



75th EAAP Annual Meeting
Session 16, 1st September 2024

Comparison of milk-related traits' heritability evaluated by functional controls vs Automatic Milking Systems

R. Moretti¹, E. Ponzo¹, S. Chessa¹, F. Masia², E. Vrieze², and P. Sacchi¹

¹ Dep. of Veterinary Sciences, University of Turin, Italy.

² Farm Mangement Support, Lely International N.V., Rotterdam, Netherlands.



UNIVERSITÀ
DI TORINO



Heritability (h^2)

- Heritability is one of the key attributes to be studied to assess the use of a trait in genomic selection.
- It is a statistics that estimates how much of the phenotypic variation we are observing is due to the genetic variation in that population.
- It is therefore relative to the specific population used for the evaluation AND highly influenced by the measurements of the phenotypes.

Milk-related traits

- Commonly recorded milk-related traits (e.g., milk yield, somatic cell count, milk composition...) are routinely measured in dairy farms to assess the quality of the milk.
- Main factors influencing how much the milk will be paid to the farmer and therefore play a pivotal role in genomic selection of the best animals.
- Monthly milk composition analyses (MCA) performed by accredited labs are the current gold standard.

A new era...

Automatic Milking Systems

75th EAAP Annual Meeting
Session 16, 1st September 2024



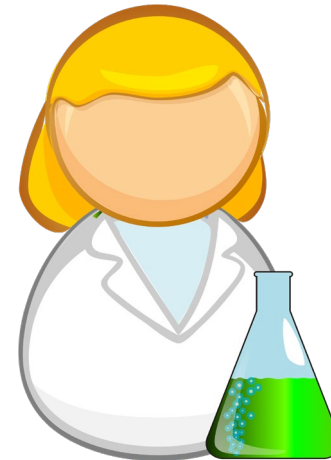
- Automatic Milking Systems (AMS) are increasingly available in commercial dairy farms around the world.
- Can record the same traits as the MCA but on a daily basis!



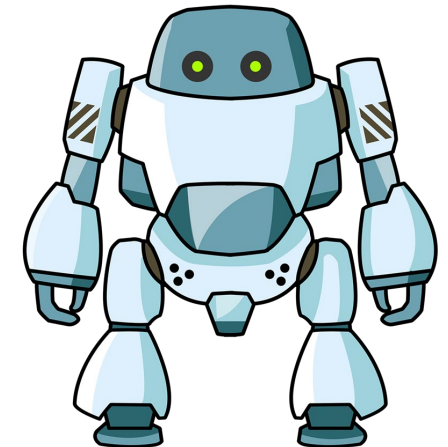


Aim of the study

- To compare the h^2 estimated on the same milk-related traits measured by two different methodologies:
 - MCA (traditional lab techniques);
 - AMS (volumetric and optical measurements operated by the milking robots)

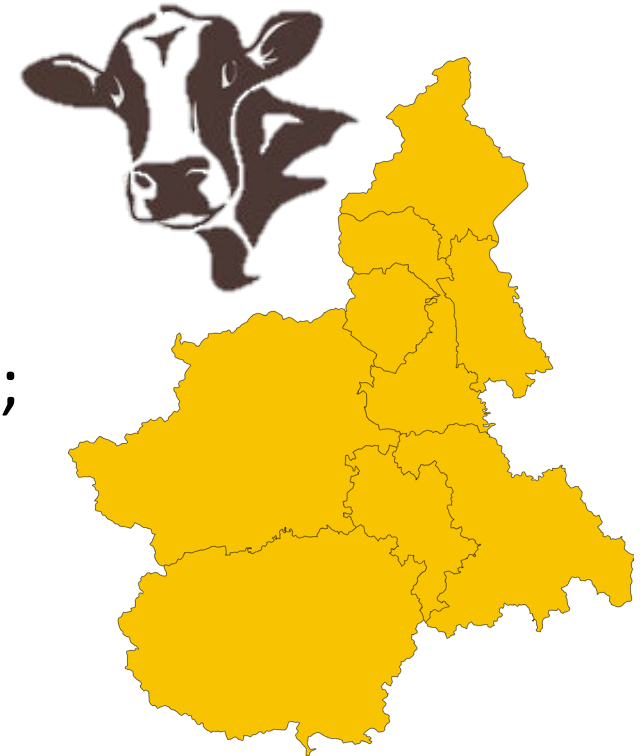


VS



Materials and Methods

- Numbers:
 - 5 farms (Northern Italy, Piedmont region);
 - 1949 Italian Holstein-Friesian cows;
 - Data recorded from March 2017 to July 2023;
 - Total same-day MCA and AMS observations: 17,910.



