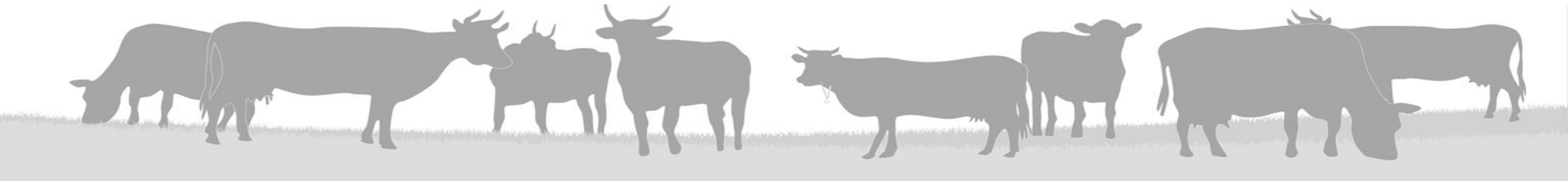
Genotype plus Environment
Integration for a more sustainable dairy production system

World survey of dairy cattle; breeding, genotyping and subpopulations

Speaker: Daragh Matthews

Brian Wickham, Francis Kearney, Peter Amer



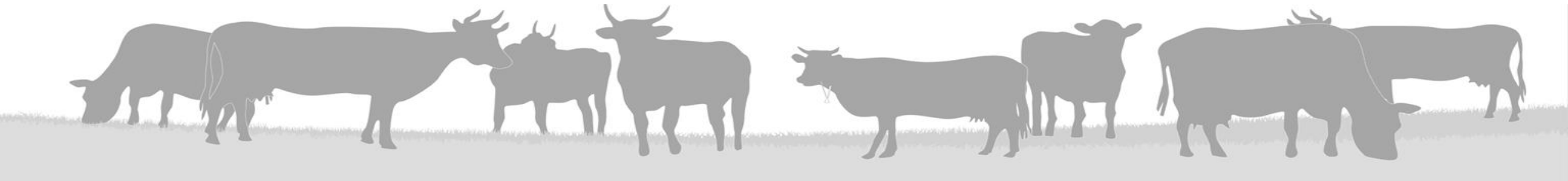
GplusE

- Five year EU funded project
- Nine individual work packages

Develop and exploit genomic data and analytical tools, new phenotyping approaches and breeding strategies for sustainable dairy production systems

Work Package 7

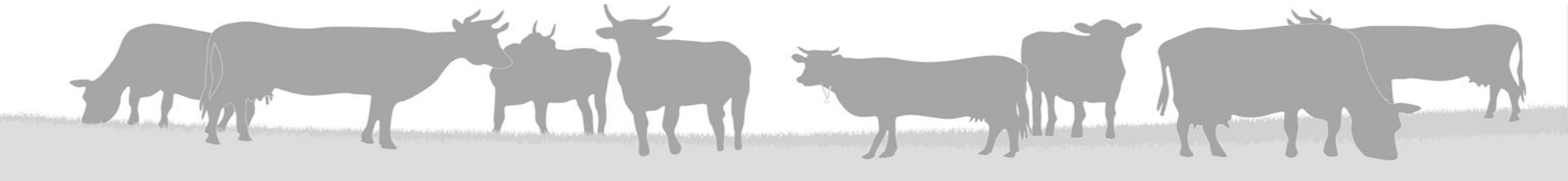
Establishing the most appropriate long term breeding strategy for the European population of Holstein Friesian cattle



Objective

Quantify the frequency of, and major differences between, subpopulations of dairy cattle worldwide

Genetic improvement perspective



Background

Country/Region Industry

Research Herds

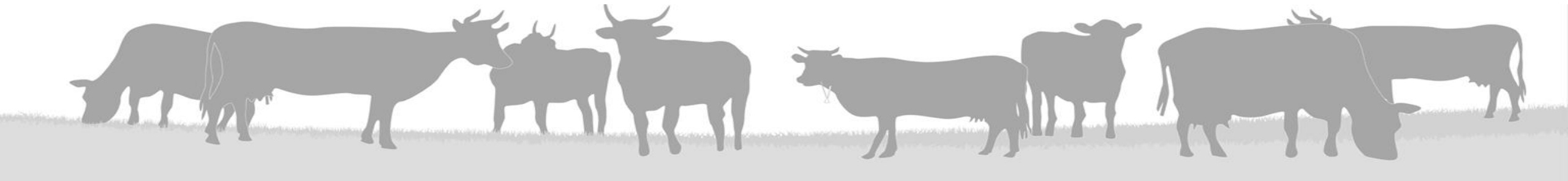
Commercial Herds

Nucleus Herds

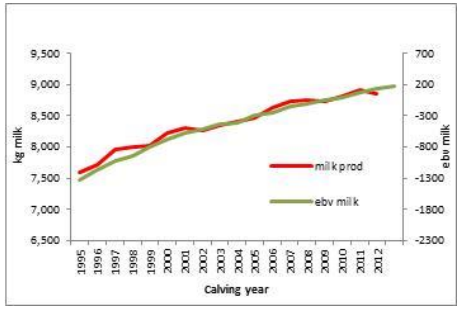
AI Bulls

Subpopulations

- Herd owners within subpopulations place emphasis on different aspects of farming
- Farming emphasis affects breeding decisions -> Cow genetic merit
- Contribute to the aggregate industry rate of genetic gain



