Use of thermography for the detection of subclinical mastitis in Italian Mediterranean Buffalo

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The Agenda

1 **Mastitis**

Why detect mastitis?

2 **Screening**

How to detect
Mastitis rapidly

3 **Technology**

The Infrared
Thermography

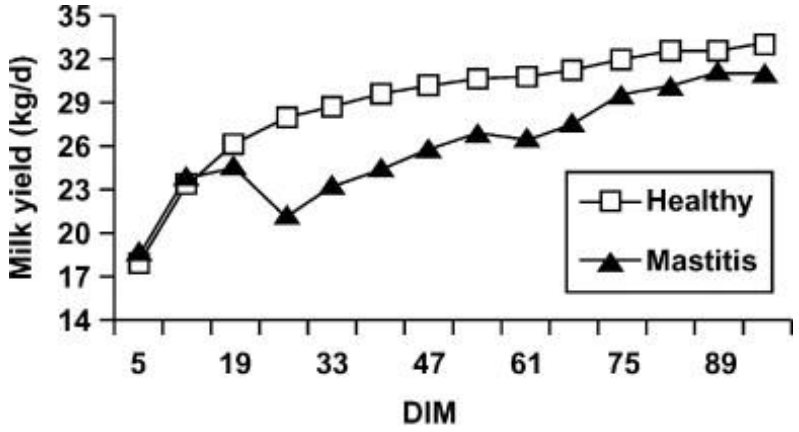
Part I – Introduction

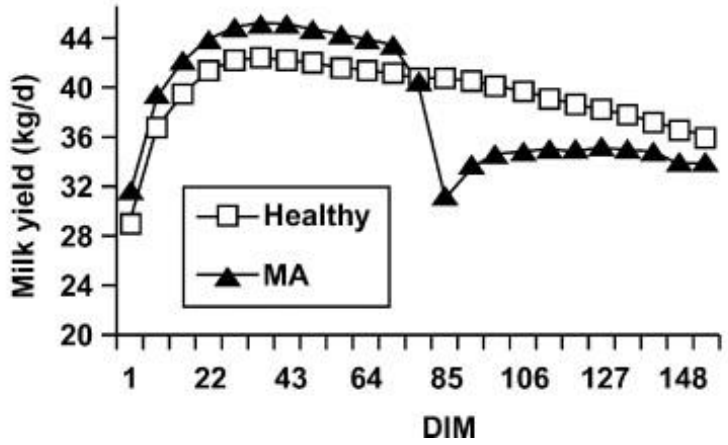
Mastitis

Bovine mastitis is an inflammatory response of the udder tissue in the mammary gland due to physical trauma or microorganism infections.

Mastitis causes losses in animal welfare and productivity

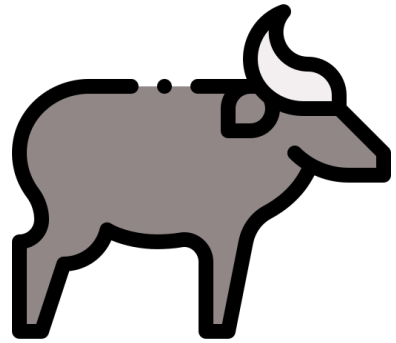
The expenses that lead to medical treatments add up to these losses.



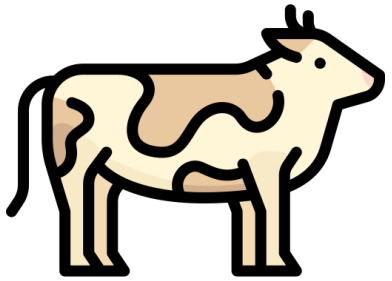


Buffalo and Cow have different anatomy and physiology!

