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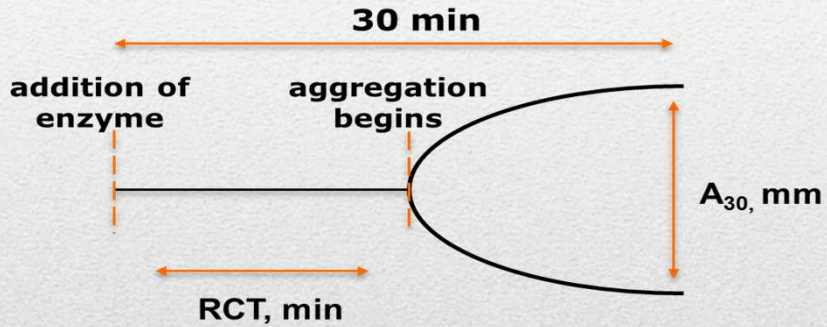
- Session 18, no 7

Genetic response of milk coaugulation properties in Italian Holstein Friesian dairy cattle population using different sets of genetic parameters

62nd EAAP – Stavanger, Norway – August 29th - September 2nd, 2011

❑ Introduction

- ❑ Milk Coagulation Properties:
  - ✓ shorter Rennet Coagulation Time (RCT, min) and
  - ✓ stronger curd firmness (A_{30}, mm) can improve cheese-making efficiency (Aleandri et al., 1989; Wedholm et al., 2006)



- ❑ Important in those countries where a wide proportion of milk is processed into cheese [Italy ~ 70 %]

- ❑ Nowadays these traits can be measured routinely in cheap way by mid-infrared spectroscopy (De Marchi et al. , 2009)

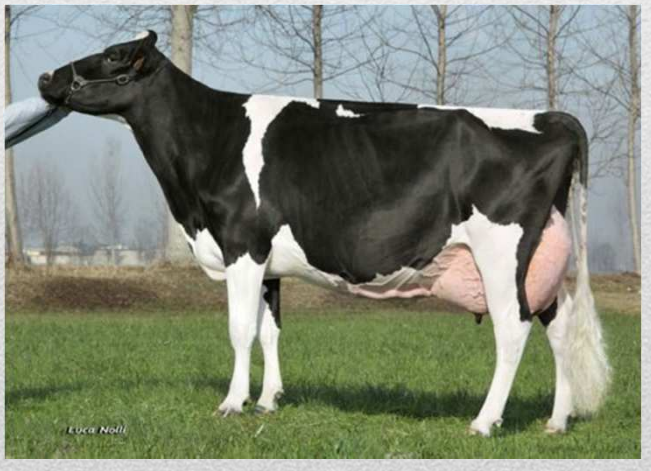
❑ Introduction

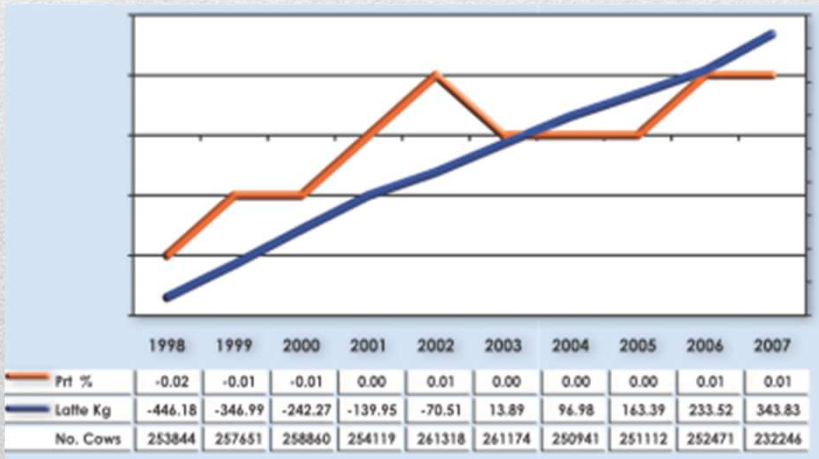
- ❑ Up to now MCP traits are not recorded routinarialy
- ❑ Selection indexes for dairy cattle populations don't consider MCP traits
- ❑ Deterioration of MCP during the years ??
  - ✓ few historical data are available
  - ✓ genetic correlation estimated between MCP traits and traits in selection index are contradictory

Example. $r_{a:\ milk\ yield,\ RCT}$= -0.24 (Cassandro et al., 2008)
-0.07 (Vallas et al., 2010)
+0.12 (Ikonen et al., 2004)

❑ Aims

- ✓ Analyze genetic response of milk coagulation properties under current selection index in Italian Holstein Friesian dairy cattle population using different sets of genetic parameters.