Research herds



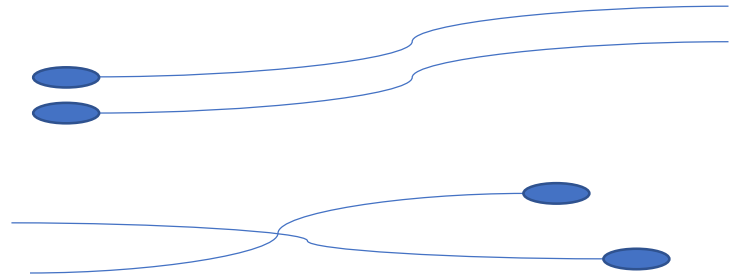
Age Distribution
Gene Flows

Nucleus Breeding herds

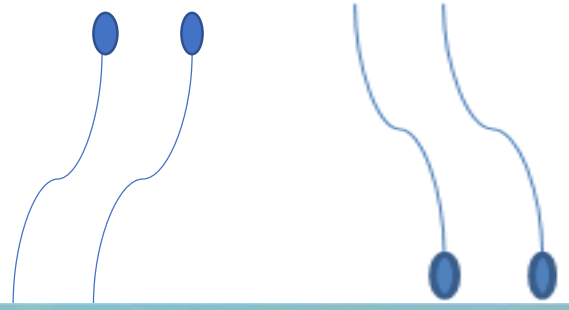
Bull Breeders herds

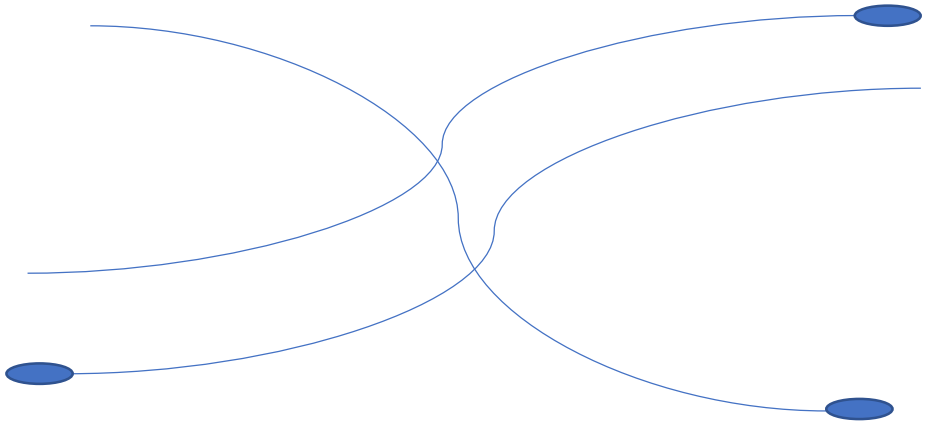
Commercial herds
(Non Bull Breeders)

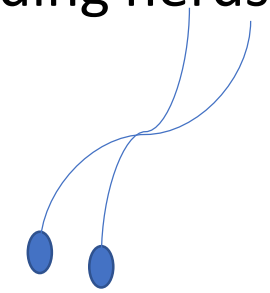
Research herds



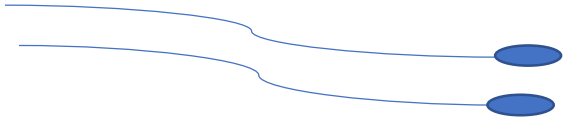
Nucleus Breeding herds







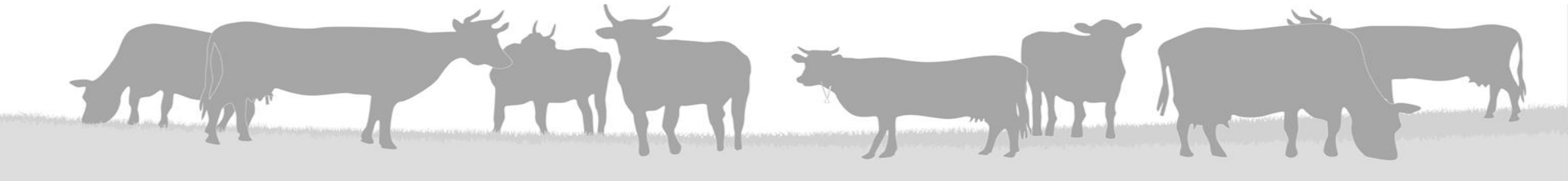
Bull Breeders herds

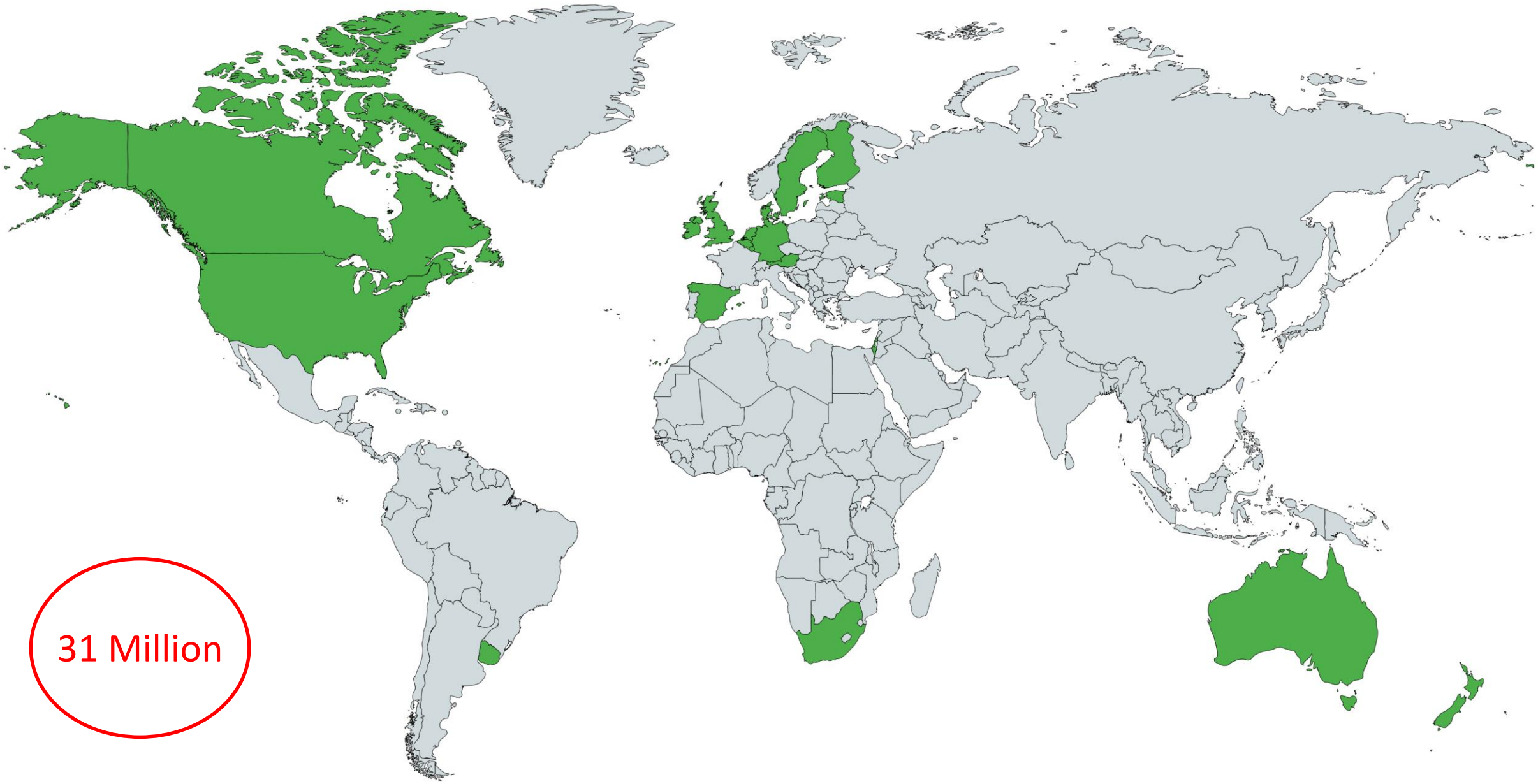


Commercial herds
(Non Bull Breeders)

