FloraPulse

Research Discussion Q&A Session

October 10th, 2023

Agenda

- New Research and Developments (~15 mins)
  - Updated manuals and videos
  - Testing of new smaller sensors
  - Developments for challenging crops: walnut, pecan, avocado
  - Soil tensiometer
  - What's Next?

- Q&A (as long as it takes!)
  - 15 questions submitted through registration.
  - Please type more questions in the chat during this meeting ☺ we will do our best to answer them!

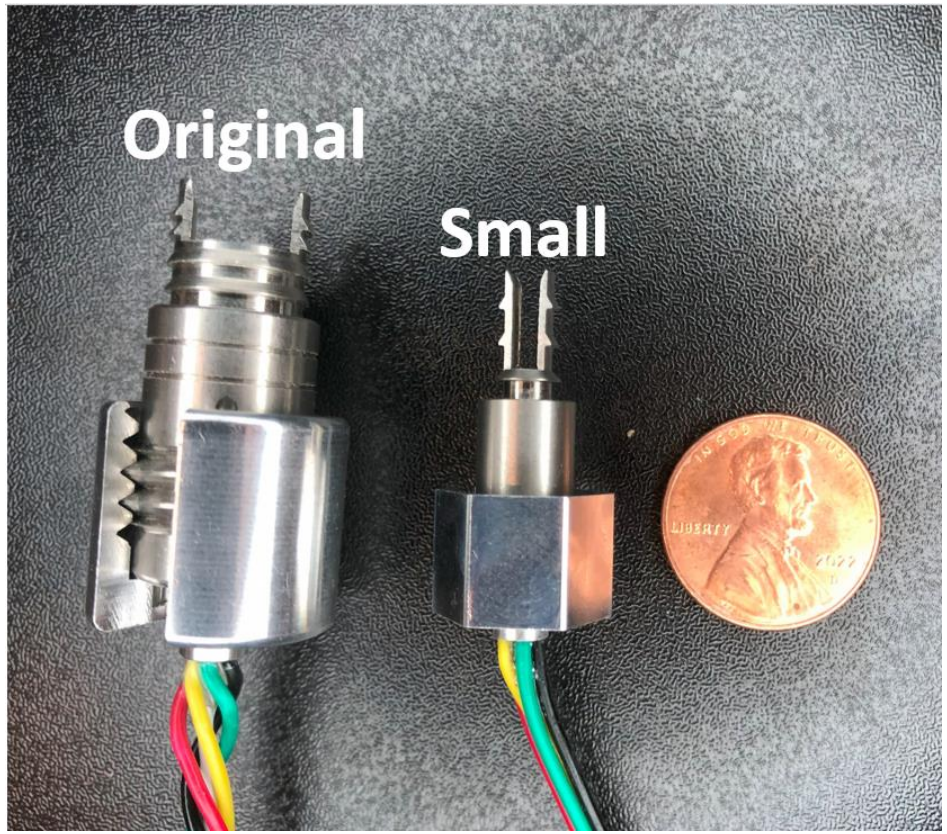
Updated installation videos and manuals

- Probe installation manual and video.
- Probe installation into thick-bark trees video.
- Probe reuse manual and video. Sensor removal video.
- Small probe installation manual and video.
- Walnut installation manual and video.
- Dashboard walkthrough video.

We will share the slides after the meeting with all participants!

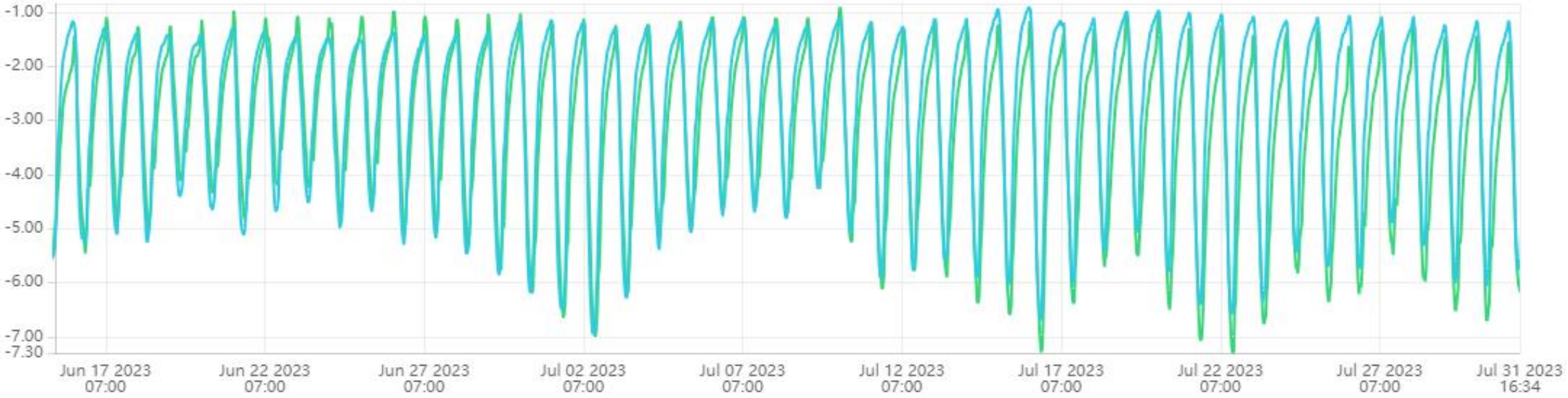
Small Probe

- Wound size went from 10 mm to 3 mm!