	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Prt %	-0.02	-0.01	-0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01
Latte Kg	-446.18	-346.99	-242.27	-139.95	-70.51	13.89	96.98	163.39	233.52	343.83
No. Cows	253844	257651	258860	254119	261318	261174	250941	251112	252471	232246

❑ M&M: Selection index theory

P b=G a

Where:

- **P** = phenotipic (co)variance matrix of traits in the selection criterion
- **G** = genetic (co)variance matrix between traits in the selection objective (selection Index) and the traits in the selection criterion
- b= vector of selection criterion coefficients
- **a**= vector of economic value coefficients

$$CR_j = i_I * \frac{b' G_j}{\sqrt{b' P b}}$$

CR_j = correlated response per generation in trait Y_j

i = selection intensity

Genetic response has been expressed as CR after 10 years of selection for all traits considered

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❑ M&M: Italian Holstein Friesian Sel. index

Trait	Relative weight	Economic value
Fat yield	8 %	4
Protein yield	36 %	22.4
Fat, %	2 %	108.7
Protein, %	3 %	350.0
SCS	-10 %	-143.9
Udder index	13 %	174.1
Feet and legs	6 %	75.9
Type	4 %	50.5
Longevity	8 %	115.1
Fertility	10 %	132.4

ANAFI, 2010

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Traits related with milk yield and quality = 59 % of total index

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Fat yield	8 %	4
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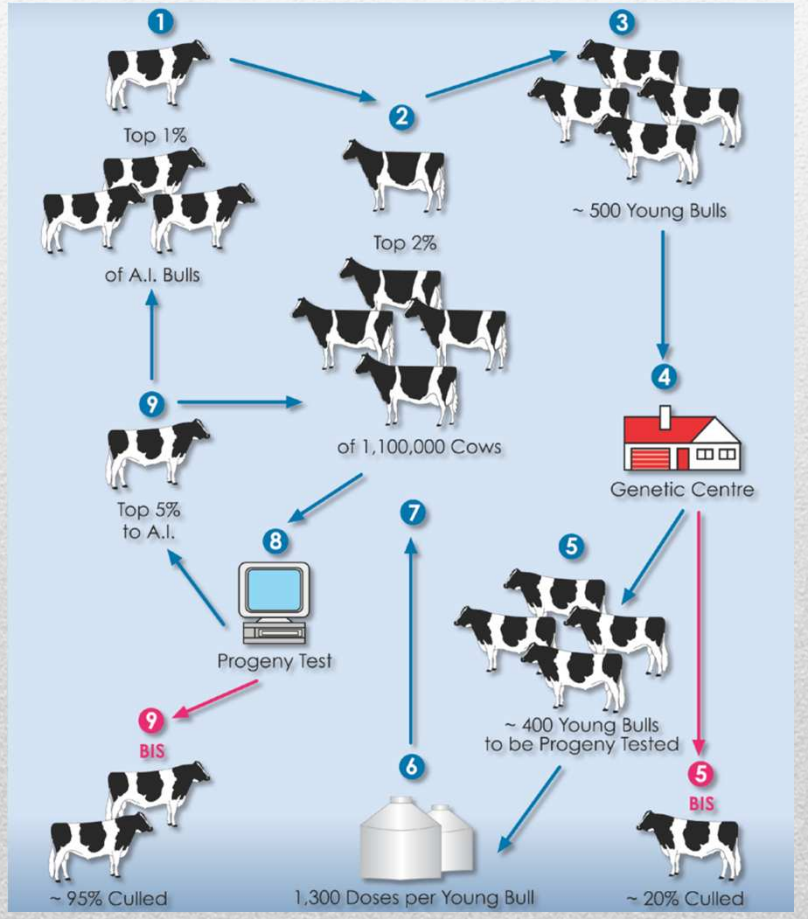
Fat, %	2 %	108.7
Protein, %	3 %	350.0
SCS	-10 %	-143.9
Milk yield	-	0
RCT, min	-	0
A_{30}, mm	-	0
pH	-	0
Titratable acidity	-	0

Traits related with milk yield and quality
= 59 % of total index

Traits not in selection index but in the calculation for correlated response

❑ M&M: Breeding scheme

- ✓ Four pathways of selection were considered
- ✓ Selection intensities (i) and generation intervals (GI) were in according with current selection scheme.