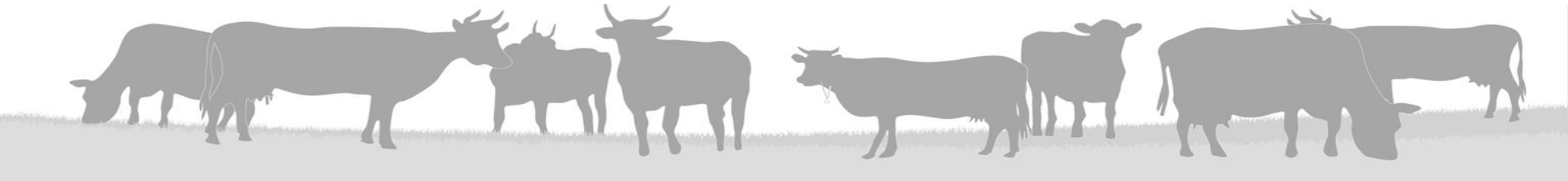
The Survey

- 16 questions
- Communicated to genetic evaluation centres in collaboration with ICAR and Interbull
- SurveyMonkey software
- 17 centres, covering 19 countries, provided a response



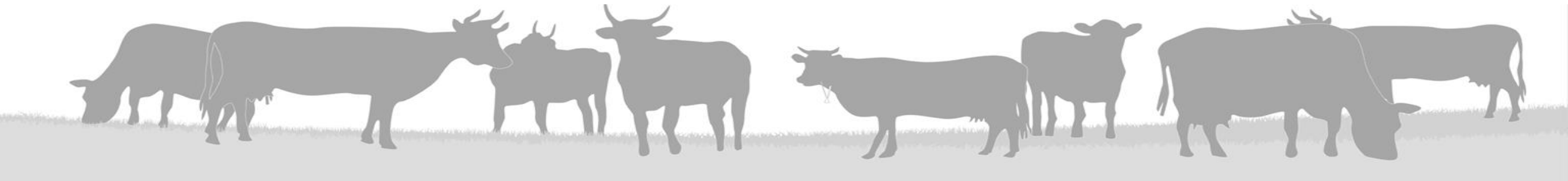

31 Million

Results



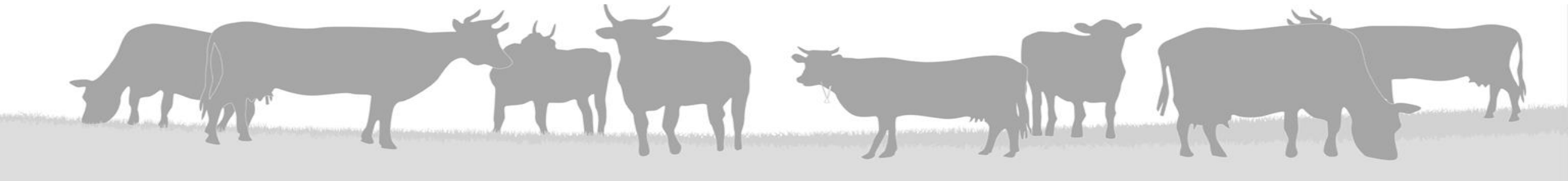
Research Herds

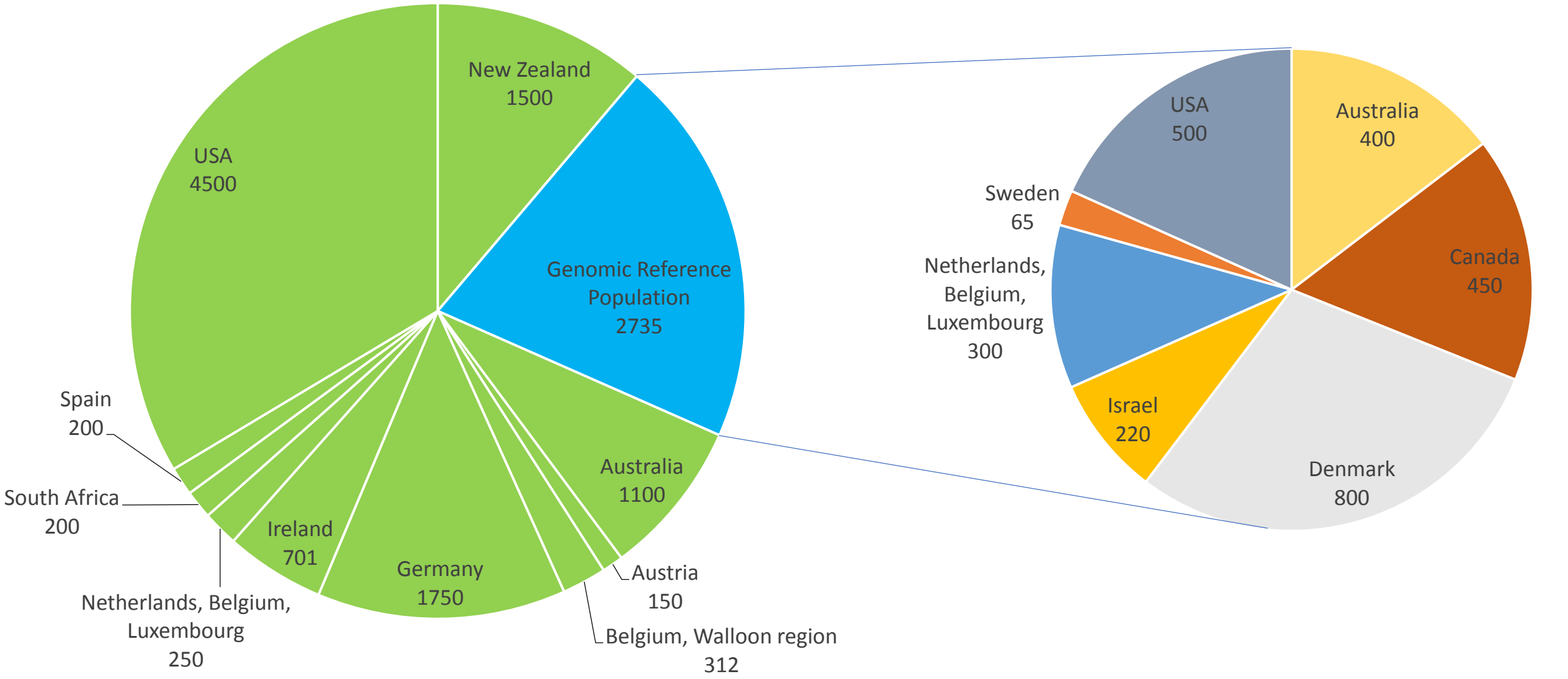
- 17 of the 19 countries represented have research herds in their country
- Only 7 have research herds that are included in a reference population for genomic evaluations



Research Herd Traits

Country/Region	Phenotypes
Australia	Residual feed intake, Heat tolerance, Interbull traits
Belgium, Walloon region	Standard Index traits
Canada	All traits in the Canadian selection index Current research traits (feed efficiency, methane emission, hoof health)
Denmark	Yield, Diseases, Conformation, Fertility, Calving, Hoof trimming, Survival, Milking speed, Temperament
Ireland	Liveweight, BCS, Methane emissions, MIR, standard traits
Israel	Milk, Fat and Protein production, SCS, Fertility, Calving ease, Calf mortality, Persistency, Longevity, Conformation (all traits)
Netherlands, Belgium, Luxembourg	All phenotypes: Milk, Conformation, Fertility, SCC, Calving traits etc.
Sweden	Yield, Diseases, Type, Female fertility, Hoof trimming, Calving performance, Survival, Milking speed, Temperament
United Kingdom	Maintenance feed costs
Uruguay	Production, Fertility, some health traits
USA	Milk, Fat, Protein, SCS, Fertility, Dystocia, Stillbirth

