Microtensiometer sensor for accurate, long-term water potential measurement in trees and vines

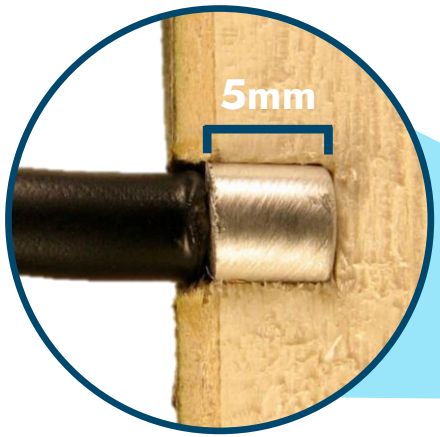
Michael Santiago, PhD

FloraPulse

Every year $100 billion worth of fruits and nuts is lost due to suboptimal irrigation.

Long-term, continuous water potential sensor

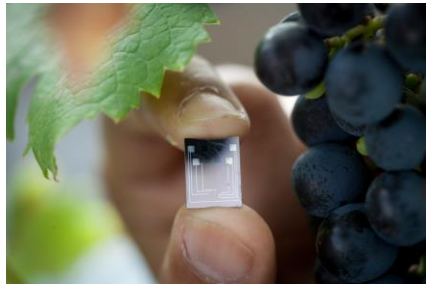
Sensor measures water potential **directly in the xylem.**

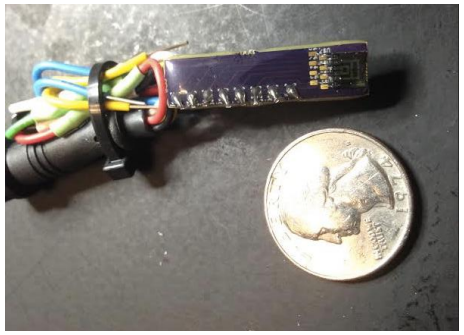


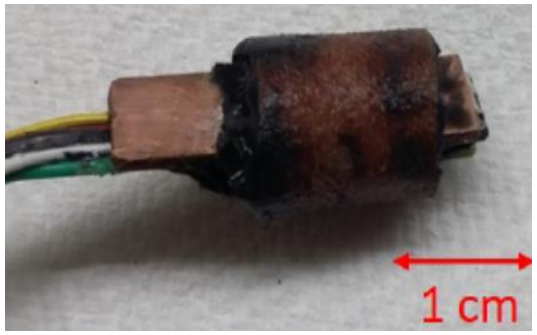
Accurate + automated
Know exactly when to irrigate.

