



75° EAAP, September 3, 2024 – Florence (IT)
*Session 59: «Milk properties for the valorization of dairy
(by-products) manufacturing » - Abstract N°:2214523*

Valorization of bioactive components in milk: exploring environmental and animal factors on the variability of milk minerals in dairy cattle

A. Zanotti, G. Stocco, A. Summer, A. Lotto, S. Blotta, S. Biffani, M. Ablondi, C. Cipolat-Gotet



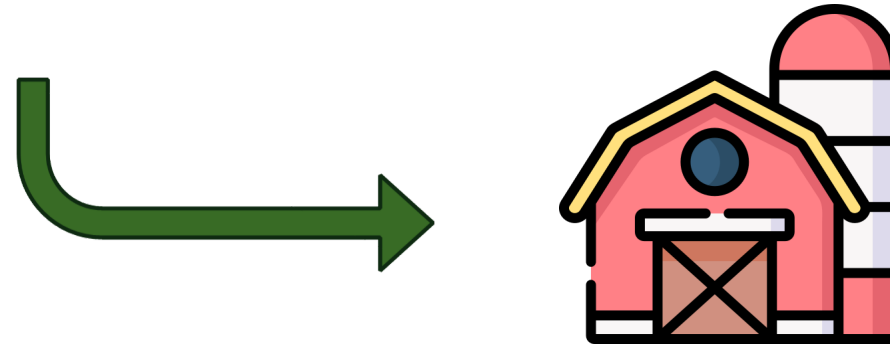
Parma
Unit for
Livestock
Science and
Education



andrea.zanotti@unipr.it

State of art of minerals in milk

- Animal factors (DIM, Parity, DMY)
- Genetic parameters
- Nutrition
- **Environmental factors**



Based on the numbers of published papers

«**HERD**»
Factor

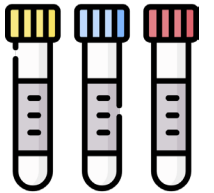
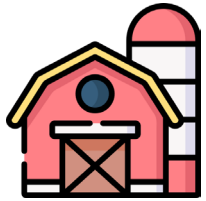
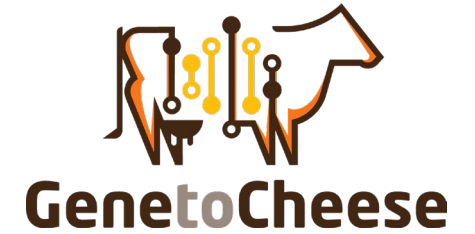


Analyse environmental factors

Influencing

Minerals in milk

Material & Methods - Experimental design



53 herds on
12 months

53 forms
(1/herd)

1060 Brown
Swiss cows
(20/herd)

2120 L of milk
(2 L/cow)

Material & Methods - Milk analyses

- Fat, protein, casein, lactose and total solids
- Infrared spectrometer

Milkoscan FT3, Foss Electric, Hillerød, Denmark



- Ca, Mg, K, S, P, Cl, Na
- Wavelength Dispersive X-ray fluorescence, non-destructive technique, calibrated on ICP

WDXRF; S6 jaguar, Bruker Corporation, Billerica, MA, USA

All the analyses were made in Milca lab (university of Parma) and Nutristar (Reggio Emilia)

Material & Methods - Form

- Season
- Altitude
- Temperature
- Humidity
- Ventilation
- Diet

UNIVERSITÀ DI PARMA
DIPARTIMENTO DI SCIENZE MEDICO-VETERINARIE

Campionamento GENETOCHEESE

Codice AUA
Destinazione latte 374003

ALLEVAMENTO
Conduzione familiare
Dipendenti

ORGANOGRAMMA
Anno Costruzione allevamento
Presenza altre razze
Vacche in lattazione
Numero bovini totale
Stabilizzazione
Cuccette
Materiale lettiera cuccetta/lett. perm. 125
BOX PALLA BOX INFERMAGLIA
Pascolo
Ventilazione e raffreddamento
Nebulizzatori

