

# SHEET – Sunburn and HEat prediction in fruit tree canopies for Evolving warning Tech solution



Manuela Zude-Sasse

2019 cofunded Call End-term Project Seminar 30<sup>th</sup> January 2024

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grand agreement no 862678 ICT-AGRI-FOOD. K2 - Informacja wewnętrzna (Internal)







Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Germany

Hungarian University of Agriculture and Life Sciences / Magyar Agrár- és Élettudományi Egyetem (MATE), Hungary

University di Bologna, Department of Agricultural and Food Sciences (UNIBO), Italy

macio GmbH (MACIO/CloudFlight), Germany

Horticultural Knowledge srl (HK), Italy

BUDGET: 670.000 € (896.000 € incl. own budget)

Kick-off (28.2.21) > Workshop at IHC, 14-18<sup>th</sup> August 2022 held in Angers > Fruit grower survey on mobile App > Farmer's Workshop on 7<sup>th</sup> July 2023 held in Bologna

End of project (31.11.23 \_ ext. 30.04.24)



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# <u>c</u>loudflight



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Leibniz-Institut für Agrartechnik und Bioökonomie



Excess solar radiation and elevated temperatures produces several physiological disorders, compromising fruit quality, storability, and enhancing food waste.

SHEET targeted:

Method development for analysing the spatial distribution of fruit temperature within canopies.

Explore also the potential of low-cost sensors for this purpose.

Characterize the fruit damage due to heat stress in apple, grape, and sweet cherry.

Measuring time series of fruit temperature data during the season and over diel course.

Develop a field uniform risk model for heat damage that can inform the farmer based on satellite weather data.

Provide a mobile App prototype with open code to farmers.









Berries with NO symptoms



125 115



Berries with symptoms



Gianluca, A., Filippetti, I., Pastore, C., Sangiorgio, D., Valentini, G., Bortolotti, G., Le Phuong Nguyen, L., Baranyai, L. (2024). Prevention of climate change induced sunburn damage on berries of Vitis vinifera L. with machine learning. Elsevier, submitted







Gianluca, A., Filippetti, I., Pastore, C., Sangiorgio, D., Valentini, G., Bortolotti, G., Le Phuong Nguyen, L., Baranyai, L. (2024). Prevention of climate change induced sunburn damage on berries of Vitis vinifera L. with machine learning. Elsevier, submitted









Zude-Sasse M; Jörissen S; Bignardi M; Regen C; Tsoulias N (2024). Temperature-annotated 3D point clouds. Data in Brief







Tsoulias N; Paraforos DS; Xanthopoulos G; Zude-Sasse M (2020). Apple shape detection based on geometric and radiometric features using a LiDAR laser scanner. Remote Sensing 12: 2481. https://doi.org/10.3390/rs12152481





Tapia-Zapata N; Saha KK; Tsoulias N; Zude-Sasse M (2024). A geometric modelling approach to estimate apple fruit size by means of LiDAR 3D point clouds. Taylor and Francis, submitted











Baranyai, L., Gillay, Z., Firtha, F., Kovács, Z. (2021). Analysis of thermodynamic properties of fruit in canopy to prevent sunburn damage. Proceedings Lippay-Ormos-Vas Scientific Conference











Baranyai, L. (2024). SHEET Deliverable

Slezak, F., Baranyai, L., Allegro, G., Boini, A., Manfrini, L., Tsoulias, N., Morandi, B., Zude-Sasse, M. (2024). Mobile App for analysing the heat damage risk in grape. Acta Horticulturae of EHC, held in Bucharest 2024



- 30+ conference presentations
- 15+ conference proceedings
- 5+ technical papers
- 3+ youtube videos (methodology details)
- 3+ open access data sets
- 5+ research articles



						**	Workshop organization (W); Industry Worksho		
Article									
Title	Author(s)	Type*	Source	DOI	Publisher	Title	Author(s)	Type**	Event
						Digitization in horticulture - challenges and	Zude-Sasse M	l; O	Sino-German Agricultural Week
						Obstanbausysteme und Digitalisierung	Zude-Sasse M	I; O	Klimawandel trifft Obstbau
Analysis of thermodynamic properties of fruit in canopy to prevent sunburn damage	Baranyai, L., Z. Gillay, F. Firtha, Z. Kovács	С	Proceedings			Analysis of thermodynamic properties of fruit in	Baranyai, L., Z. Gillay, F. Firtha, Z. Kovács	C; O	Lippay-Ormos-Vas Scientific Conference
An approach to segment wood structure using a 2D LiDAR in apple trees	Tsoulias N; Penzel M; Zude-Sasse M	С	Proceedings	https:// www.e cpa2021	ECPA	An approach to segment wood structure using a 2D	Tsoulias N; Penzel M; Zude-Sasse M	С; Р	ECPA
Obtaining remote sensor data of fruit trees by means of circular conveyor system	Zude-Sasse M; Tsoulias N; Elwert S; Geyer M	С	Proceedings	https:// www.e cpa2021	ECPA	Obtaining remote sensor data of fruit trees by means of	Zude-Sasse M; Tsoulias N; Elwert S; Geyer M	С; Р	ECPA
How can we reach enhanced climate resilience considering sunburn and heat damage in fruit	Morandi B; Boini A; Kalcsits L; Baranyai L; Allegro G; Manfrini L;	С	Acta Horticulturae	https:// doi.org /10.17	ISHS	How can we reach enhanced climate resilience considering	Morandi B; Boini A; Kalcsits L; Baranyai L; Allegro G; Manfrini L;	w	31st International Horticultural Congres (IHC)
						Modelling of fruit temperature distribution	Baranyai, L.	C; O	Workshop "How can we reach enhanced climate resilience
						application of RGB images to estimate fruit position and 3D	Manfrini, L.	C; O	Workshop "How car we reach enhanced climate resilience
						Sunburn damage in vineyards	Allegro, G.	C; O	Workshop "How can we reach enhanced climate resilience

K2 - Informacja wewnętrzna (Internal)





- Characterizing the phenomenon of heatwaves was achieved by innovative time series analysis of 3D fruit skin temperature (experimental and low-cost) as a reliable indicator for type of sunburn symptoms in apples, grape, and sweet cherry.
- Thermodynamic model has been approached and ANN field-uniform risk model has been implemented by mobile App (beta-version 01/28/2024)





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### Ready to ...

- apply the methodology in ecophysiological studies
- improve thermodynamic model to optimize fruit production measures
- release adjusted version of the mobile App by commercial partner







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competence/horticultural-engineering/precision-horticulture-1

## **Fhank you for your attention!**