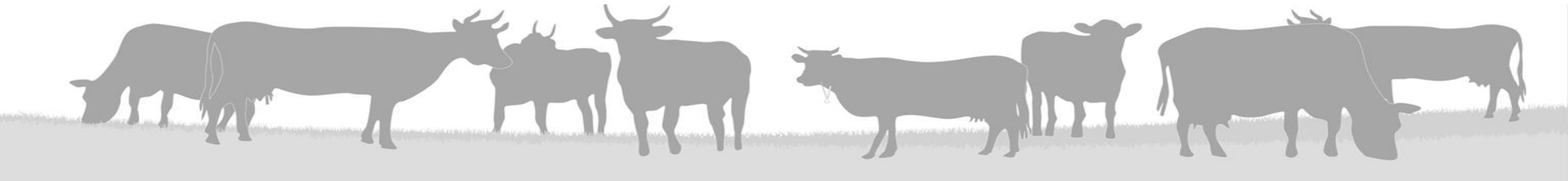




Relative Size of Research Subpopulation in Responding Countries

Nucleus Herds

"Are there elite herds of Holstein/Friesian cows as part of the breeding programs for the country(s) you provide genetic evaluation services for?"

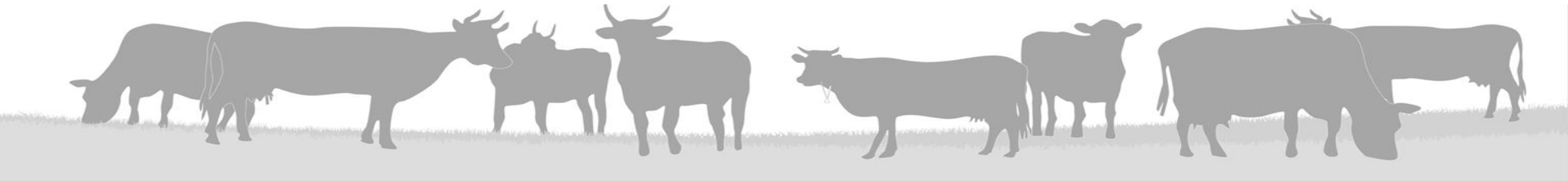


Nucleus Herds

Country/Region	No. herds	No. females
New Zealand	2000	800000
Spain	25	7455
Australia	20	6000
Ireland	133	3023
Canada	10	1500
Netherlands, Belgium, Luxembourg	6	1000
Finland	1	Small no.'s of HOL

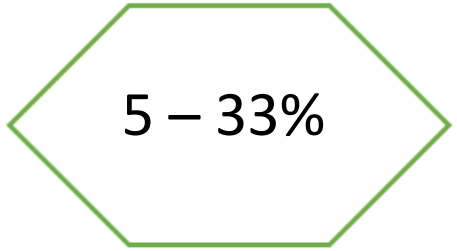
Breeding AI bulls

"What percentage of Holstein/Friesian cows in your country(s) are potential mothers of AI bulls?"

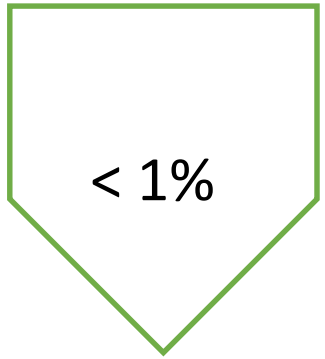


Potential AI dams

Israel
Uruguay
Denmark
Sweden
Finland



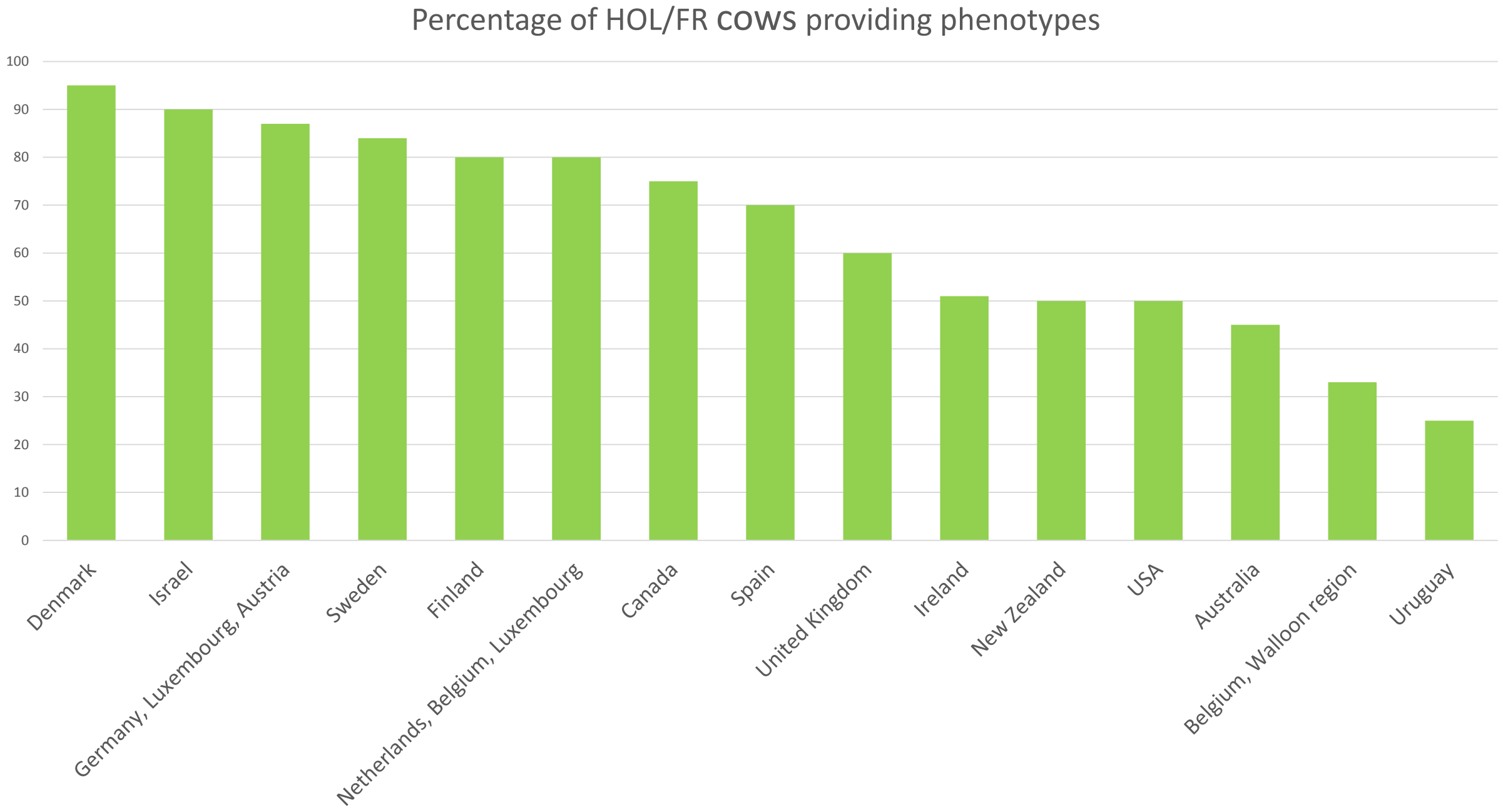
Belgium, Walloon region
Ireland
South Africa
Germany, Luxembourg, Austria
USA