ALLEVAMENTO e STABILIZZAZIONE
Numero... 70
Numero... 68
Numero... 125
Lettera permanente
Fissa
Sala sala
Tipologia: a+4
Numero poste/gruppi: 62 / 0051

IMPIANTO DI MUNGITURA
Unifeed
Autoalimentatori
Tradizionale

ALIMENTAZIONE
SI NO
GIUGER OMCIO
+ FRESCHIE ACQUA
A POCCHIA 25K
+ HANZE UNIFEE
VIRELLI BORGHIO
A R. CATE
+ ACQUA
+ HANZIO
FINO 3 MESI
+ 3 BOX - D 7 GRADUANDA
2-9 (20 GIORNI PRIMA PALLA) CACCIO
+ BOX - D 3-8 MESI (1 BOX)
+ BOX - D 16 MESI (FREQUAZIONE)

Material & Methods - Form

Temperature, Humidity



Used together to create a
Temperature Humidity Index (THI)
(Mader et al., 2006)

<72: no heat stress

73-79: moderate heat stress

≥80: high heat stress

Altitude

≤300asl: plain

300-600asl: hill

≥600asl: mountain



Diet

Dry TMR

Silage TMR

Traditional



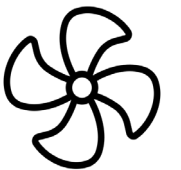
Season

Spring, summer,
autumn, winter



Ventilation

yes, no



Material & Methods - Statistical model

$y = \text{Minerals}$

Fixed factors

Random factors



DIM



Parity



DMY



Herd

e

Residuals

Nested factors



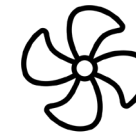
Season



Altitude



THI



Ventilation



Diet



Results

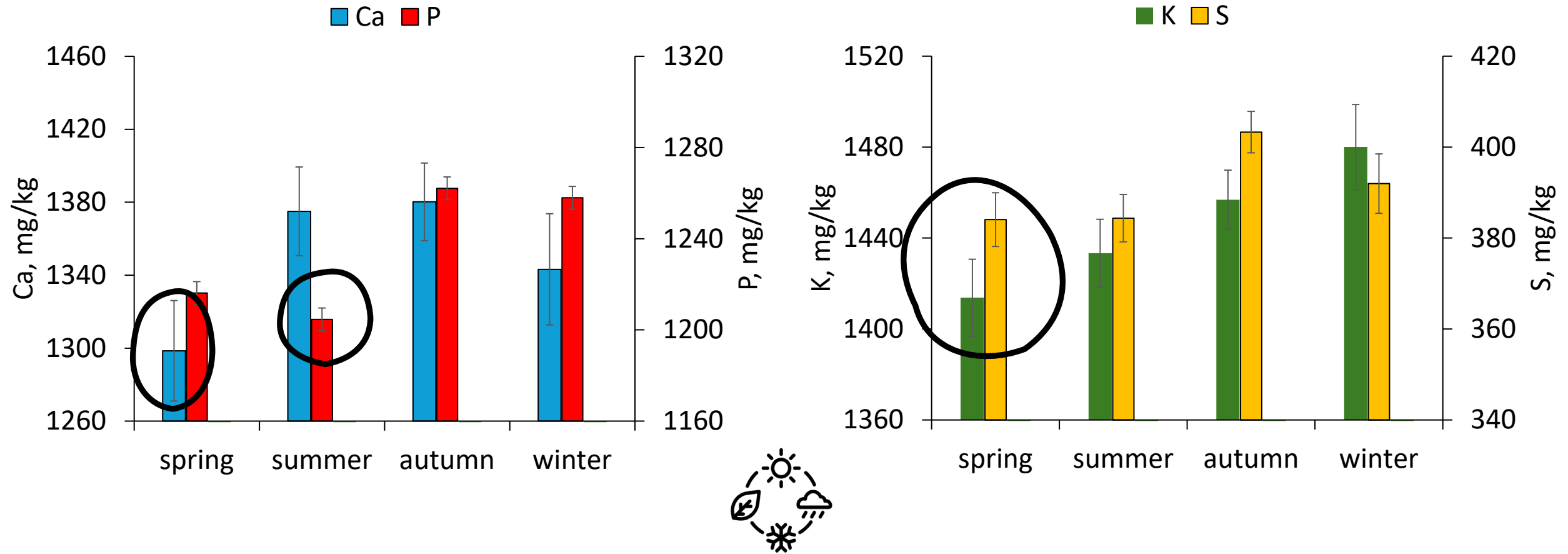
Results - ANOVA



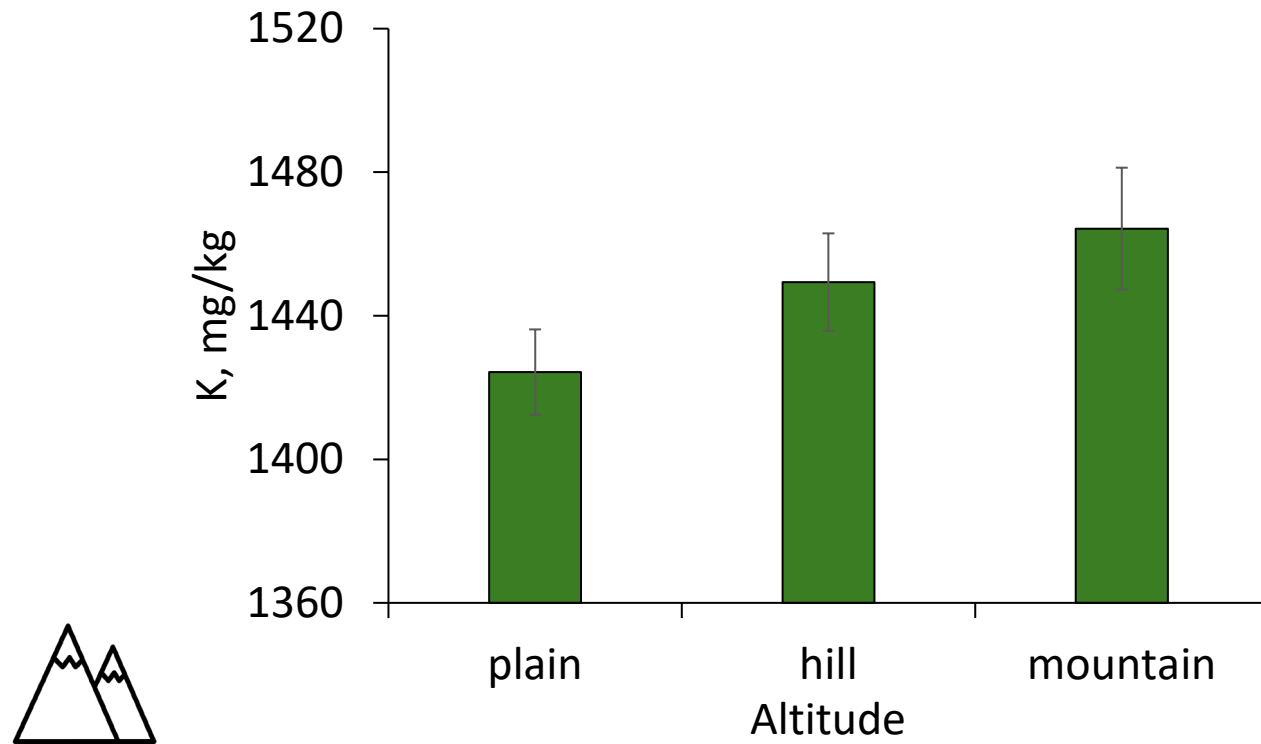
	% of variance explained by "Herd"		Environmental factors					Herd (% on total variance)	RMSE
	Present study	<i>Stocco et al. 2021</i>	THI	Altitude	Season	Diet	Ventilation		
Ca	19	10			**			1.44	113
Mg	44	15						0.23	12
K	22	12		*	***			0.63	74
S	21	/			***	**		9.24	29
P	12	27	*		***	***	*	0.03	107
Cl	12	/						0.35	105
Na	15	14						0.00	77

