Integrating innovative TECHnologies along the value Chain
to improve small ruminant welfARE management

THIcare APP: a PLF tool for environmental welfare in sheep and goat farms

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Environmental welfare and THIcare APP

- Small ruminants (SR) live in **harsh environments** using **shelters** for protection to face high requirements (lambing, lactation, fattening), extreme weather conditions (winter and summer) or predation.
- **Shelter conditions** (TºC, RH%, gases, bedding…) are a **concern in SR** but they are only monitored during farmer's working hours.
- **Environmental welfare issues** as group PLF were identified as a priority in the TechCare WP2 survey.
- **Continuous monitorization** by a **cheap** and **user-friendly PLF tool** is needed: **"THIcare"**

PLF3: Environmental welfare and THIcare APP

- **Review** of welfare conditions for sheep and goats.
- Interest of the **THI** (Thermohygrometric Index) for thermal discomfort based on TºC and RH%. Simplified equation (Mader et al., 2006):

$$THI = 0.8 \cdot T + RH/100 \cdot (T - 14.41) + 46.4$$

- Implementation of **weather stations** (on farms) and **indoor sensors** (in pens). Key indicators:
  - **Thermal discomfort (THI)**
  - **Air quality (AQI)**
  - **Bedding quality (BQI)**
- **Critical thresholds** of indicators for EWS.

Low-cost meteo stations and indoor wireless sensors for monitoring outdoor and indoor farm's conditions

Froggit system (DE):

1 wi-fi

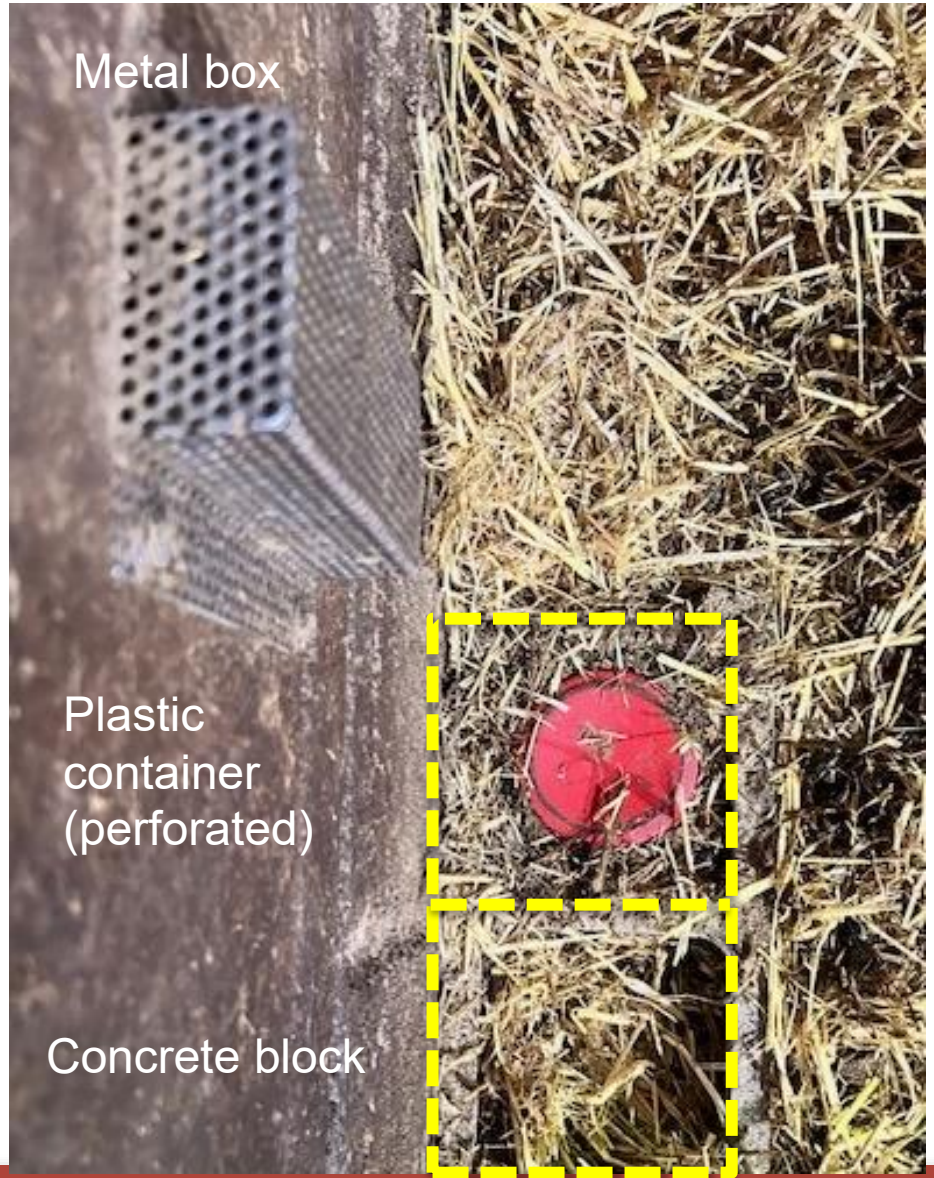
20 sensors
1 tablet
Bluetooth

Web platform & App

ecowitt

TechCare: Detail of indoor sensors installed in the farm: (UAB, Bellaterra, ES)

Bedding capacitance sensor



Ecowitt dashboard in a TechCare farm

EWS chart according to THI in dairy ewes (Caja, 2024)

by using the equation of Mader et al. (2006)

$$THI = 0.8 \cdot T + RH/100 \cdot (T - 14.4) + 46.4$$

Relative humidity, % \ Temperature, ºC	-10	-8	-6	-4	-2	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
10	36	38	40	41	43	47	49	50	52	54	56	58	59	61	63	65	67	68	70	72	74	76	77	79	81	83	85
20	34	36	38	40	42	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88
30	31	33	35	38	40	44	46	49	51	53	55	57	60	62	64	66	68	71	73	75	77	79	82	84	86	88	90
40	29	31	33	36	38	43	45	48	50	53	55	57	60	62	65	67	69	72	74	77	79	81	84	86	89	91	93
50	26	29	31	34	37	42	44	47	50	52	55	57	60	63	65	68	70	73	76	78	81	83	86	89	91	94	96
60	24	27	29	32	35	41	43	46	49	52	55	57	60	63	66	69	71	74	77	80	83	85	88	91	94	97	99
70	21	24	27	30	33	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96	99	102
80	19	22	25	28	32	38	41	44	48	51	54	57	60	64	67	70	73	76	80	83	86	89	92	96	99	102	105
90	16	20	23	27	30	37	40	44	47	50	54	57	61	64	67	71	74	78	81	84	88	91	95	98	101	105	108
100	14	18	21	25	28	36	39	43	46	50	54	57	61	64	68	72	75	79	82	86	90	93	97	100	104	108	111

