UNIVERSITÀ DEGLI STUDI DI MILANO
FACOLTÀ DI SCIENZE AGRARIE E ALIMENTARI

REE SMARTCOW

PRECISION LIVESTOCK FARMING IN CALF MANAGEMENT

IS IT USEFUL?

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ABSTRACT

- Management of young animal health is an important economic factor in dairy cattle farming;
- The main purpose of our study was to use infrared thermal imaging camera and accelerometers;
- The study was carried out at the experimental farm of the University of Milan;
- The results showed that the infrared camera is a valid device;
- The accelerometer application demonstrating a relationship between behavior and age;

INTRODUCTION

The problem:

Mortality in calves (from 24h to weaning)**is 8.9** ±7.9% *(Zucali et al., 2013);*

The most important disease are **gastrointestinal disorders** *(Torsein et al., 2011)* **and pneumonia**.

The aim:

Use **PLF tools to make early diagnosis** of principal disease

PLF: why should be used in calf management?

POSSIBLE BENEFITS

- Improved animal's health and welfare;
- Reduced antimicrobial use;
- Increased efficiency;
- Reduced costs;
- Reduced environmental impact;

MATERIAL AND METHODS

SAMPLE

- No. monitored calves: 10
- Monitoring period: 2 months (from 30/06/22 to 13/09/22)

Anemometer

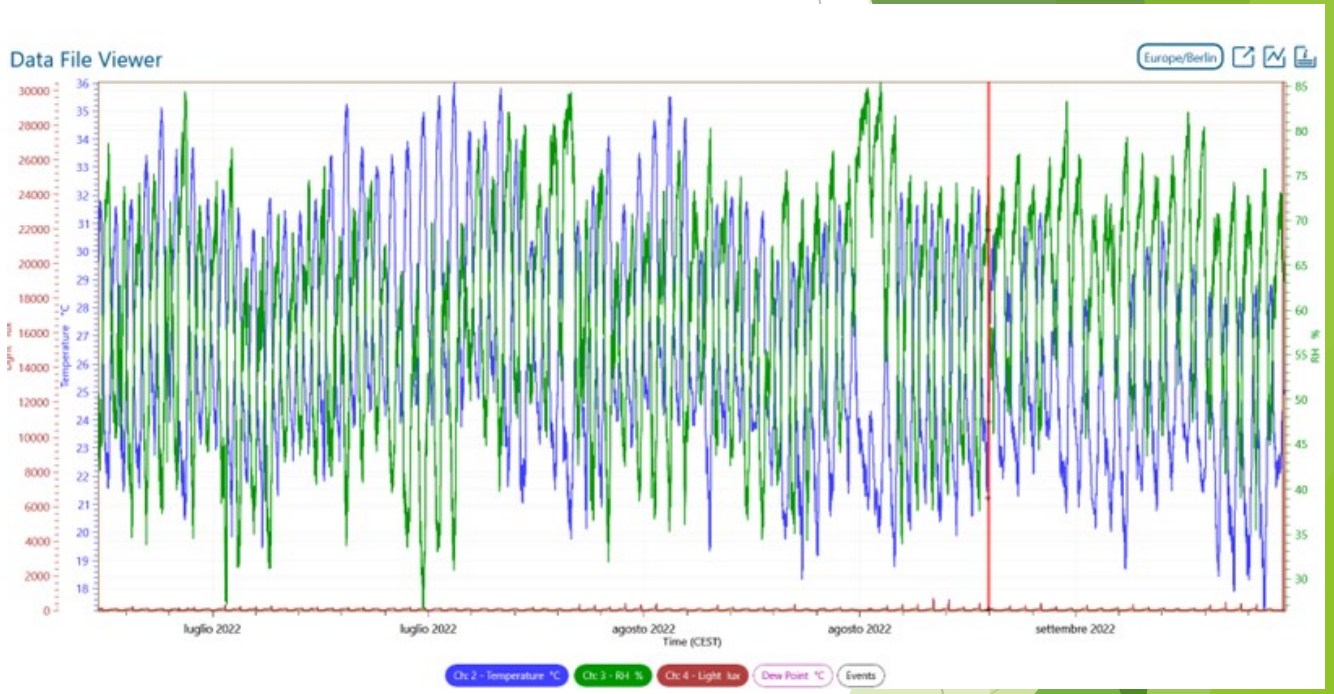
MEASUREMENTS

- Rectal temperature with digital thermometer
- Infrared thermography camera
- Anemometer
- Drager® Accuro pump
- Accelerometers HOBO® PENDANT