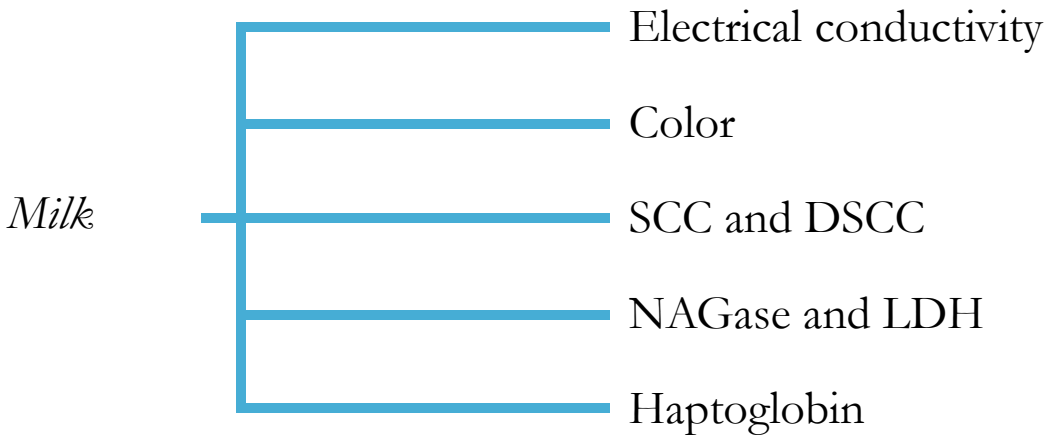
This explains the lower incidence of mastitis in Buffalo farming. However, the alert for this pathology must be high in both species.



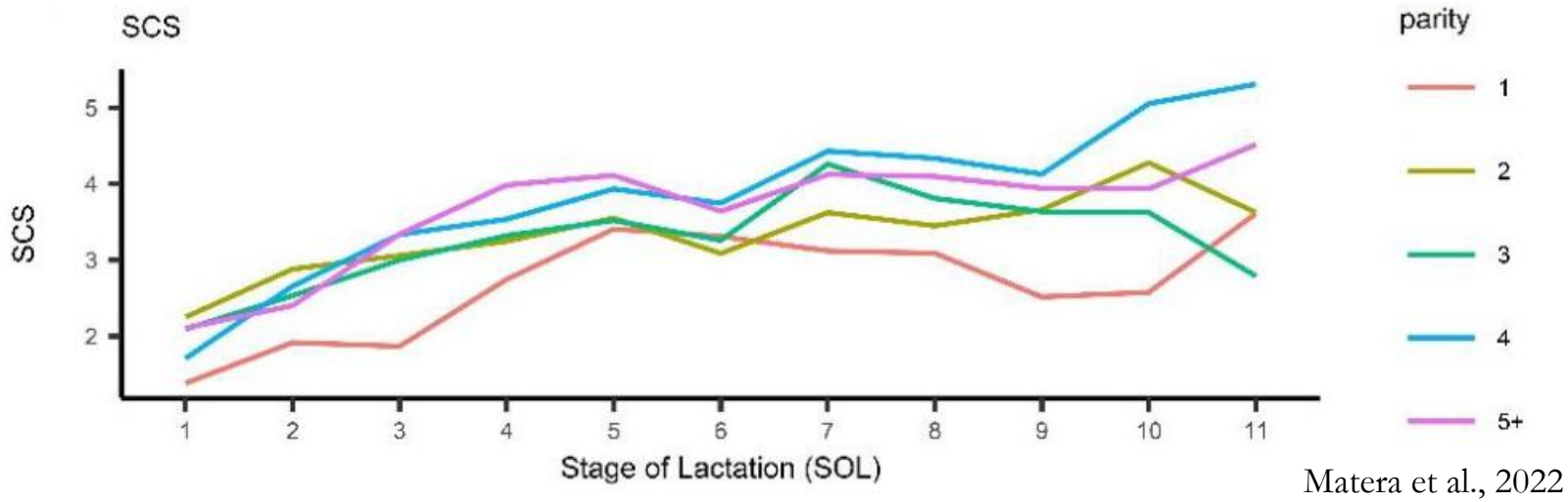
vs



Techniques for rapid screening



Somatic Cell Count



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The cut-off used for somatic cells is 200,000 Cells/mL

Linear Score

LS is a logarithmic to base 2 conversion of somatic cell count.