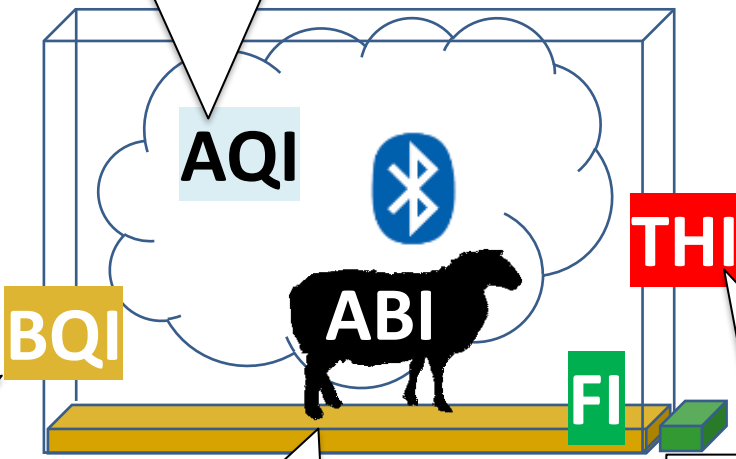
Icy | Very cold | Cold | Fresh | Neutral | Warm | Hot | Very hot | Extremly hot | Fatal

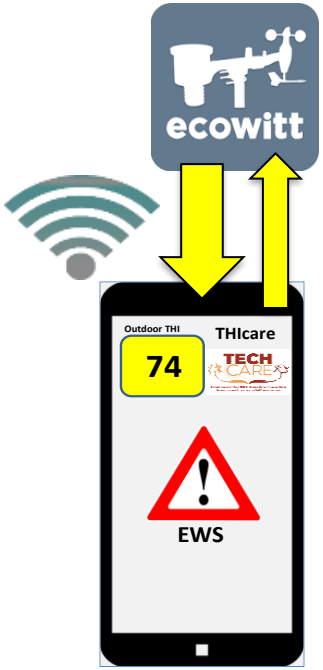
The colors shown in the chart are a compromise of critical thresholds for **milk production and conception rate** in dairy ewes.

EWS for environmental welfare indicators in the THIcare APP

Air

AQI	Quality	Color	Condition
<50	Good	Green	Clean
51-100	Moderate	Yellow	Acceptable
101-150	Poor	Orange	Unhealthy
151-200	Bad	Red	Very unhealthy
201-300	Very bad	Purple	Unacceptable
>300	Fatal	Black	Toxic





Bedding

BQI	Quality	Color	Condition
<30	Good	Green	Clean
31-55	Moderate	Yellow	Add straw
56-65	Poor	Orange	Dirty
66-75	Bad	Red	Very dirty
76-80	Very bad	Purple	Wet
>80	Fatal	Maroon	Remove

awin
ANIMAL WELFARE INDICATORS

Thermal

THI	Quality	Color	Condition
<30	Icy	White	Freezing
31-39	Bad	Black	Very cold
40-45	Poor	Dark blue	Cold
46-50	Moderate	Light blue	Fresh
51-65	Neutral	Green	Mild
66-75	Alarm	Yellow	Warm
76-80	Poor	Orange	Hot
81-85	Bad	Red	Very hot
86-90	Very bad	Purple	Extremly hot
>90	Fatal	Black	Fatal

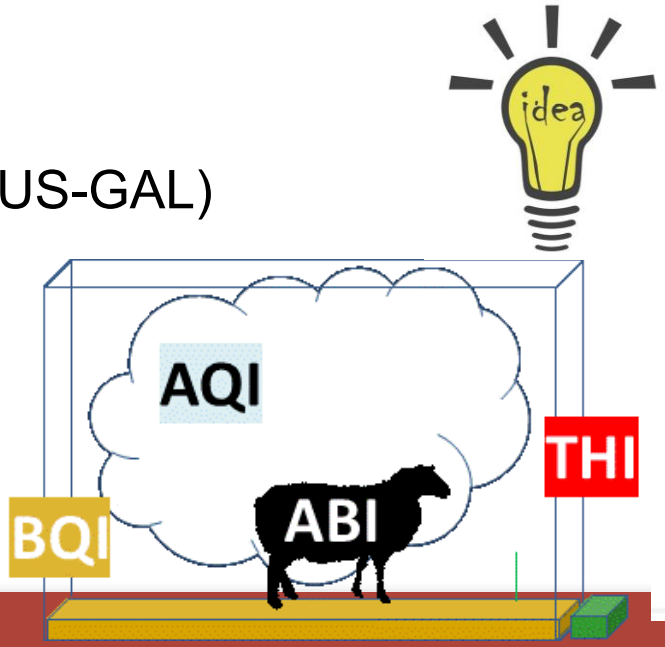
THIcare App innovation

Freely available in 2 operative systems:

- **iOS Apple**
- **Android Google**

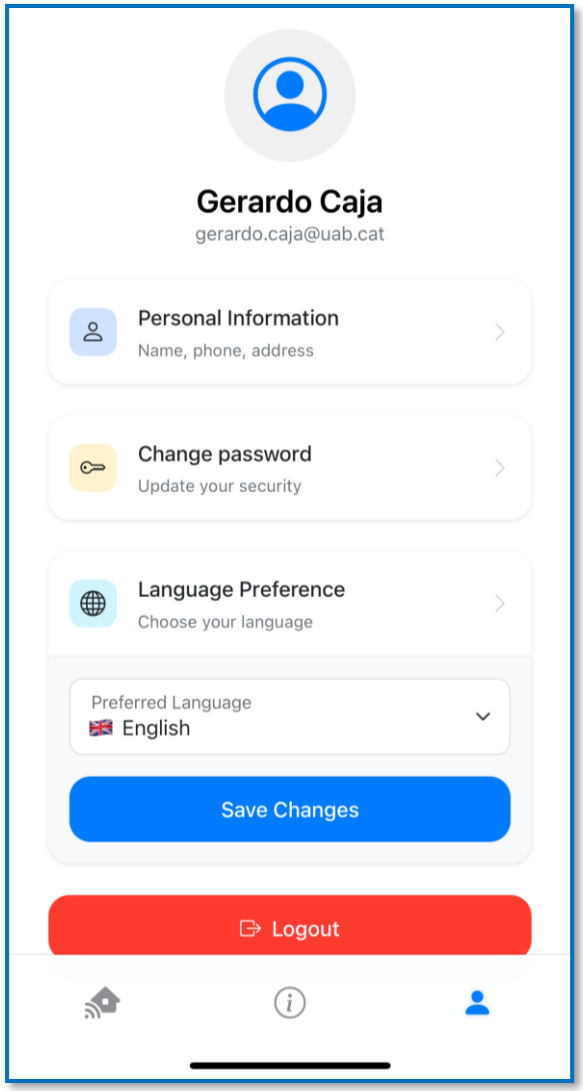
- **DEMO: UAB's experimental farm**
  User = demo.thicare@uab.cat
  Password = **techcare2020**

