World survey of dairy cattle; breeding, genotyping and subpopulations

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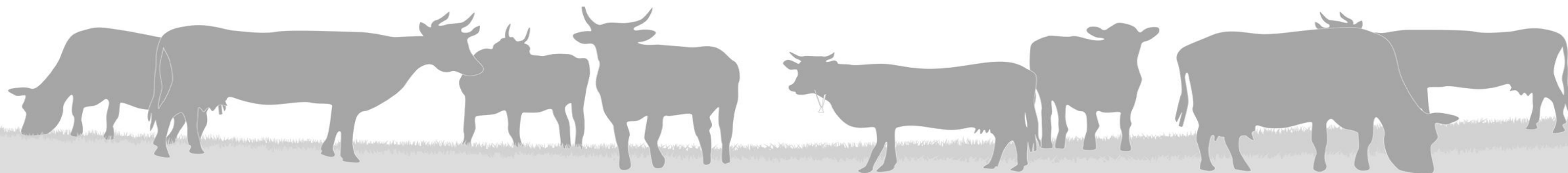
GplusE

- 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

Research Herds

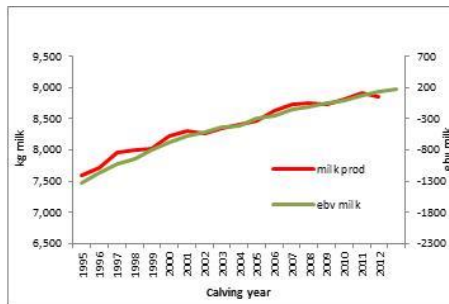Commercial Herds

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

Nucleus Breeding herds

Bull Breeders herds

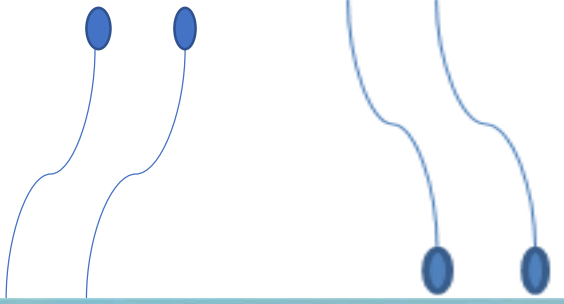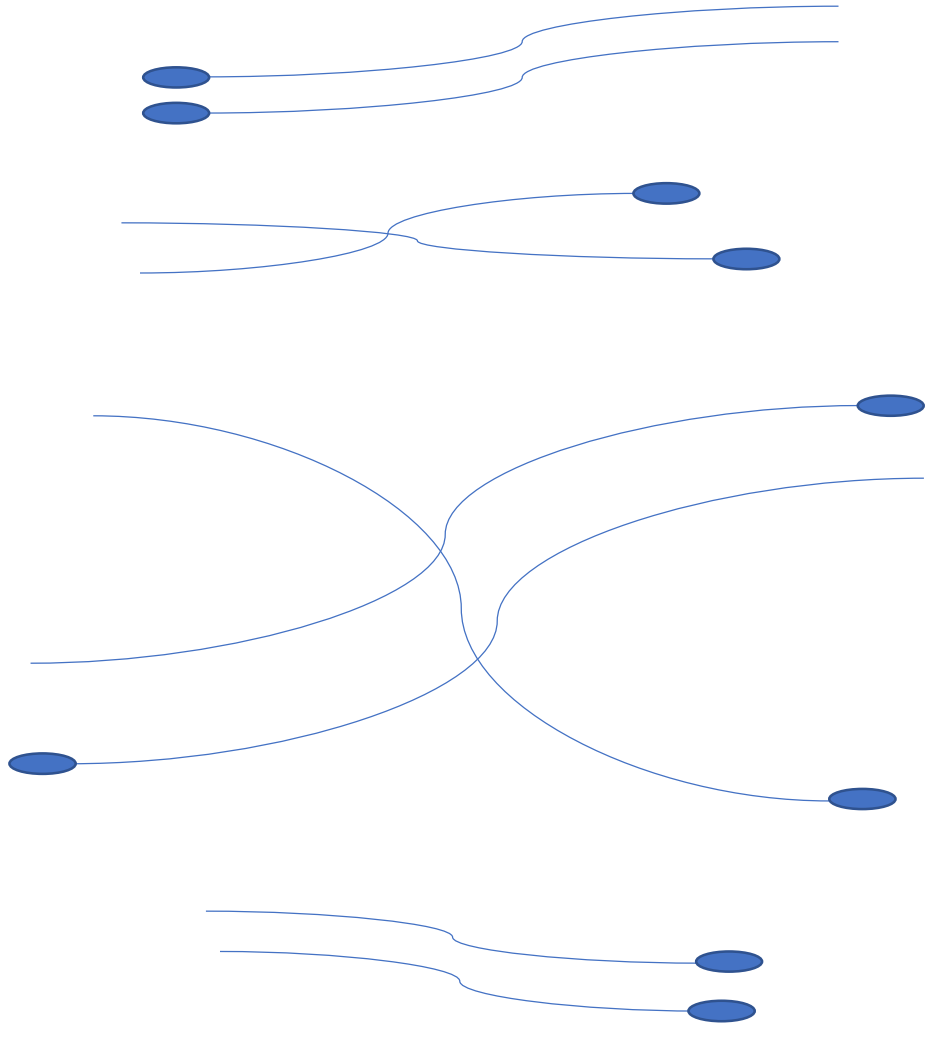Commercial herds
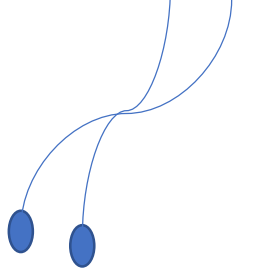(Non Bull Breeders)