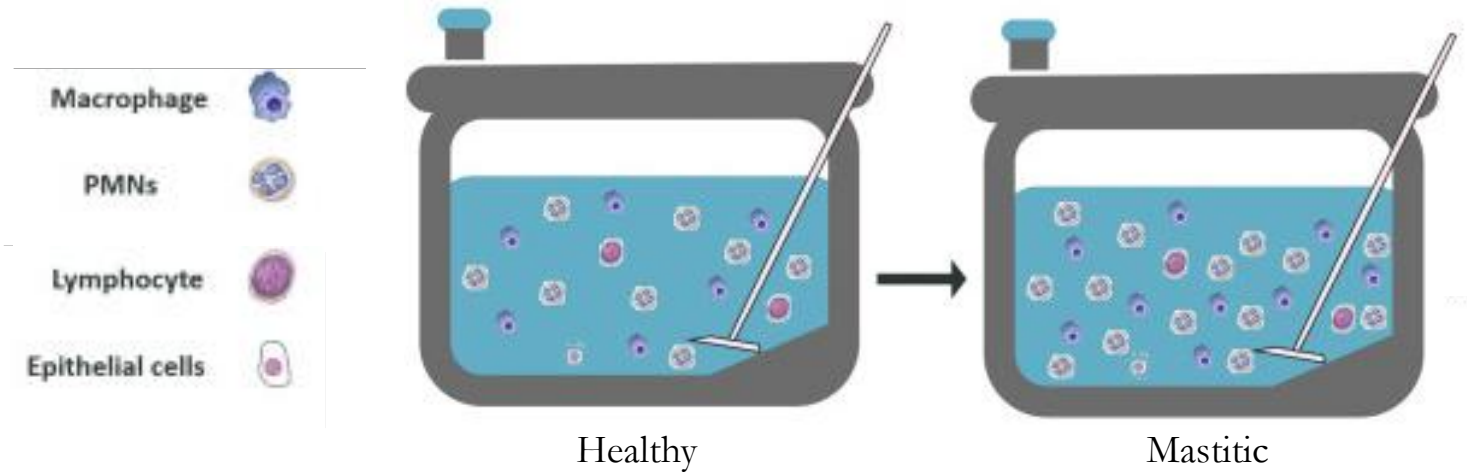
It reduces the variability of the SCC and expresses somatic cells as a linear measure.

Linear Score	Mean SCC	SCC Range
0	12.500	0-17.000
1	25.000	18-34.000
2	50.000	35-70.000
3	100.000	71-140.000
4	200.000	141-282.000
5	400.000	283-565.000
6	800.00	566-1.130.000
7	1.600.000	1.131-2.262.000
8	3.200.000	2.263-4.525.00
9	6.400.000	4.526.00+

California Mastitis Test

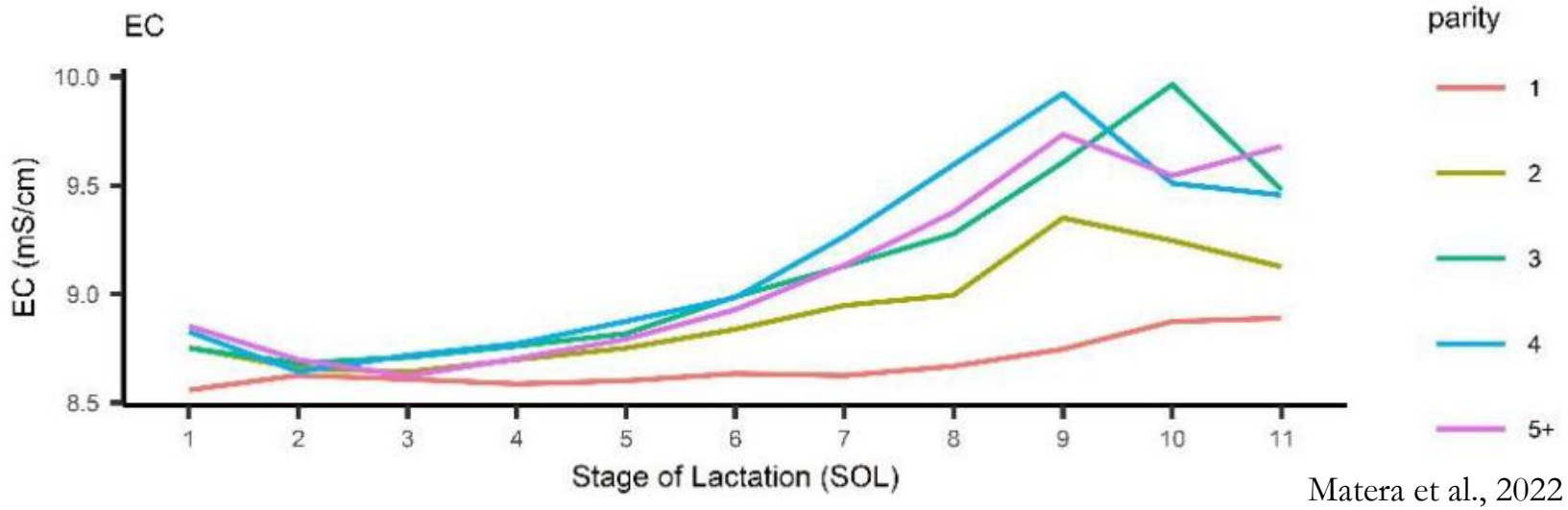
Reading		
Aspect	Score	
	Value	Cross
Consistency normal or Gray color	0	(0)
Light gel disappearing after stirring or Purplish gray color	1	(±)
Light persistent gel-crumbly filaments or Purple gray	2	(+)
Immediate thickening viscous cluster at the bottom of the well	3	(++)
Thick gel consistency of egg white color dark purple	4	(+++)

