Indice di Attitudine Casearia (IAC): dalla lattodinamografia alla spettroscopia, esperienze e prospettive nella realtà del Veneto

UNIVERSITÀ DEGLI STUDI DI PADOVA

Martino Cassandro
Massimo de Marchi
Università di Padova

DAFNAE
Department of Agronomy Food Natural resources Animals Environment

Stefano De Paoli
Sofia Ton
ARAV

A.I.A. ARAL

SEMINARIO
AIA Laboratori e 19° ARAL SATA

Nuove tecnologie analitiche e strumenti innovativi al servizio della consulenza

24 - 25 GENNAIO 2017

PADENGHE SUL GARDA (BS)
VIA PRAIS, 32 - WEST GARDA HOTEL

Indice

SEMINARIO
AIA Laboratori e 19° ARAL SATA

Nuove tecnologie analitiche e strumenti innovativi al servizio della consulenza

24 - 25 GENNAIO 2017

PADENGHE SUL GARDA (BS)
VIA PRAIS, 32 - WEST GARDA HOTEL

Variazioni fenotipiche, genetiche e valori economici
Martino Cassandro / Massimo De Marchi

Implementazione indice IAC
Stefano De Paoli

Ricerca e sviluppo laboratorio latte qualità ARAV
Sofia Ton

UNIVERSITÀ DEGLI STUDI DI PADOVA
DAFNAE
Department of Agronomy Food Natural resources Animals Environment

Partecipanti ai progetti regionali

Veneto cheese

DISTRETTO VENETO LATTIERO CASEARIO

…2007, dieci anni fa DISTRETTO LATTIERO-CASEARIO

"PROGETTO FILATVE"

1) CARTA TERRITORIALE della CASEIFICABILITA’ del LATTE in VENETO

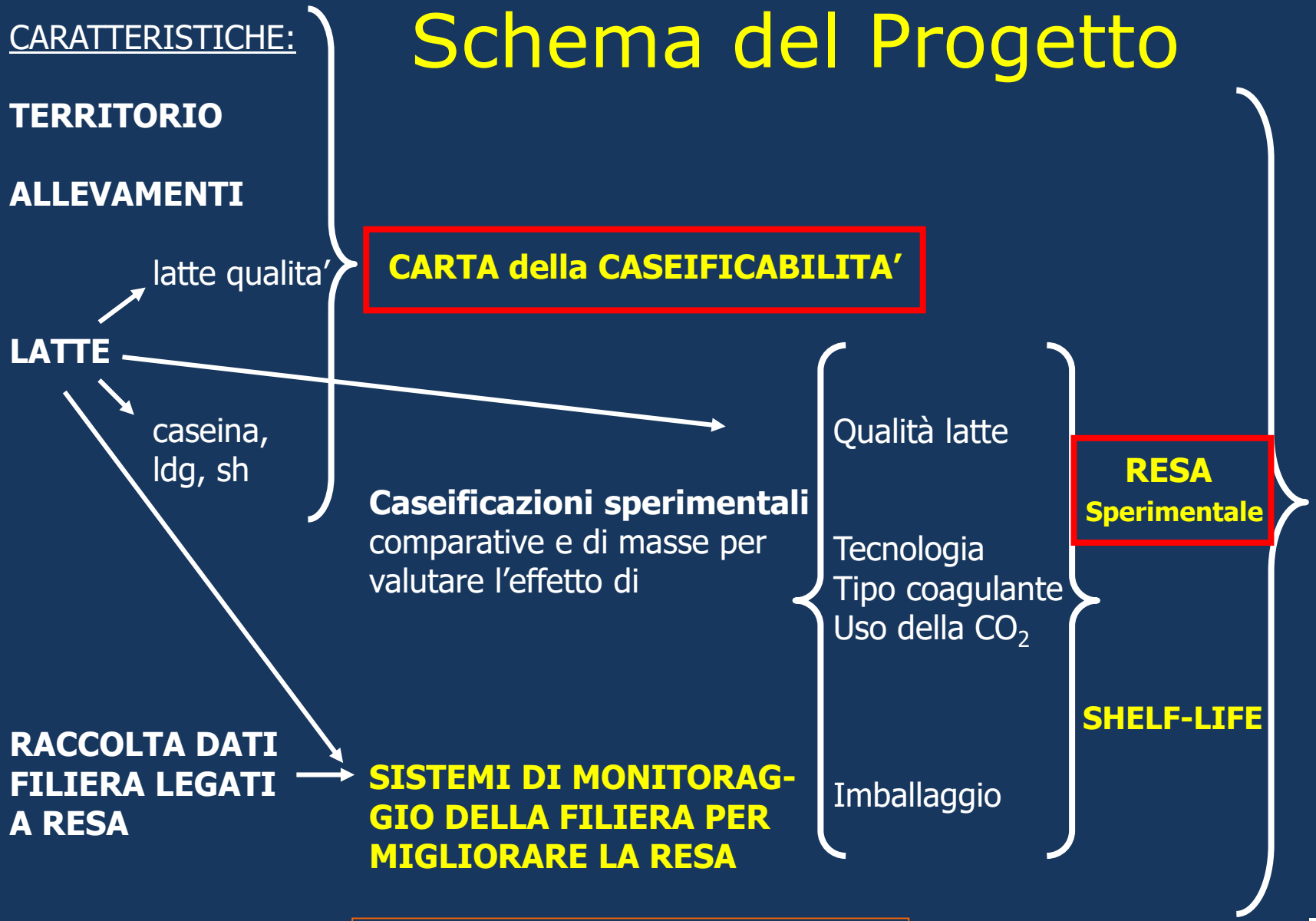
2) EFFETTO della ATTITUDINE CASEARIA del LATTE sulla RESA

3) VALUTAZIONE e VALORIZZAZIONE della RESA CASEARIA

4) STUDIO della PROBLEMATICA della SHELF-LIFE in PRODOTTI FRESCHI

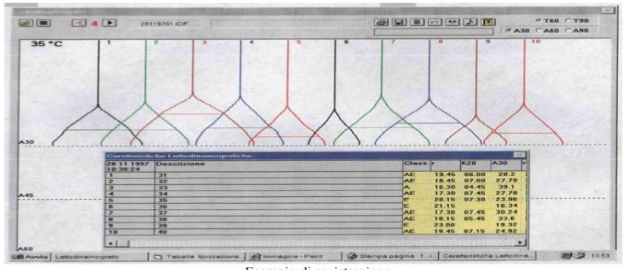
5) PREVENZIONE-CONTROLLO dello SVILUPPO di MUFFE SUPERFICIALI in FORMAGGIO