Age Distribution
Gene Flows

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
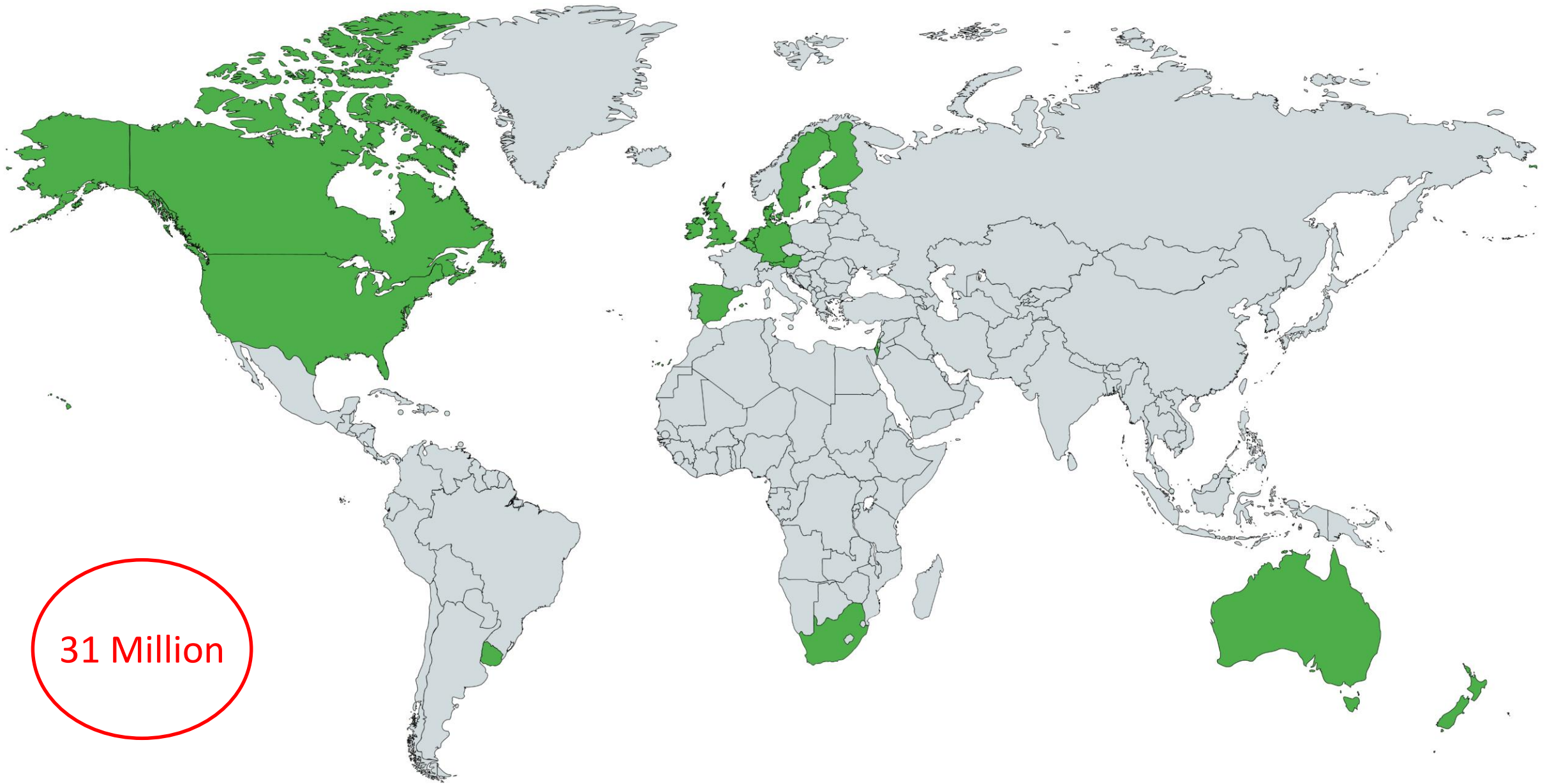
31 Million