Differential Somatic Cell Count



The Differential Somatic Cells Count is expressed as the percentage of PMNs and Lymphocytes.

Electrical Conductivity



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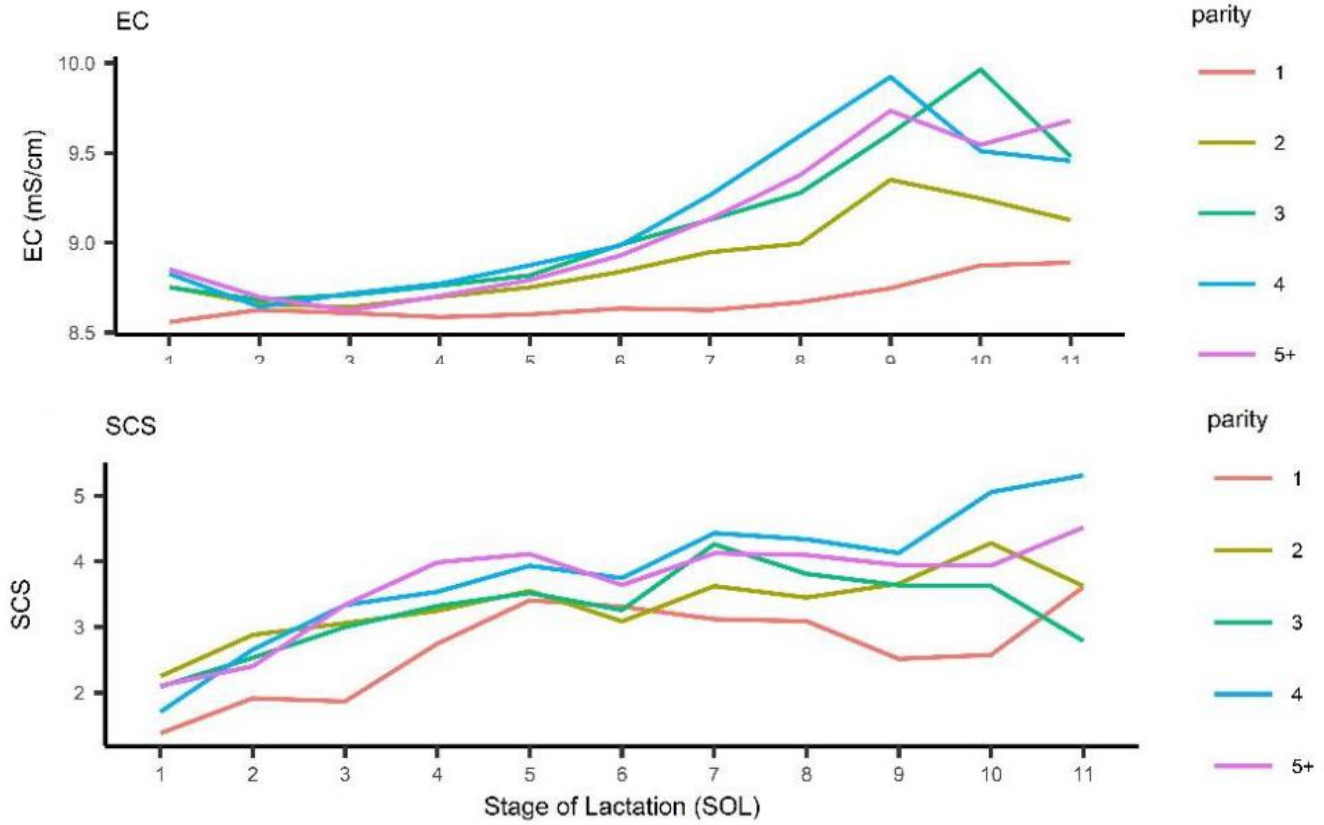
Electrical Conductivity and SCC