Materials and Methods

- Two subsets:
 - primiparous (7,011 obs per 1405 animals);
 - pluriparous (10,005 obs per 1294 animals).
- Correlation was calculated between the same traits measured with the two techniques.
- Heritability was estimated using breedR package in R.

Results and Discussion

- Correlation between MCA and AMS measured traits:

Variable	Corr %	P-value	Corr primip %	P-value	Corr plurip %	P-value
Milk yield	93.1	< 0.001	91.4	< 0.001	92.2	< 0.001
Fat %	51.7	< 0.001	53.0	< 0.001	53.5	< 0.001
Protein %	47.7	< 0.001	46.7	< 0.001	49.1	< 0.001
SCS	49.4	< 0.001	35.5	< 0.001	54.8	< 0.001

- Milk yield correlation is higher because both the technologies use volumetric approaches!

Results and Discussion

- Heritability estimated on each trait:

	Variable	Milk Composition Analyses		Automatic Milking Systems	
		h^2	SE	h^2	SE
Primiparous	Milk yield	0.297	0.043	0.345	0.046
	Fat %	0.133	0.026	0.384	0.043
	Protein %	0.257	0.035	0.367	0.045
	SCS	0.153	0.040	0.076	0.020
Pluriparous	Milk yield	0.157	0.033	0.227	0.041
	Fat %	0.116	0.022	0.431	0.046
	Protein %	0.227	0.032	0.270	0.040
	SCS	0.141	0.032	0.074	0.021

Results and Discussion

- Heritability estimated on AMS data is higher for milk yield, fat %, and protein % in both primi- and pluriparous cows.
- SCS h^2 only is higher in MCA data than in AMS ones (2-folds).
- The highest difference was observed in pluriparous fat % (almost 4-folds).

	Variable	MCA	AMS
		h^2	h^2
Primiparous	Milk yield	0.297	0.345
	Fat %	0.133	0.384
	Protein %	0.257	0.367
	SCS	0.153	0.076
Pluriparous	Milk yield	0.157	0.227
	Fat %	0.116	0.431
	Protein %	0.227	0.270
	SCS	0.141	0.074

Results and Discussion

- Observed differences are due to the different technologies of measurements between MCA and AMS.
- It is known that AMS still have some measurement issues (e.g., vibrations) yet to be addressed.
- AMS measure data with a much higher frequency than MCA (everyday vs once a month).
- The higher number of observation can improve precision of the final estimate!

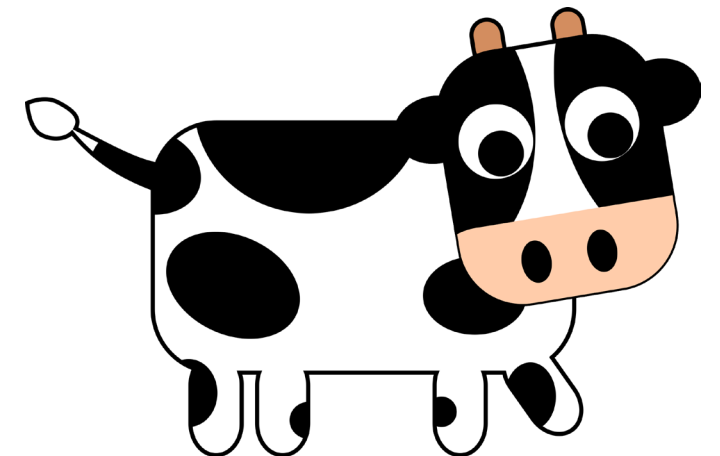
Take-home messages

- AMS are a cheap and valuable source of big data for milk-related phenotypes, commonly available in dairy farms.
- Even if few technological issues are still present, the high number of observations for each animal can overcome them.
- A comparison of milk-related traits h^2 estimated on a complete dataset of daily AMS observations will be in our next paper...

... STAY TUNED!

Acknowledgements

- This study is part of the project “Use of Automatic Milking System data for the early aetiological diagnosis of mastitis in dairy cows” and is funded by Fondazione CRT “Finanziamento Bando Richieste Ordinarie 2023” (106803/2023.1760).
- Thanks to Lely International NV for AMS data.
- Thanks to the involved farmers and cows!





UNIVERSITÀ
DI TORINO

And thank you for your attention!

Questions?