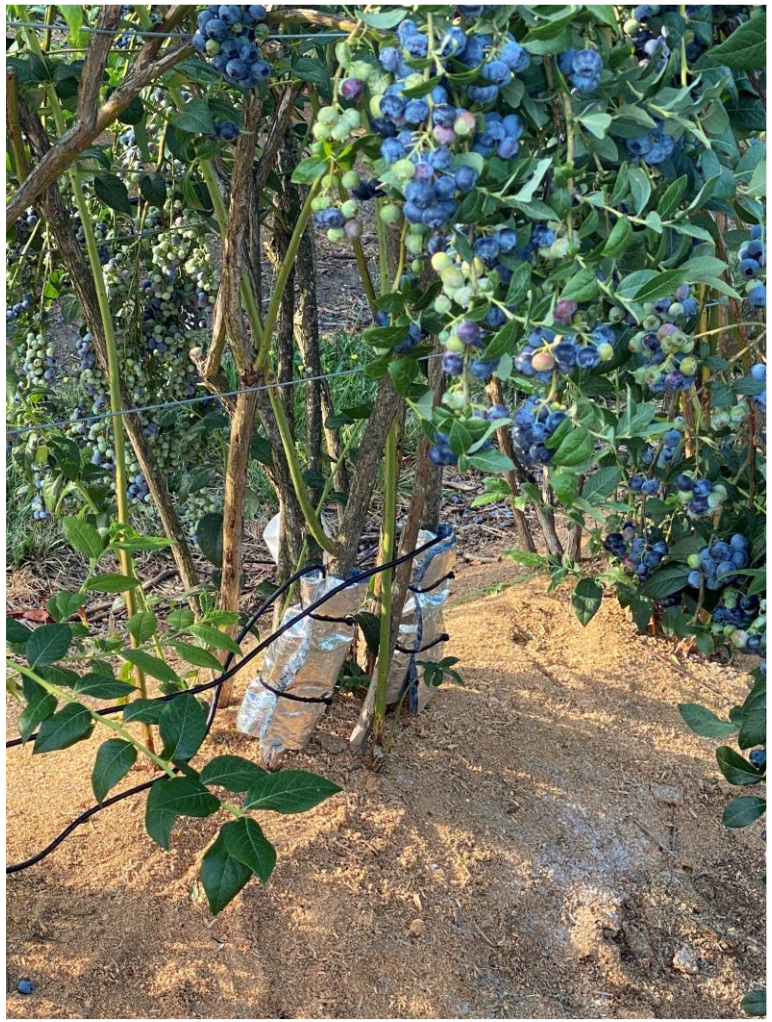


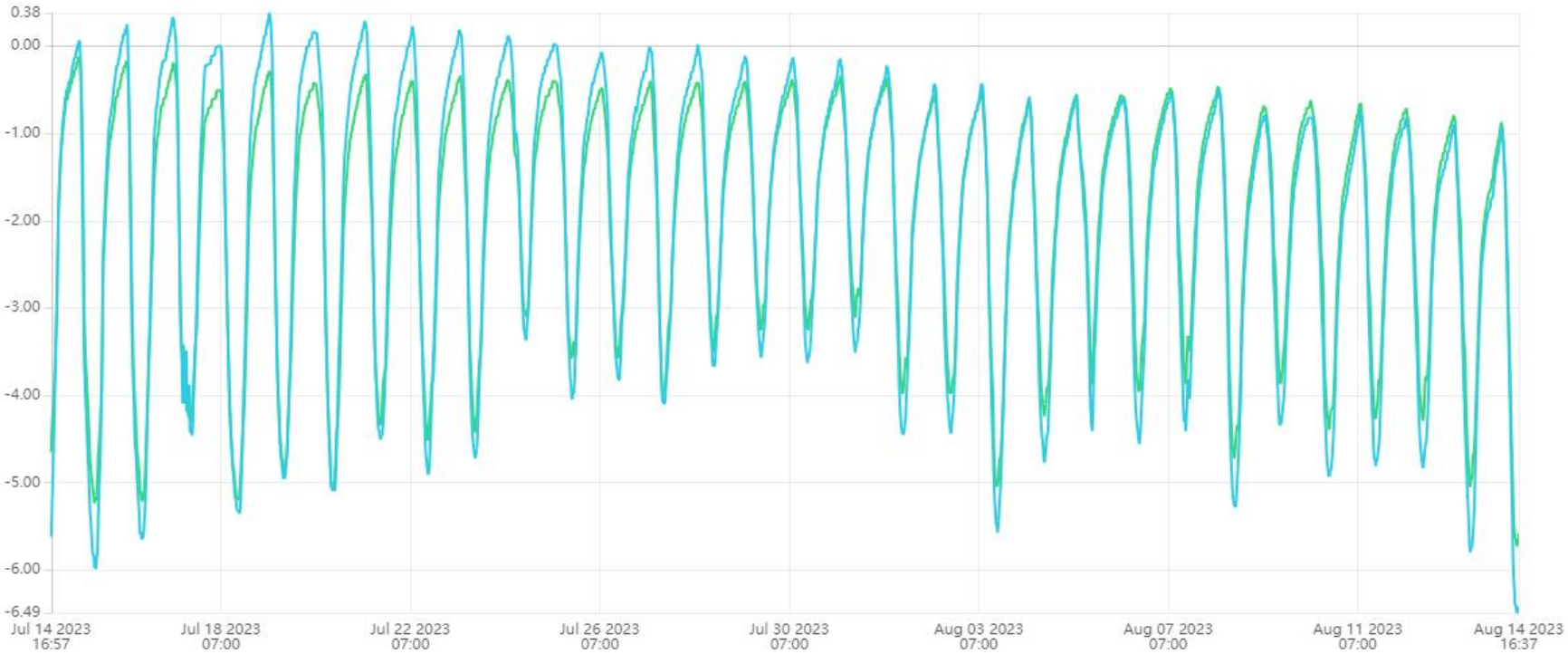
Small Grape Vines

- Grapevines as small as 0.5” in diameter!
- Internal testing
  - also with Advanced Viticulture