- Information and labels in 10 languages:
  - EN
  - ES (CAT-EUS-GAL)
  - FR
  - GR
  - IT
  - NO
  - RO

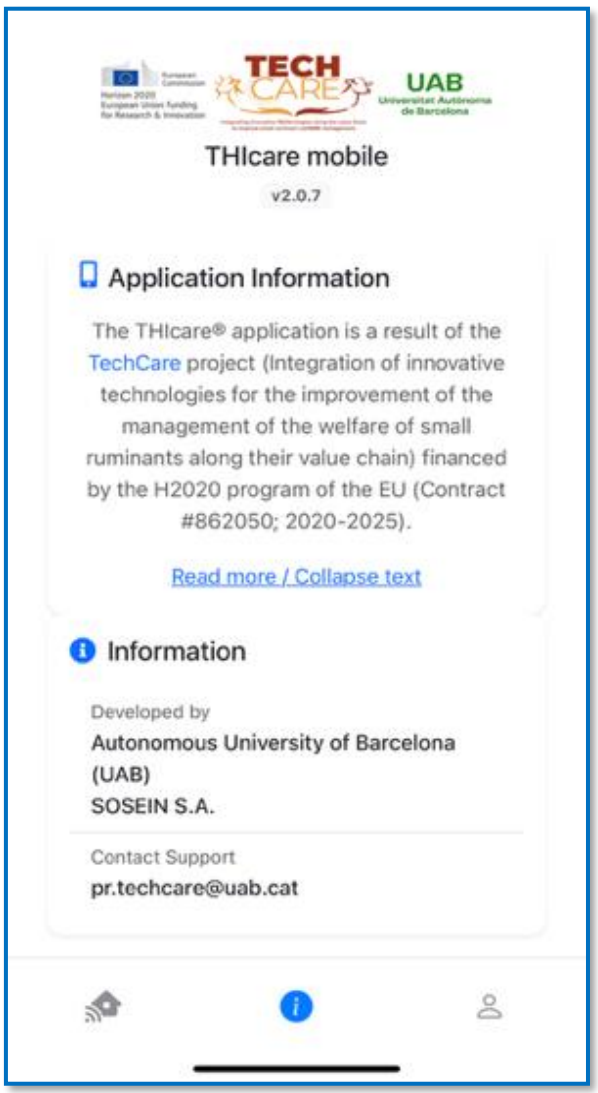


TechCare: THIcare

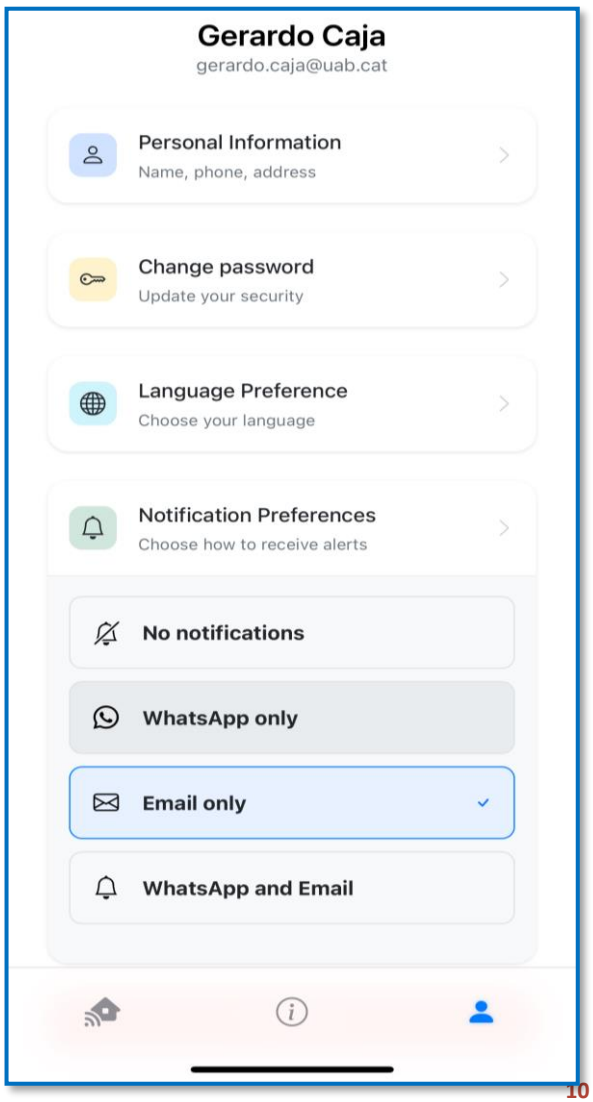
1) User data



2) APP information



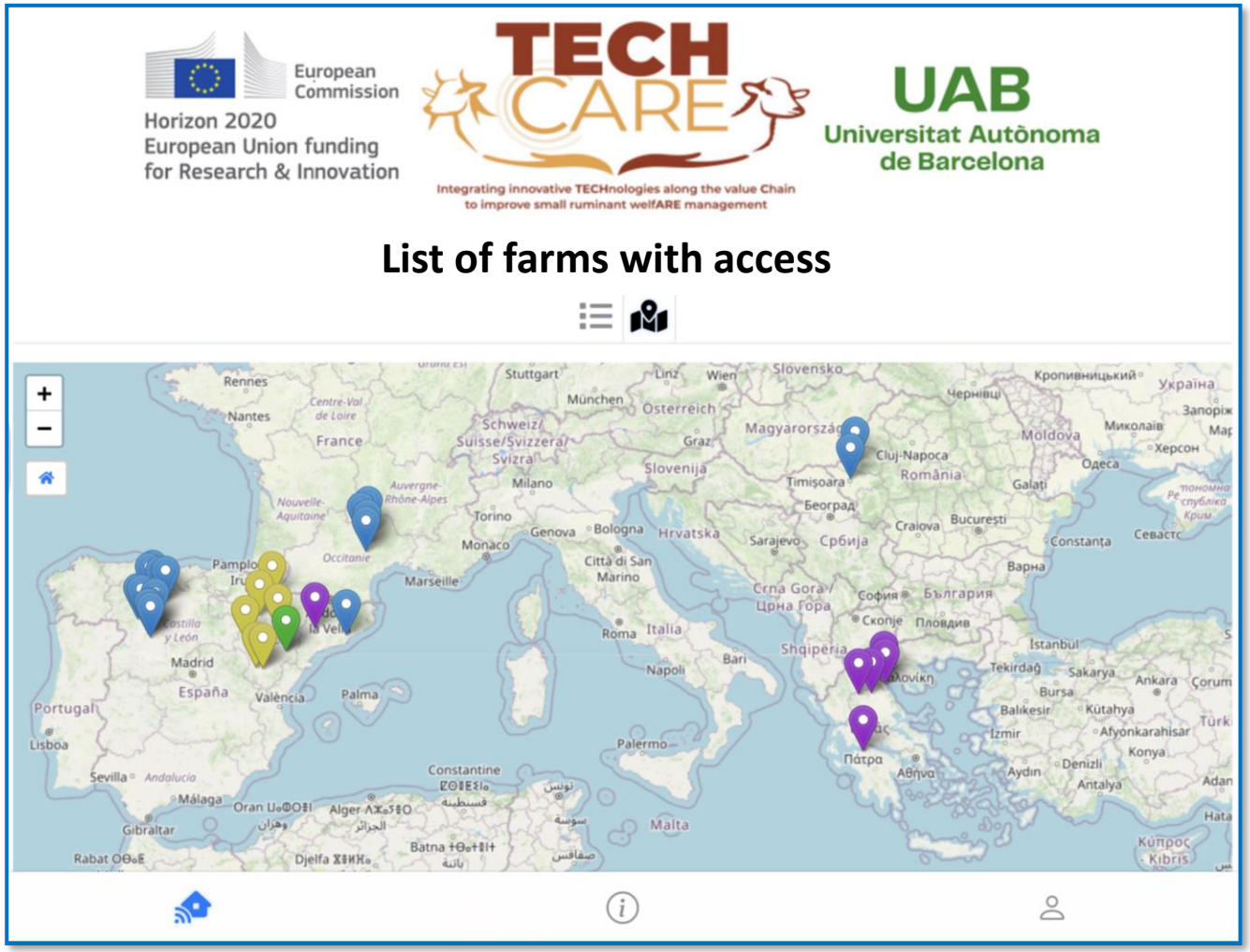
3) Alarm settings