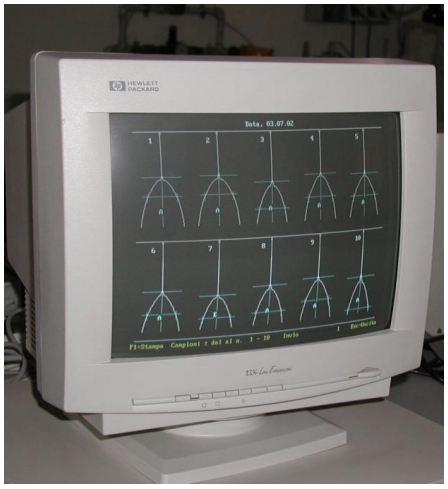
Schema del Progetto

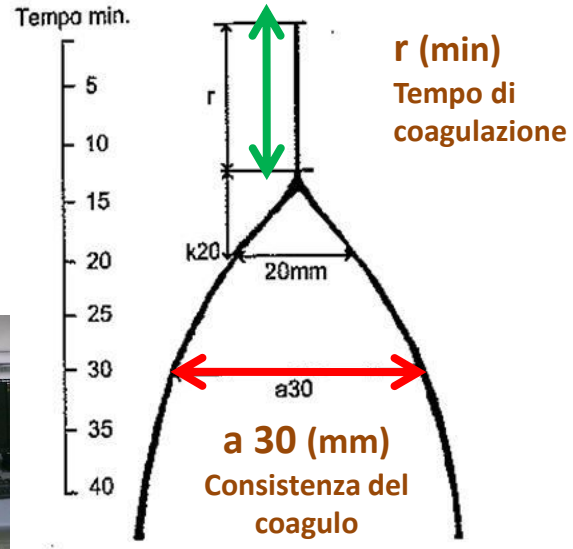


Proprietà coagulative del latte: schema

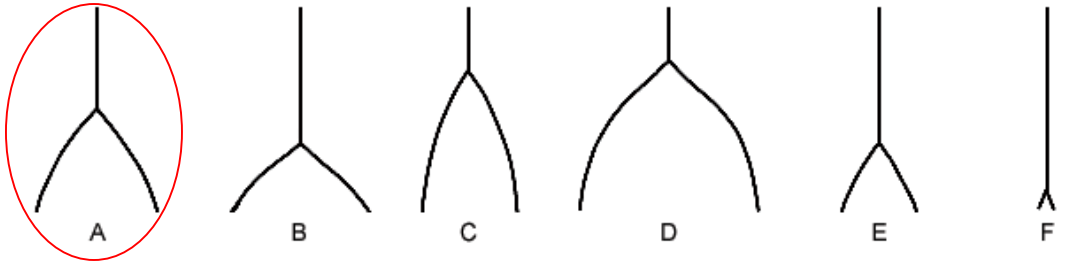
1) Lactodinamograph -LDG



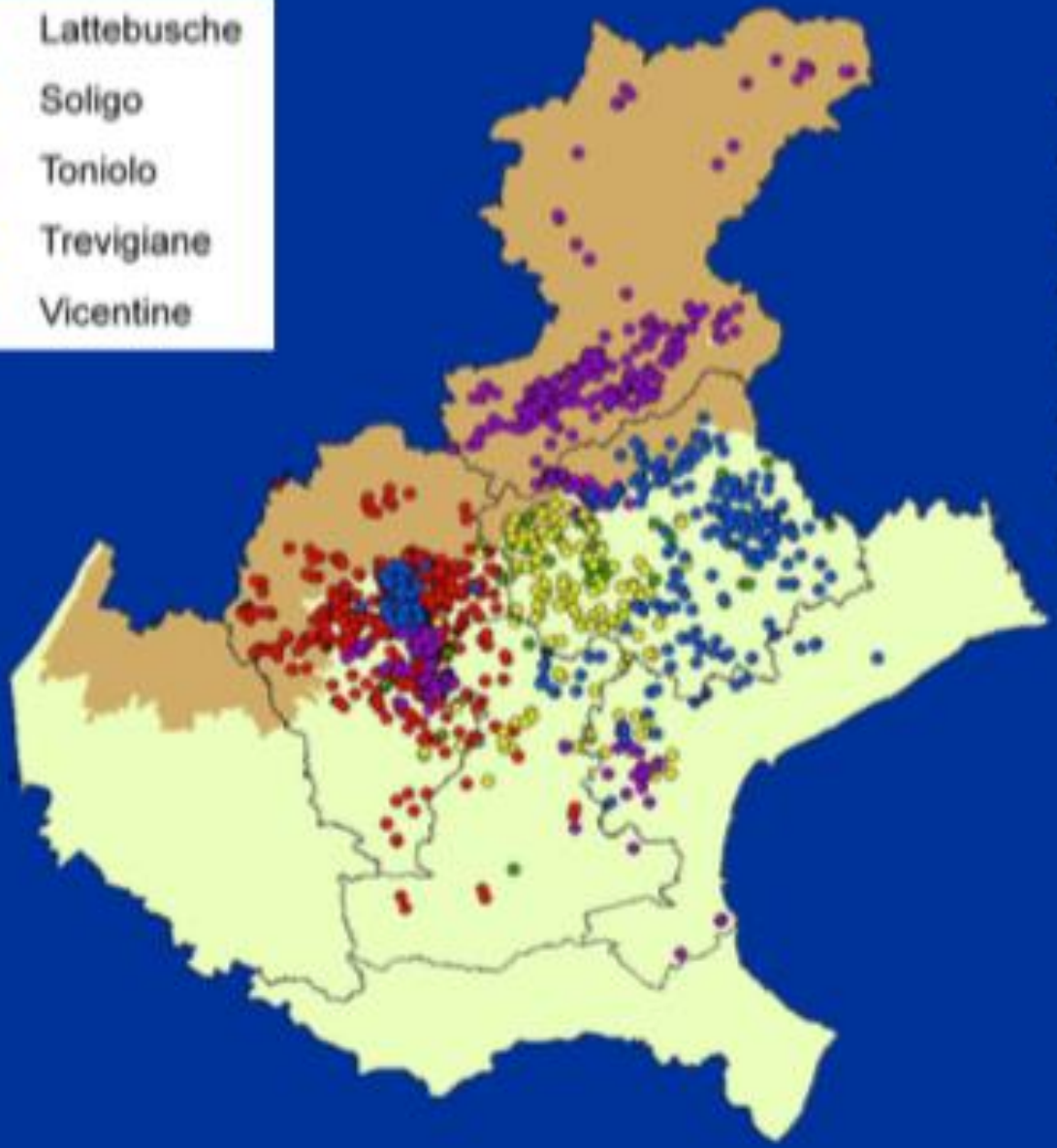




Good coagulation properties

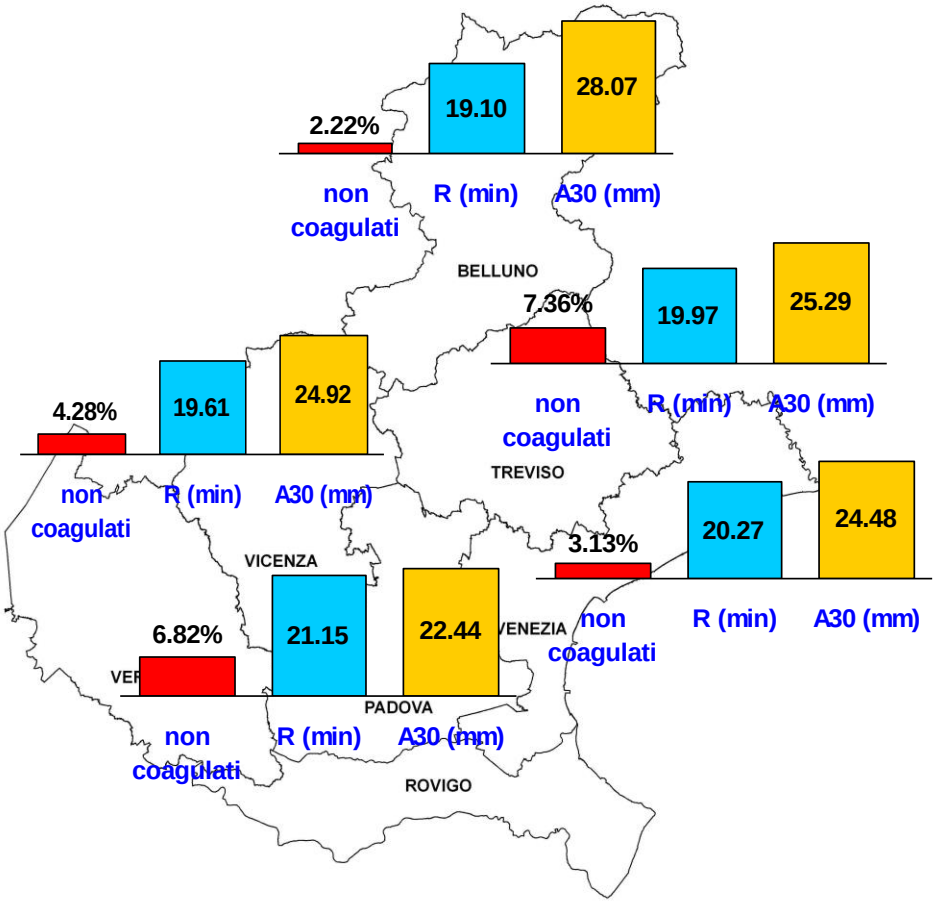


Aziende analizzate



- Analisi qualità 2007
- 13.646 dati
- 1253 aziende
- 5 Caseifici coinvolti
- Laboratori 2
- 5 province su 7
- 239 Comuni analizzati
- LDG (2008) 966 (452 az.)