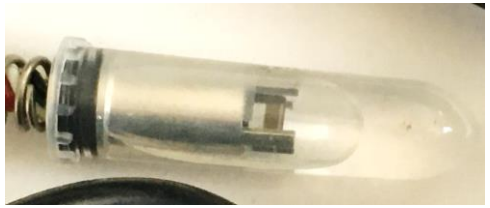
FloraPulse

15 years in development at Cornell + FloraPulse









ABRAHAM STROOCK

Professor & Director of Digital Ag

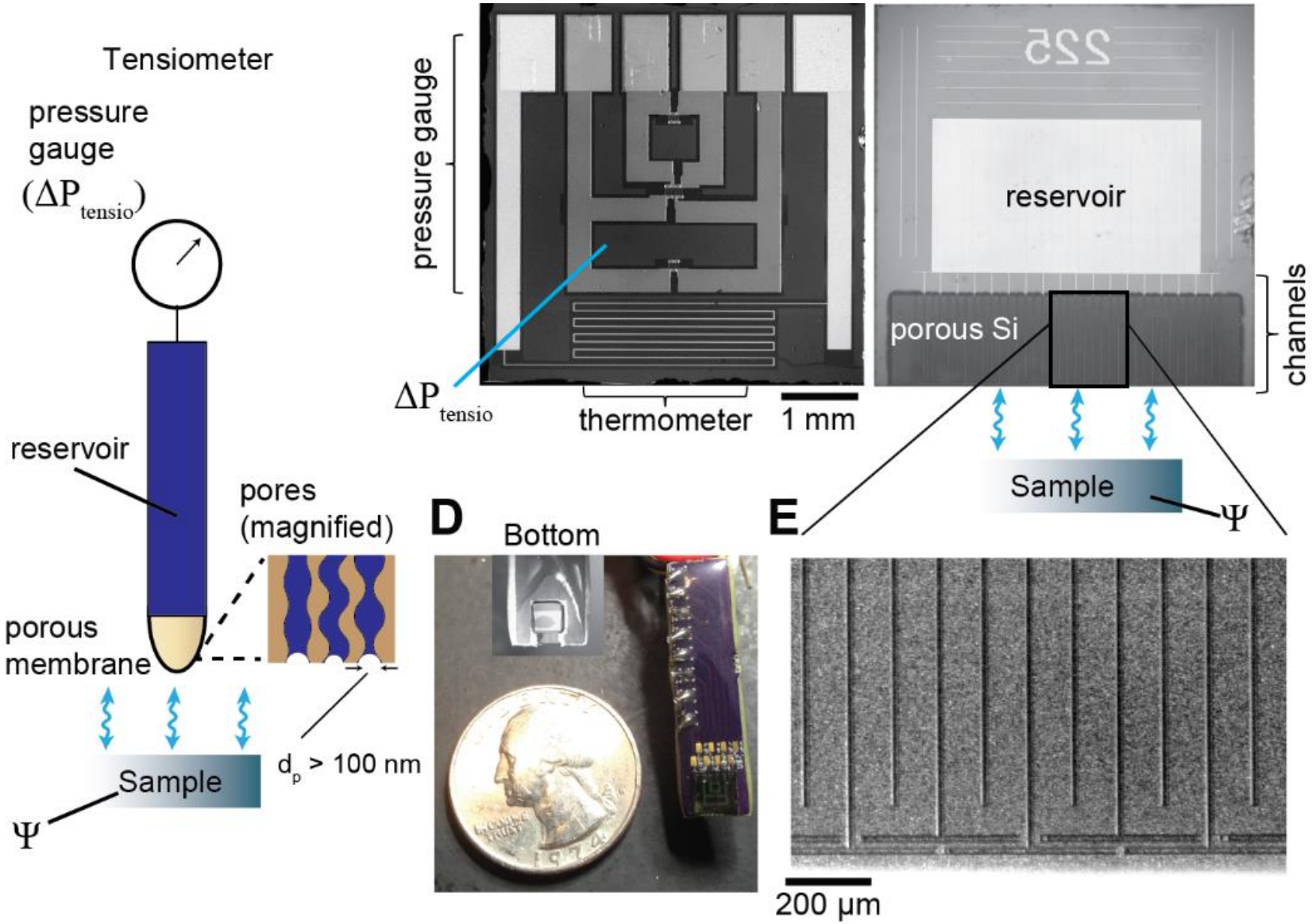
ALAN LAKSO

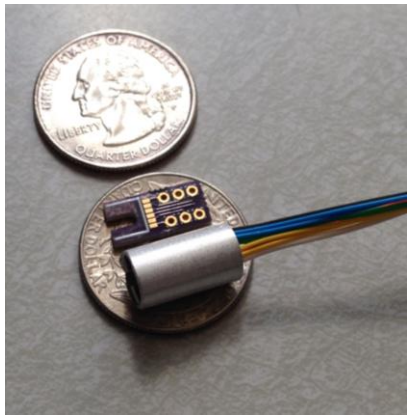
Plant Science Professor

MICHAEL SANTIAGO

Mechanical Engineering PhD

Microchip tensiometer (microtensiometer)





Encapsulated
Form factor

Biggest challenges in measuring water potential

Plant wounding response ‘blocks’ sensor

Consistent access to xylem (difficult installation)

Long-term seal

60 bar/°C error!