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
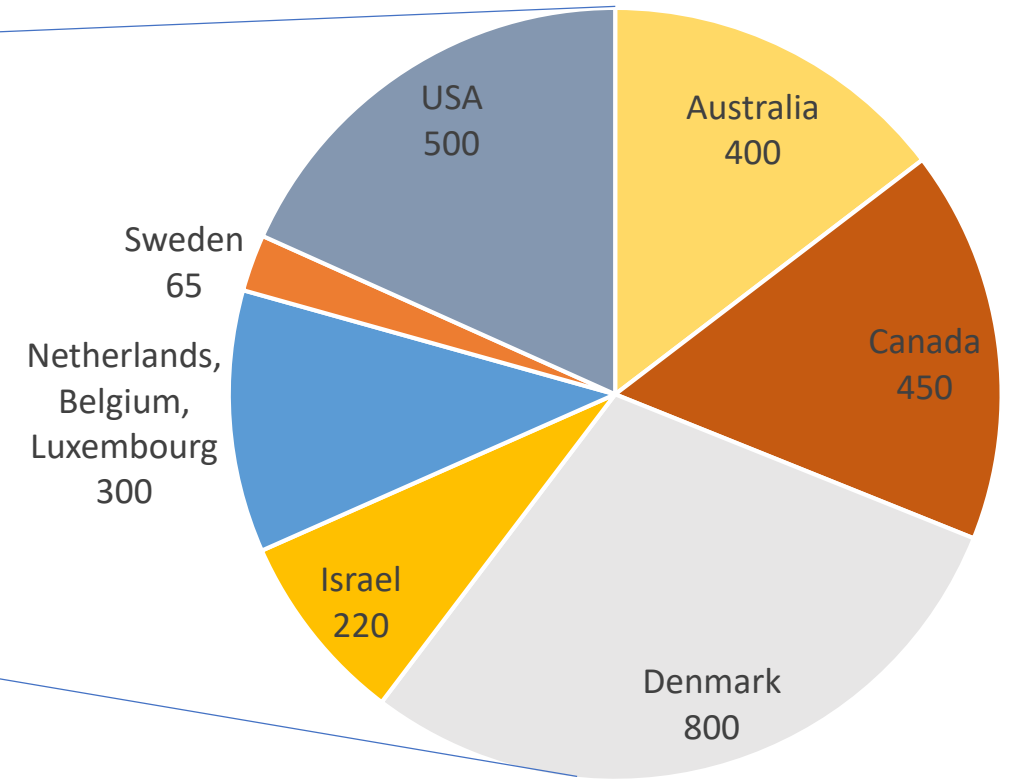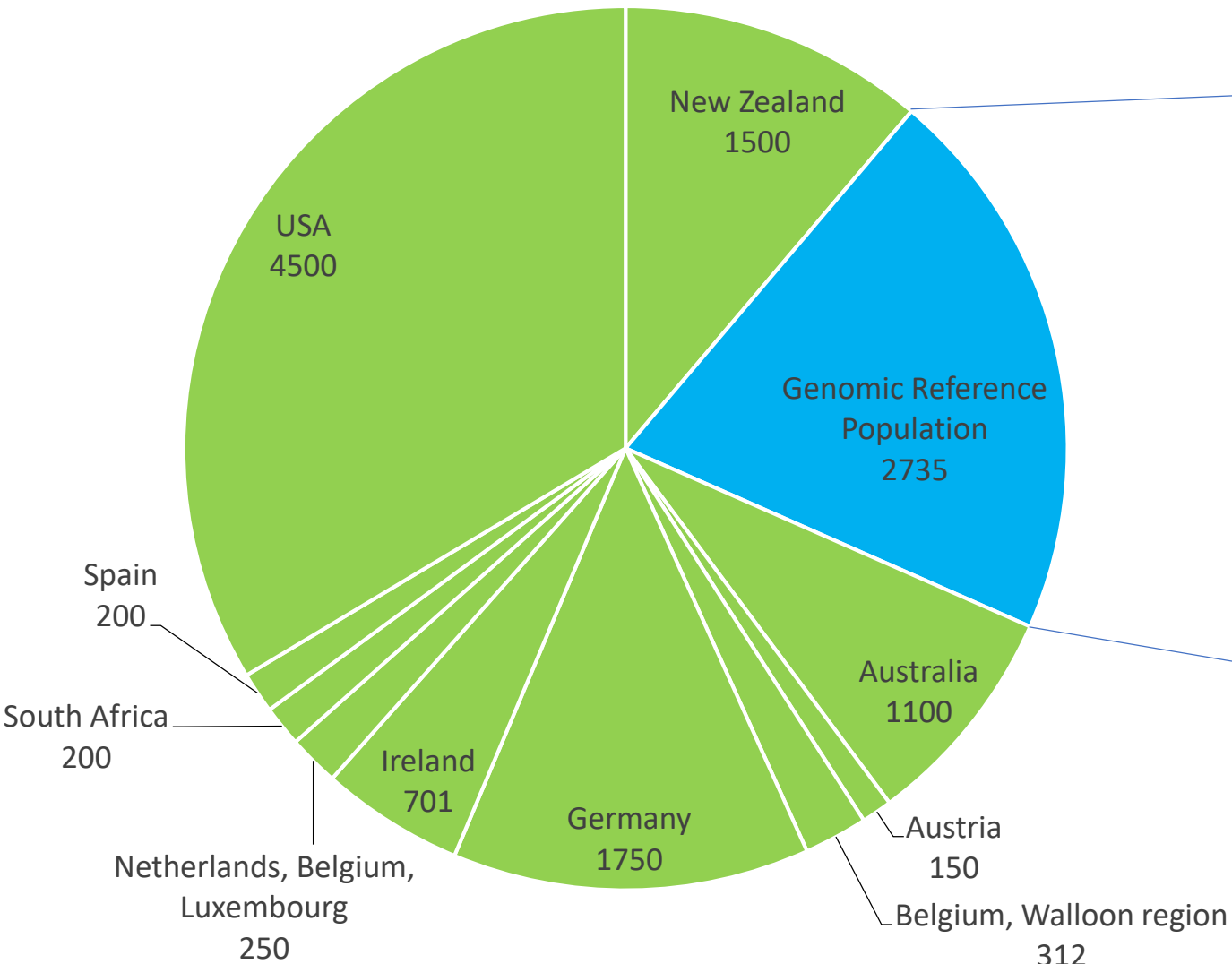
Legend:
- Research cows <u>not</u> included in reference population (green)
- Research cows <u>included</u> in reference population (blue)

Left pie chart:
- USA 4500
- New Zealand 1500
- Genomic Reference Population 2735
- Australia 1100
- Austria 150
- Belgium, Walloon region 312
- Germany 1750
- Ireland 701
- Netherlands, Belgium, Luxembourg 250
- South Africa 200
- Spain 200

Right pie chart (Genomic Reference Population breakdown):
- Australia 400
- Canada 450
- Denmark 800
- Israel 220
- Netherlands, Belgium, Luxembourg 300
- Sweden 65
- USA 500

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

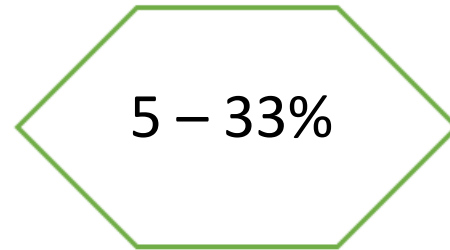"What percentage of Holstein/Friesian cows in your country(s) are potential mothers of AI bulls?"