Australia
United Kingdom
New Zealand
Canada
Spain
Estonia

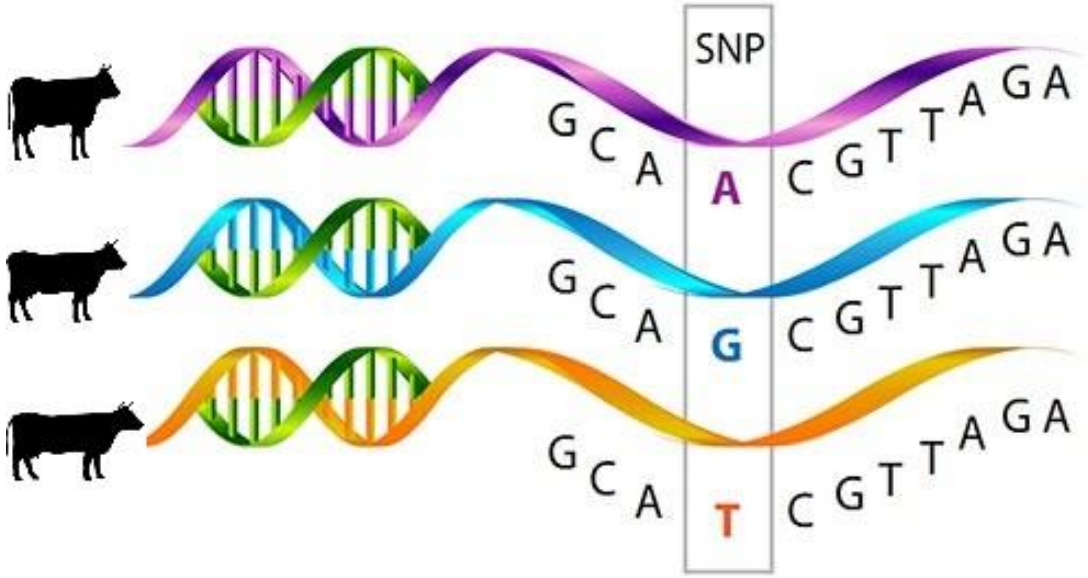
Commercial Herds

- Percentage of cows that provide phenotypic data

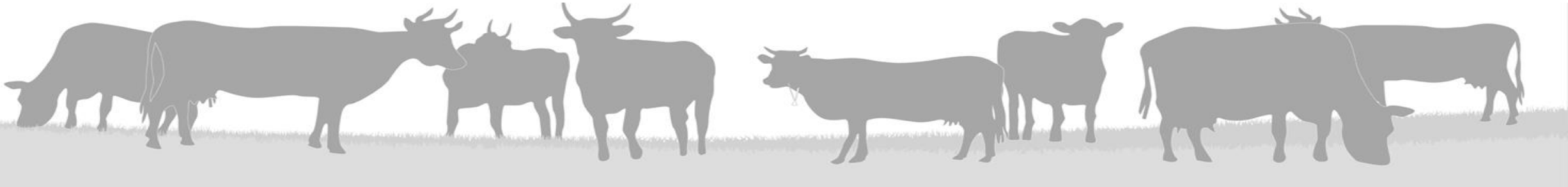

Percentage of HOL/FR cows providing phenotypes
100
90
80
70
60
50
40
30
20
10
0
Denmark
Israel
Germany, Luxembourg, Austria
Sweden
Finland
Netherlands, Belgium, Luxembourg
Canada
Spain
United Kingdom
Ireland
New Zealand
USA
Australia
Belgium, Walloon region
Uruguay