Blueberry

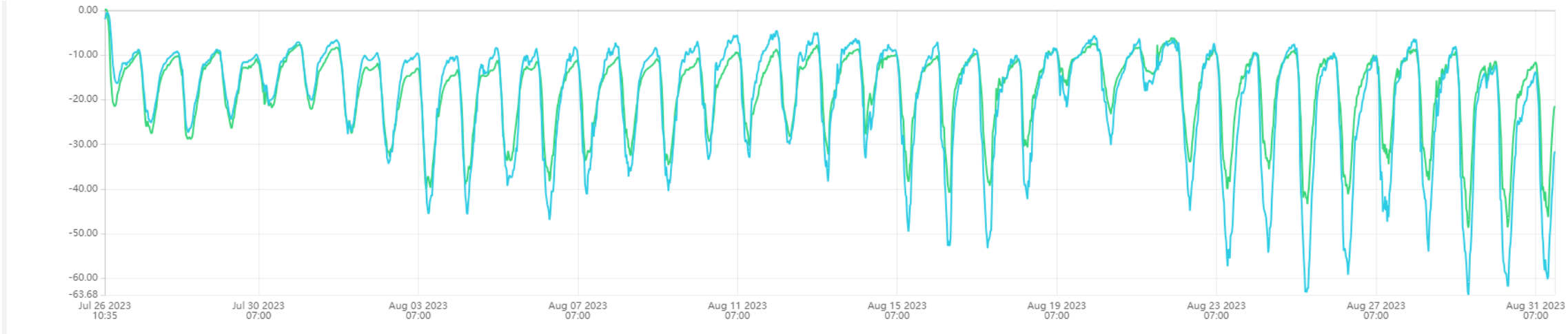




Courtesy: David Bryla

Cotton

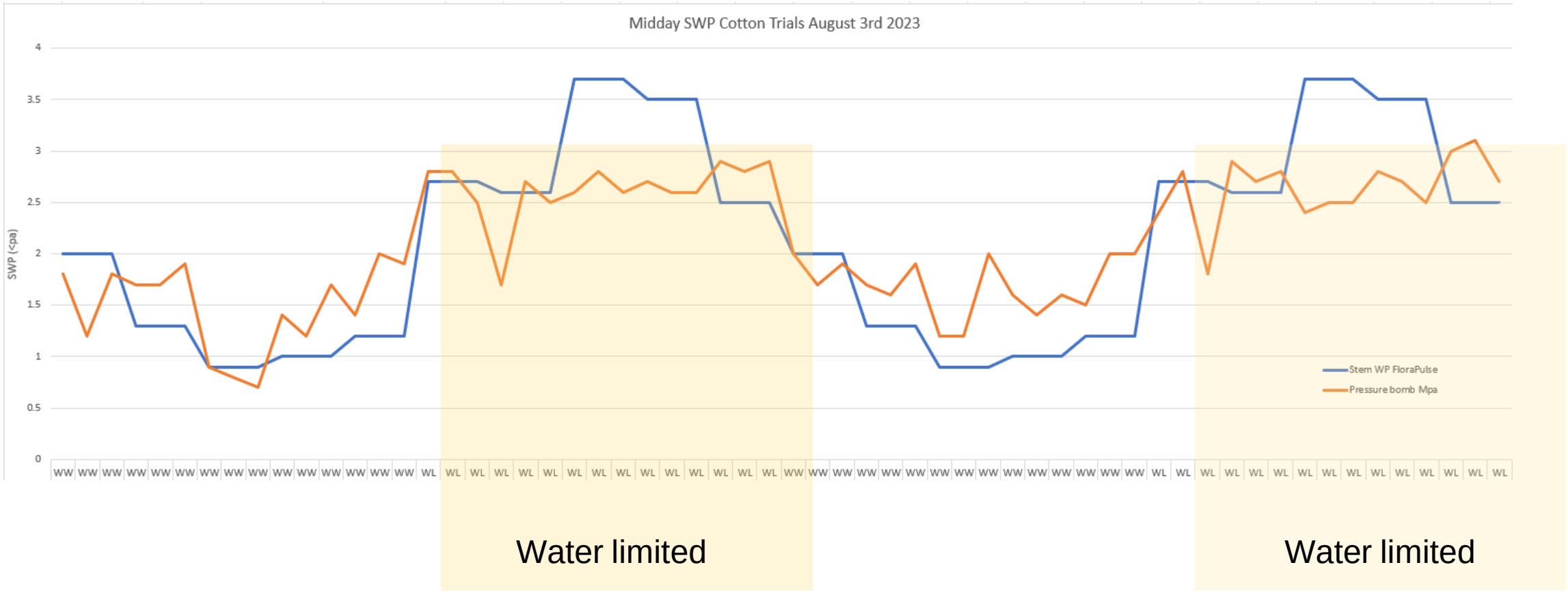
Plants are very small at ~7-10 mm in diameter. Great initial results in 2022, ran into challenges with updated design in 2023.