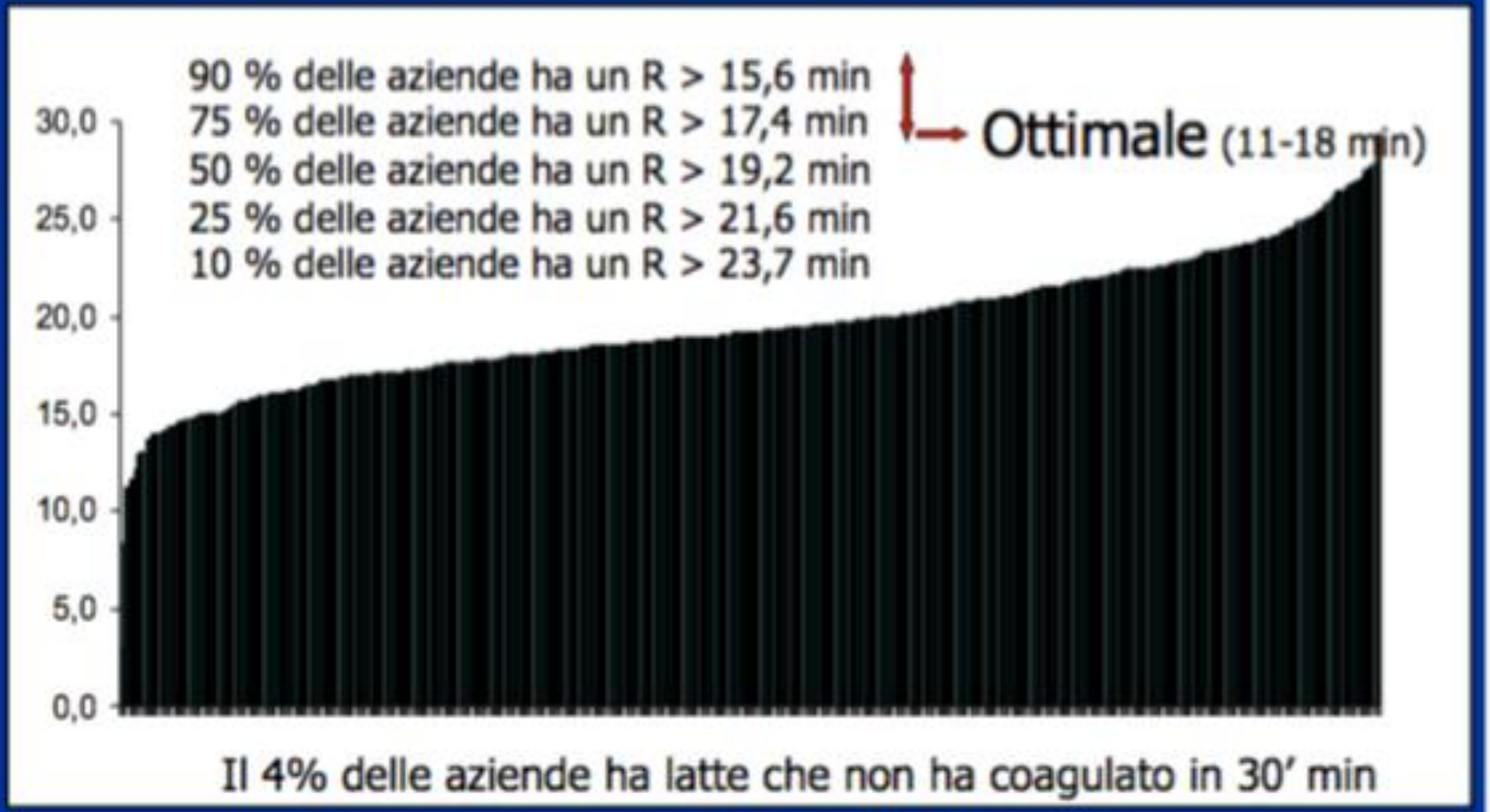
CARTA TERRITORIALE del TEMPO DI COAGULAZIONE (R) e di FORZA DEL COAGULO (A30) NEL LATTE IN VENETO



Dati monitoraggio 2008

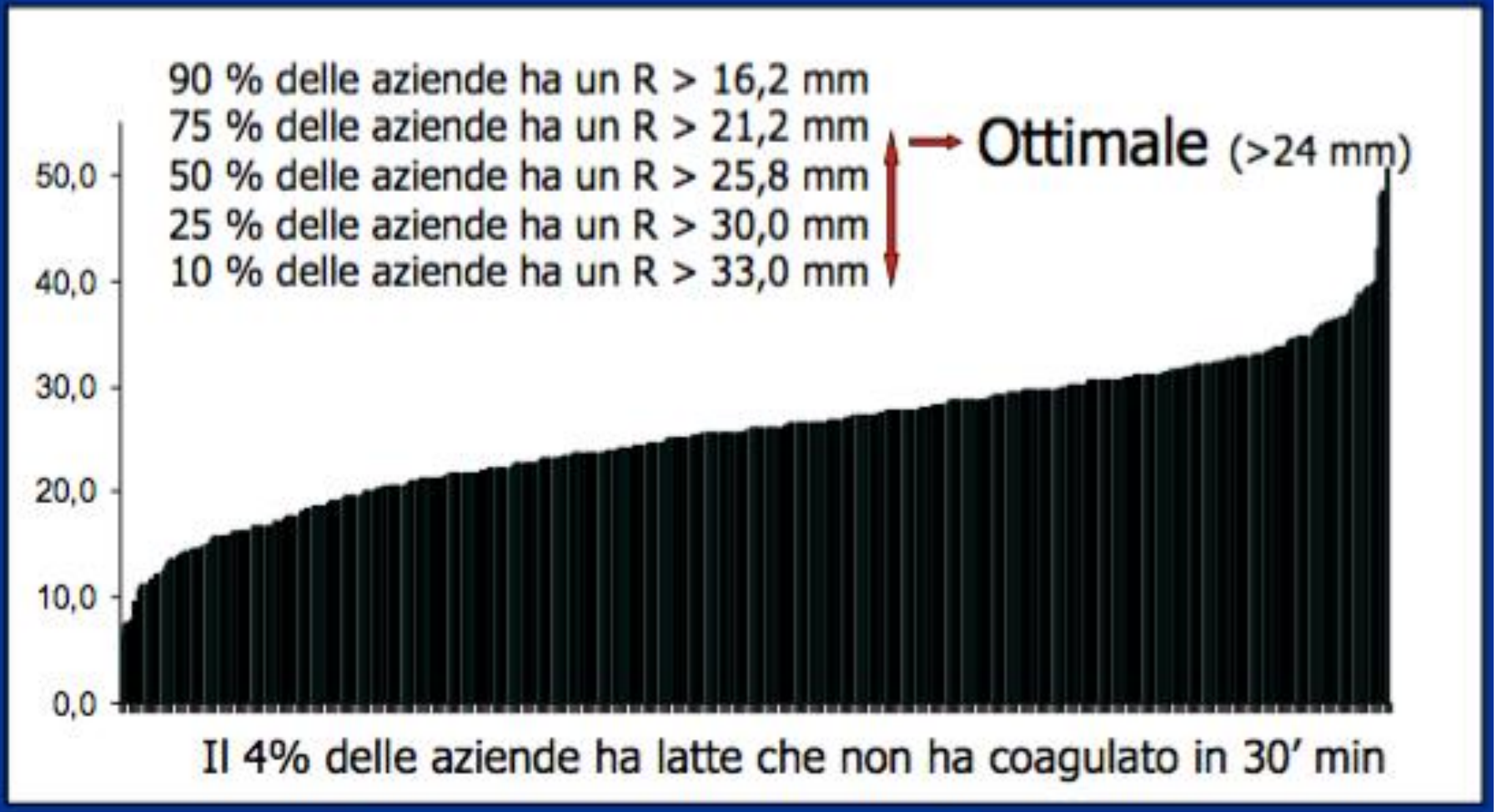
Attività FILATVE – Linea Ricerca 1

Variabilità del TEMPO di COAGULAZIONE nelle Aziende da LATTE in VENETO



Attività FILATVE – Linea Ricerca 1

Variabilità della FORZA del COAGULO nelle Aziende da LATTE in VENETO



Prediction of milk coagulation properties by Fourier Transform Mid-Infrared Spectroscopy (FTMIR) for genetic purposes, herd management and dairy profitability