A total of 31 farms are uploaded in THIcare up to June 2025

(meat sheep, 1; dairy sheep, 17; dairy goats, 6; fattening lambs, 7)

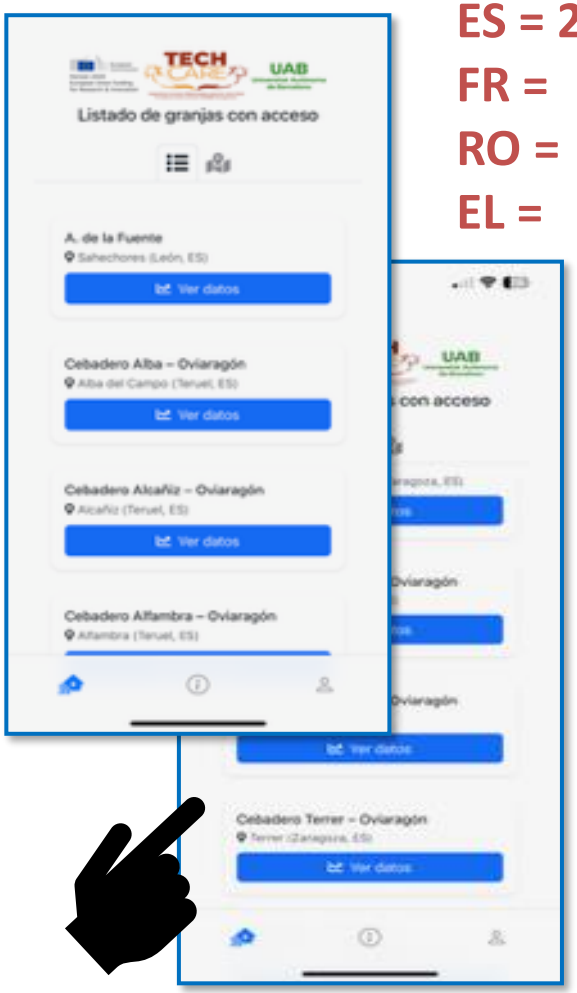
(ES = 20, FR = 4, GR = 5, RO = 2)

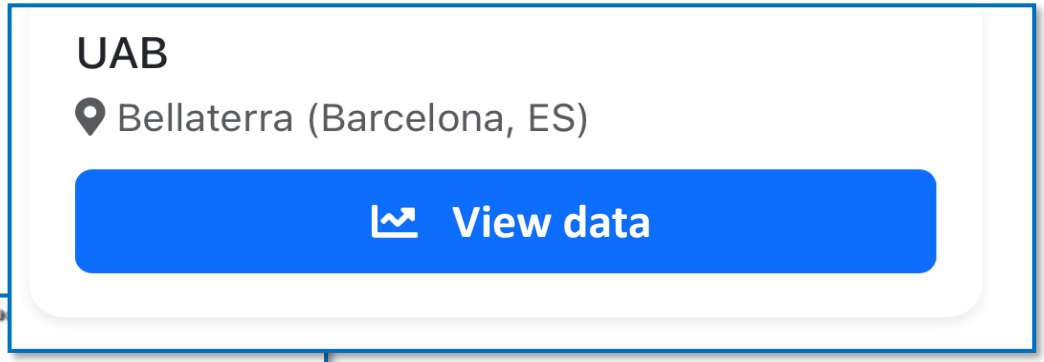


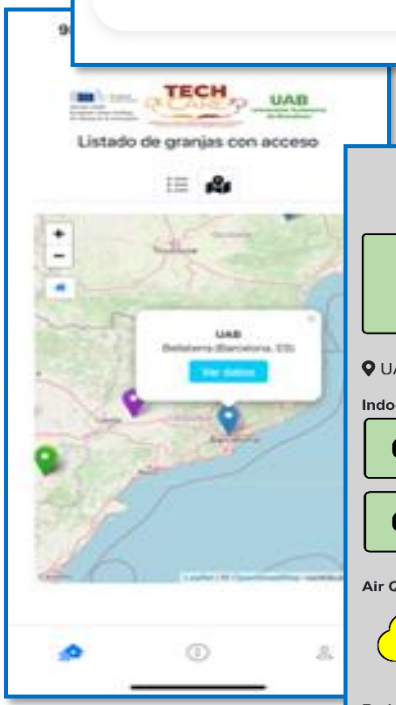
TechCare: THIcare

4) Farms list (n = 31)