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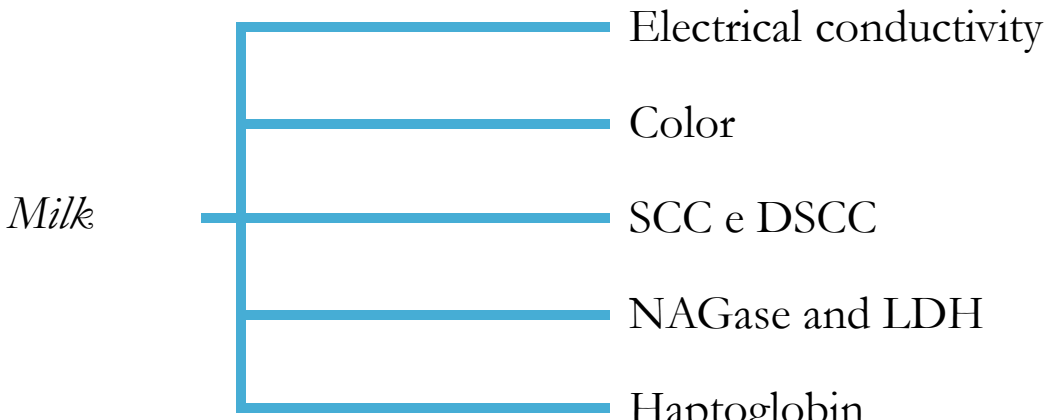
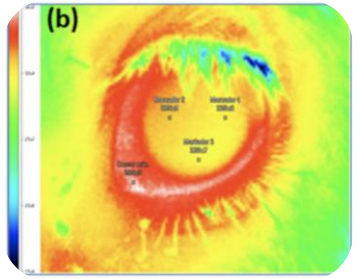
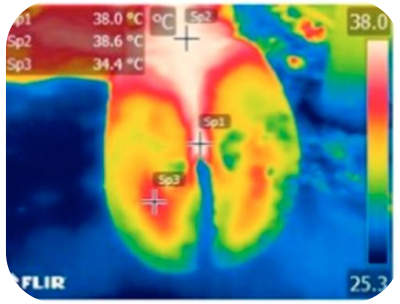
Techniques for rapid screening



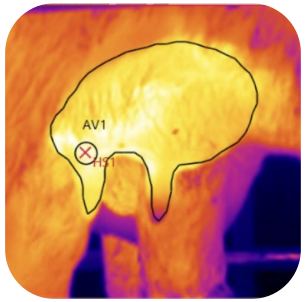
Infrared Thermography as fast and non-invasive screening technique