Martino CASSANDRO e Massimo De MARCHI

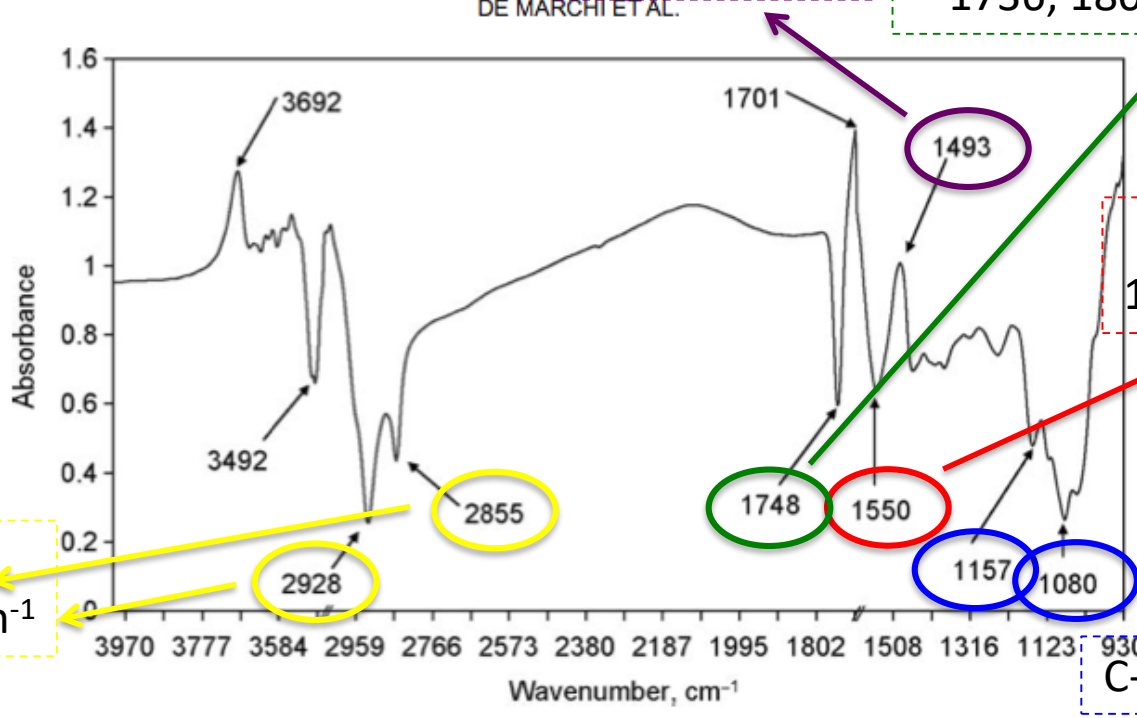
Department of Agronomy, Food, Natural resources, Animals and Environment
DAFNAE - University of Padova - Italy

Predizione del LDG dal FTMIR

1. Fast / No destructive / Easy to use.
2. Largely used by milk labs to assess milk quality and for milk payment or for routine milk recording analyses.
3. Absorptions of IR at frequencies correlated to the vibrations of specific chemical bonds within a molecule (Coates, 2000).

C-H bending
640-1500 cm^{-1}

Fatty acid carbonyl group
1736; 1805;1745 cm^{-1}



Protein
1570-1550 cm^{-1}

Lipids
3000-2800 cm^{-1}

C-O stretching

Predizione del LDG dal FTMIR

2009 → 2010÷2011 → 2012

- 1,200 individual milk samples.
- NO preservative / Analysis within 3 hours.
- Computerized renneting meter (Polo Trade).
- Spectra from Milko-Scan FT120.
- RCT (14.96±3.84 min) and a_{30} (41.7±8.76 mm).
- **RCT = R^2_{cv} of 0.62; a_{30} R^2_{cv} of 0.37.**

RCT model → allows the discrimination between high and low value.

a_{30} → no satisfactory prediction.

K_{20} → no prediction.

Low range of variability (no samples RCT > 29.5 min).

Reference methods / Lab conditions.

De Marchi et al., 2009 J. Dairy Sci. 92:423–432

Predizione del LDG dal FTMIR

2009 → **2010÷2011 →** 2012

- 850 milk samples (individual HF and bulk).
- Preservative / Analysis within 3 days.
- Formagraph (Foss Electric).
- Spectra from Milko-Scan FT6000.
- RCT (19.82±4.59 min) and a_{30} (22.63±10.95 mm).
- **RCT = R^2_{cv} of 0.66; a_{30} R^2_{cv} of 0.70.**

RCT and a_{30} → quite satisfactory prediction models.

K_{20} → no prediction.

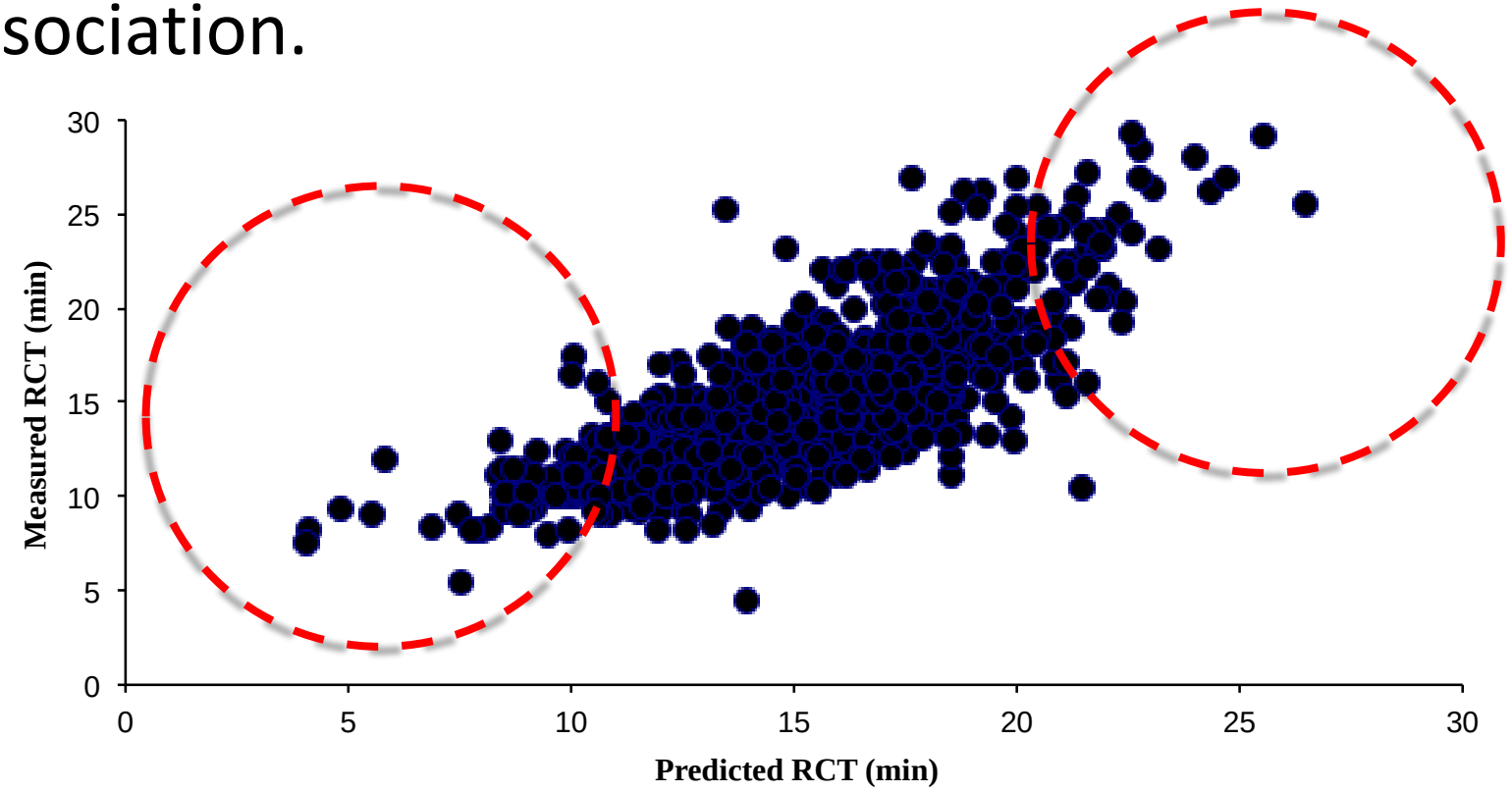
no sample RCT > 29.5 min.

Limited range (RCT from 8 to 25 min).

Predizione del LDG dal FTMIR

2009 → **2010÷2011 →** 2012

Summer 2011 - RCT and a_{30} models were installed in Milko-scan FT6000 of Regional breeder association.



Difficult to predict RCT < 8 and > 24 minutes

Predizione del LDG dal FTMIR

2009 → 2010÷2011 → **2012**

- 350 milk samples (mainly HF).
- Formagraph (Foss Electric).
- RCT, K_{20}, a_{30} and a_{60}.
- Milko-Scan FT6000.
- RCT (range from 7.55 to 59.00 min)

	RCT, min	K_{20}, min	a_{30}, mm	a_{60}, mm
R^2_{cv}	0.76	0.72	0.70	0.42
RPD	2.03	1.96	1.80	1.26
RER	25.22	14.22	28.20	21.20

1-VR = coefficient of determination of cross-validation.
RER = SEC_{CV}/range. RPD = SD/SEC_{CV}.