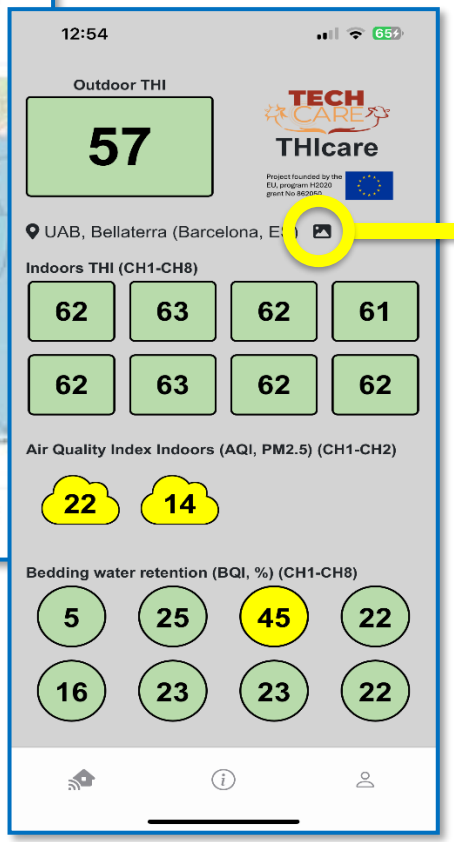
ES = 20
FR = 4
RO = 2
EL = 5







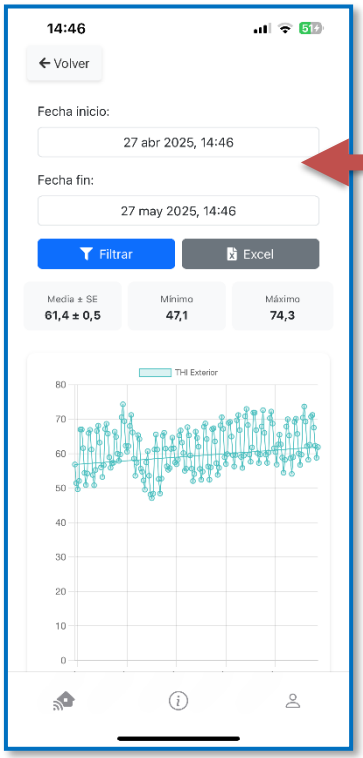
Current data

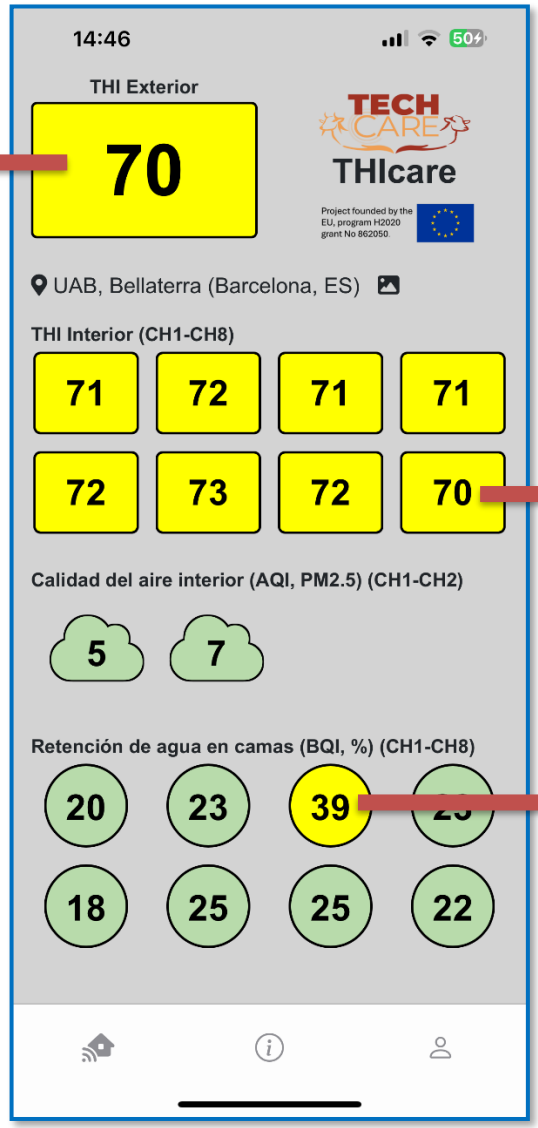


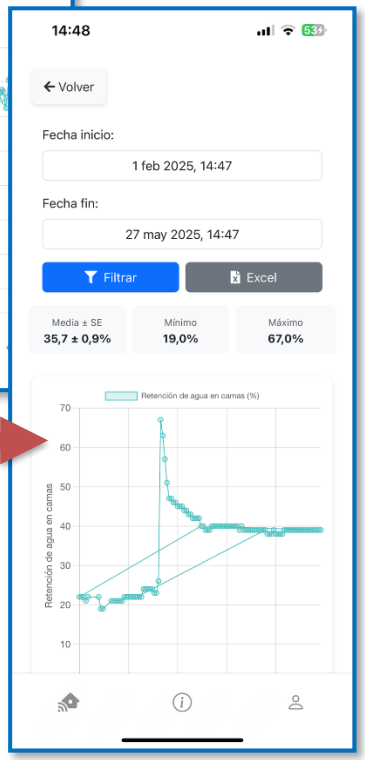
Sensors positioning

User = demo.thicare@uab.cat