Potential AI dams

> 80%	5 – 33%	< 1%
Israel	Belgium, Walloon region	Australia
Uruguay	Ireland	United Kingdom
Denmark	South Africa	New Zealand
Sweden	Germany, Luxembourg, Austria	Canada
Finland	USA	Spain
		Estonia

Commercial Herds
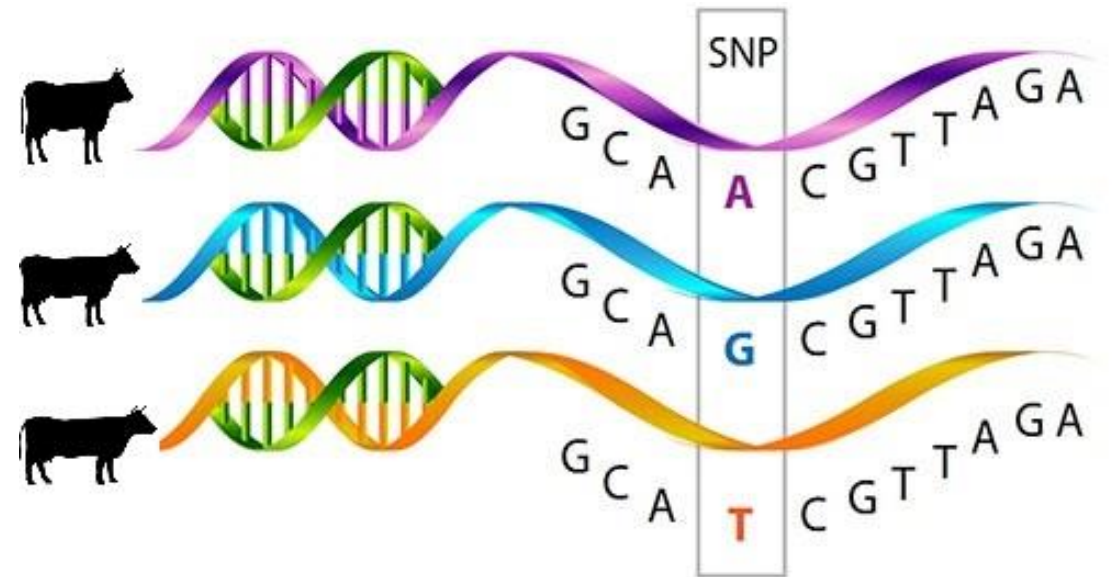
- Percentage of cows that provide phenotypic data
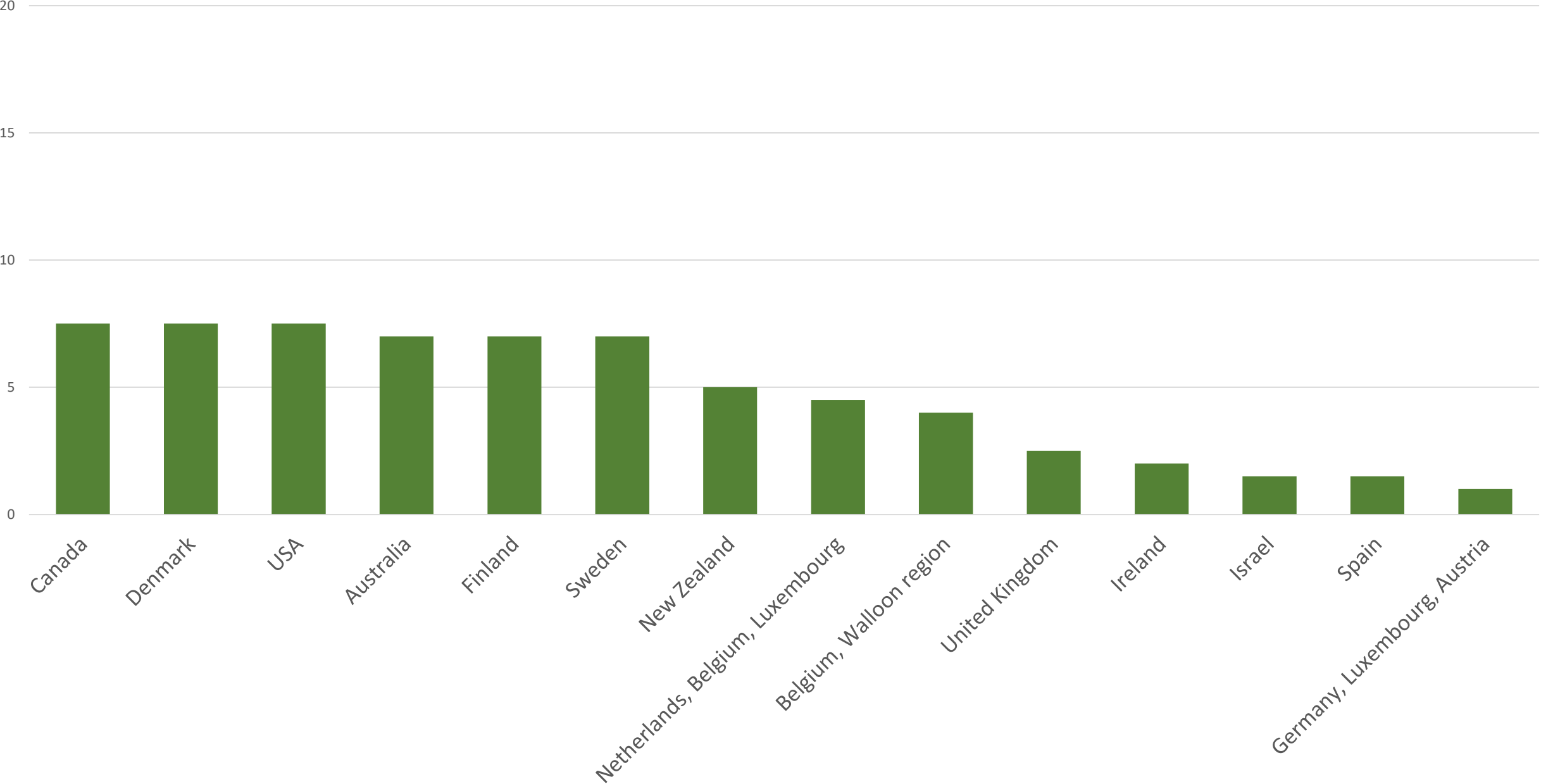
Percentage of HOL/FR COWS providing phenotypes
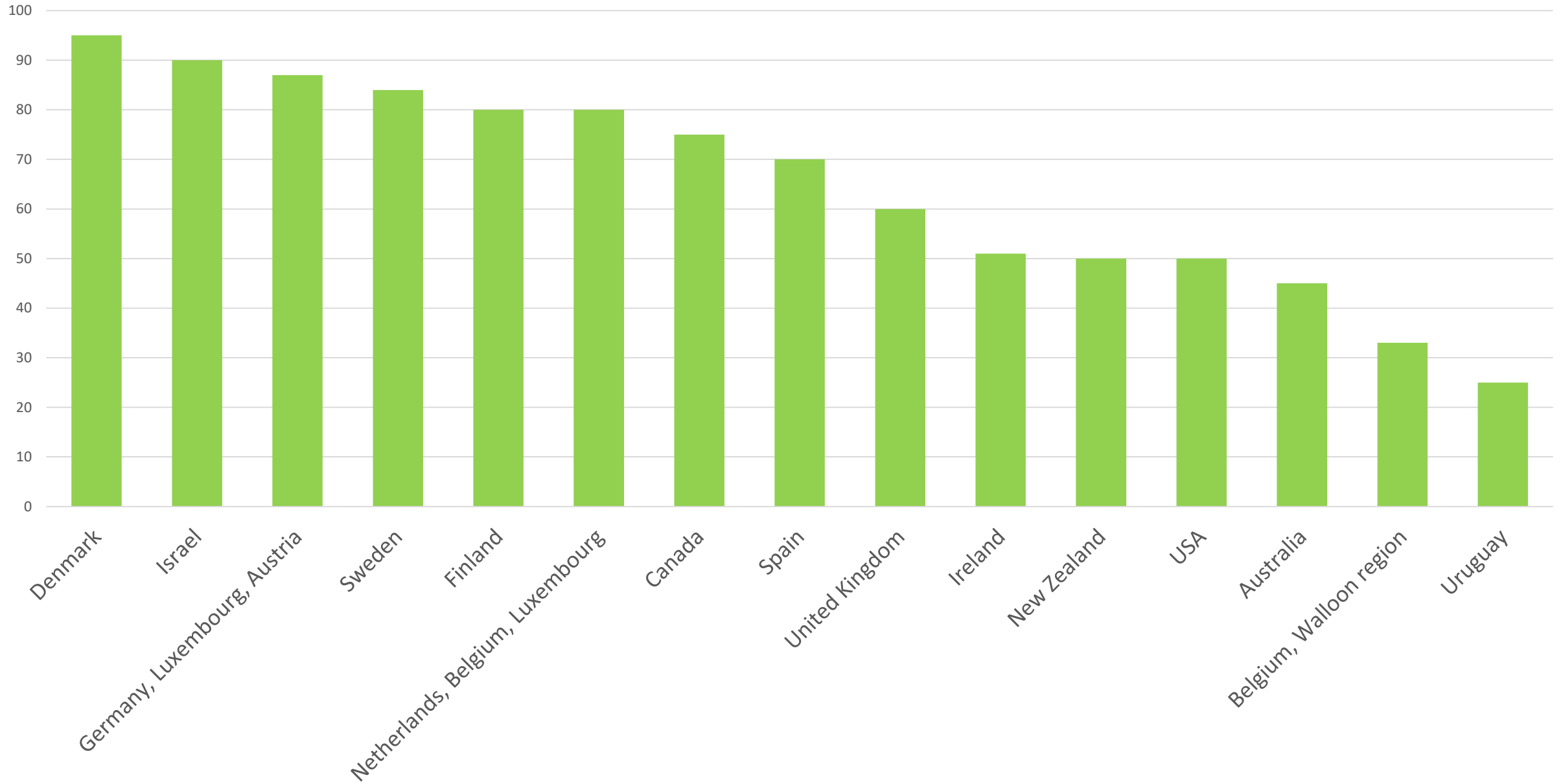
Commercial Herds