Drager® Accuro pump with ammonia tube

ENVIRONMENTAL MEASUREMENTS

- HOBO® data loggers supplied by ONSET®
- Temperature
- Relative humidity
- Illumination



Output of environmental HOBO®

STATISTICS WITH EXCEL

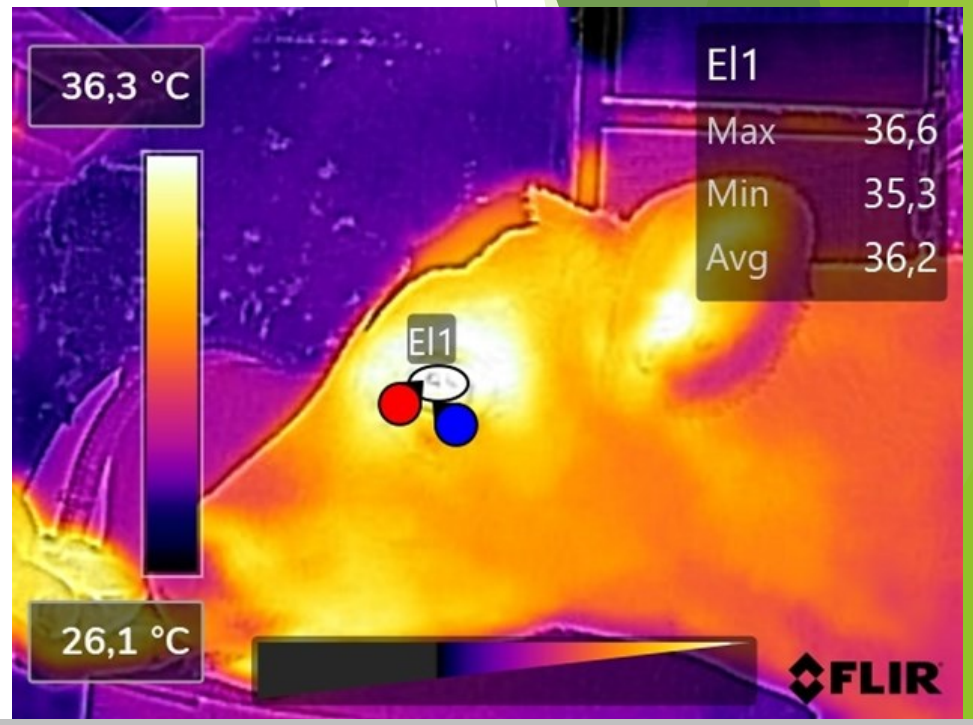
- Excel: hourly and daily averages
- Functions to evaluate correlation
- Multiple regression for rectal T estimation

INFRARED THERMOGRAPHY (IRT)

The infrared radiation emitted from the surface of the body of animals is measured in order to determine radiated temperature.

BENEFITS

- Non-invasive
- Can be used from distance
- Passive method



Thermal image processed by the FLIR application

The best surface to estimate calf-body temperature with **IRT** could be the eye.

