LIFE FROSTDEFEND

Newsletter #4

June 2024

LIFE20 CCA/GR/001747

Plant Phenology and Frost Hardiness

The risk of frost is closely linked to changes in plant phenology, which is the study of periodic plant life cycle events and how they are influenced by seasonal and environmental changes.

As climate change affects temperatures and seasonal patterns, the timing of these life cycle events, such as flowering and budding, may shift.

This can lead to increased vulnerability to frost if plants enter sensitive phases earlier or later than usual, coinciding with unexpected frost events.

Consequently, understanding and predicting these phenological changes are crucial for mitigating frost damage in plants.

Testing of the FROSTDEFEND Tool in French orchard

Plant Vulnerability and Supercooling

The risk of frost primarily depends on temperatures falling below 0°C, the freezing point of water.

However, plants can often remain in a state of supercooling, which allows them to avoid freezing at temperatures slightly below 0°C (-5°C for the tree in the picture). This phenomenon enables plants to endure lower temperatures without forming ice crystals within their tissues.

Nevertheless, if temperatures drop significantly, this supercooling state may fail, causing the plants to freeze and potentially suffer damage.

Thus, while the general threshold for frost risk is around the freezing point, the actual vulnerability of plants can vary depending on their ability to supercool.

Plants will not necessarily freeze at sub-zero temperatures!

Orange tree this winter in France

Strategies to cope with tree freezing stress

Within the framework of the LIFE FROSTDEFEND project, the intricate relationship between citrus phenology and frost vulnerability has been investigated.

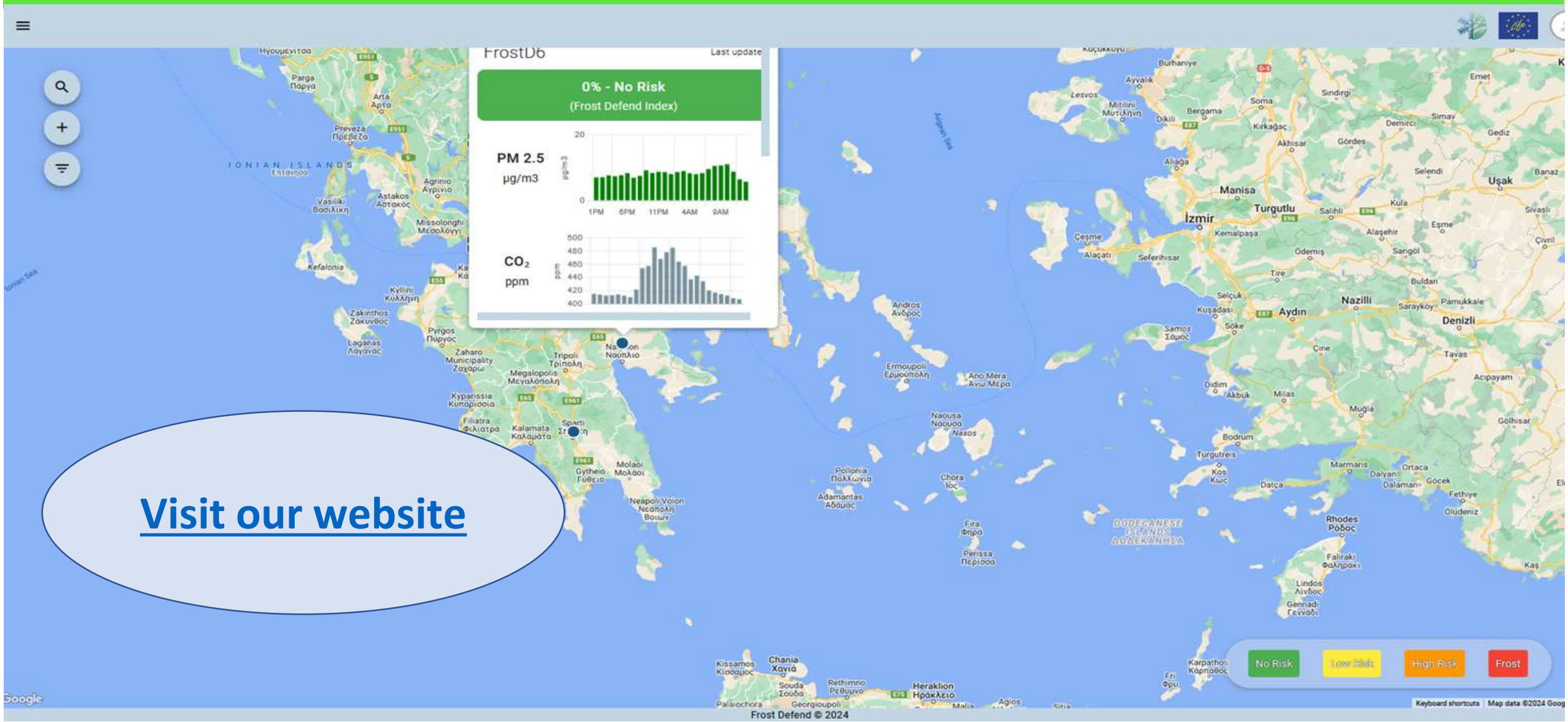
Citrus relies on a supercooling strategy to cope with frost stress. This frost tolerance exhibits an acclimation pattern, as the temperature in the days before the freezing event (mean temperature over two weeks) affects ice nucleation temperature in plant tissues.

Citrus sinensis equipped with thermocouple inside temperature control chamber (INRAe)

Recommendations emphasize incorporating acclimation treatment before freezing, accounting for phenology effects, and considering the intensity and duration of frost events, into the LIFE FROSTDEFEND Tool for an accurate assessment of citrus frost vulnerability.