- Percentage of cows that provide phenotypic data

- Percentage of cows that are genotyped

Percentage of HOL/FR cows genotyped

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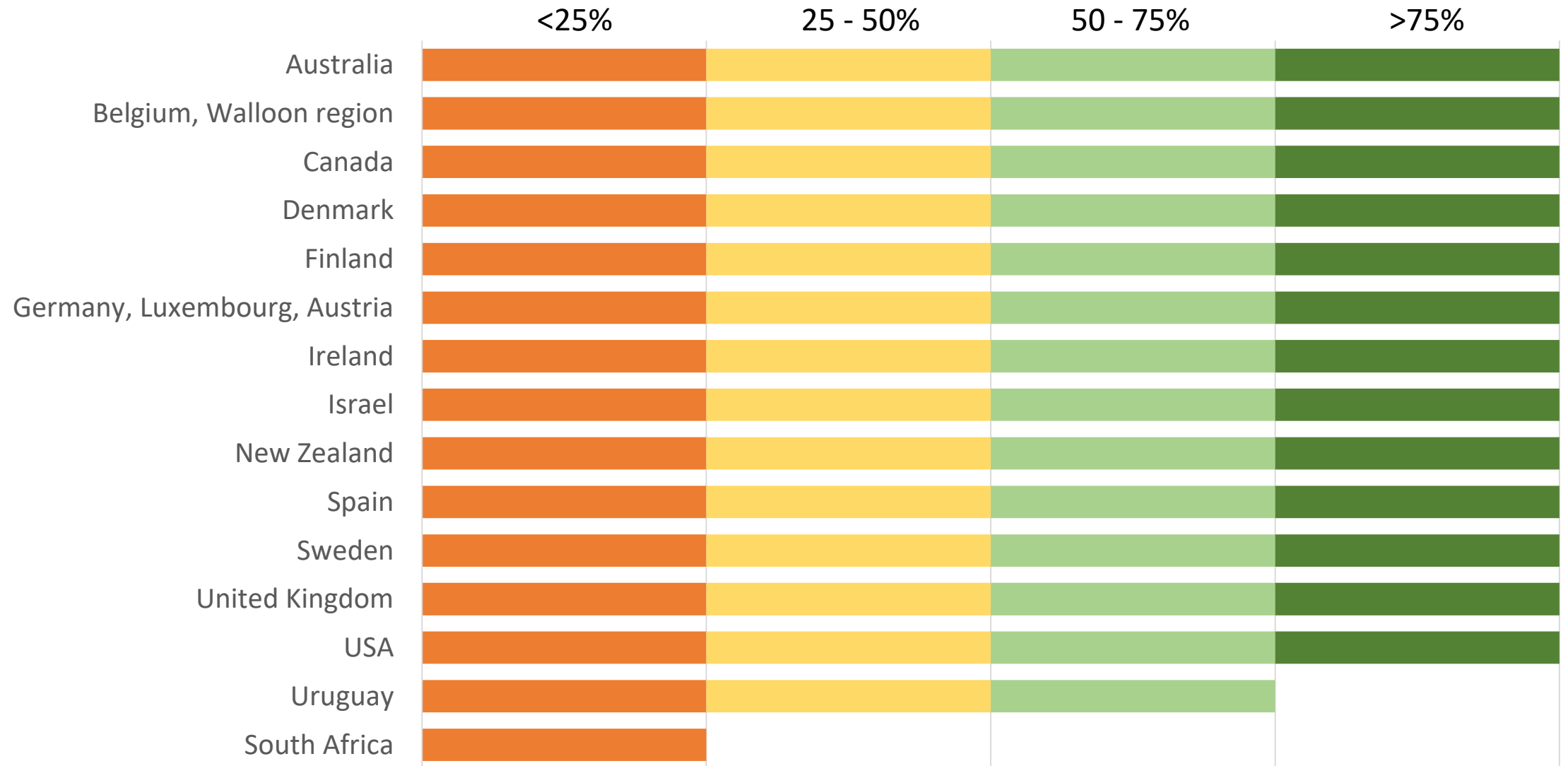
	<25%	25% to <50%	50% to 75%	75%+	N/A
Research herds	○	○	○	○	○
AI bulls	○	○	○	○	○
Elite herds associated with breeding programs	○	○	○	○	○
Bull breeder commercial herds	○	○	○	○	○