Password = techcare2020

5) Data of each sensor during 1 year





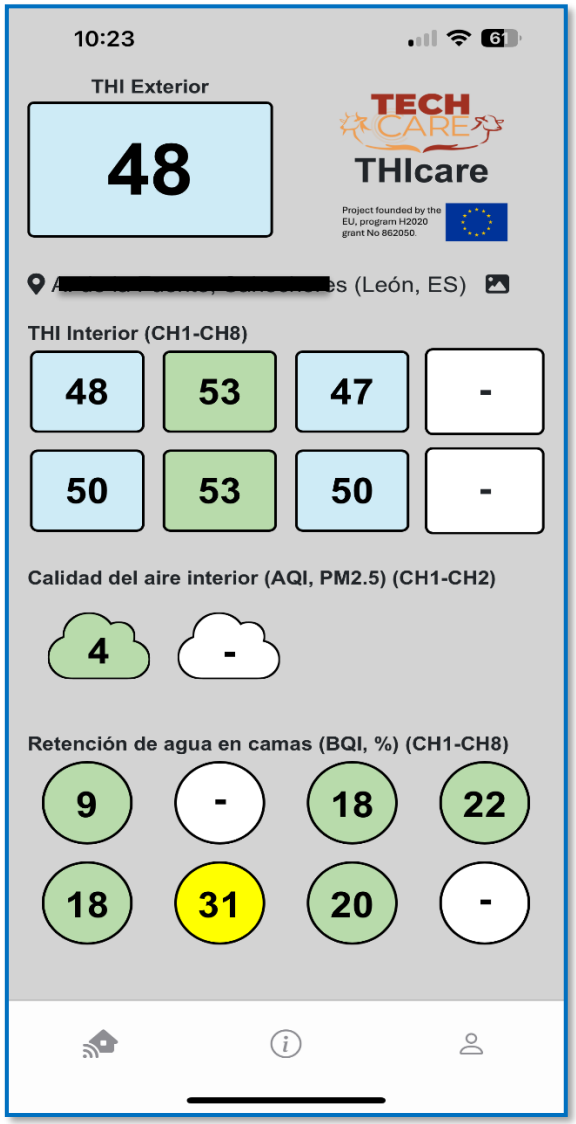


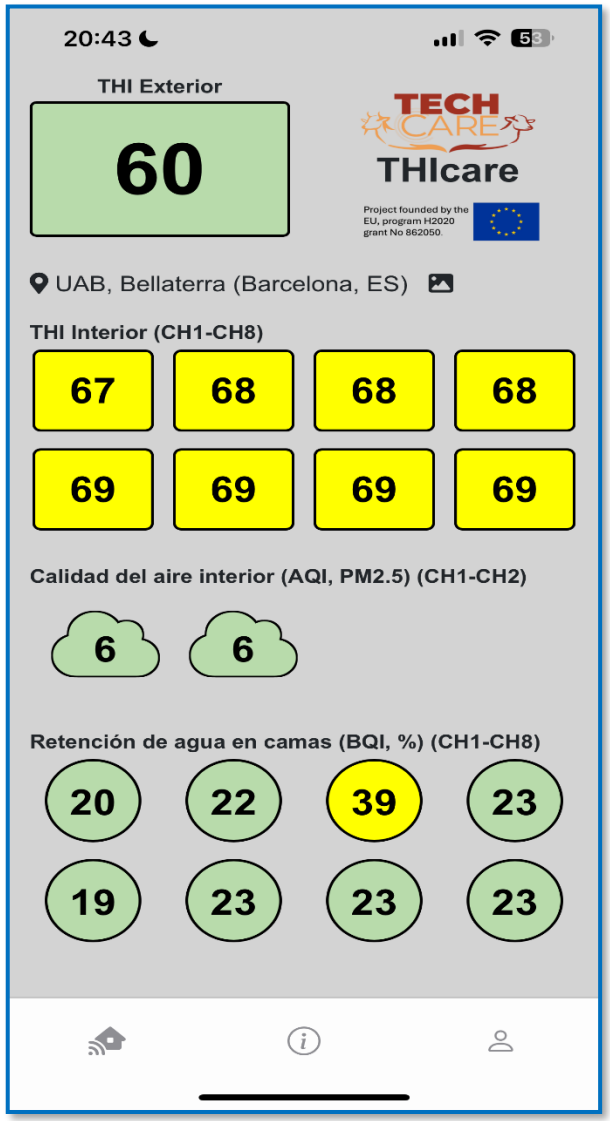
Mean ± SE
Minimum
Maximum

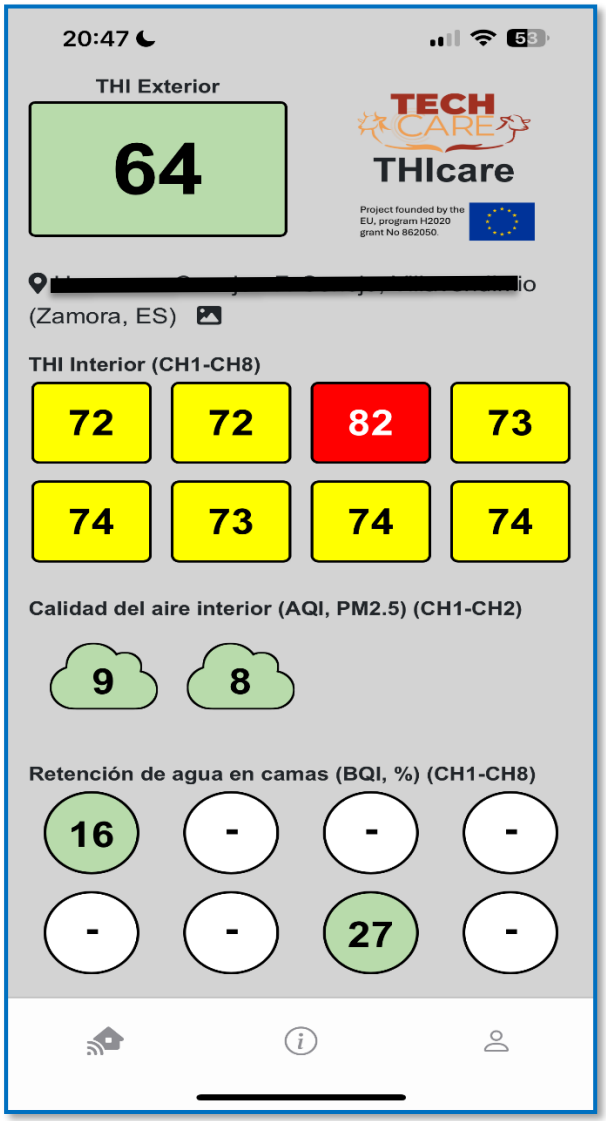
Event search

TechCare: THIcare

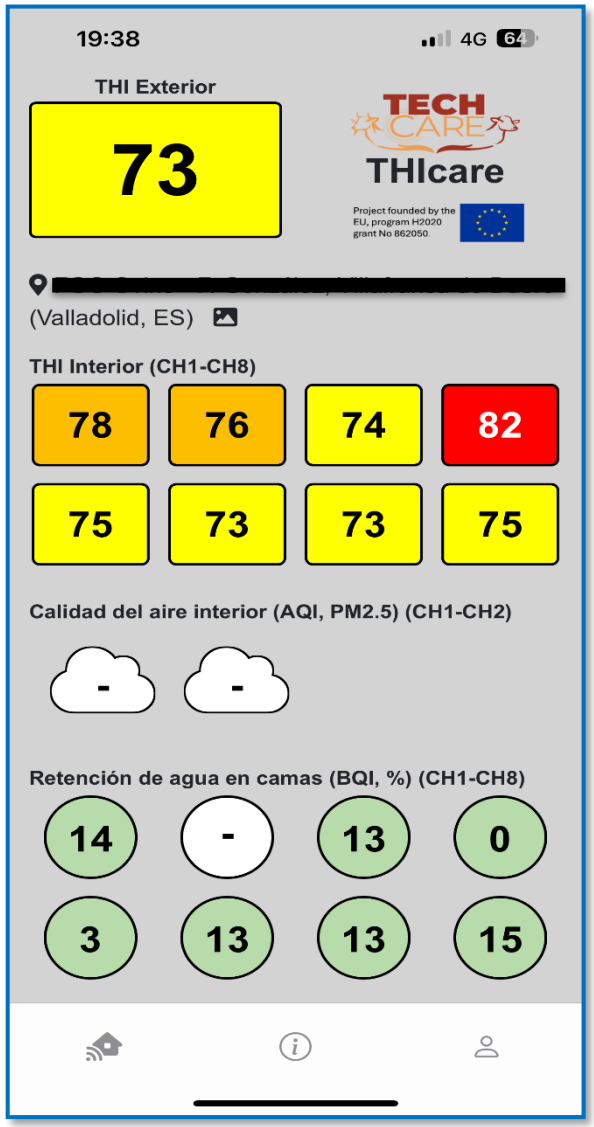