Extreme temperature sensitivity

Installation process – overcomes challenges

Hammer sleeve into tree

Drill into sleeve

Fill with mating compound

Insert sensor

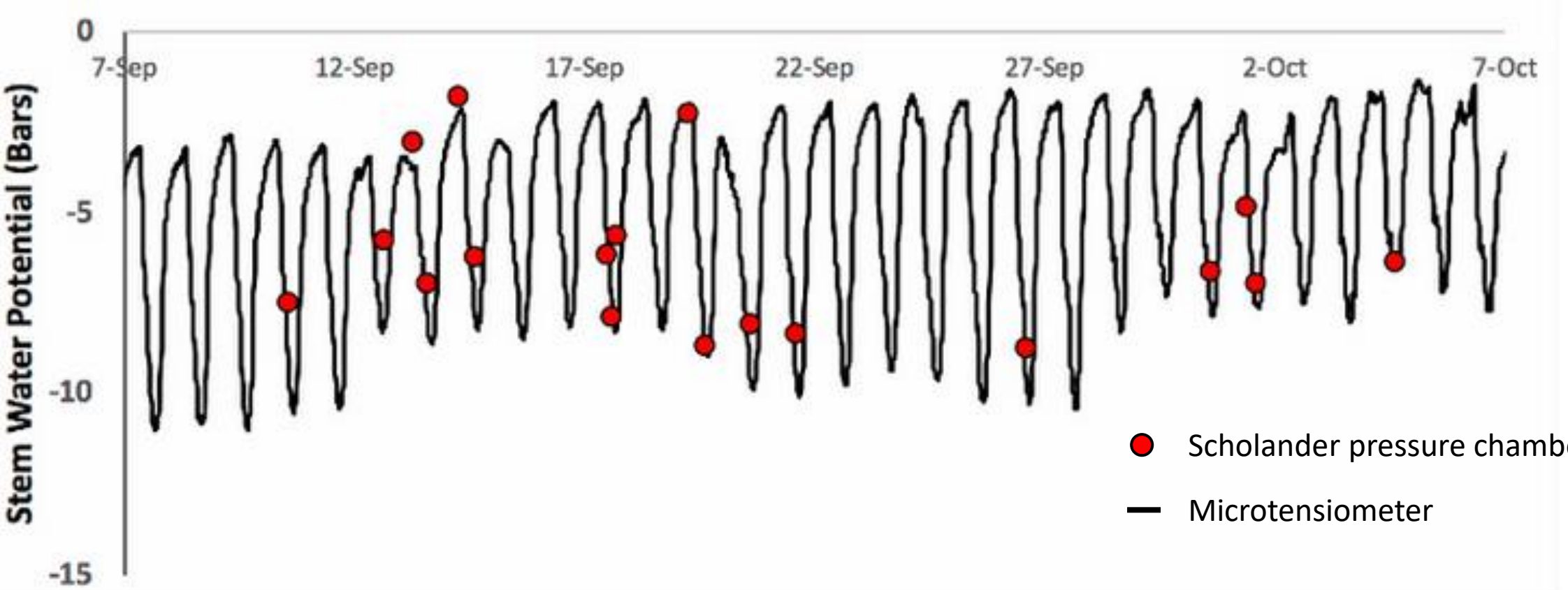
Grease backup seal

Tape backup seal/protection

Batting insulation

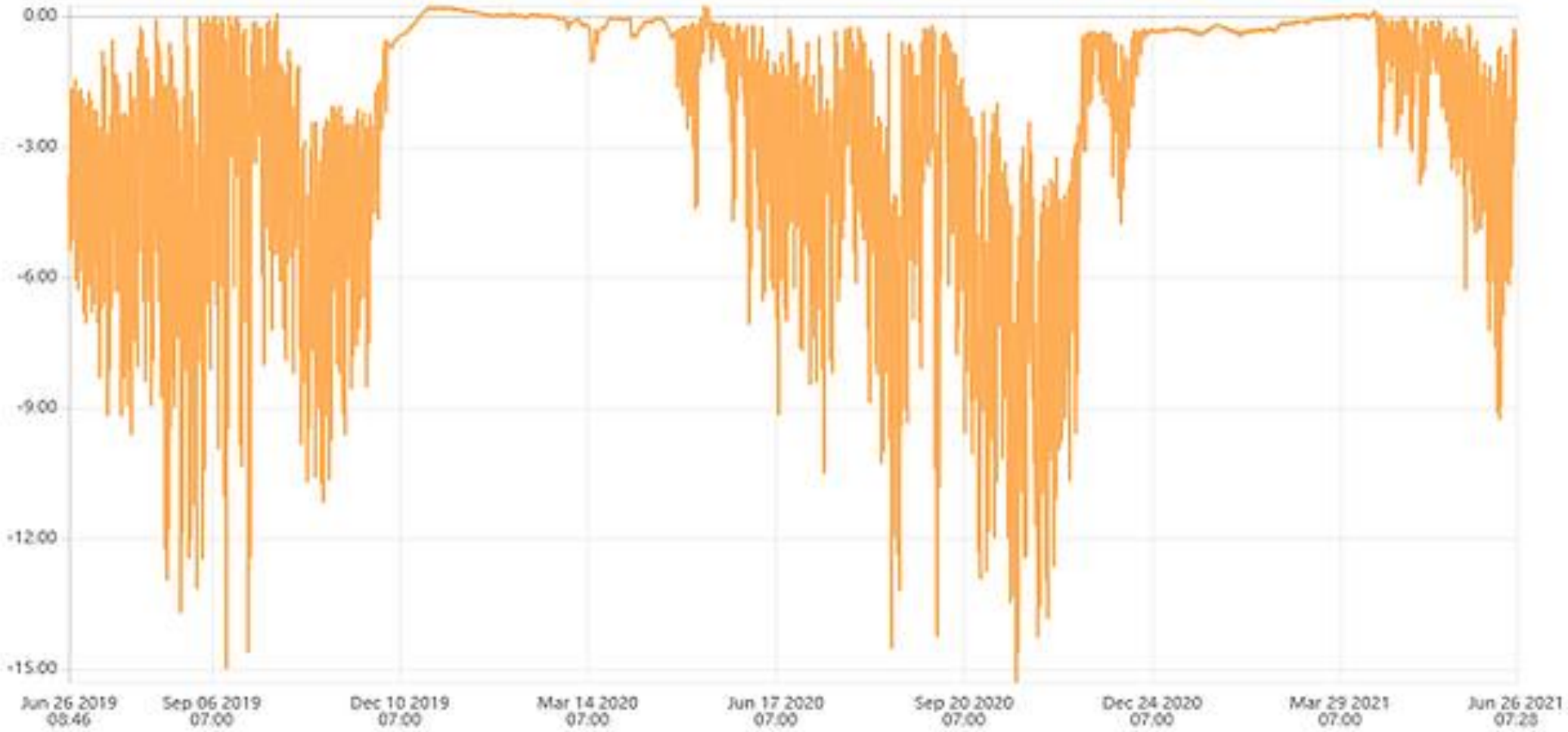
Hang datalogger

Result #1: Continuous SWP