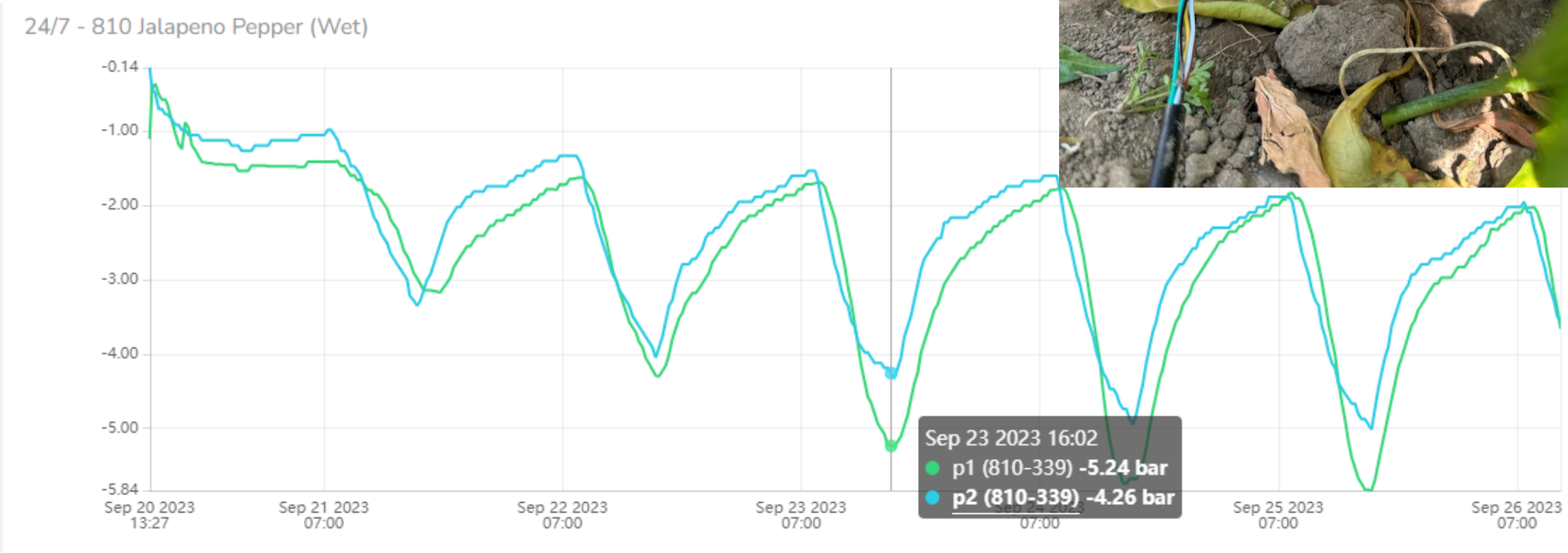
Courtesy: Duke Pauli

Cotton

Very strong agreement between sensor Middays and Pressure bomb, but a difference as high as 10 bars can appear under water-limited conditions.



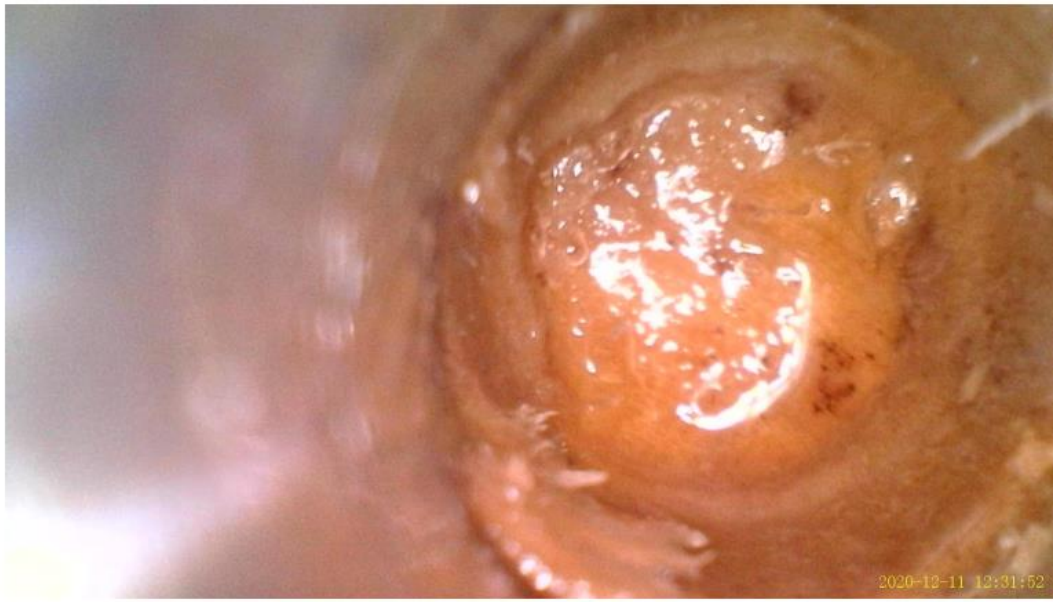
Most Recently: Pepper!