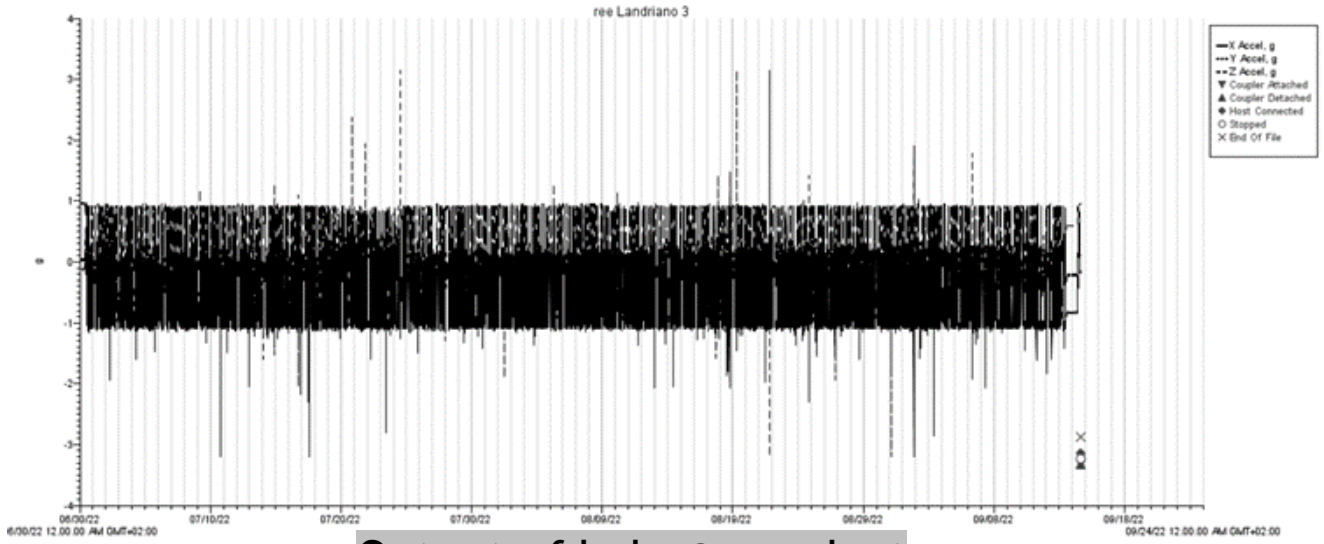
(Hoffmann et al., 2012)

ACCELEROMETERS

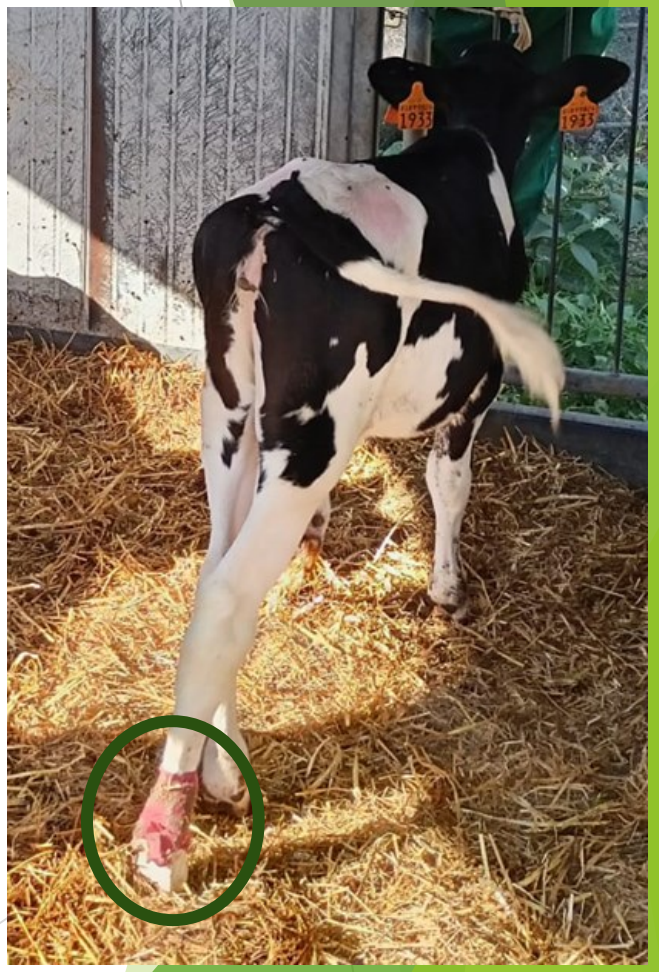
Accelerometer allows to determine calf relative position and its activity.