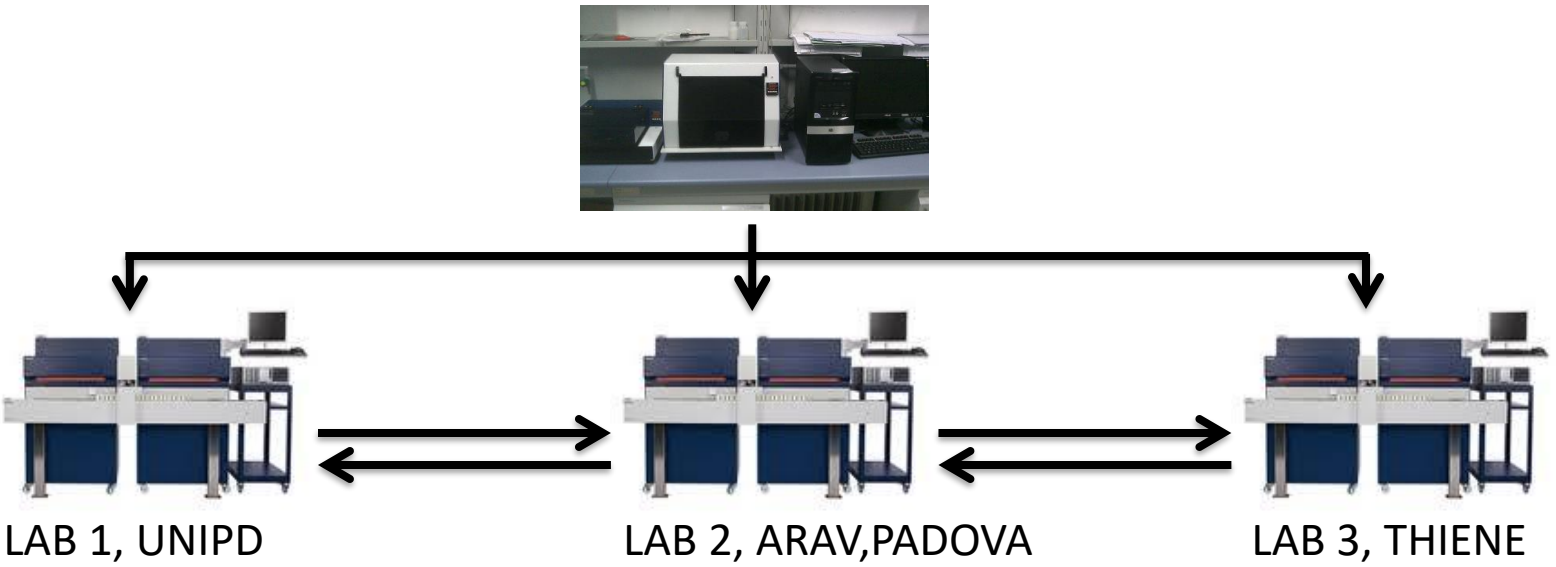
De Marchi et al., 2012

Predizione del LDG dal FTMIR

2009 → 2010÷2011 → **2012**

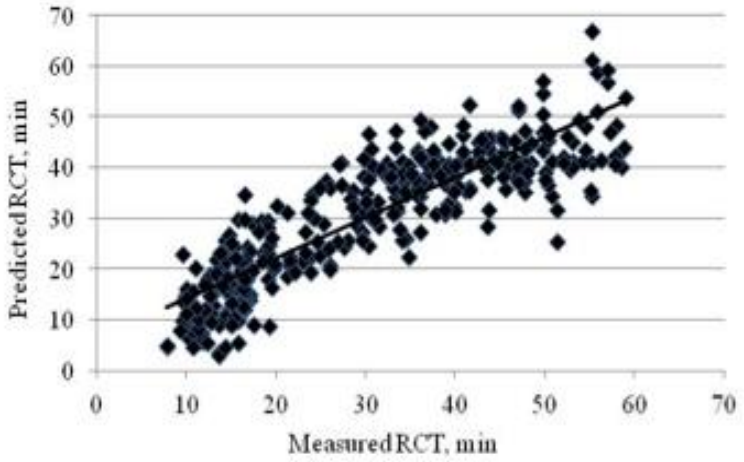
Ring test is carrying out by three labs, twice per month using individual and bulk milk samples to reduce the bias between FTMIR instruments and reference data and among FTMIR instruments.

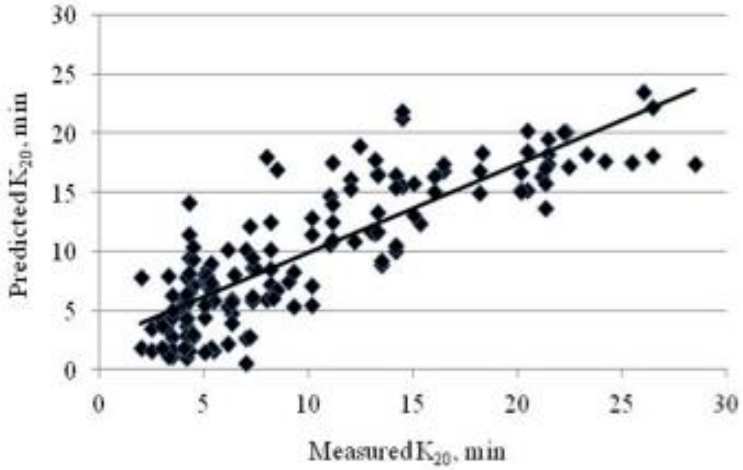
The correlation between LDG values measured by FT6000 and LDG measured by Formagraph in routinely condition range from 0.88 to 0.91 for RCT and a_{30}, respectively (update to April 2012).

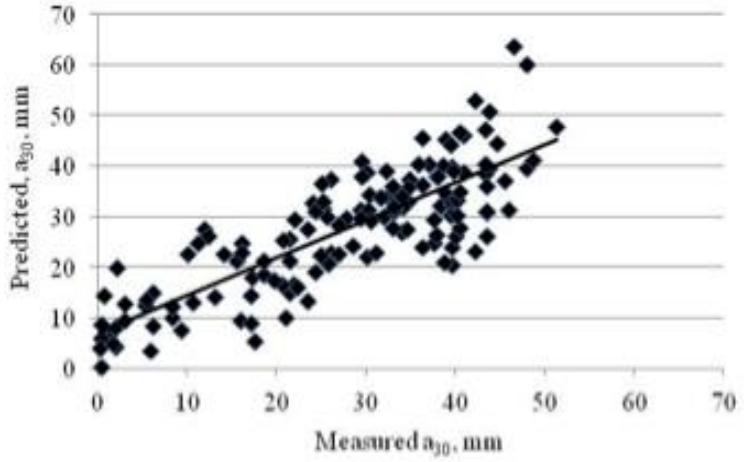


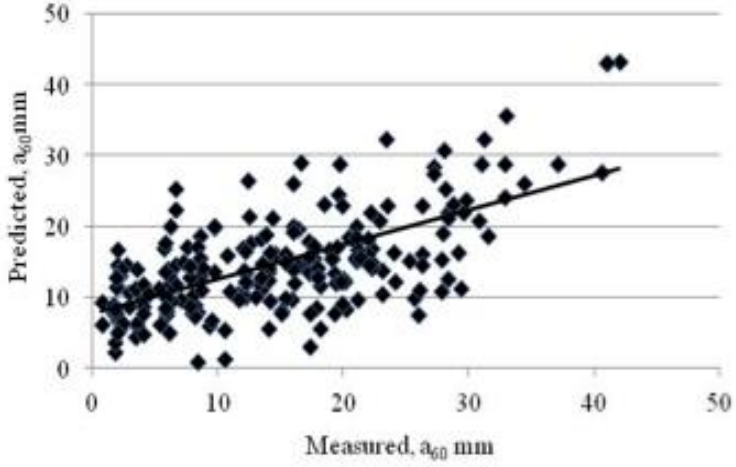
Predizione del LDG dal FTMIR

Scatter plots of predicted (y-axis) on measured (x-axis) (RCT = rennet coagulation time; k_{20} = curd-firming time; a_{30} = curd firmness at 30 minutes; a_{60} = curd firmness at 60 minutes).