Research Herds Genotyping
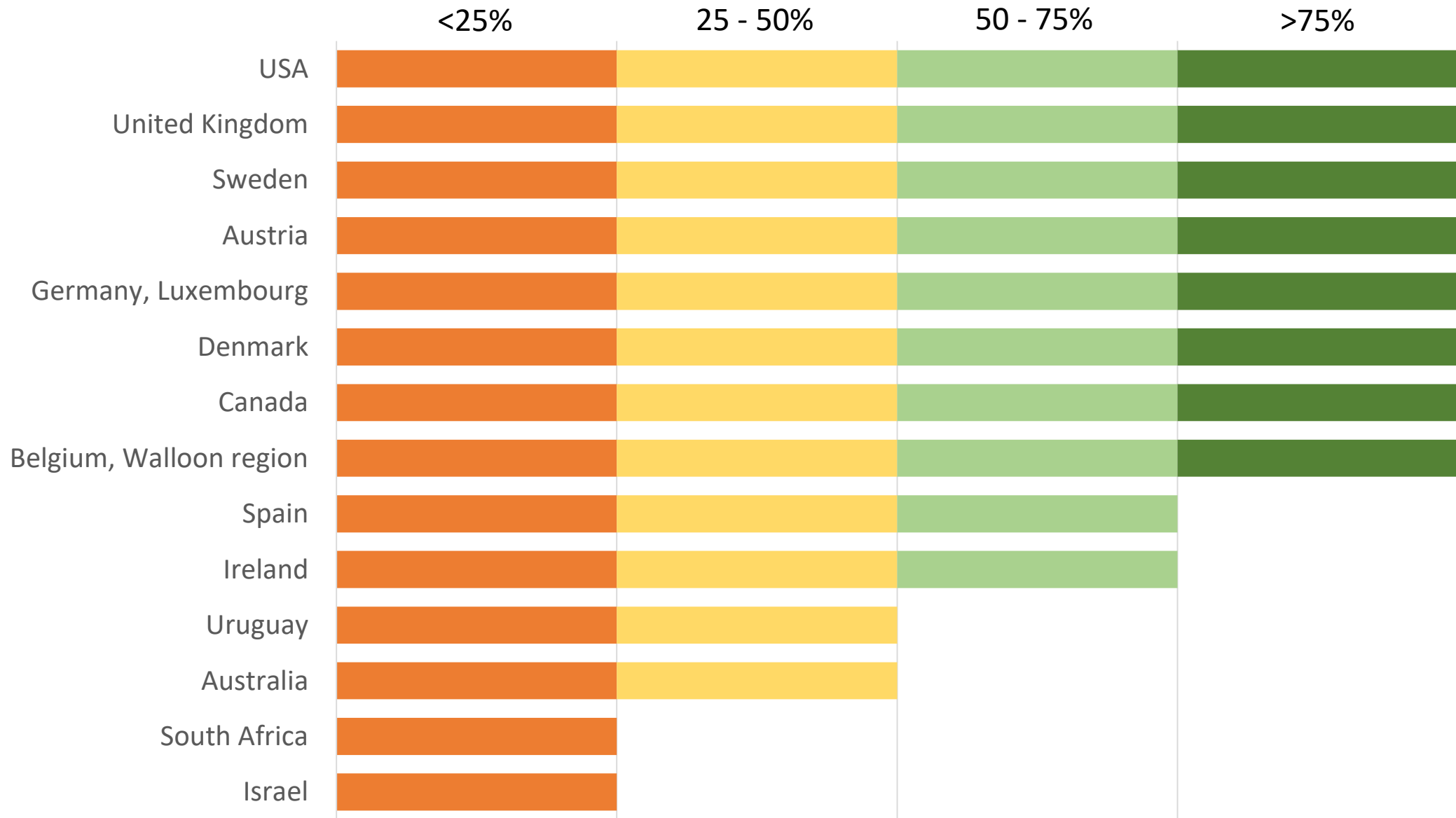
AI Bulls Genotyping

Nucleus Herds Genotyping
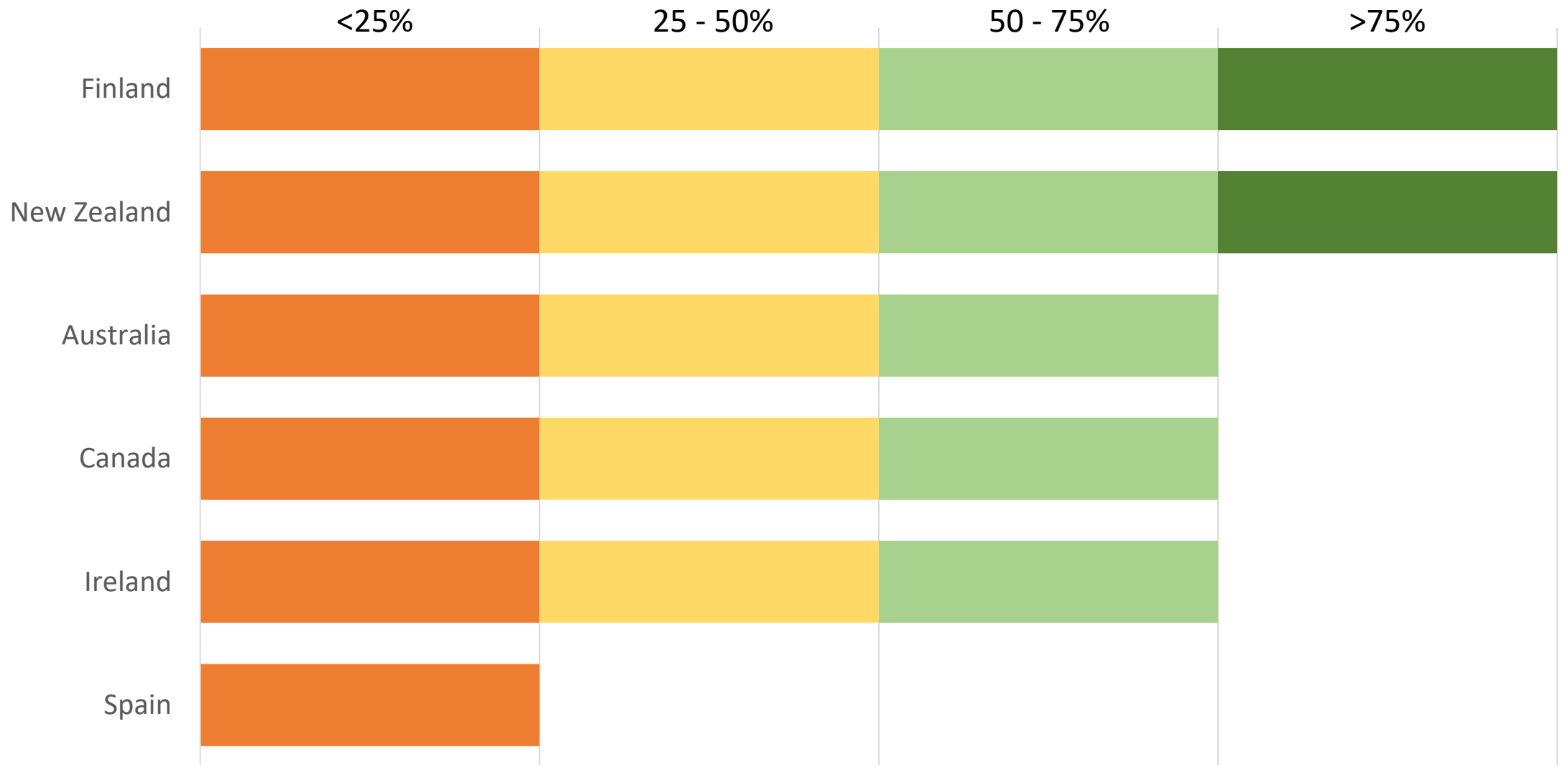
Commercial Bull Breeder Herds Genotyping