BENEFITS

- Non-invasive
- Collect real-time data
- Automatic system

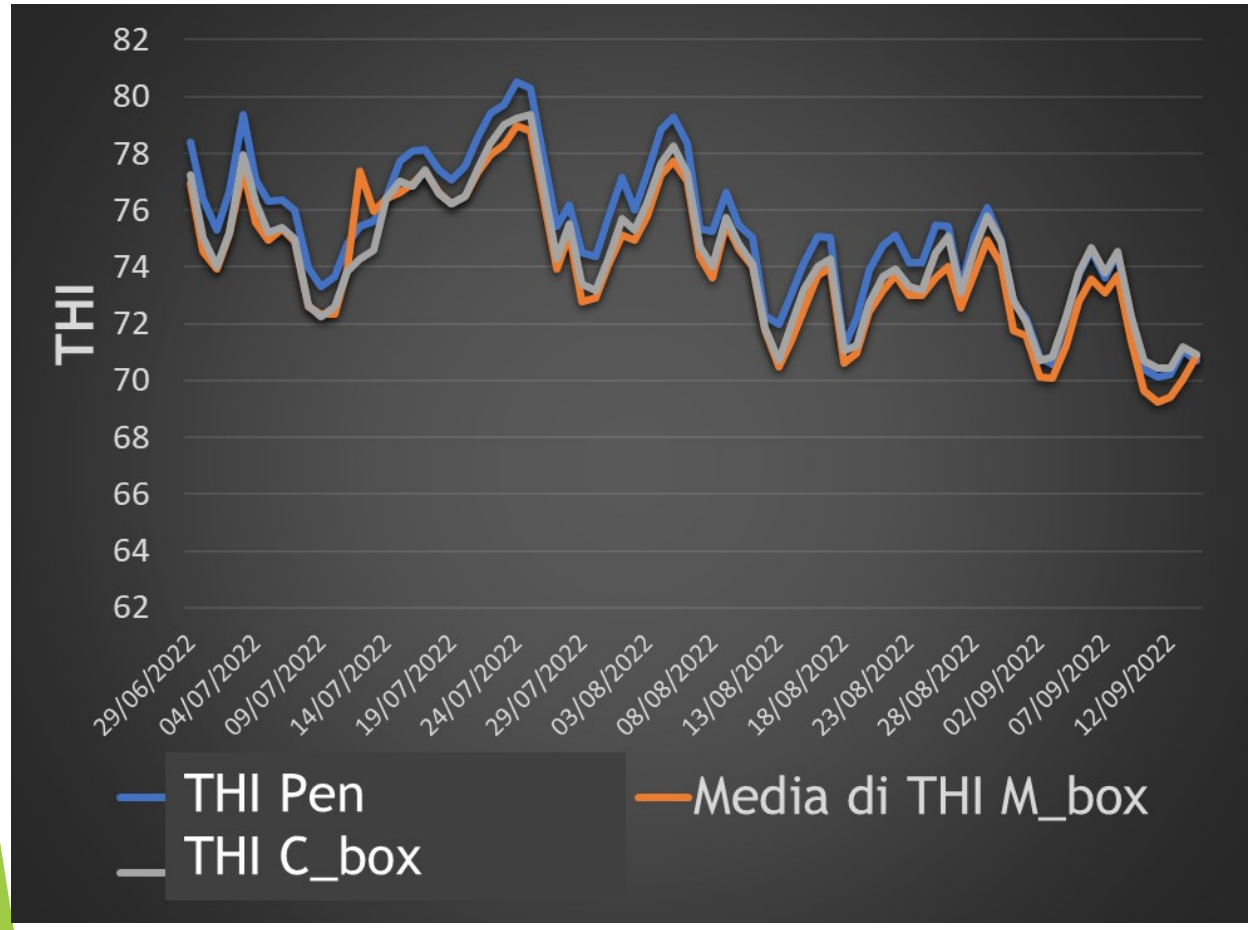


Output of hobo® pendant



RESULTS

Trend of THI during the experiment

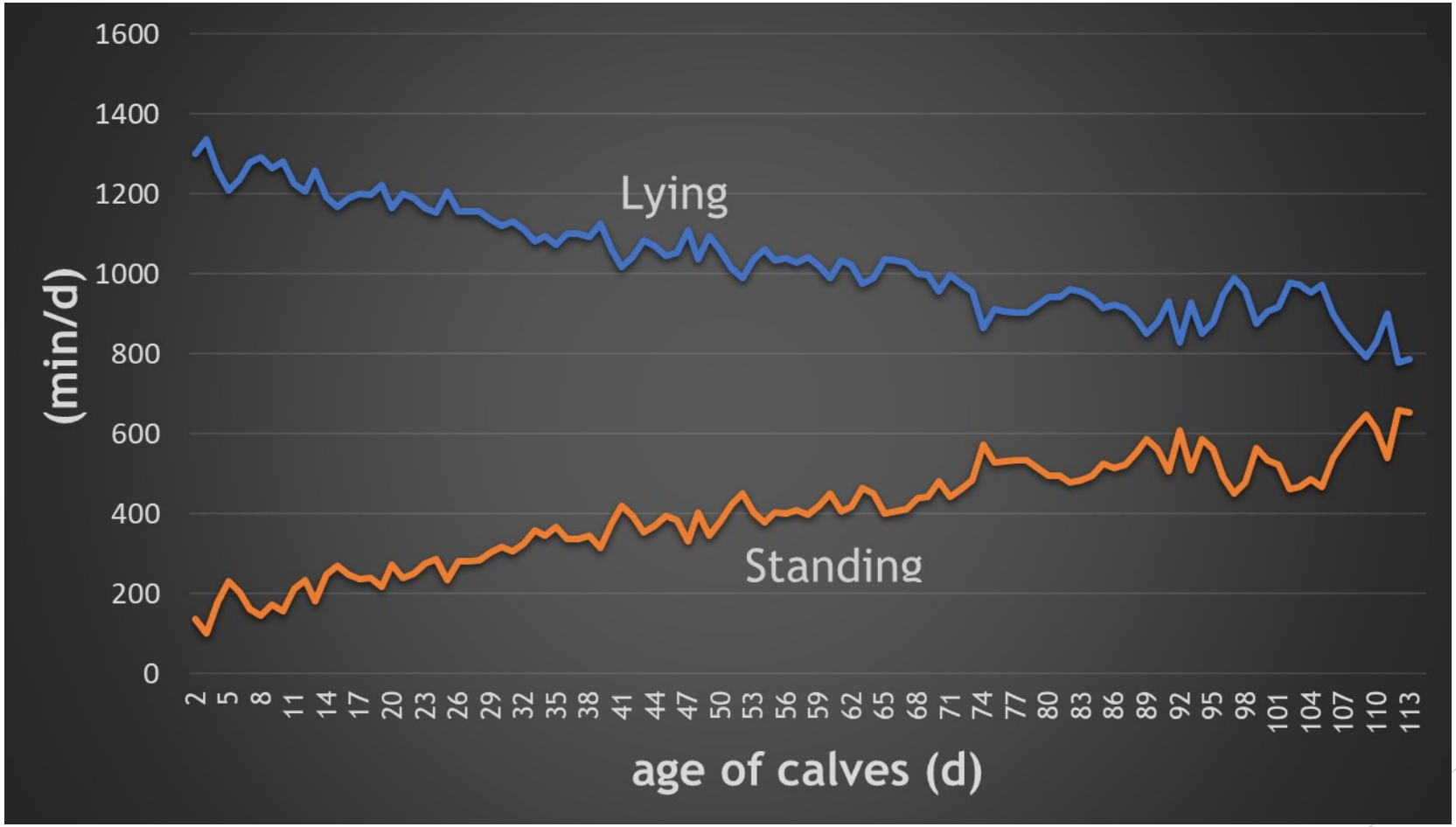


Air ammonia concentration

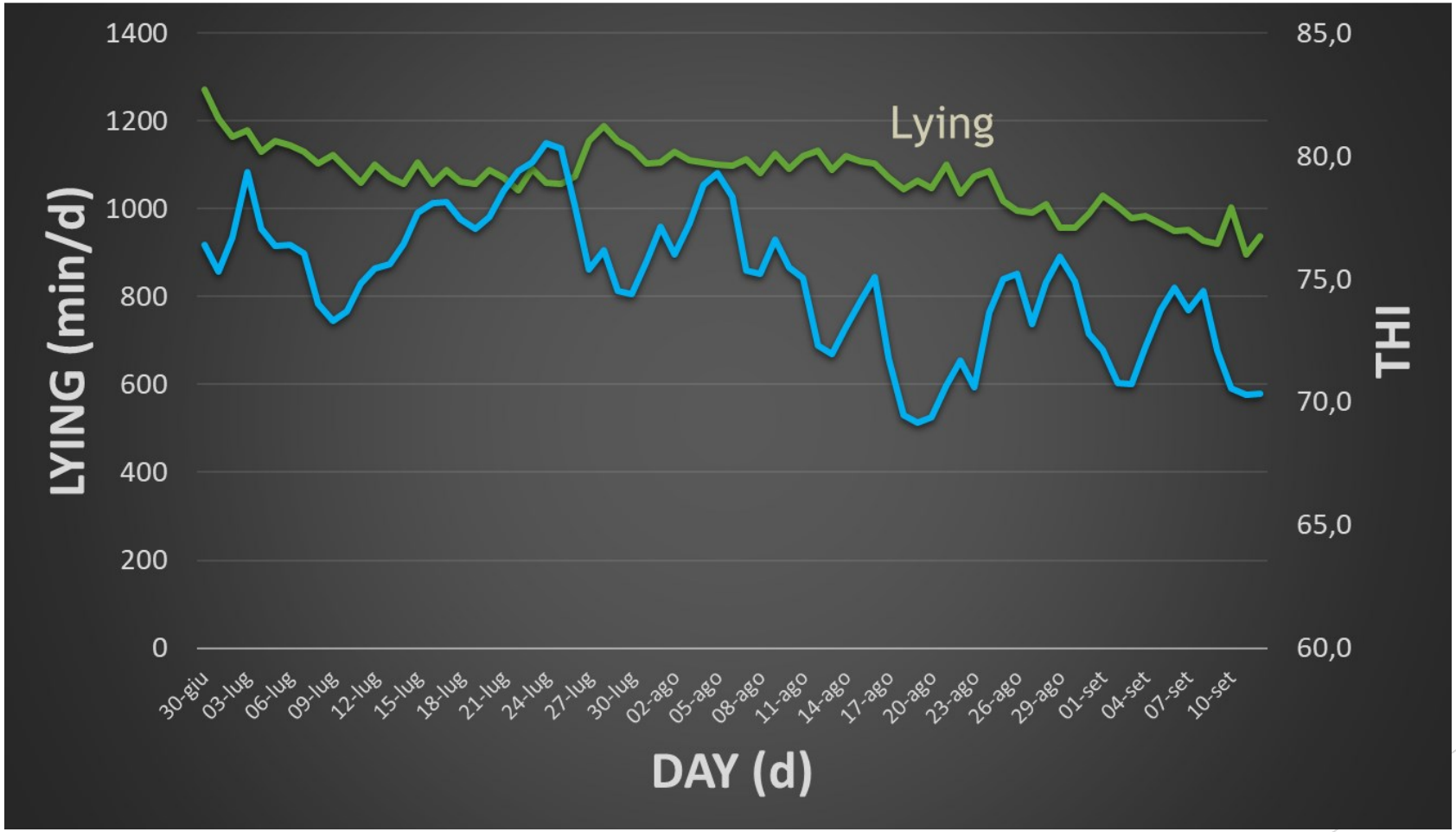
	Group pen	Multiple pen	Individual pen
Mean (ppm)	0.3	0.58	1.25
SD (ppm)	0.2	0.3	1.27
n.	3	4	7

- Critical **THI 78 - 88** *(Kovàcs et al., 2020)*
- Critical **ammonia concentration 4.7-6 ppm** *(van Leenen et al., 2020)*

RELATIONSHIP AMONG LYING AND STANDING BEHAVIORS AND AGE



TREND OF LYING AND THI DURING THE EXPERIMENT



MULTIPLE REGRESSION FOR ESTIMATING RECTAL T FROM MEASURED ENVIRONMENTAL DATA AND THERMAL IMAGING CAMERA

EQUATIONS			
	Total calves	Calves from 0 to 30 days	Calves from 31 days
Y - intercept	30.9	32.7	31.2
Environmental temperature	-0.02	-0.01	-0.01
Wind speed	-0.09	-0.15	0
Eye max temperature	0.24	0.19	0.24
R^2	0.29	0.34	0.24
N. samples*	5935	3342	2593

* Part of data were obtained by *Cossa et al., 2019*

CONCLUSIONS

- It is important to pay attention to environmental conditions as both **THI and air ammonia concentrations** in calf pens;
- It is interesting to evaluate the parameters of '**lying and standing**', distinguishing the effective activity of calf (relationships, playing and eating moments);
- **Eye IR temperature** seems to be a potential good method for estimating body temperature;
- **Infrared thermography** and **accelerometers** could be a useful tools for the early diagnosis of diseases.

THANKS FOR YOUR ATTENTION