Problem “Wet Crops”

- Moisture from xylem floods the install site, sensor reads 0 bars
- Walnut, Avocado, Pecan

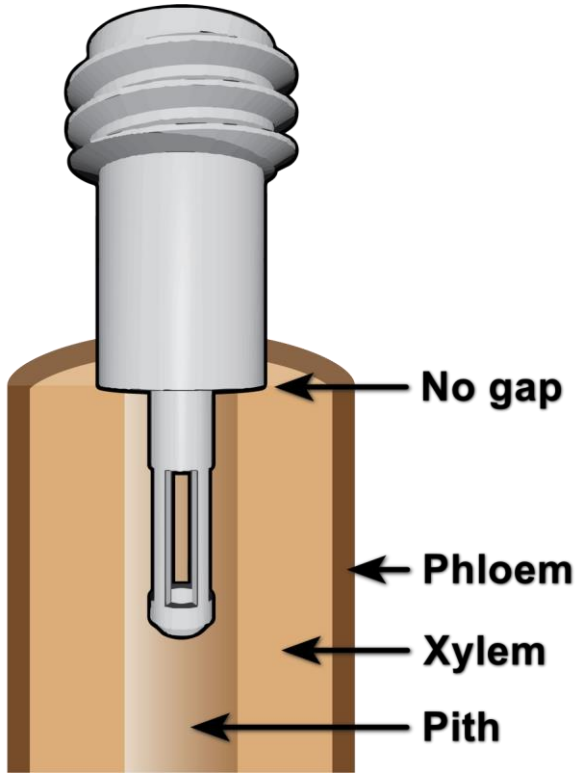
Walnut Xylem, freshly Drilled



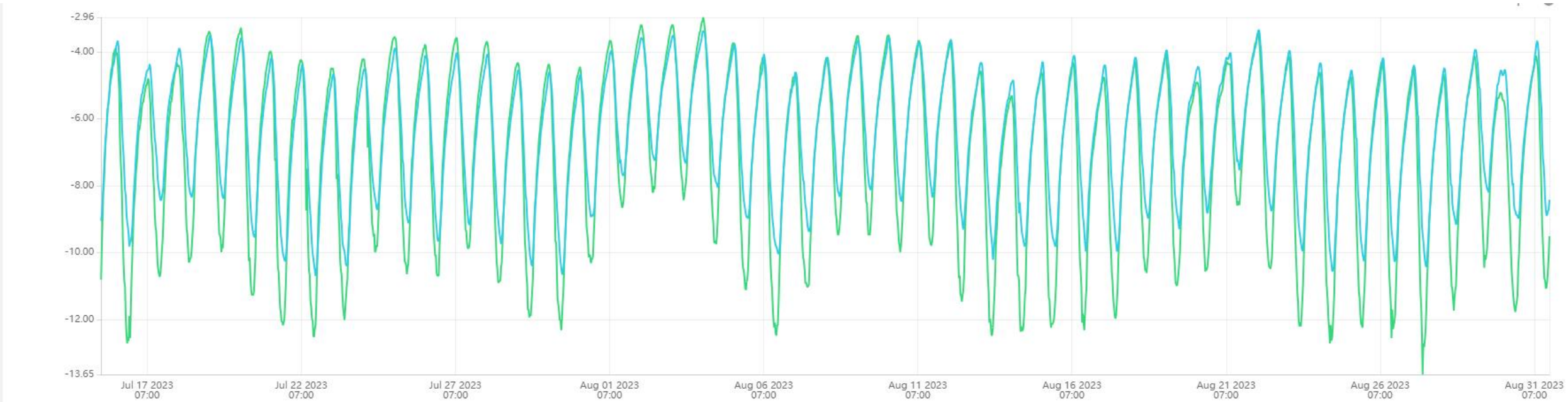
Walnut Xylem, 3 weeks after drilling

Solution: Heading Cut Technique

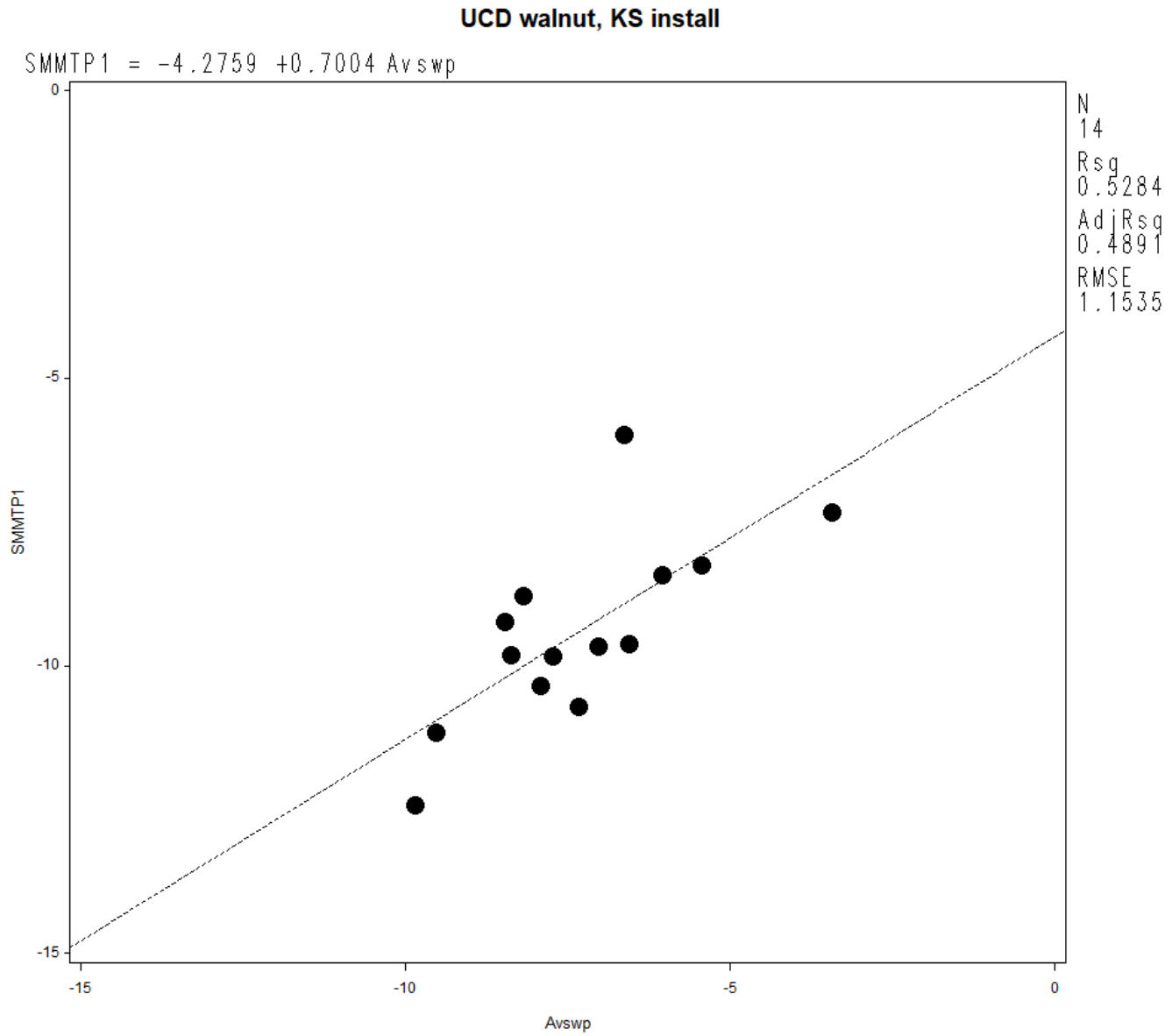
Aims to avoid installing through the bark by making a heading cut on a young shoot.