Growth chamber with different citrus conditioning for forcing test (INRAe)

LIFE FROSTDEFEND Tool



LIFE FROSTDEFEND Seminars

On Friday, May 24, 2024, Nicolas Dusart from INRAe presented the seminar titled FROSTDEFEND - Frost Risk in Citrus: Interaction Between Plant Vulnerability and Ice-Nucleating Bacteria. This seminar took place at the Cézeaux Campus, Biology Pole, Conference Room 01 (UCA).

LIFE FROSTDEFEND Seminars

On June 6, Prof. Papadakis and Prof. Georgakopoulos delivered enlightening talks on frost damage mitigation strategies at the Agricultural University of Athens (AUA) amphitheater. They presented to a keen audience of undergraduate students.

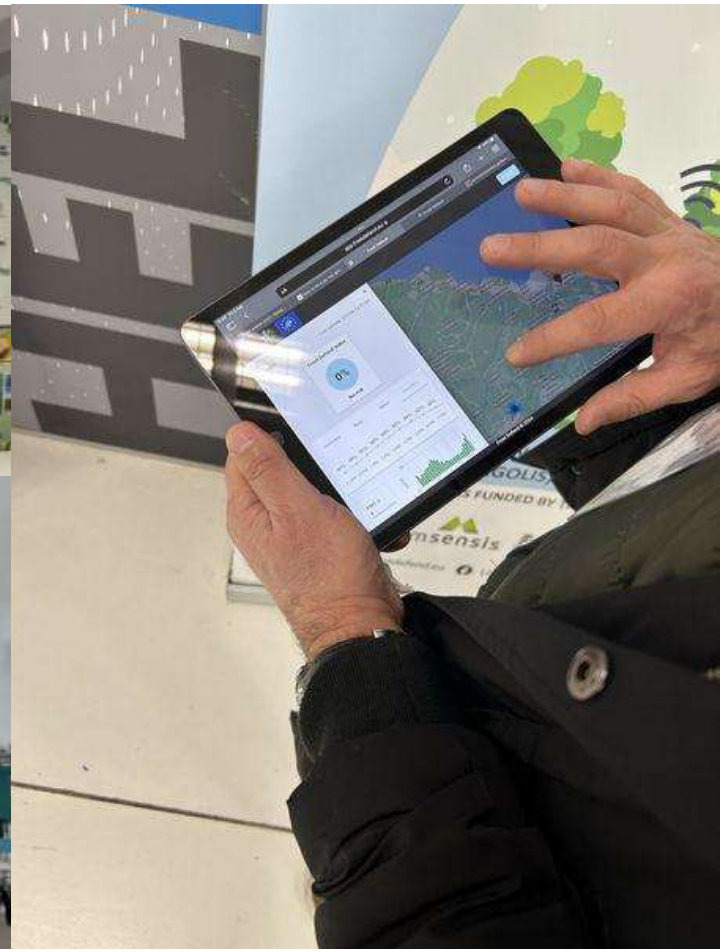
Frost damage will be a significant issue for the AUA future agriculture professionals, and the insights shared by Prof. Papadakis and Prof. Georgakopoulos were invaluable. They emphasized practical approaches and cutting-edge technologies that can be employed to safeguard crops, ensuring food security and the livelihood of farmers. Their presentations sparked vibrant discussions and numerous questions from the eager attendees, highlighting the importance of addressing frost issues in agriculture.

Dissemination and Networking Highlights

Prof. Dimitri Georgakopoulos and Dr. Khalil Geballa-Koukoulas from the Agricultural University of Athens presented our work at the 10th Conference of the Mikrokosmos society in Larisa, Greece (30/11-2/12/2023)

The LIFE FROSTDEFEND project was @ the 31st Conference of the Hellenic Society of Fruit and Vegetable Science organized in Heraklion, Crete from 29 October-2 November 2023.

Dissemination and Networking Highlights



The leading sectoral exhibition in Greece in the agro-economic sector!

153.000+
Visitors

60.000
Mixed sq.m.

1.800+
Exhibitors

MSENSIS in Agrotica 2024 with LIFE FROSTDEFEND: 1-4 February 2024 @ Thessaloniki International Exhibition Centre

Dissemination and Networking Highlights

The 20th International Plant Protection Congress is taking place in Athens. Prof. Dimitris Georgakopoulos from AUA coordinates the session "Frost Damage Mitigation Strategies for Crops," organized by the LIFE FROSTDEFEND project, with the objective of showcasing our project to key stakeholders in plant protection.

Dissemination and Networking Highlights

A highlight of this session is the presentation by Prof. Jean-François Berthoumieu, a world-renowned expert in the field. Prof. Berthoumieu, a steering committee member of the project, will open the session with a compelling presentation on "How Could the Energy of the Soil Contribute to Reduce or Increase the Risk of Frost? The Experience of Vineyards and Orchards in the South-West of France".

Other esteemed scientists, including Prof. Steven E. Lindow from UC Berkeley, the “guru” of biological ice nucleation (virtual presentation), and Dr. Lia Lamacque, will also contribute their expertise to the session.

The LIFE FROSTDEFEND team will be represented by Prof. Georgakopoulos from the Agricultural University of Athens, Dr. Nicolas Dusart from INRAE, and Dr. Khalil Geballa Koukoulas from the Agricultural University of Athens.

This event highlights the global significance of addressing climate-related challenges in agriculture and the collective effort needed to develop resilient agricultural practices.

LIFE FROSTDEFEND

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The project has received funding from the LIFE Programme of the European Union under GA number LIFE20 CCA/GR/001747. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

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