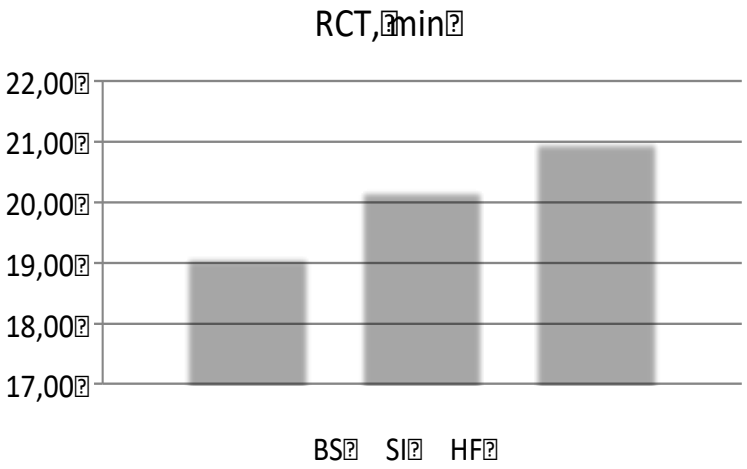


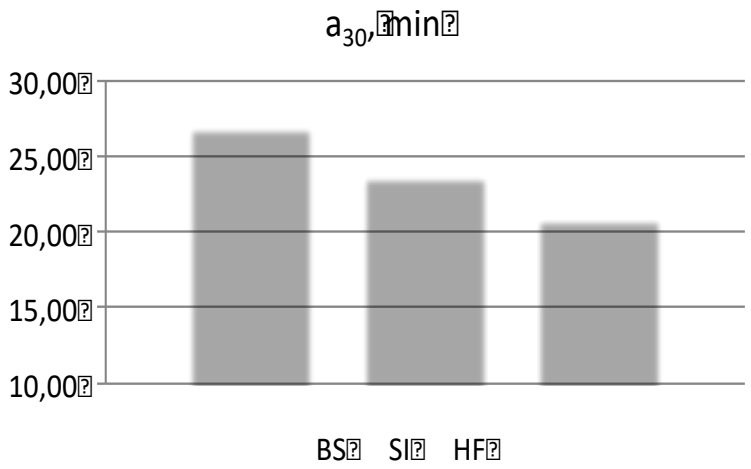


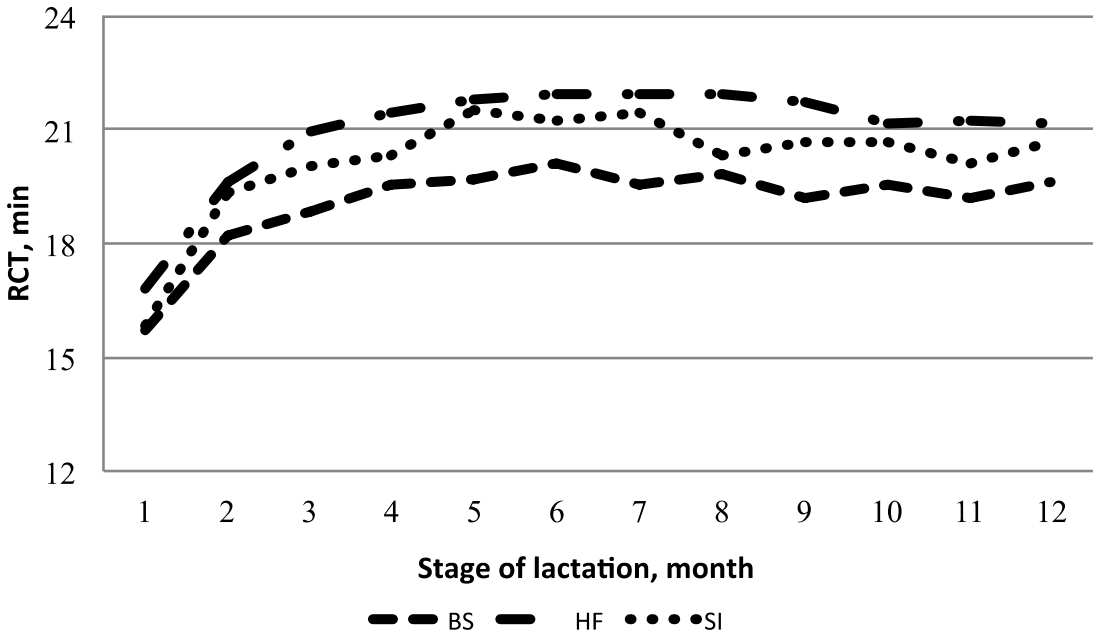


De Marchi et al., 2012

Predicted MCP Values: genetic applications







Predicted MCP Values: genetic applications

Genetic parameters for MCP in Holstein Friesian

312 herds - 3,488 HF cows - 140 bulls

	Mean	SD	Range	h^2	SE
Parity, n	1.9	1.1	1-10		
Days in milk, d	198	130	5-982		
Milk Yield, kg/d	30.90	9.60	3.8-88.0	0.12	0.04
Protein, %	3.40	0.40	2.29-5.87	0.20	0.02
Fat, %	3.72	0.75	1.50-8.75	0.29	0.06
SCS, punti	3.08	1.94	-1.64-10.72	0.03	0.02
pH	6.66	0.10	6.17-7.13	0.19	0.04
RCT, min	**19.50**	**5.00**	**2.90-30.00**	**0.17**	**0.05**
a_{30}, mm	**25.00**	**12.50**	**1.00-64.3**	**0.20**	**0.04**

Measured vs. Predicted MCP: Genetic analysis

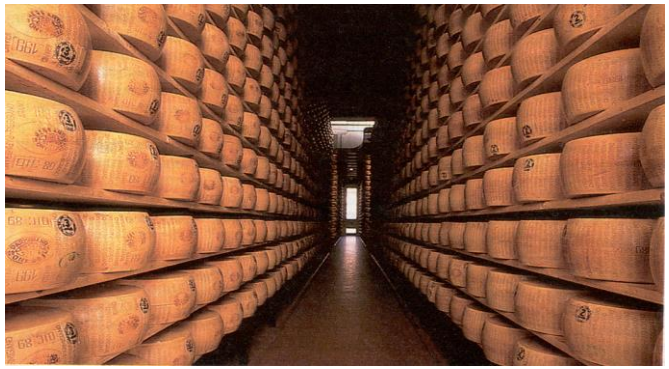
1,200 Brown Swiss cows, 50 sires, 30 herds.
Measured MCP: RCT and a_{30} measured by Coagulometer
Predicted MCP: RCT and a_{30} predicted by Milko-scan FT120

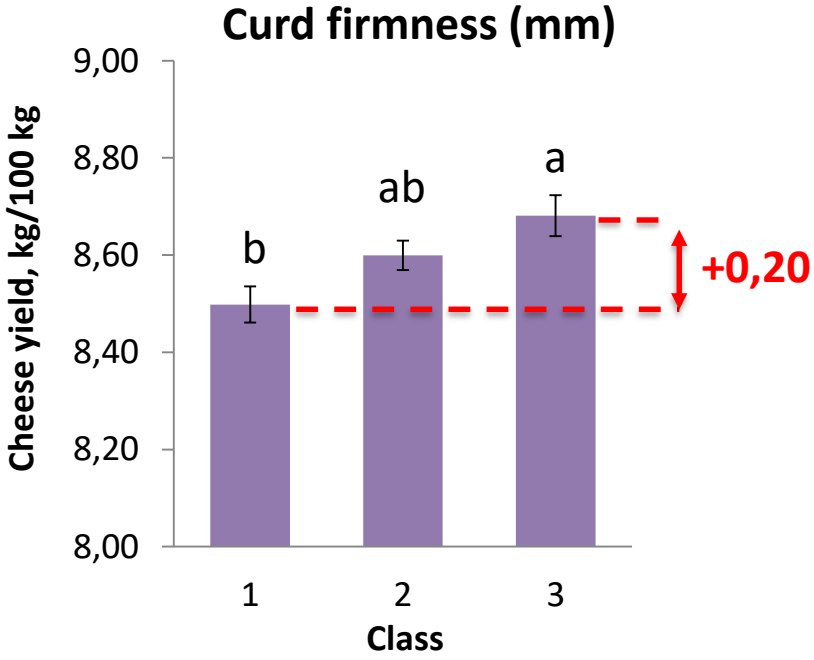
	RCT, min		a_{30}, mm	
	Measured	Predicted	Measured	Predicted
R^2 MIRS	0.64		0.49	
Mean	15.1	14.9	41.5	41.7
σ^2_a	4.9	3.7	19.4	17.2
σ^2_h	1.7	1.5	9.4	5.3
σ^2_e	9.5	4.6	20.6	20.0
h^2	32	37	24	35
r_g	94		77	

De Marchi et al. 2009. J. Dairy Sci. 92:423-432
Cecchinato et al. 2009 J. Dairy Sci. 92:5304-5313

MCP and Dairy Industry: Cheese Yield

		Cheese yield	
Effect[1]	df	SS	P-value
Cheese-making day	11	1.246	<0.0001
Milk fat, %	2	0.525	<0.0001
Milk protein, %	2	0.446	0.0002
TA, SH°/50 mL	2	0.383	0.0006
a30, mm	2	0.175	0.0277