Eye



Hoof

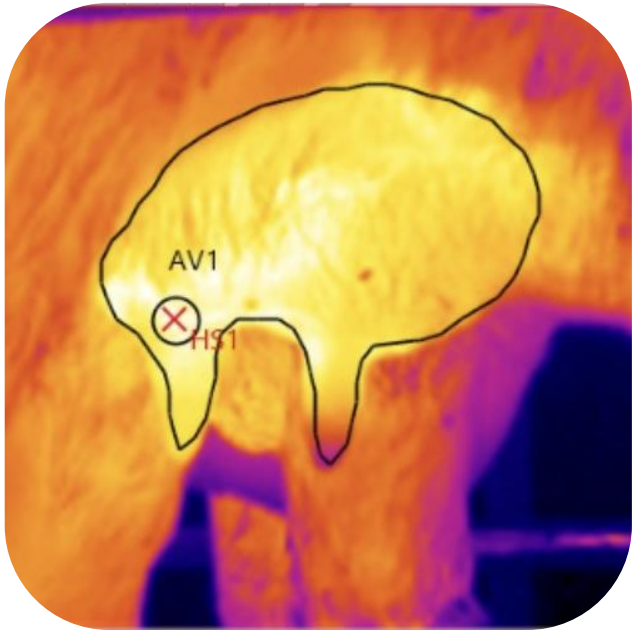


Udder

Part II – Experiment

Aim of the study

The purpose of the study was to evaluate the use of infrared thermography (IRT) as a fast and non-invasive instrument for the detection of subclinical mastitis, taking into account the temperature and relative humidity of the air at the time of sampling.



Materials and Methods

59 Buffaloes of a farm in Caserta

20-127 Days in Milk

3 Samplings in March, April and May

2 Images per udder

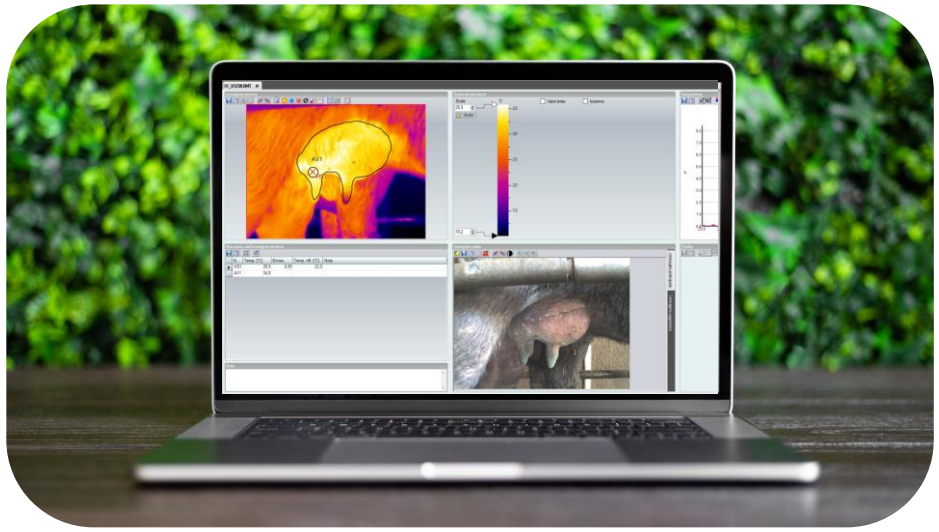
Materials and Methods **- Weather**

The parameters of ambient temperature (Celsius degrees) and relative humidity (%)were extracted and the THI was calculated with the following formula:

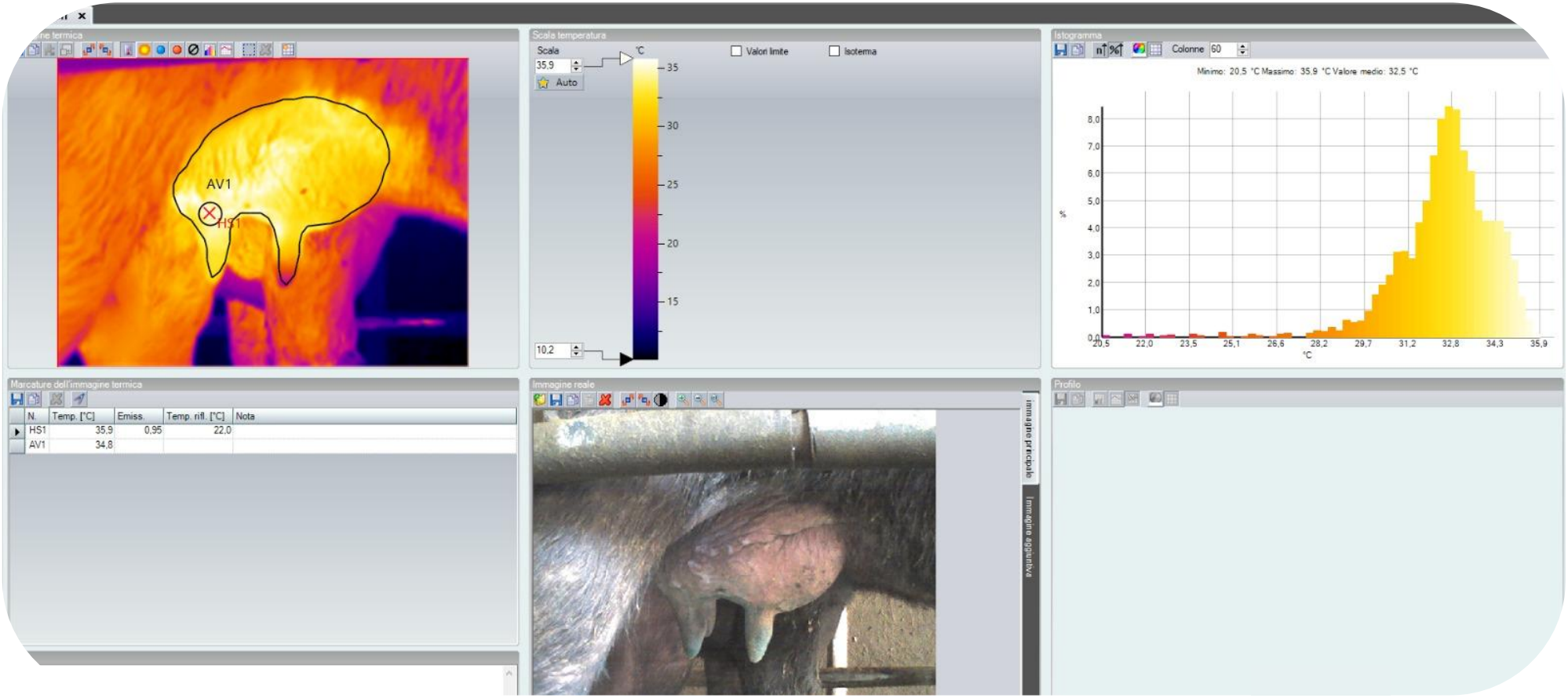
$$THI = (0.8 \times T) + [(\%\ RH \div 100) \times (T - 14.4)] + 46.4$$

Materials and Methods – **Detection of the images**

Thermal Imaging Camera
Testo 881 (640x480 px)



Software *IrSoft* (v4)


AV1
HS1
Scala temperatura
Scala
35,9
Auto
°C
Valori limite
Isoterma
35
30
25
20
15
10,2
Istogramma
Colonne 60
Minimo: 20,5 °C Massimo: 35,9 °C Valore medio: 32,5 °C
%
20,5
22,0
23,5
25,1
26,6
28,2
29,7
31,2
32,8
34,3
35,9
°C
Marcature dell'immagine termica
N.
Temp. [°C]
Emiss.
Temp. rifl. [°C]
Nota
HS1
35,9
0,95
22,0
AV1
34,8
Immagine reale
Immagine principale
Immagine aggiuntiva
Profilo

Materials and Methods – **Statistical Analysis**

One-way **ANOVA** was used to highlight differences between sampling times and DIM.

In addition, the correlation and multiple linear regression between Linear Score and Udder Surface Temperature was analyzed.

Results and Discussion - **ANOVA THI**

Temperatures recorded in the different sampling months				
Month of the sampling	**Buffaloes (n)**	**Sum**	**Mean**	**Variance**
March	21	686,5	32,69 a	0,86
April	19	649,25	34,17 b	0,72
May	19	660,85	34,78 c	0,64

Results and Discussion - **ANOVA DIM Classes**

The average parameters related to the classes of DIM (Class 1: 0 to 50 DIM; Class 2: from 51 to 100 DIM and Class 3 >101 DIM)