Walnut Results

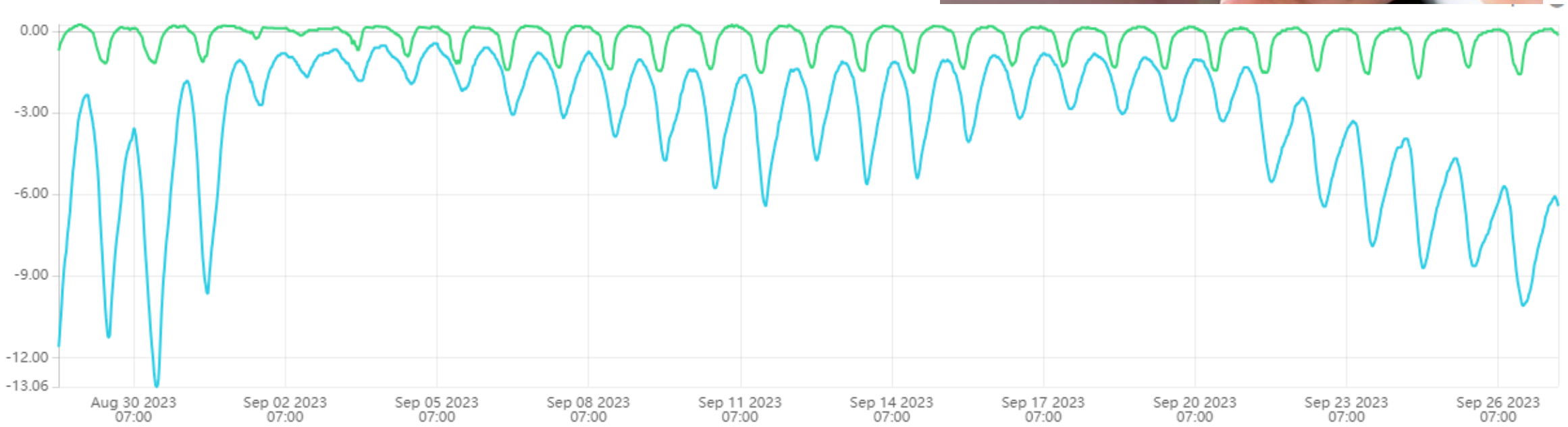


Walnut Results



Avocado results

Avocado – hand twist a drill bit to clear the pith



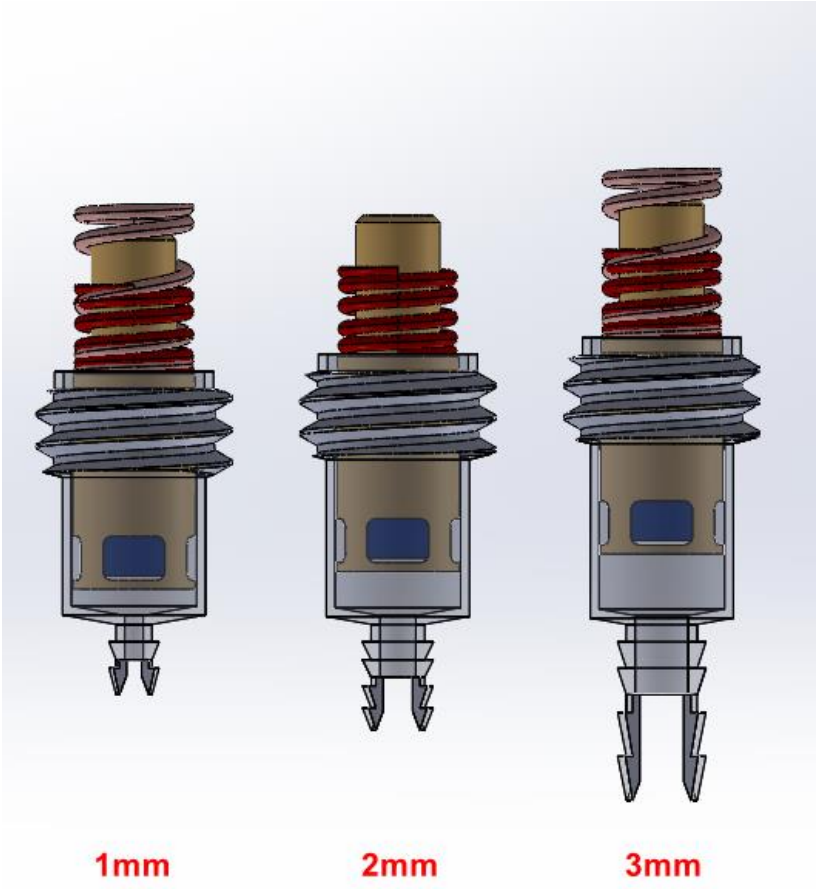
What’s Next? Small Probe

Improve Strength of Hydraulic Connectivity between Sensor and Xylem

- Experiment with new mating compounds

- Characterize sensor temperature effects for different wound sizes

Make the Small Probe installs easier, more accurate and consistent!



Experimental sleeve designs, down to 1mm wound size.

What’s Next? New Crops

Tropical Fruits

Herbacious Crops

Forestry

Coffee and Cacao

- Testing continues in the Southern hemisphere! Full Season Results expected for:
  - Walnut
  - Avocado
  - Blueberry
  - Kiwi
  - Winegrapes

Have crops to test? Please contact us ☺ admin@florapulse.com

Updated crop list

Works great. Validated.

- Almond
- Prune
- Cherry
- Apple
- Grapevine >2”

Works with issues.

- Pistachio
- Citrus

Good initial validation:

- Pine
- Hazelnut
- Pepper
- Cotton
- Grapevine >0.5”
- Olive
- Fig
- Mango
- Blueberry

Experimental:

- Avocado
- Walnut
- Pecan
- Kiwi

Soil probe

- Developing a soil microtensiometer with extended range: 0 to 30 bars of tension.

Interested? Let us know.

Q&A

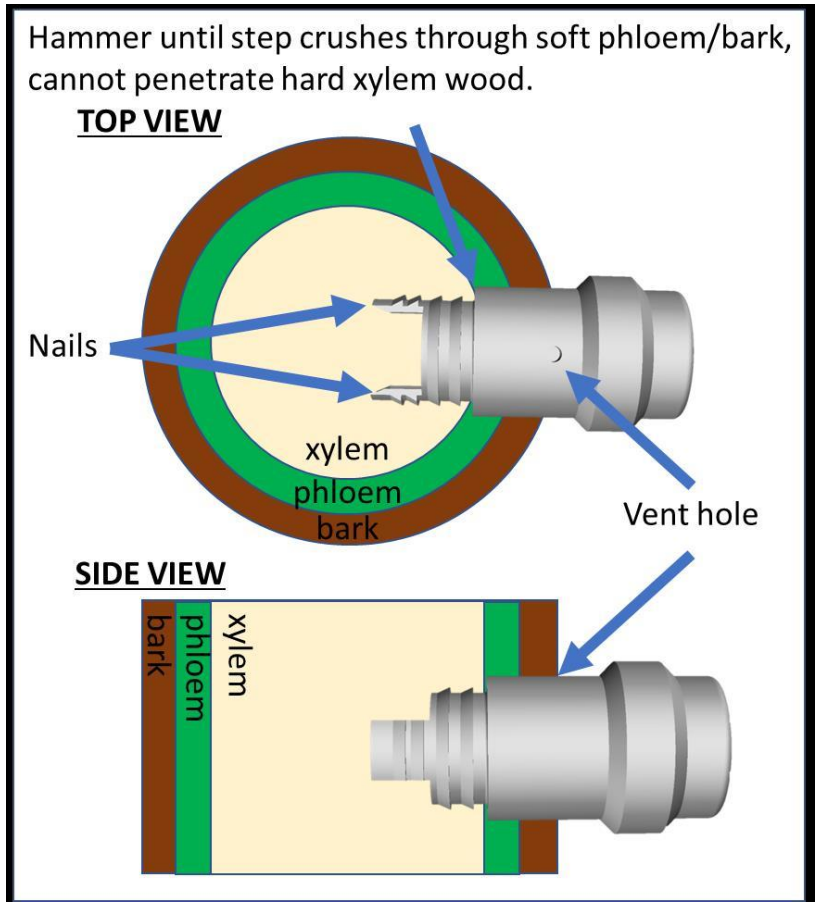
Please ask any questions you have in the chat! We will answer them in the order they are received ☺