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

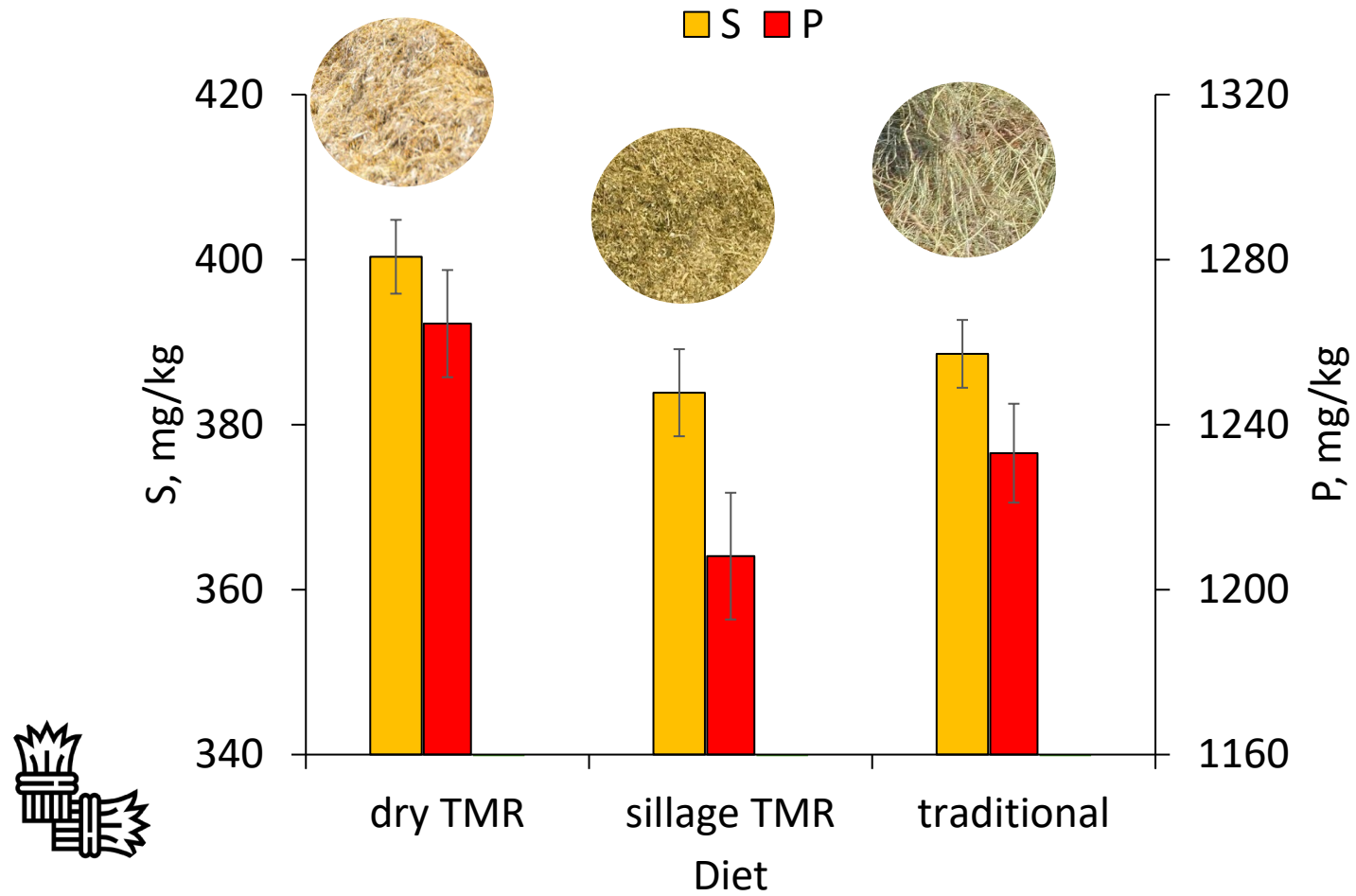
Results - Season



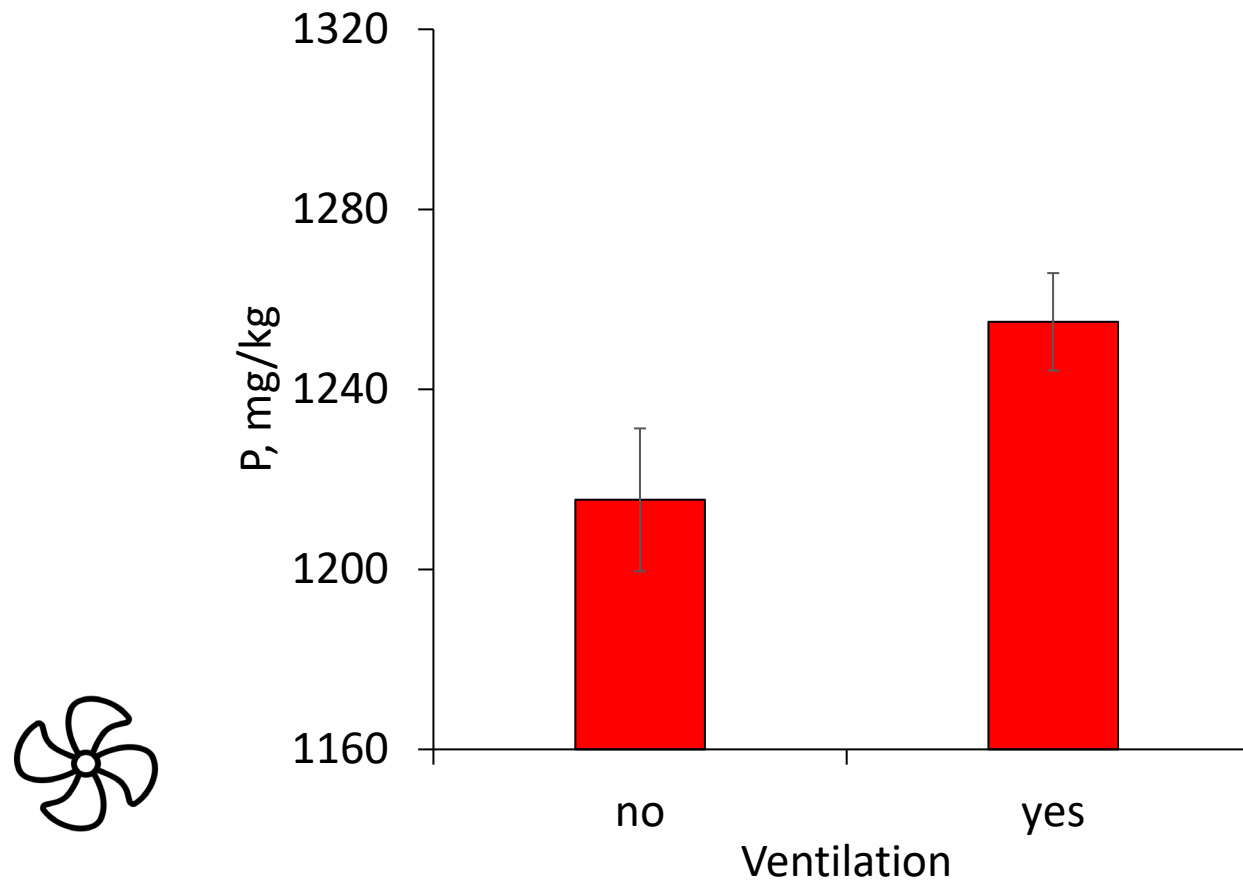
Results - Altitude



Results - Diet



Results - Ventilation



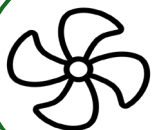
Take home message



Exploring HERD factor allows a better understanding of what influences each mineral



Diets with high forages:
higher minerals in milk suitable for
cheesemaking



Minerals can be exploited as indirect
indicators of animal welfare



Mountainous environment might increase
udder health and milk quality

Future perspectives

Inclusion of an animal model to
evaluate genetic parameters of milk
minerals



Further investigations with selected
environmental factors for each
mineral, increasing the database to
create interactions between factors



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Thanks for your attention