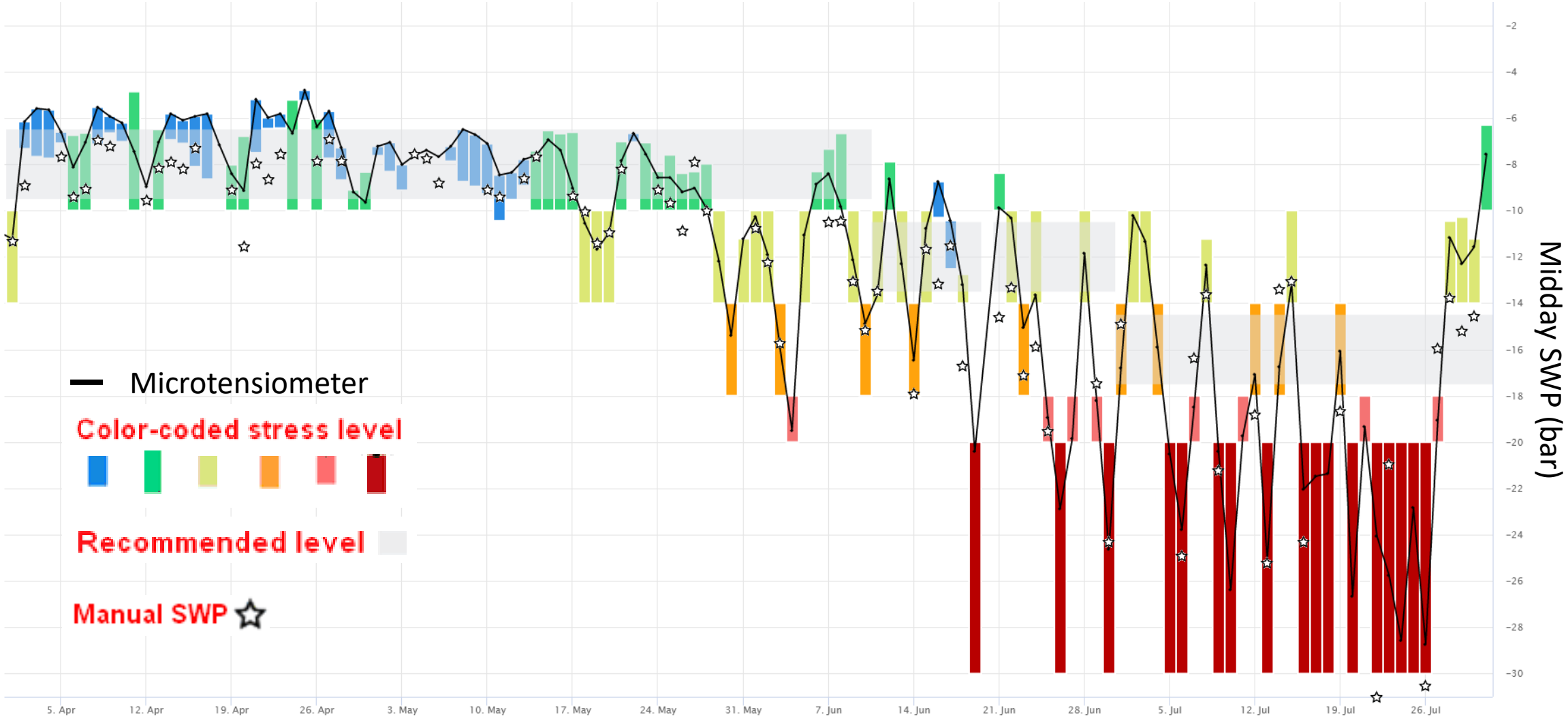
Merlot grape – Zamora, CA

Result #2: 2+ years of SWP



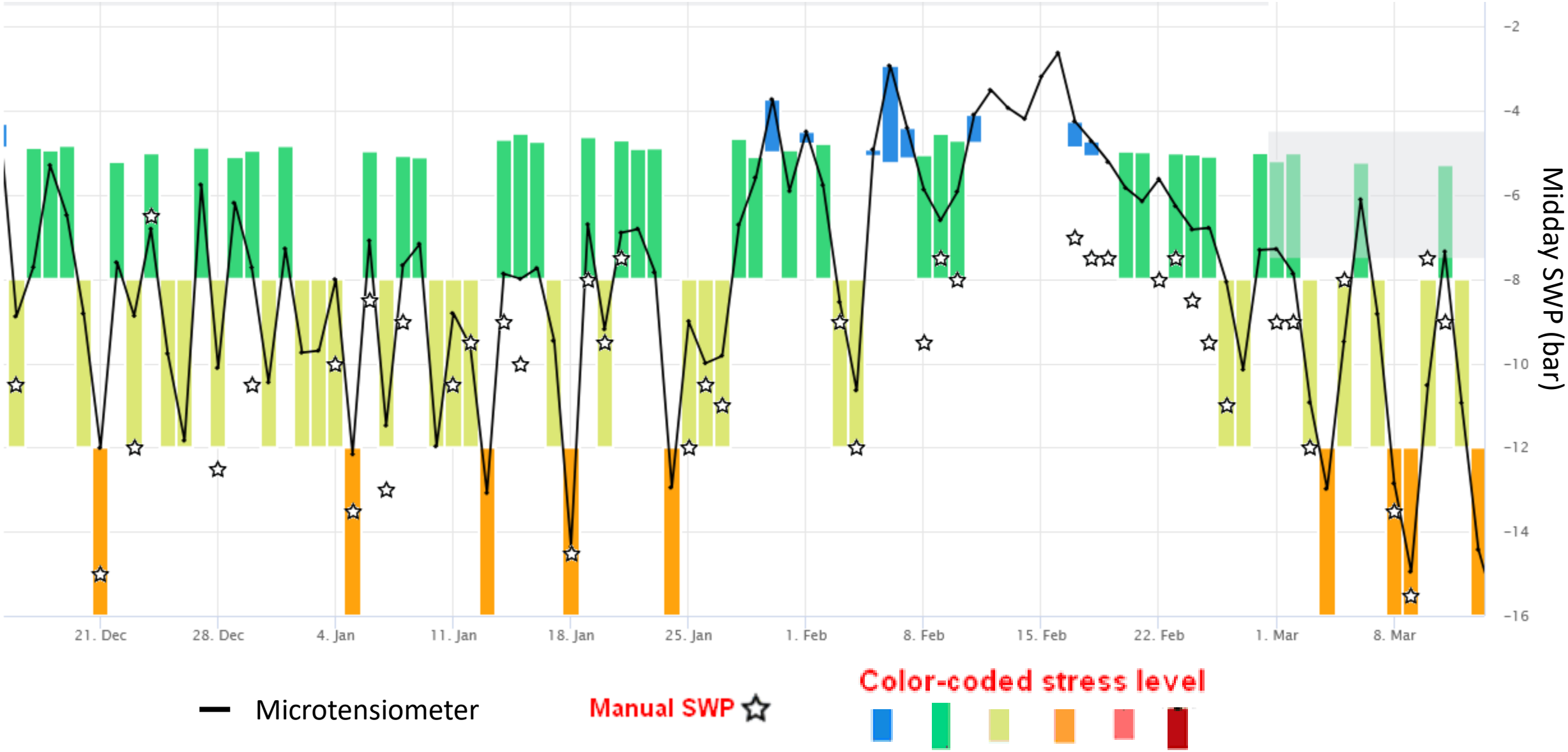
Cabernet grape – Napa, CA

Result #3: Midday SWP in almond



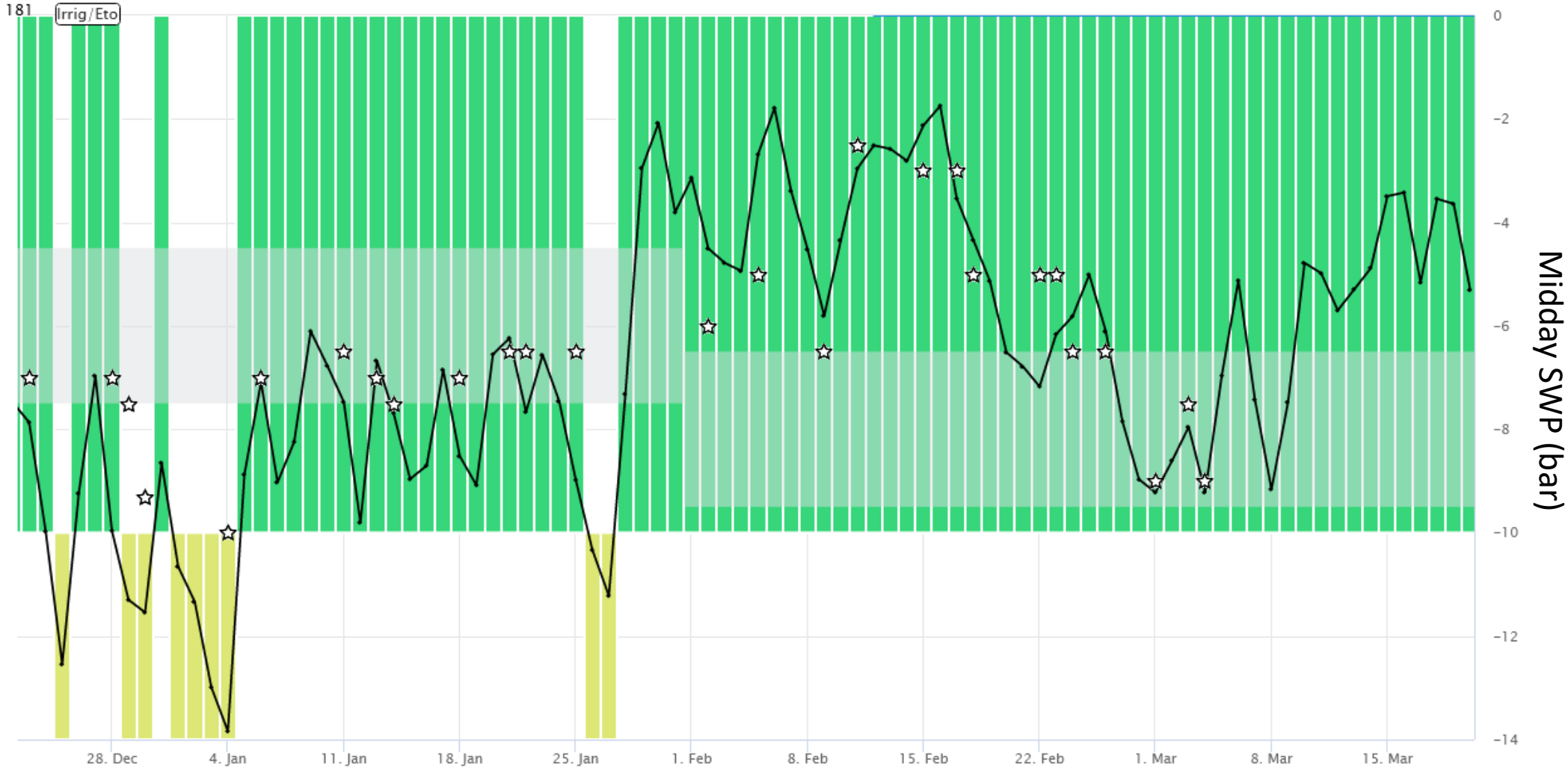
Courtesy: Ken Shackel

Result #4: Midday SWP in prune



Courtesy: OLIVOS riego

