CPS: Medium: Field-specific weather-driven automated frost mitigation

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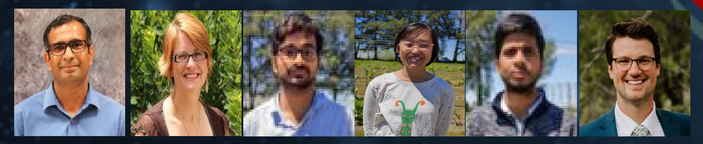
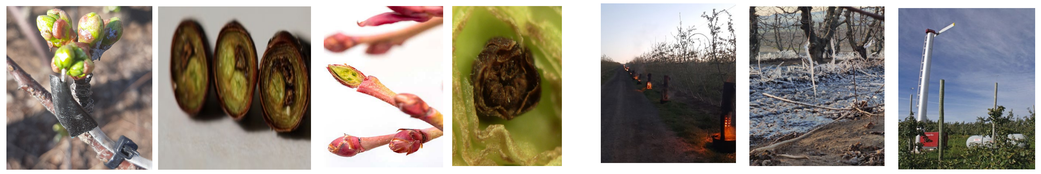


Washington State (WA) is top producer of fresh market sweet cherry (61%) and blueberry (21%) in the United States

Frost damages: Highly vulnerable in the Spring from bud break until fruit set and can cause up to 70% yield losses



Frost damages in sweet cherry and blueberry buds | **Mitigation approaches**

Challenges

- Existing methods use non-site-specific temperature forecasts driven empirical models.
- Lack of bud temperature driven automated active frost mitigation strategies

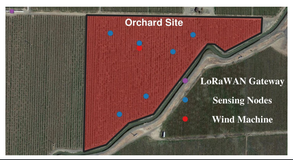
Objectives

1. Integrate surface and aerial meteorological observations into field-specific, short-term forecasts.
2. Develop localized weather data-driven intelligent crop loss management system through real-time actuation of either-or combinations of active frost mitigation techniques.
3. Assess grower evaluation/validation of decision aid tools and prototype performance.

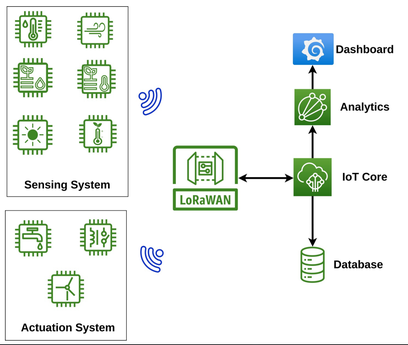
Impact

- Scientific: Crop physiology sensing and real-time intelligent control system to overcome barriers to manage frost related crop loss.
- Education: Enhance multidisciplinary graduate education
- Societal: Promoting greater food security

Approach



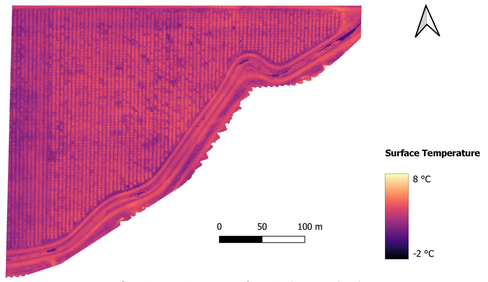
Intelligent Wireless Sensing Network (WSN)



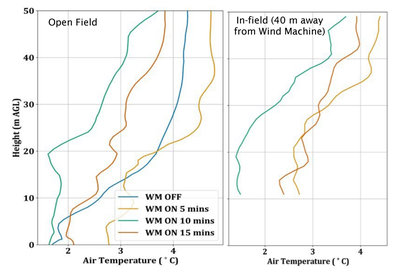
Inversion and Thermal Image Mapping

Thermal Mapping
Altitude: 50 m
Imager: DJI Mavic 3 Thermal
GSD: 6.59 cm/pixel
Resolution: 640 x 512

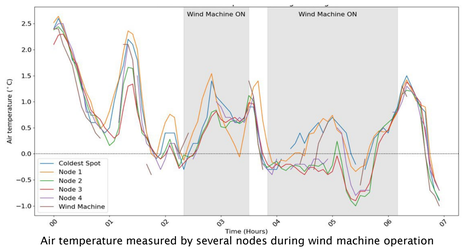
Inversion Mapping
Altitude: 9–50 m
Sensor: iMet XQ2
Ascent Speed: 1m/s
Resolution: 1 second



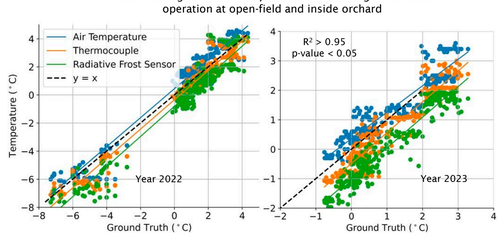
Surface temperature map of sweet cherry orchard



Inversion strength measured by drone sonde during wind machine operation at open-field and inside orchard



Air temperature measured by several nodes during wind machine operation



Correlation between various sensors and ground truth for tissue temperature

Acknowledgements

WSU CPAAS Precision Ag Lab members and AWN team
Dave Brown (METERS Group, Pullman), Joe Boomgard- Zagrodnik
Grower cooperators: Lighthouse Farms, Hayden Farms, Olsen Farms

Award ID#:2021-67021-34336