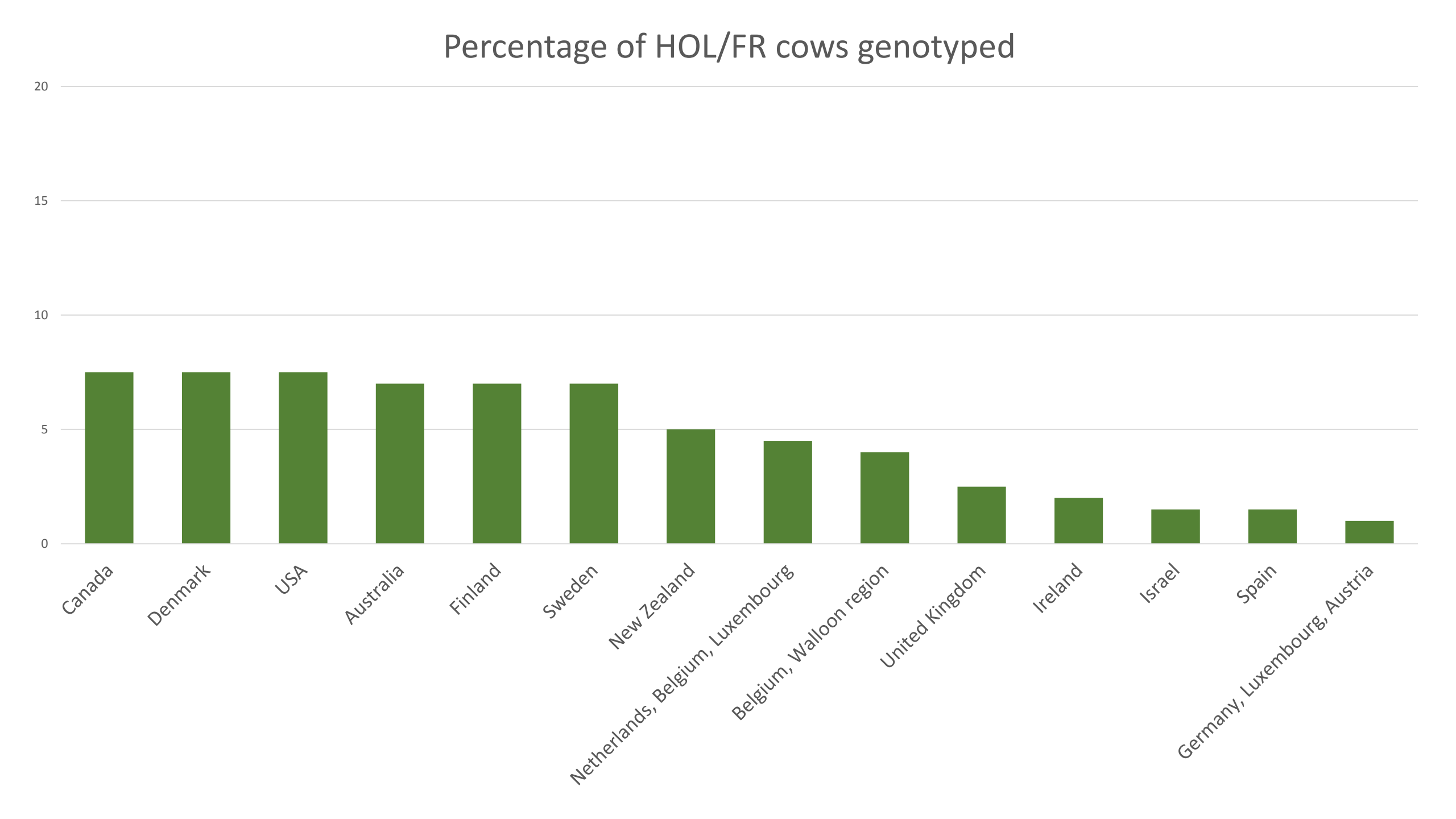
Commercial Herds

- Percentage of cows that provide phenotypic data



- Percentage of cows that are genotyped



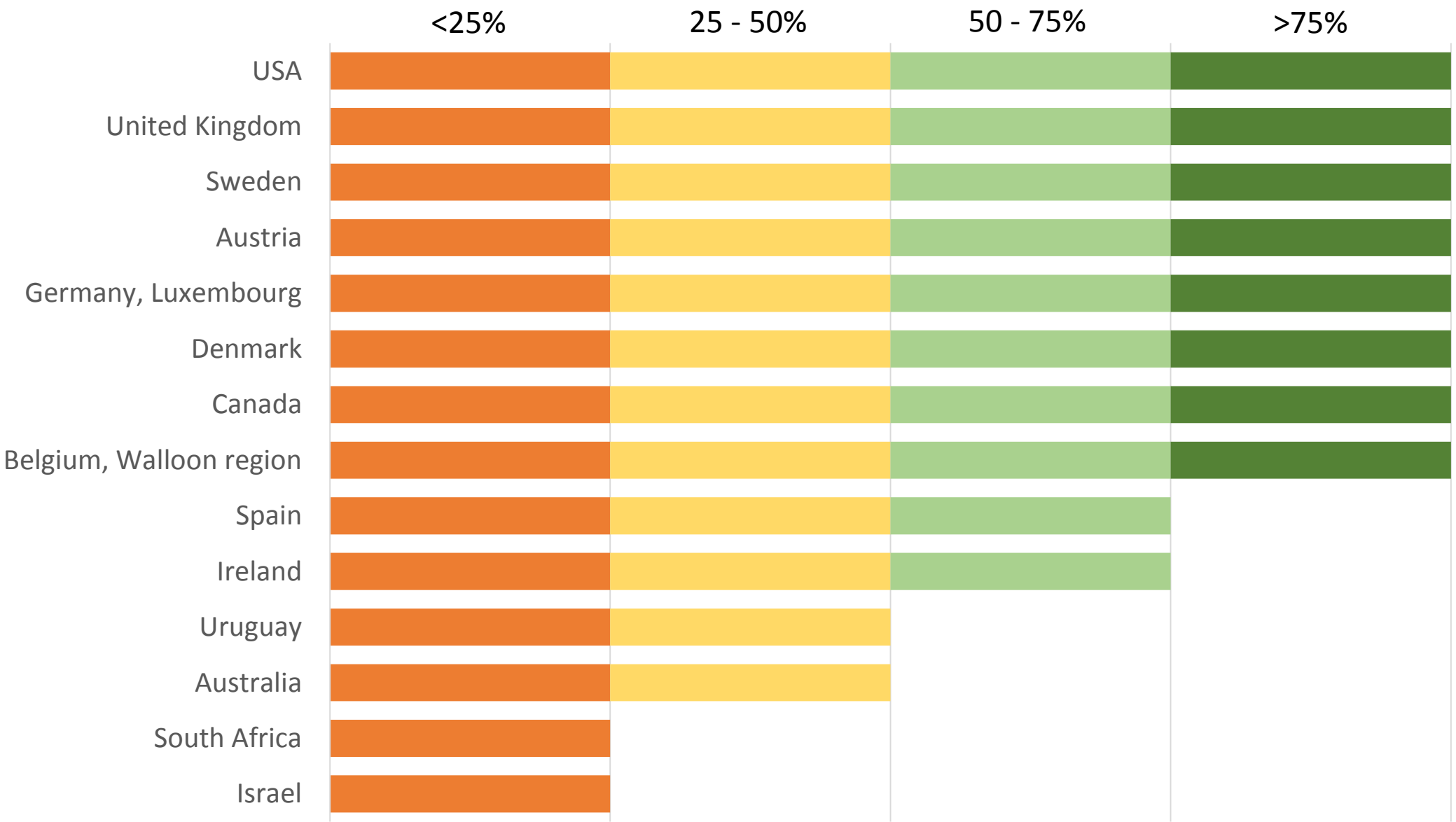

Percentage of HOL/FR cows genotyped
20
15
10
5
0
Canada
Denmark
USA
Australia
Finland
Sweden
New Zealand
Netherlands, Belgium, Luxembourg
Belgium, Walloon region
United Kingdom
Ireland
Israel
Spain
Germany, Luxembourg, Austria