Monitoring THI values in different farms trhough the year (1/2)

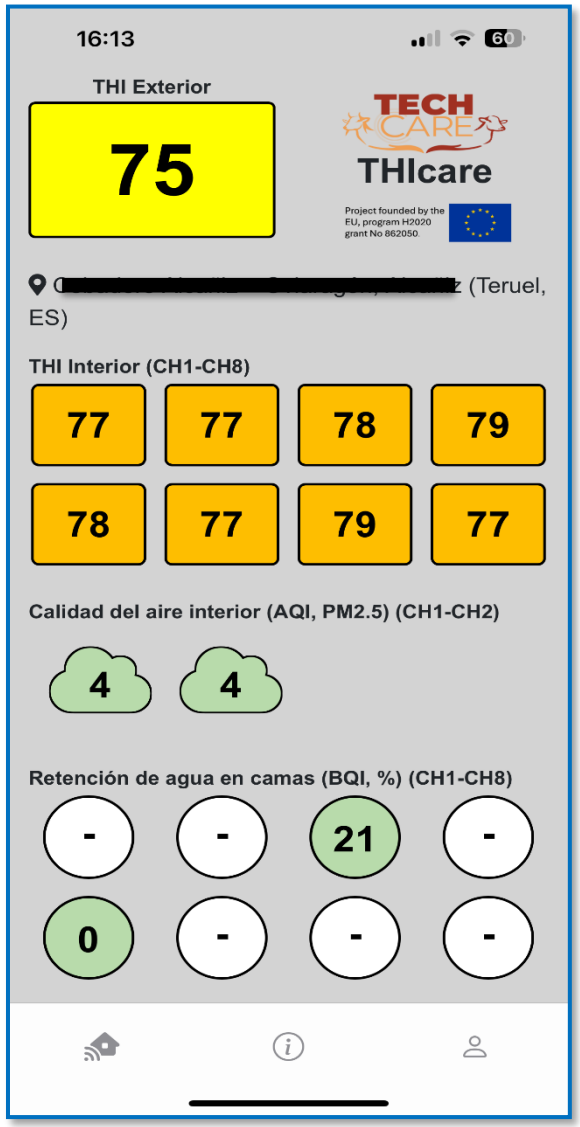


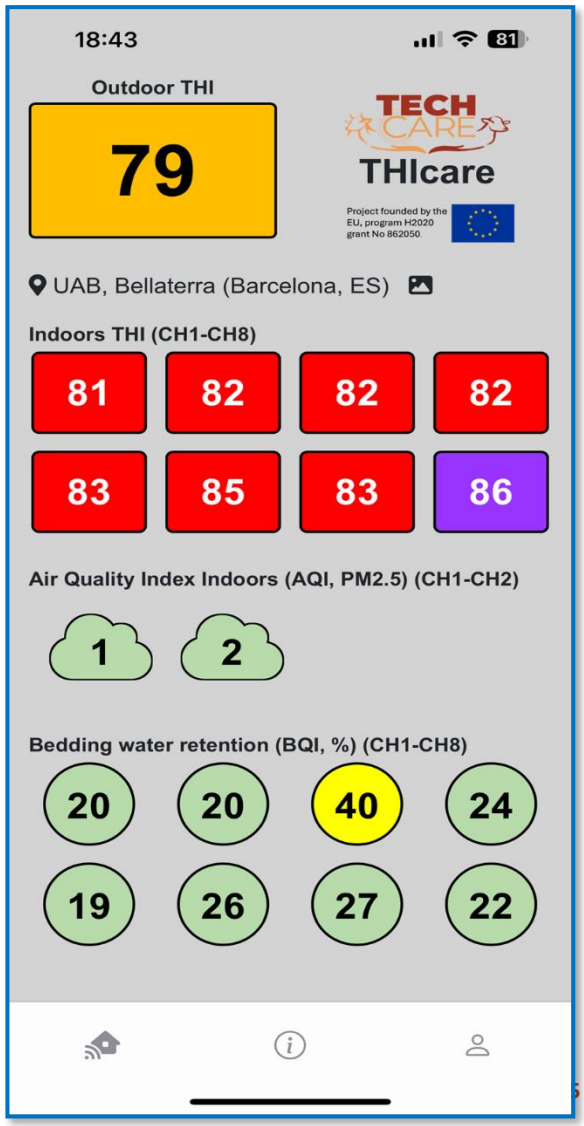




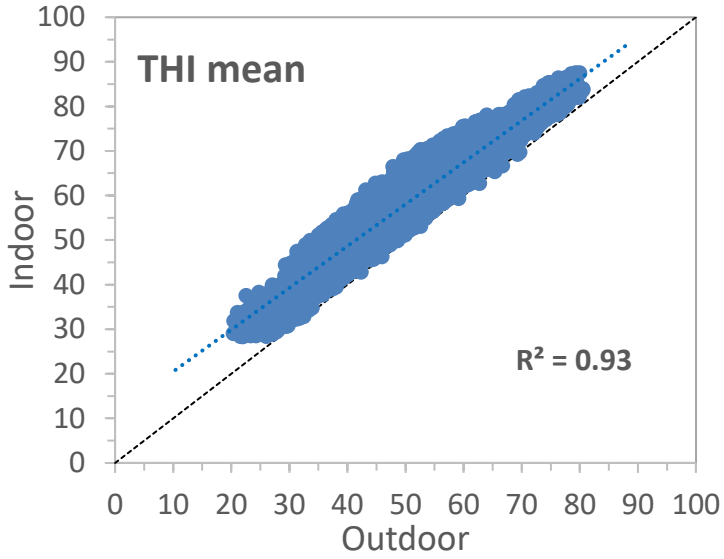
Monitoring THI values in different farms trhough the year (2/2)