ANAFI, 2010

Pathway	progeny, n	i	GI, yr	Lactation with records
CC[1]		0.05	4	1
CB[1]		2.42	5	2
BC[2]	100	2.06	6	1
BB[2]	100	2.66	8	1

[1] Own performance

[2] performance per each daughter in progeny testing

❑ M&M: Genetic parameters

Traits in sel. index

Trait	σ_a	h^2	r
Milk Yield, kg/305d	875.40[1]	0.31[1]	0.48[4]
Fat Yield, kg/305d	33.74[1]	0.29[1]	0.40[4]
Protein Yield, kg/305d	27.14[1]	0.30[1]	0.46[4]
Fat %	0.31[1]	0.39[2]	0.57[4]
Protein %	0.14[1]	0.30[2]	0.55[4]
SCS	1.17[1]	0.21[1]	0.27[4]
RCT	2.22[2]-0.94[3]	0.25[2]-0.28[3]	0.45[3]
A_{30}	4.06[2]	0.15[2]	0.50[3]
pH	0.05[2]	0.21[2]	0.36[3]
Titratable acidity	0.15[2]	0.17[2]	0.36

[1] Interbull, 2011; [2] Cassandro et al., 2008; [3]Vallas et al., 2010; [4] Welper and Freeman, 1992

❑ M&M: Correlation set

✓ Phenotipic (below diag) and genetic (up diag) correlation were assumed from different sources and validated for positive definite matrix (method Jorjani et al., 2003).

Trait	MY	FY	PY	F%	P%	SCS
MY, kg/305d	-	0.49	0.83	-0.50	-0.43	0.22
FY, kg/305d	0.74	-	0.66	0.51	0.20	0.07
PY, kg/305d	0.92	0.81	-	-0.16	0.15	0.22
F%	-0.33	0.37	-0.12	-	0.63	-0.16
P%	-0.31	0.08	0.10	0.54	-	-0.10
SCS, point	-0.08	-0.09	-0.05	-0.02	0.07	-

Castillo-Juarez et al., 2002

❑ M&M: Correlation set

✓ Genetic response was estimated assumed three different sets of genetic correlation parameters for MCP traits →**A: Cassandro et al., 2008**

Trait	RCT	a30	pH	TA
MY, kg/305d	-0.24	0.22	-0.19	0.19
FY, kg/305d	0.00	0.00	0.00	0.00
PY, kg/305d	0.00	0.00	0.00	0.00
F%	-0.05	0.14	-0.16	0.49
P%	-0.08	0.44	-0.24	0.58
SCS	0.25	-0.40	0.44	-0.08
RCT	-	-0.89	0.81	-0.50
A_{30}		-	-0.85	0.66
pH			-	-0.68
Titratable Acidity				-

Cassandro et al., 2008
Unknown, set 0.00

❑ M&M: Correlation set

✓ Genetic response was estimated assumed three different sets of genetic correlation parameters for MCP traits →**B: Ikonen et al., 2004**

Trait	RCT	a30	pH	TA
MY, kg/305d	0.12	-0.07	-0.19	0.19
FY, kg/305d	0.00	0.00	0.00	0.00
PY, kg/305d	0.00	0.00	0.00	0.00
F%	0.08	0.02	-0.16	0.49
P%	0.22	-0.07	-0.24	0.58
SCS	0.29	-0.33	0.44	-0.08
RCT	-	-0.93	0.81	-0.50
A_{30}		-	-0.85	0.66
pH			-	-0.68
Titratable Acidity				-

Ikonen et al., 2004
Cassandro et al., 2008
Unknown, set 0.00

❑ M&M: Correlation set

✓ Genetic response was estimated assumed three different sets of genetic correlation parameters for MCP traits →**C:Vallas et al., 2010**

Trait	RCT	a30	pH	TA
MY, kg/305d	-0.07	-0.29	-0.19	0.19
FY, kg/305d	0.00	0.00	0.00	0.00
PY, kg/305d	0.00	0.00	0.00	0.00
F%	-0.10	0.25	-0.16	0.49
P%	0.19	0.48	-0.24	0.58
SCS	0.06	-0.04	0.44	-0.08
RCT	-	-0.16	0.81	-0.50
A_{30}		-	-0.85	0.66
pH			-	-0.68
Titratable Acidity				-