Levels of Genotyping in Subpopulations

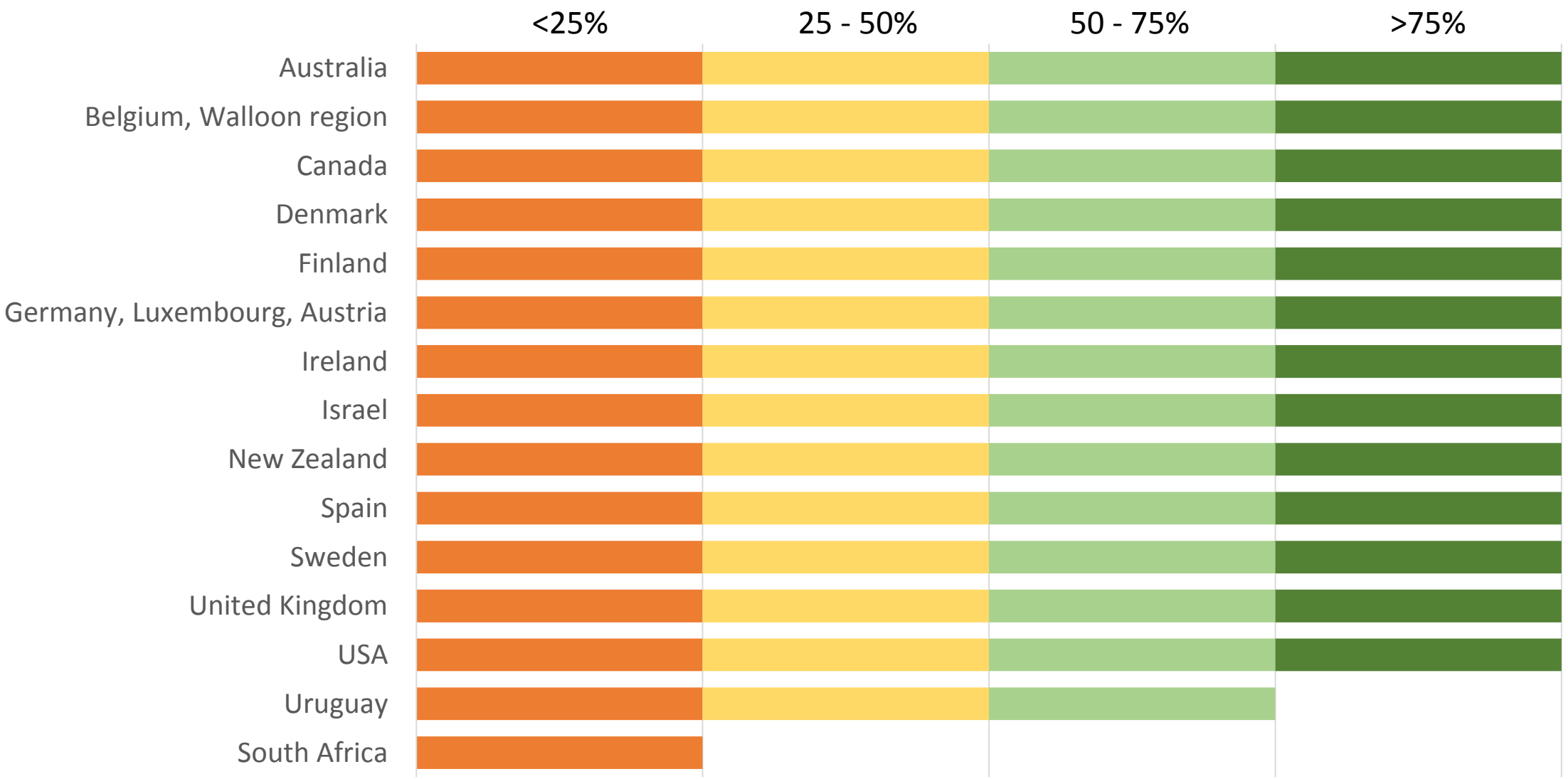
7. What is the level of genotyping in the following sub-populations of Holstein/Friesian cows in your country(s)?

	<25%	25% to <50%	50% to 75%	75%+	N/A
Research herds	○	○	○	○	○
AI bulls	○	○	○	○	○
Elite herds associated with breeding programs	○	○	○	○	○
Bull breeder commercial herds	○	○	○	○	○