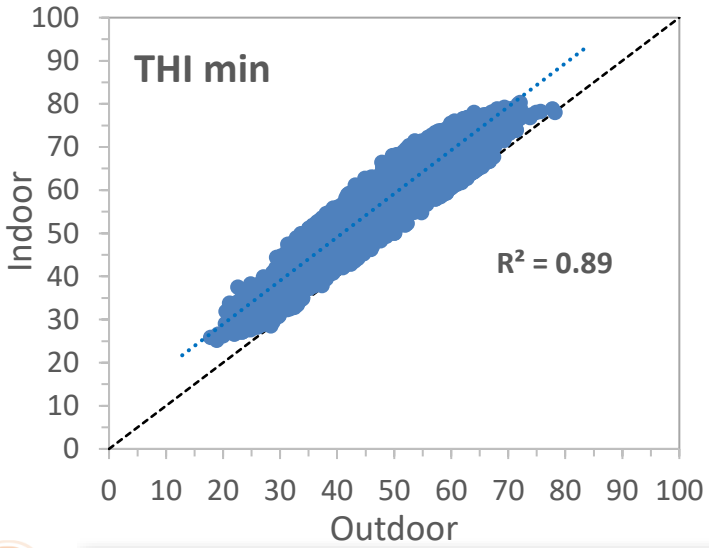


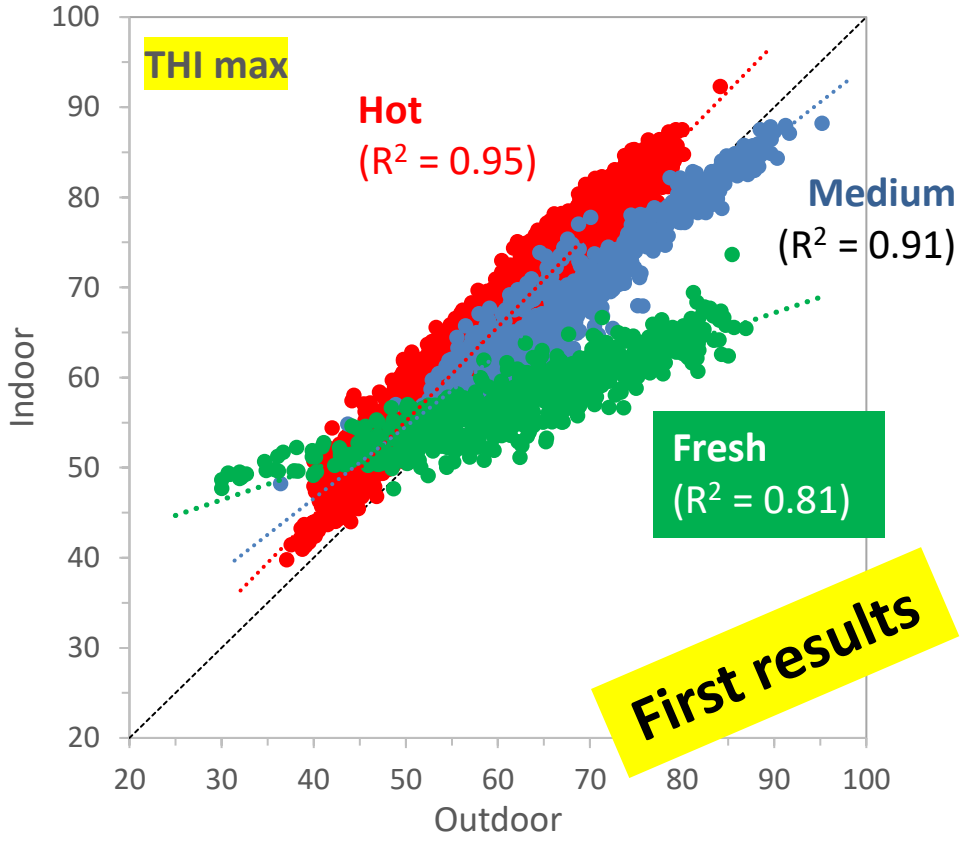




TechCare – Daily thermal response of dairy sheep and goat farms during the whole year in Spain (2023-25; n = 12 farms; ~7,500 data)







Dramatic differences for maximum THI

- Heat load
- Isolation and ventilation
- Protection and mitigation measures

Monitoring heat stress in dairy sheep and goats in Spain (UAB farm): THI > 80

Monitoring heat stress in dairy sheep and goats in Spain (UAB farm): THI > 80

Conclusions:

- **THIcare is an already available PLF tool** for immediate use in small ruminant farms (2 operating systems and 9 languages!).
- Easy to adapt to other livestock species (cattle…).
- **Compatible** with different commercial types of weather stations (low cost), peripheric sensors and free access climatic data platforms.
- Scalable architecture.
- **User-friendly** and intuitive use for farmers.
- **Well accepted by sheep and goat farmers** in different countries (currently 4). Earner of 2 gold medals.

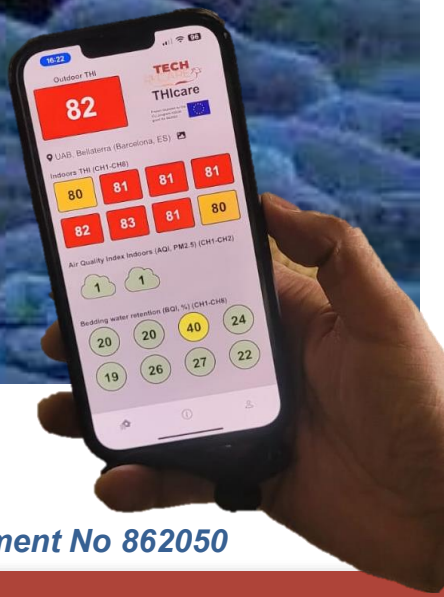
Thanks for attention!

TECH CARE

Integrating innovative TECHnologies along the value Chain to improve small ruminant welfARE management

https://techcare-project.eu/

Shadow and air, please…



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