Mean per class: 20.52 - 26.05 - 31.88

Pretto et al. – 2012, J. Dairy Research

Attitudine Casearia

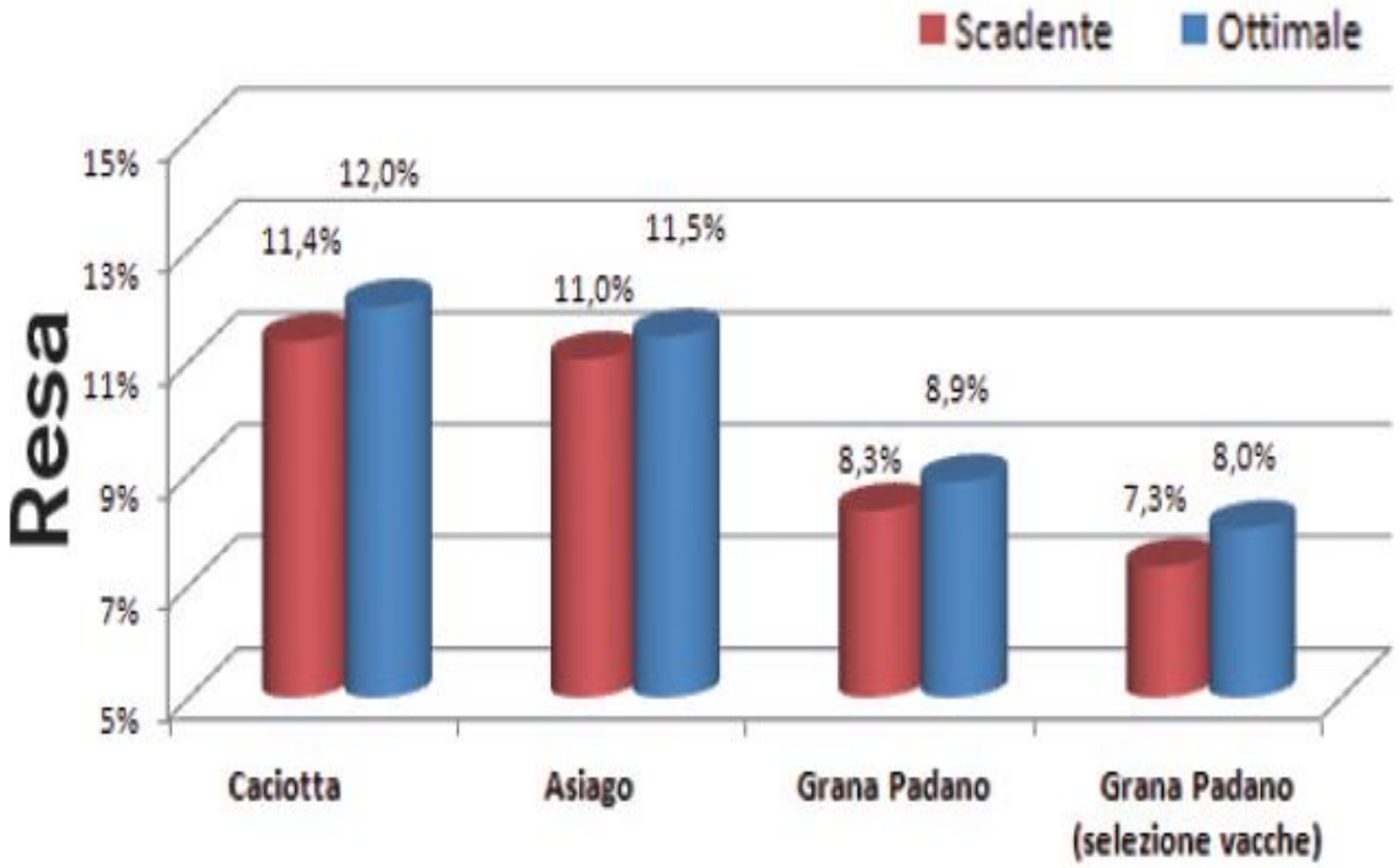


Fig.4 - Risultati delle prove industriali effettuate presso caseifici del Veneto.

Profit Function

The profit per cow per year (Π) was calculated using the following function:

$$\Pi = R - C, \quad [1]$$

where R are revenues and C are costs per cow. In the present study, only revenues from selling of Grana Padano cheese, butter and whey, and only costs for feed related to milk production, milk collection, and cheese processing were assumed to be a function of the evaluated milk traits. All other revenues and costs on farms were not considered in the profit function because their partial derivative with respect to these milk traits is zero.

The dairy market in Europe has been restricted by a quota system, which was introduced by the European Union and was in place from 1984 to April 2015. In

Table 1. Production parameters in the basic situation

Production parameter[1]	Mean
305-d milk production, kg	9,072[2]
Fat, %	3.66[2]
Protein, %	3.31[2]
Casein, %	2.58[3]
305-d fat production, kg	332
305-d protein production, kg	300
305-d milk carrier production, kg	8,440[4]
RCT, min	16.90[5]
a_{30}, mm	32.00[5]

[1]RCT = rennet coagulation time; a_{30} = curd firmness 30 min after rennet addition.

[2]AIA (2012).

[3]Assuming a protein to casein ratio of 0.78 (Norman et al., 1991).

[4]Calculated as milk production − (fat production + protein production).

[5]Cassandro et al. (2008).

J. Dairy Sci. 99:1–8
http://dx.doi.org/10.3168/jds.2015-10228

Estimation of economic values for milk coagulation properties in Italian Holstein-Friesian cattle

M. Cassandro,*[1] D. Pretto,† N. Lopez-Villalobos,‡ M. De Marchi,* and M. Penasa*
*Department of Agronomy, Food, Natural Resources, Animals and Environment, University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy
†Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, Kreutzwaldi 1, 51014 Tartu, Estonia
‡Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North, New Zealand

Table 4. Economic values (EV, €/unit of the trait) and relative standardized economic weight (rEW, %) of milk coagulation properties (MCP) and production traits[1]

		0%		2.5%		5%		10%	
Trait[2]	σ_g[3]	EV	rEW	EV	rEW	EV	rEW	EV	rEW
RCT, min	2.22			−2.213	1.5	−4.426	2.8	−8.852	5.4
a_{30}, mm	4.06			0.877	1.1	1.755	2.1	3.509	3.9
305-d fat production, kg	33.7	2.109	21.6	2.109	21.1	2.109	20.6	2.109	19.6
305-d protein production, kg	27.1	8.627	71.2	8.627	69.3	8.627	67.7	8.627	64.6
305-d carrier production, kg	875.4	0.027	7.2	0.027	7.0	0.027	6.8	0.027	6.5

[1]Different scenarios (0, 2.5, 5, and 10%) of increments in cheese yield due to the effect of MCP are presented. Relative standardized economic weight for trait i calculated as $rEW_i = 100 \times |EV_i \times \sigma g_i| / \sum_i |EV_i \times \sigma g_i|$ (Komlósi et al., 2010).

[2]RCT = rennet coagulation time; a_{30} = curd firmness 30 min after rennet addition.

[3]Genetic standard deviation. Values for MCP and production traits were retrieved from Cassandro et al. (2008) and Interbull (2011), respectively.