List of questions

1. If I need to install sensors, especially the small stem versions, at different locations up a tree like the trunk and large, medium and small branches, how do I deal with the varying bark thickness to get comparable xylem depths?
2. What is about the life span of the sensors? Are there experiences of their use in citrus groves?
3. How many years can the sensor stay working on the vine trunk; can it survive to the winter or should it be taken out?
4. Pueden los sensores cambiarse de una planta a otra?
5. Is there a potential limit that FloraPulse sensors should not cross? * Is the sensitivity and accuracy of FloraPulse s
6. Reliability, battery consumption, price...
7. Maintenance of Florapulse device.
8. Could it be used on lettuce crops? What measurements does it record? What is the product range tested on? Is it available in SA?
9. 1. How do the new sensors work after winter temperatures? 2. Should new sensors be installed annually?
10. Can you provide guidance on installing FloraPulse on vegetable plants such as potatoes?
11. What minimum diameter trunk is required to use FloraPulse?
12. Application of FloraPulse sensors for grapevines
13. Relation of florapulse readings with leaf and stem water potential, soil moisture and evapotranspiration or transpiration.
14. Have you ever used FloraPulse in Kiwi? Is FloraPulse sensitive to Ψstem values lower to 0.5 MPa (absolute values)?
15. How are people using the FloraPulse tensiometer?

How do I deal with the varying bark thickness to get comparable xylem depths?

- Our installation method takes care of this. Hammer until the sleeve stops going in.



What is about the life span of the sensors? Are there experiences of their use in citrus groves?

- Sensor guaranteed lifespan is 1 growing season. We have seen sensors last up to 3 years installed, but this is uncertain.
  - Sensors can be damaged by winter temperatures or blocked by wounding responses.
- We have had good results testing in citrus internally, but our customers sometimes run into issues with the wounding response. We’re looking into this.

How many years can the sensor stay working on the vine trunk; can it survive to the winter or should it be taken out?

- We guarantee 1 growing season, but have seen them work for up to 3 years, continuously, in grape.
  - We recommend installing new sensors each season. Particularly in crops such as almond where the sensor response decreases after the winter (we think the tree closes the xylem in contact with the sensor). This issue is less pronounced in grape.
- Sensors can withstand temperatures down to 0C. Below that, they may freeze and break. We are testing their freeze-tolerance this winter.

Pueden los sensores cambiarse de una planta a otra?

- Can you change the sensors from one plant to another?
- We recommend only moving the sensors when strictly necessary. The sensor removal process can be tricky and could break the sensors.
- Sensors can be reused (see our manual), but this is not covered by warranty. Do so at your own risk.

Is there a potential limit that FloraPulse sensors should not cross?

- Sensors are guaranteed to measure water potential down to -35 bars. Sensors can measure lower water potentials, but below this threshold you run the risk of the sensor cavitating (then it won’t work!).
  - Sensors can be refilled after cavitation, but this requires specialized equipment. So usually if a sensor cavitates it is discarded.
  - We are working with Lab-Ferrer to set up a filling station in Spain for cavitated sensors. This may or may not work!

Reliability, battery consumption, price...

- Reliability – guaranteed for 1 growing season
- Battery consumption
  - Analog sensors: 2 kohm resistor, TINY power use.
  - SDI12 sensors: 1mA continuous power, can cycle on/off.
  - Datalogger: solar powered.
- Price: email admin@florapulse.com for a quote

Maintenance of FloraPulse device.

- Install it and get data for a growing season.
- See our sensor reuse manual if you want to try and reuse it, but this is not guaranteed! Recommend new sensor for each season.

Could it be used on lettuce crops? What measurements does it record? What is the product range tested on? Is it available in SA?

- Lettuce: probably not. We’re developing a soil sensor that could work for this crop.
- Records stem water potential.
- List of crops shown previously.
- We sell directly anywhere in the world, but have distributors in some places. So yes, contact us.

Can you provide guidance on installing FloraPulse on vegetable plants such as potatoes?

- We’re developing a small sensor for use in small-stem plants. The sensor is installed in the trunk. Hard to say about potatoes! Needs trial.
- We had good initial success in pepper.

What minimum diameter trunk is required to use FloraPulse?

- 50mm or 2” for our normal probe.
- New small probe will be 0.5”, but still TBD.

Application of FloraPulse sensors for grapevines

- Looks great. Already being sold through partners. Requires 2” vines (big).
- New small version under testing for vines > 0.5”

Relation of florapulse readings with leaf and stem water potential, soil moisture and evapotranspiration or transpiration.

- The sensors generally track stem water potential, but they are strictly not the same measurement because water potential is measured in the trunk, using a different instrument. Don’t expect 100% agreement, but it has been validated by outside experts.
- Comparisons with leaf water potential, soil moisture and evapotranspiration will depend on the crop and other conditions! Very complicated, but overall trend ‘should’ be similar.

Have you ever used FloraPulse in Kiwi? Is FloraPulse sensitive to Ψstem values lower to 0.5 MPa (absolute values)?

- One of our customers tested in kiwi with mixed results.
- We’re testing further in the southern hemisphere this 2023.
- 5 bars (0.5 Mpa) is no problem.

How are people using the FloraPulse tensiometer?

- Scientists
  - Validation in new crops
  - Forestry
  - In the Amazon
  - Water savings
  - Laboratory experiments
  - Irrigating their trial
- Growers
  - Improve their irrigation
  - Peace of mind
  - Tree health
- Distributors