Result #5: Midday SWP in Cherry



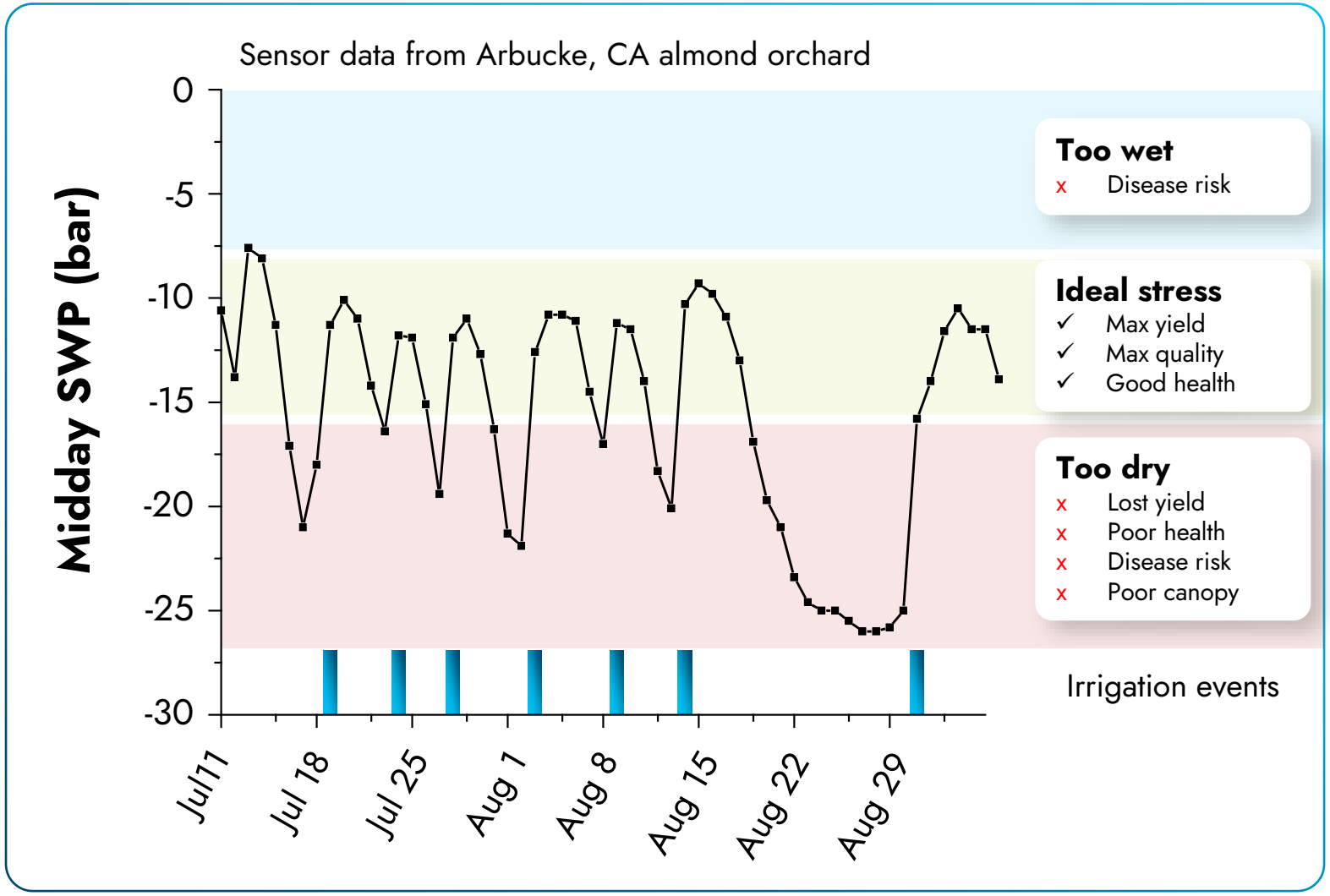
— Microtensiometer

Manual SWP ☆

Color-coded stress level

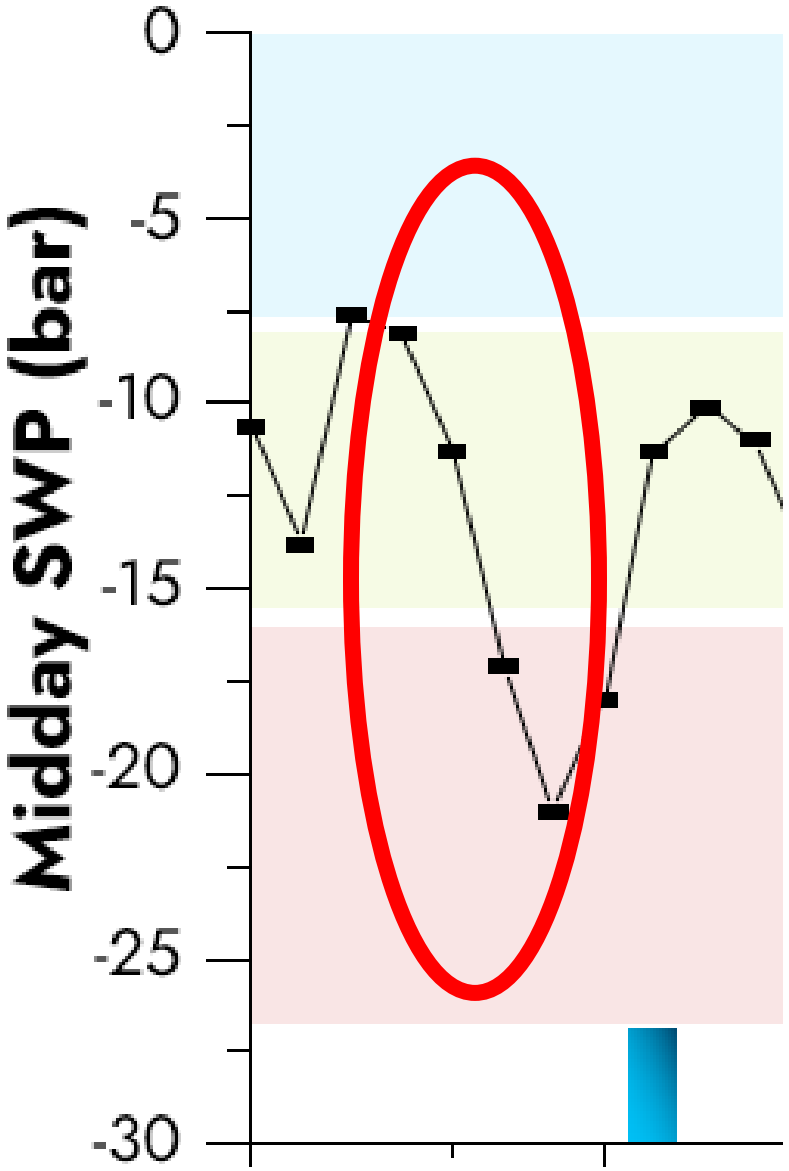
Courtesy: OLIVOS riego

Initial finding #1: growers over- & under-irrigate



Courtesy: John Monroe

Initial finding #2: trees can ‘crash’ from wet to dry