Vallas et al., 2010
Cassandro et al., 2008
Unknown, set 0.00

❑ Results

✓ Correlated response for each trait after 10 years of selection

Traits in sel. index

Trait	correlation set A	B	C
MY, kg/305d	1254.8	1190.6	1281.3
FY, kg/305d	67.1	67.6	67.7
PY, kg/305d	66.7	66.8	66.8
F%	0.10	0.09	0.10
P%	0.13	0.13	0.13
SCS, point	-0.10	-0.12	-0.07
RCT, min	-0.15	-0.06	0.11
A_{30}, mm	1.53	0.48	0.59
pH	-0.01	-0.02	-0.02
Titratable Acidity	0.04	0.05	0.04

❑ Results

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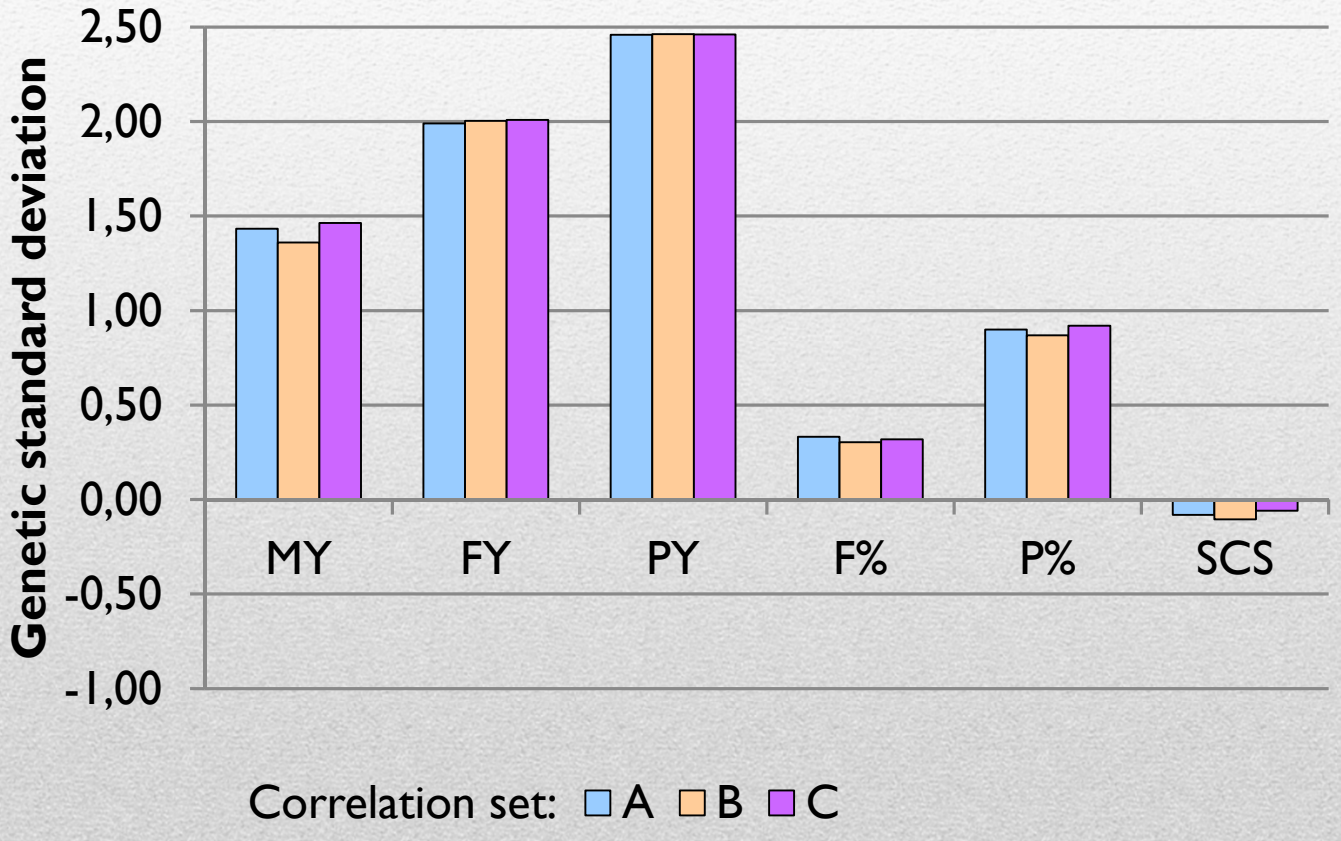
Traits in sel. index