	<25%	25 - 50%	50 - 75%	>75%
Canada				
Australia				
Finland				
United Kingdom				
Belgium, Walloon region				
Denmark				
Germany, Luxembourg, Austria				
Ireland				
Israel				
New Zealand				
South Africa				
Spain				
Sweden				
USA				
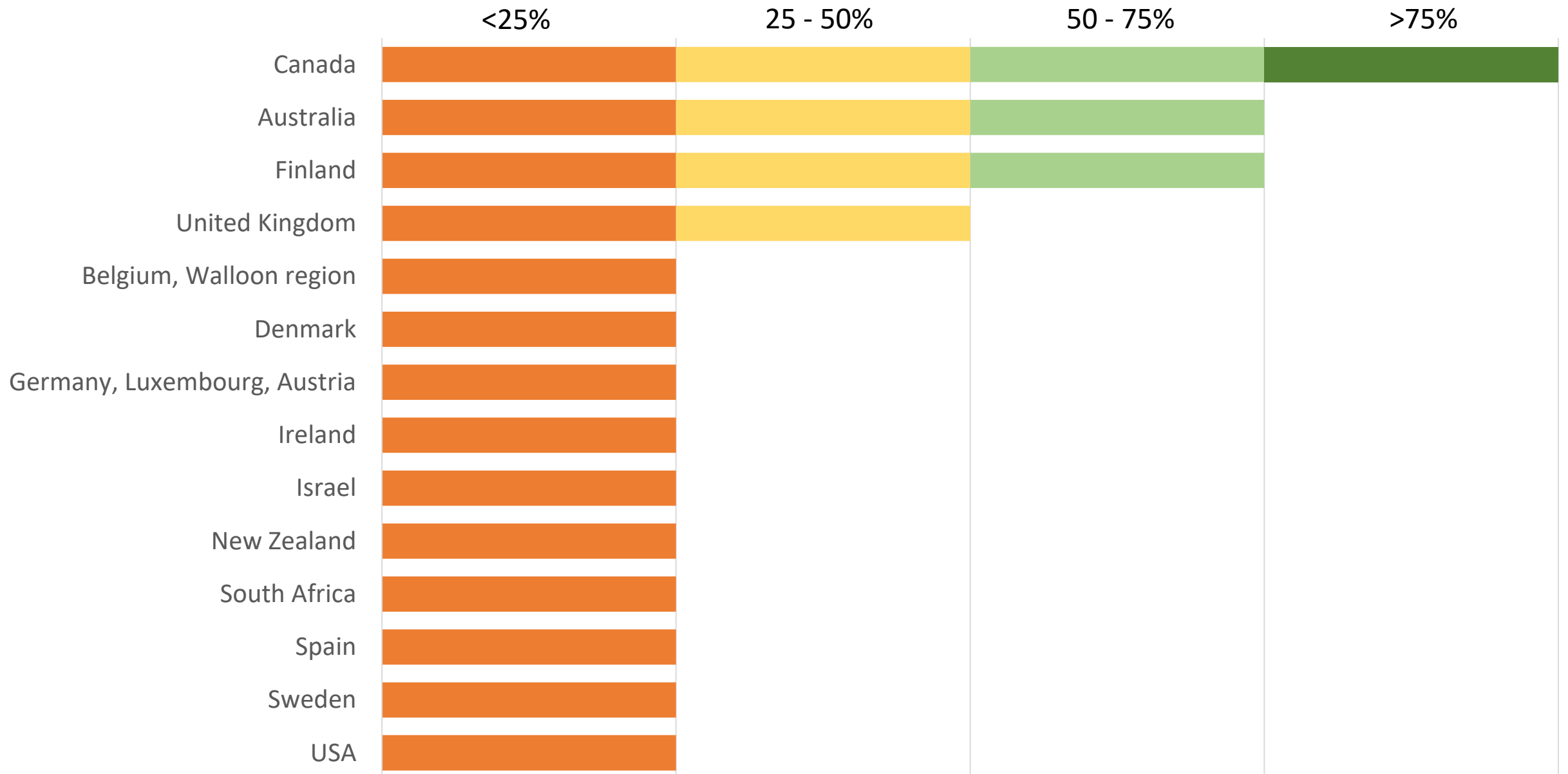
Conclusion

- 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

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