Almond went from fully wet to very stressed in 3 days!

Missed with weekly pressure chamber.

-7.5 bar to -22 bar

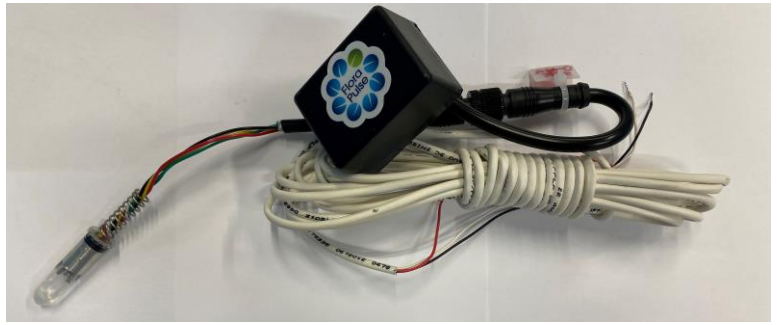
The power of daily water potential

- Decreased water use by 45%.
- Decreased pumping and drying costs.
- Increased fruit size and yields.

Andres Olivos, Prune grower
OLIVOS riego
Rengo, Chile

Sensor versions

Analog microtensiometer



SDI12 microtensiometer

Microtensiometer + logger + data

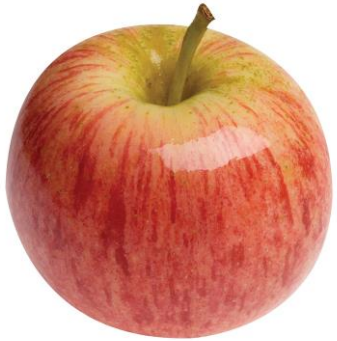
Validated in many crops

- Almond
- Grape
- Pistachio
- Orange
- Prune
- Apple
- Pear
- Peach
- Cherry
- Olive
- Mango
- Oak
- Fig








Crops in progress – positive pressure in xylem?

- Walnut
- Avocado
- Pecan

Crops that need testing:

- Pomegranate
- Kiwi
- Papaya
- Macadamia
- Coffee
- Hazelnut
- Others…








Conclusion: long-term SWP sensor

- Continuous water potential sensor
- Can last for years
- Validated in many crops
- Commercially available

Ask: Tell your friends!

Interested? Let’s talk.

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