2,6 % **4,9%** **9,3%**

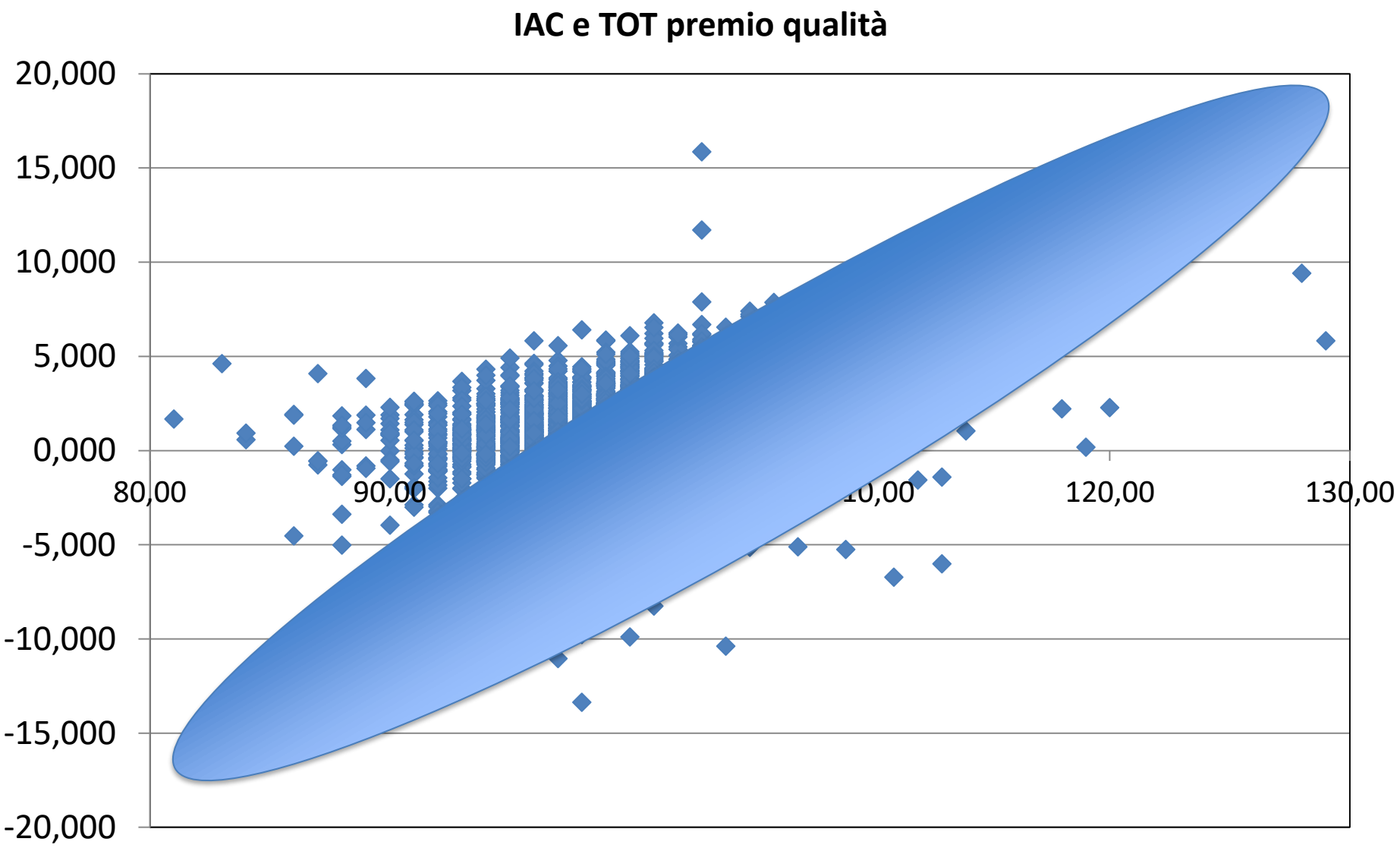
Università degli Studi di Padova
DAFNAE Department of Agronomy Food Natural resources Animals Environment

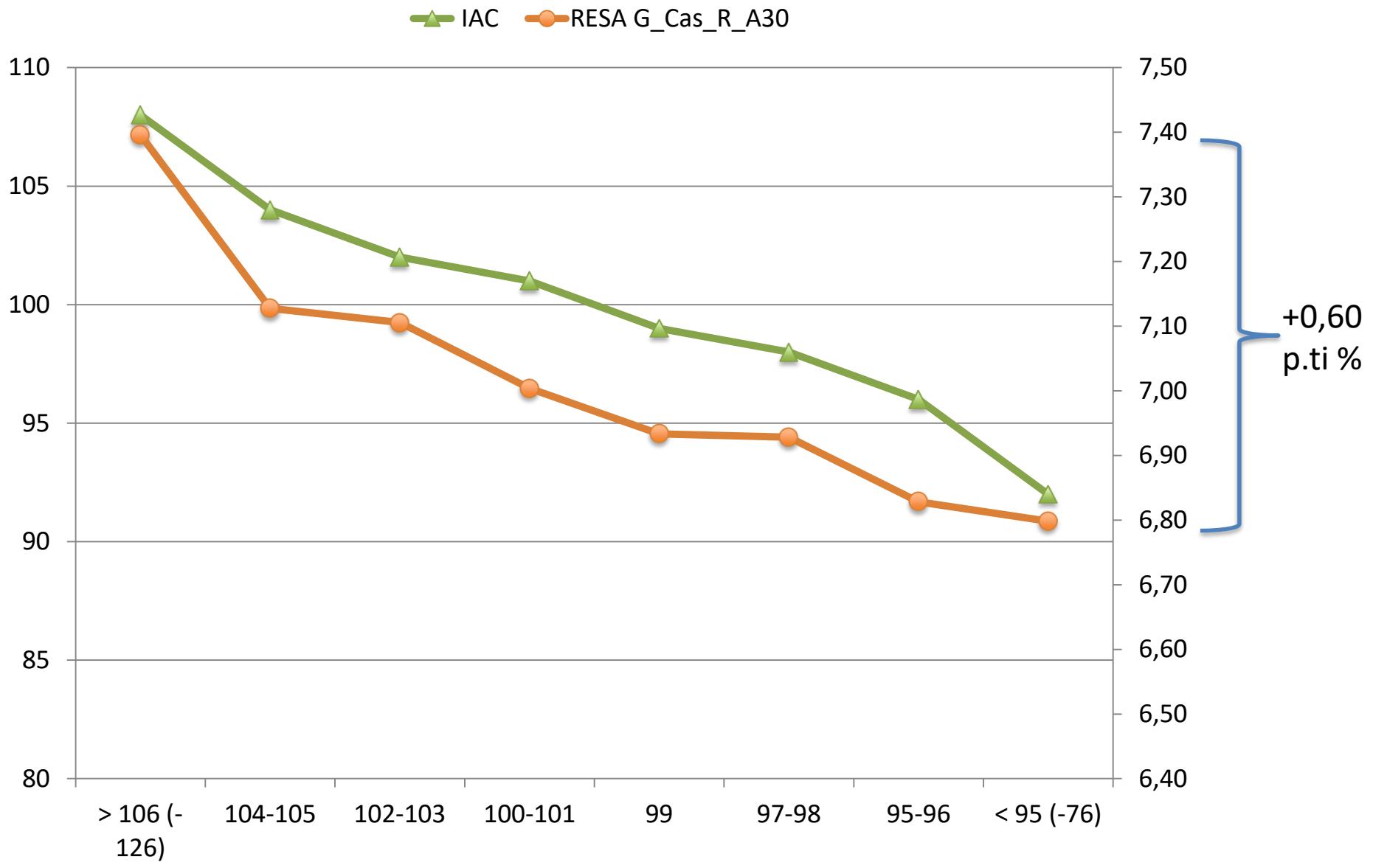
Carattere	N. Az	MEDIA	DS	Minimo	Massimo
IAC, punti	377	100	4,9	83,1	116,7
RCT, min	377	19,4	1,6	14,4	25,1
A30, mm	377	29,2	3,2	19,7	40,0
GRS,%	377	3,91	0,19	3,47	4,72
PRT, %	377	3,38	0,15	2,91	3,87
Cellule som.	377	260,9	97,4	57	743,3
Carica batt.	377	58,96	79,35	10,57	782,0
Lattosio,%	377	4,82	0,08	4,44	5,13

UNIVERSITÀ DEGLI STUDI DI PADOVA

DAFNAE
Department of Agronomy Food Natural resources Animals Environment

Dati da gennaio a ottobre 2012


IAC e TOT premio qualità
20,000
15,000
10,000
5,000
0,000
-5,000
-10,000
-15,000
-20,000
80,00
90,00
10,00
120,00
130,00


IAC
RESA G_Cas_R_A30
110
105
100
95
90
85
80
7,50
7,40
7,30
7,20
7,10
7,00
6,90
6,80
6,70
6,60
6,50
6,40
+0,60
p.ti %
> 106 (-126)
104-105
102-103
100-101
99
97-98
95-96
< 95 (-76)

Conclusioni

L'IAC rappresenta un interessante parametro di qualità tecnologica del latte, oggi disponibile a tutti i soci ARAV e potenzialmente a tutti gli allevatori iscritti ai CC.FF.

I soci di ARAV presentano una variabilità significativa per l'IAC che merita attenzione, miglioramento e un prossimo riconoscimento economico.

Indice

SEMINARIO
AIA Laboratori e 19° ARAL SATA

Nuove tecnologie analitiche e strumenti innovativi al servizio della consulenza

24 - 25 GENNAIO 2017

PADENGHE SUL GARDA (BS)
VIA PRAIS, 32 - WEST GARDA HOTEL

Variazioni fenotipiche, genetiche e valori economici
Martino Cassandro / Massimo De Marchi

Implementazione indice IAC
Stefano De Paoli

Ricerca e sviluppo laboratorio latte qualità ARAV
Sofia Ton

UNIVERSITÀ DEGLI STUDI DI PADOVA

DAFNAE
Department of Agronomy Food Natural resources Animals Environment