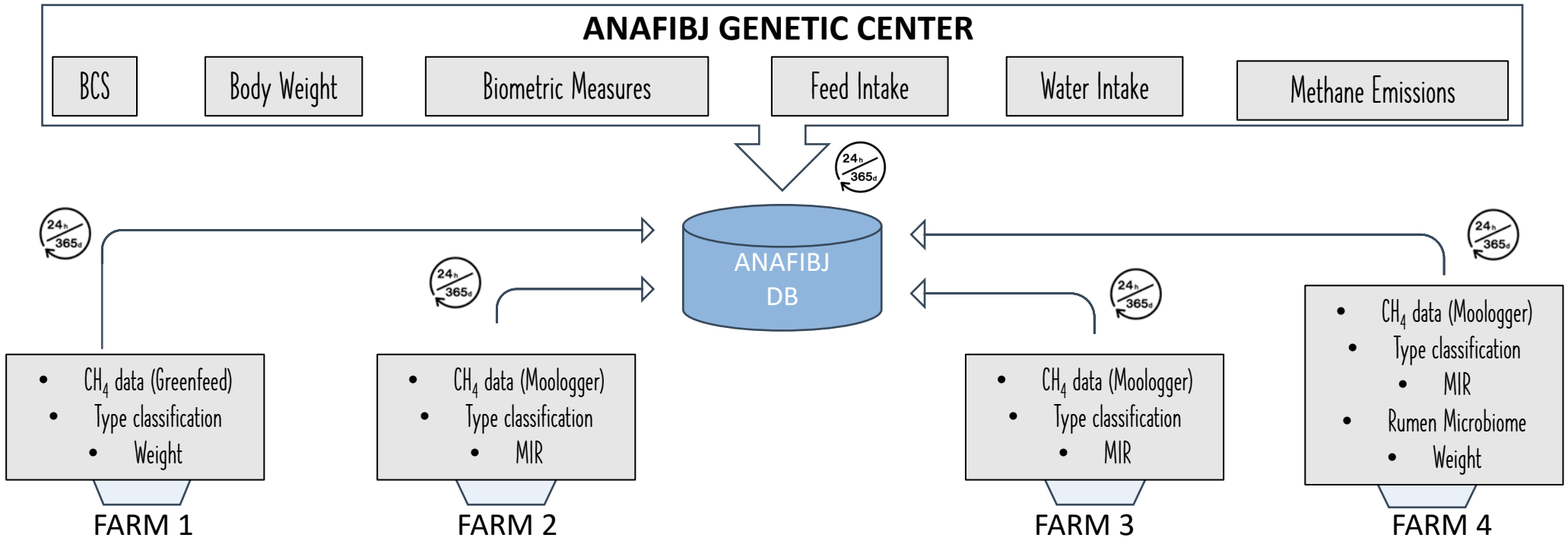
DATA COLLECTION	
CH_4 emissions (Greenfeed ®)	Milk Spectra Records (MIR)
CH_4 emissions (Moologger ®)	Ruminal Microbiome
Type Traits	Weight

your COW our FUTURE

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.



your COW our FUTURE

RESULTS

ITALIAN HOLSTEIN YOUNG BULLS

- 35,653 CH_4 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

your COW our FUTURE

RESULTS

ITALIAN HOLSTEIN YOUNG BULLS **GREEN PASSPORT**

ANAFIBJ Associazione Nazionale Allevatori della Razza Frisona, 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:

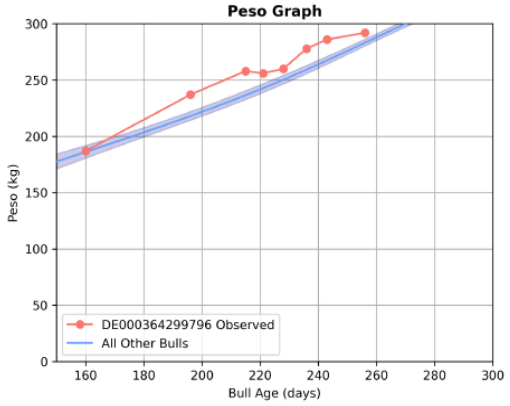
• Mean Daily Production:	16.05 (kg/day)
• Average daily for the population:	20.44 (kg/day)

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

Growth Report- Weight

Matricola: [redacted] 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	-

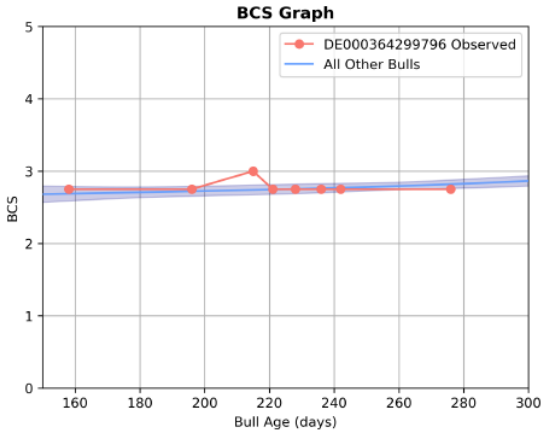


ANAFIBJ Associazione Nazionale Allevatori della Razza Frisona, Bruna e Jersey Italiana

Growth Report- BCS

Matricola: [redacted], 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



your **COW**
our **FUTURE**

RESULTS

ITALIAN HOLSTEIN COWS

- 25,400 CH_4 records (Moologger ®)
  - ~ 250 CH_4 records/day

In addition, from University Farms:

- Weight
- Rumen Microbiome

For each cow enrolled:

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

120 Italian Holstein cows continuosly recorded.

your COW our FUTURE

RESULTS

Environmental Sustainability Evaluation using **LCA approach**

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

Total UAA (Utilised agricultural area)	0
Biogas	○Si ◉No
Organic Farm	○Si ◉No
Amount of hay in the ration (kg/d)	12,3
Amount of soybean meal in the ration (kg/d)	3
Total feed quantity (kg/d)	
Amount of protein concentrate in the ration (kg/d)	
Total dry matter intake per day	27

Elabora Chiudi

HERD UP

Parametri	Default	Simulazione
Reference year	2024	
Daily milk yield of current cows (kg/d)	35,62	40,00
Estimated annual herd milk production (q/year)	78007,80	87600,00
Fat (%)	3,72	
Protein (%)	3,40	
Cows (lactation + dry) (n)	600	
Heifers > 12 mo (n)	246	300
Heifers between 12 and 6 mo (n)	184	200
Female calves < 6 mo (n)	110	150
Age at first calving (mo)	23,49	
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	70
Herd environmental impact (CO2/milk kg)	1,76	1,70

your COW our FUTURE

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!

Benzoni Lorenzo

lorenzobenzoni@anafi.it

www.anafibj.it

your COW our FUTURE