Class	SCC (cells/mL)	AVHS dx sx (°C)	Linear score	T av sx (°C)	T av dx (°C)
1	347.7 ± 184.5^{ab}	$32,61 \pm 0,20^{A}$	$12,71 \pm 0,44^{a}$	$30,10 \pm 0,27^{A}$	$30,83 \pm 0,19^{A}$
2	121.6 ± 59.4^{a}	$34,15 \pm 0,18^{B}$	$11,64 \pm 0,41^{a,C}$	$32,02 \pm 0,23^{B}$	$32,25 \pm 0,20^{B}$
3	491.8 ± 146.4^{b}	$34,76 \pm 0,16^{C}$	$14,03 \pm 0,44^{b}$	$32,57 \pm 0,13^{c}$	$32,69 \pm 0,20^{B}$

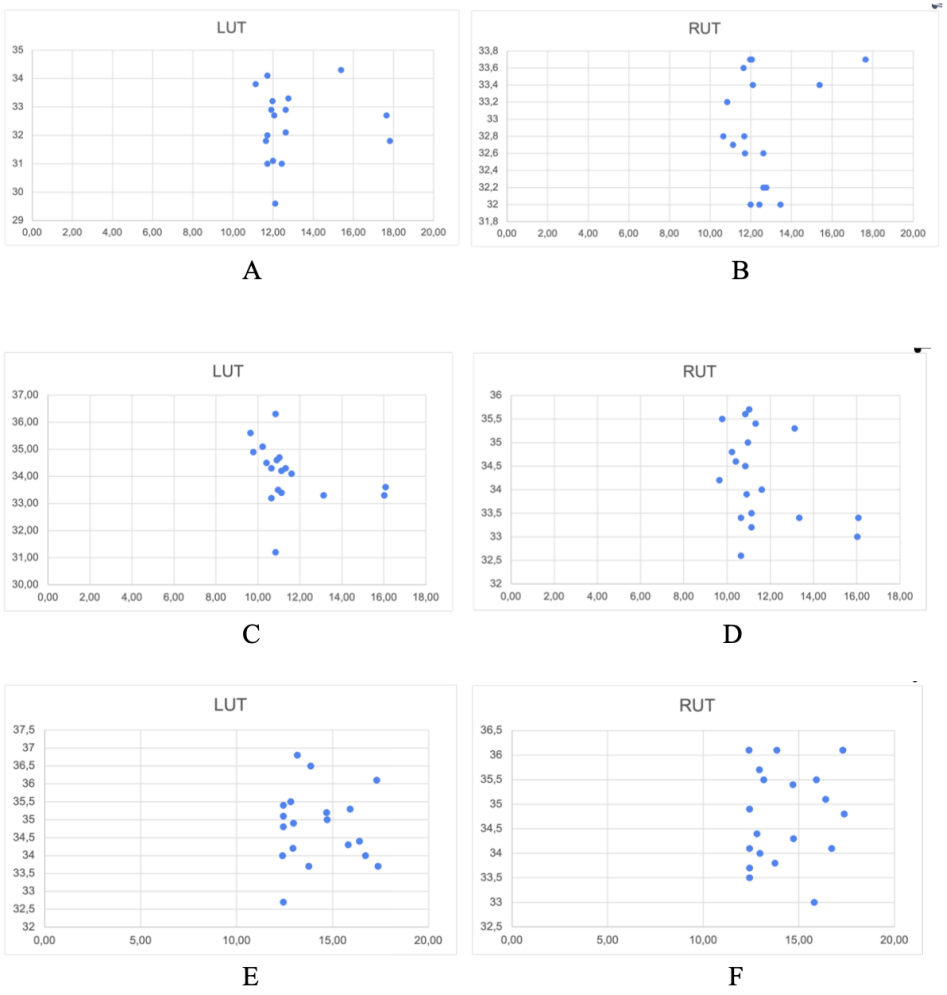
The values with different letters in the same columns are significantly different (a,b,c – $P<0,05$; A,B,C – $P<0,01$).

Results and Discussion

Correlation

A correlation between LS and the parameter T av sx has been identified only in subjects with LS > 4 (r=0,61; P<0,05), while no correlation emerged in subjects with LS < 4. The same was found for regression according to the equation:

$R^2 = 39,823 + 0,39*DIM - 0,448*LS – 0,136*THI$



Conclusions

The relationship found between subjects with LS>4 and udder surface temperature, regardless of the bioclimatic index THI, if confirmed by further investigation, could represent a new frontier for the early detection of mastitis in buffaloes.


Thank you for
your attention!