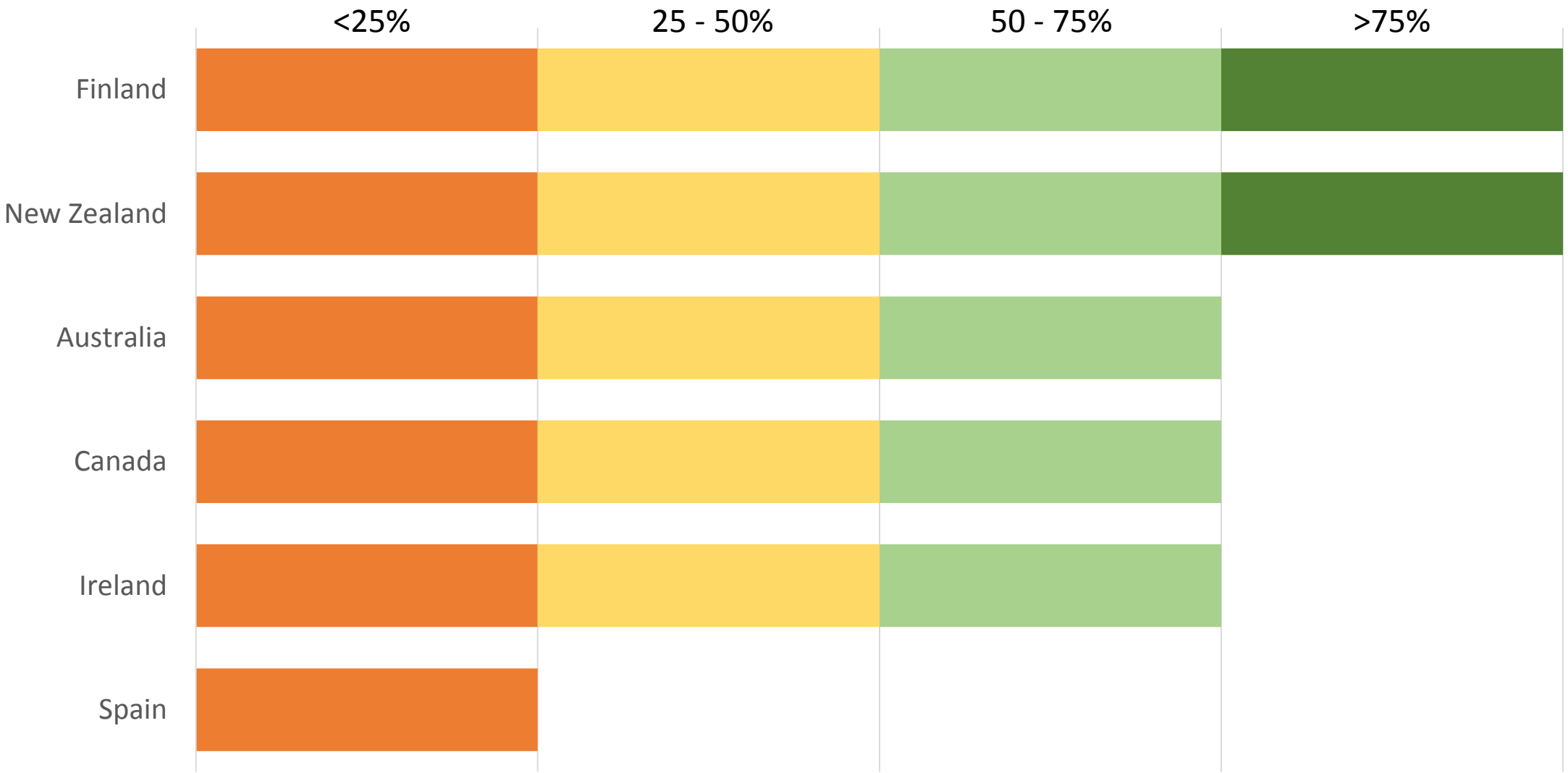
Research Herds Genotyping



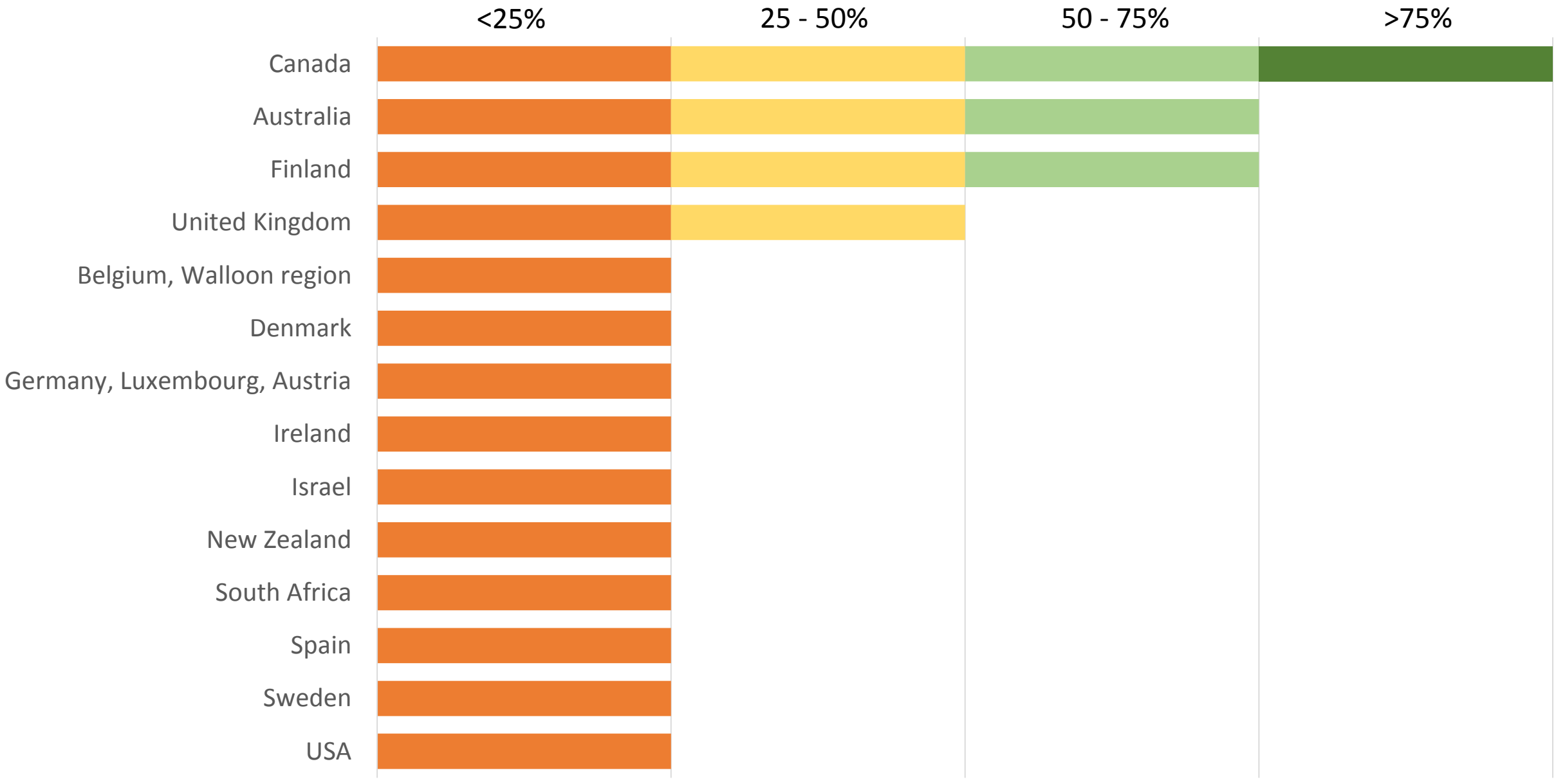
AI Bulls Genotyping



Nucleus Herds Genotyping



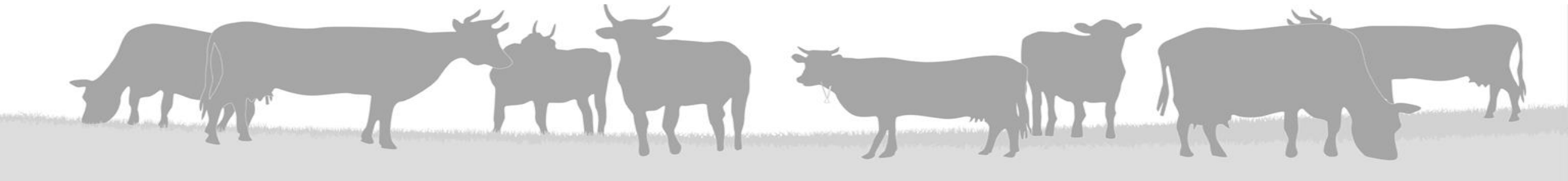
Commercial Bull Breeder Herds Genotyping



Conclusion

- Difficult to categorise subpopulations
- All participating countries have < 10% of commercial cows genotyped
- Research herds and AI bulls have high levels of genotyping
- Nucleus herds are present but less common than research herds in represented countries

Breeding organisations follow different paths in their drive to increase genetic trends



Acknowledgments and Disclaimer

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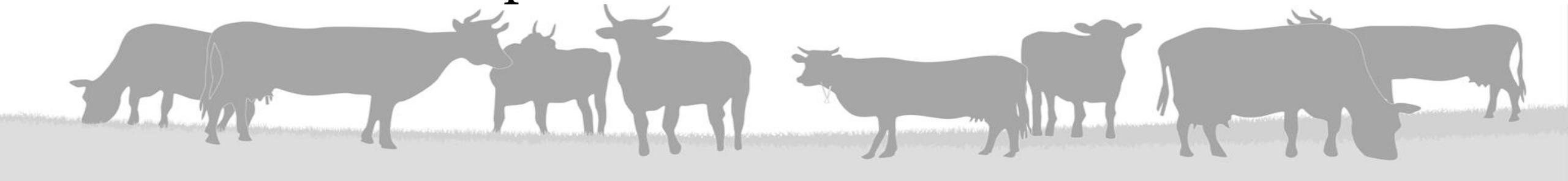

Further Acknowledgements

Country	Organisation
Australia	DataGene
Belgium, Walloon Region	ULg-Gembloux Agro-Bio Tech
Canada	University of Guelph
Denmark	Seges
Estonia	Eesti Põllumajandusloomade Jõudluskontrolli AS
Finland	Faba
Germany, Luxembourg, Austria	Vereinigte Informationssysteme Tierhaltung wV (VIT)
Ireland	Irish Cattle Breeding Federation (ICBF)
Israel	Agricultural Research Organization (ARO), Volcani Center
Netherlands, Belgium, Luxembourg	CRV
New Zealand	New Zealand Animal Evaluation Limited (NZAEL)
South Africa	South African Stud Book
Spain	CONAFE
Sweden	Växa Sverige
United Kingdom	Agriculture & Horticulture Development Board (AHDB) Dairy
Uruguay	Instituto Nacional de Investigacion Agropecuaria (INIA)
USA	United States Department of Agriculture