Trait	correlation set A	B	C
MY, kg/305d	1254.8	1190.6	1281.3
FY, kg/305d	67.1	67.6	67.7
PY, kg/305d	66.7	66.8	66.8
F%	0.10	0.09	0.10
P%	0.13	0.13	0.13
SCS, point	-0.10	-0.12	-0.07
RCT, min	**-0.15**	**-0.06**	**0.11**
A_{30}, mm	**1.53**	**0.48**	**0.59**
pH	-0.01	-0.02	-0.02
Titratable Acidity	0.04	0.05	0.04

❑ Results

✓ Correlated response for traits in selection index after 10 years of selection in genetic standard deviation



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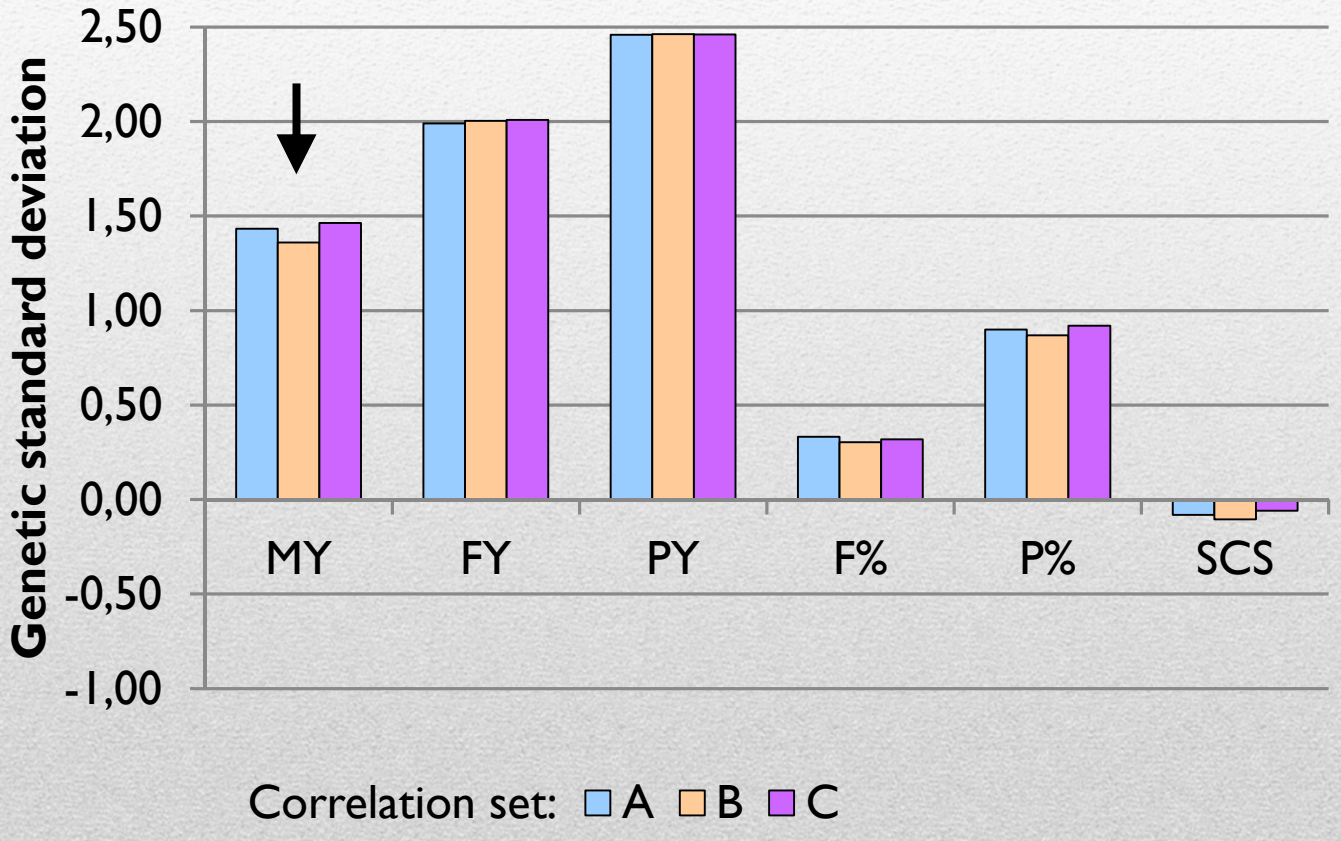

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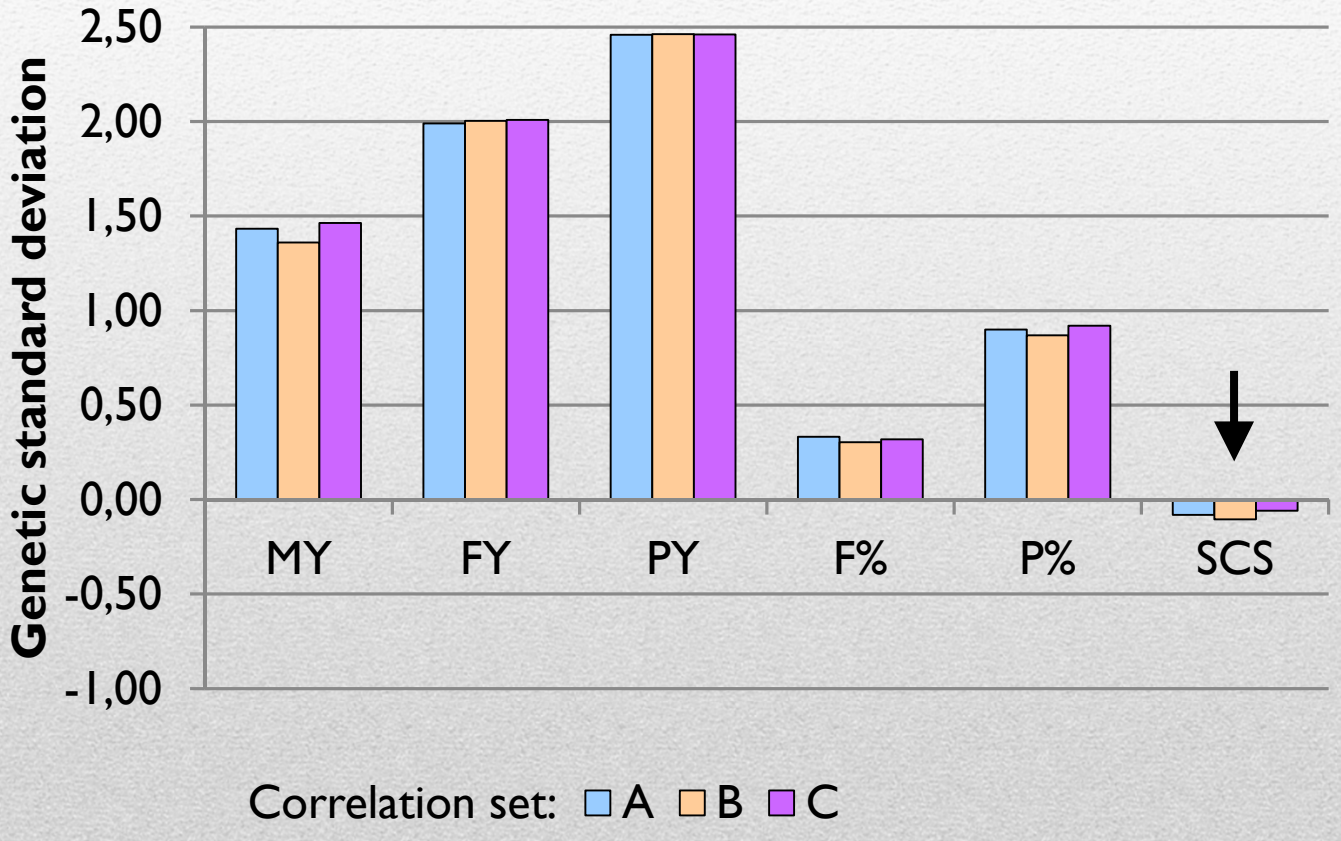
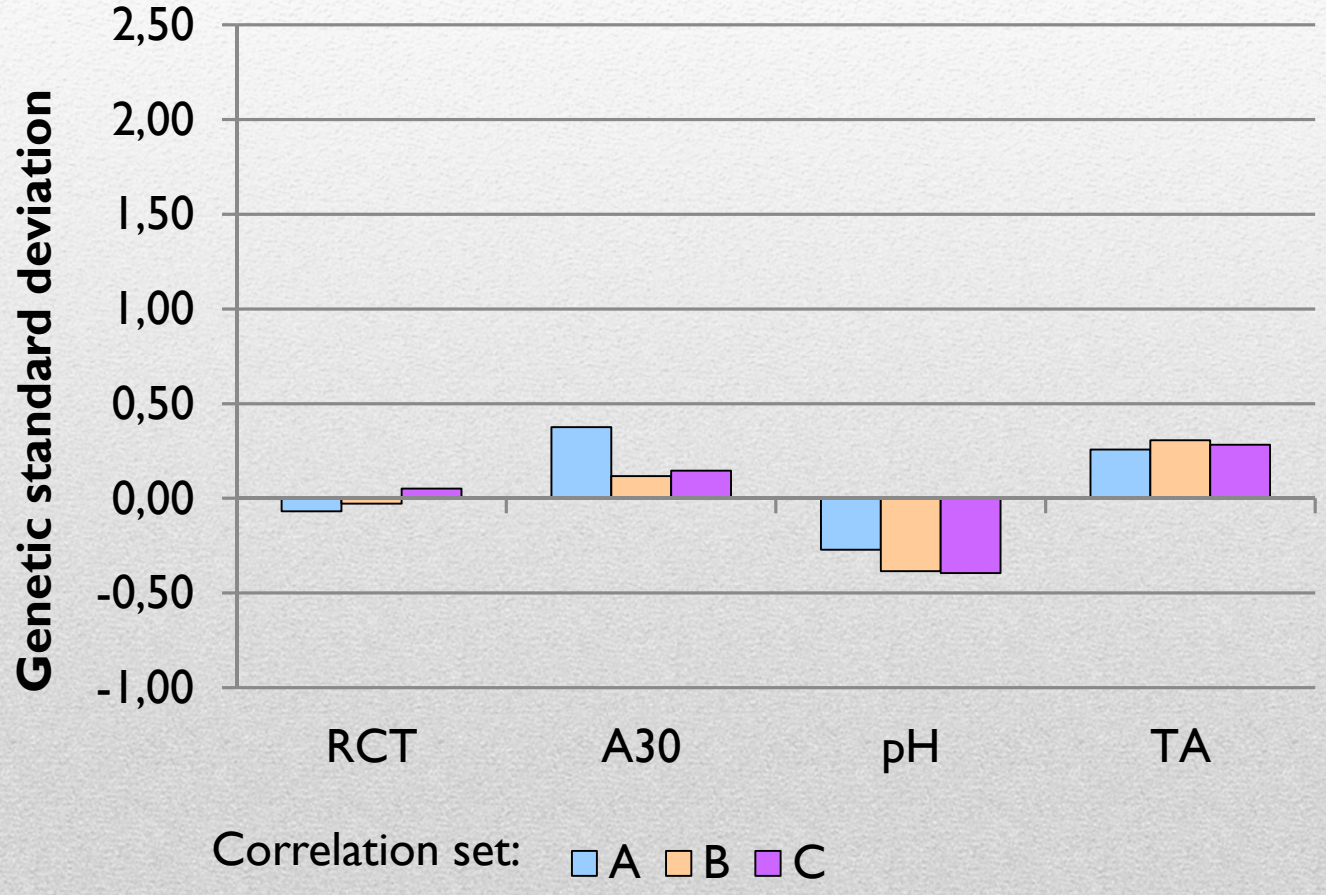


❑ Results

✓ Correlated response for MCP traits and milk acidity after 10 year of selection in genetic standard deviation



❑ Conclusions

- ✓ Current selection index gives more pressure to yield than milk quality
- ✓ It seems not to deteriorate MCP traits
- ✓ The trend could be different depending on correlation set considered
- ✓ In this calculation has been taken into account only a part of traits in selection index
- ✓ For improve significantly these traits should need a routinely phenotipic recording and insert them in selection index

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Thanks you for your attention!

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Veneto cheese
DISTRETTO VENETO LATTIERO CASEARIO

Massey University