

Optimize Irrigation for Hazelnuts with Midday Stem Water Potential

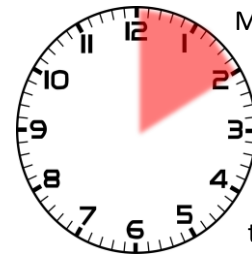
Using stem water potential (SWP) helps farmers to reduce water usage and improve yield by targeting irrigation more effectively. SWP measures tree water tension and is highly sensitive to soil moisture in rooting zone and atmospheric demand.



What do you need?

For SWP, you will need a **pressure chamber** (see picture), **pruning shears**, **razorblades**, **foiled leaf bags**, **plastic bag**, **magnifying glass**, **flash light**, **cooler**, **icepack**.

When to measure?



Measure SWP at late morning / early afternoon (between 12:00 to 2:00PM) to get the **most accurate readings** of maximum tree water tensions.

Step-by-step procedure?

- Select mature leaf on established branch
- Slide leaf into foiled bag and gently seal
- Cut leaf from tree at petiole after 30min
- Insert cut leaf into plastic bag and seal bag
- Place plastic bag in cooler with icepack
- At pressure chamber, set rate valve to achieve pressure increase of 1bar/10sec
- Remove leaf from cooler
- Insert petiole through bottom of chamber lid
- Tighten the gasket by twisting the black ring
- Lock chamber lid
- Turn Control valve to "Chamber" position
- Observe petiole end with magnifying glass as pressure rises in chamber
- Turn control valve to "Off" position when water appears on petiole end (color change from light to dark green)
- The recorder pressure is your SWP (-)**

Additional Resources: <https://www.pmsinstrument.com>

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How to use it?

Calculate 'SWP from baseline' (Δ SWP) to determine the stress the tree feels because of limited soil moisture:

$$\Delta\text{SWP} = \text{SWP} - \text{'Baseline SWP'}$$

(for information on 'Baseline SWP', see next page)



Soil moisture

If Δ SWP levels are below -10 bar, your crop may require immediate irrigation (+++) to secure yield potential. If Δ SWP is above -4bar, irrigation is not required (o) and may result in excessive vegetative growth and/or drainage:

Δ SWP	Stress level	Irrigation
0 to -4bar	None	o
-4 to -7bar	Mild	+
-7 to -10bar	Moderate	++
-10 to -20bar	High	+++

*Estimated stress levels correspond to stomatal behavior

Start measuring SWP this season to optimize your irrigation strategy and improve yield potential. For more guidance on SWP measurements, contact us or your local agriculture advisor.

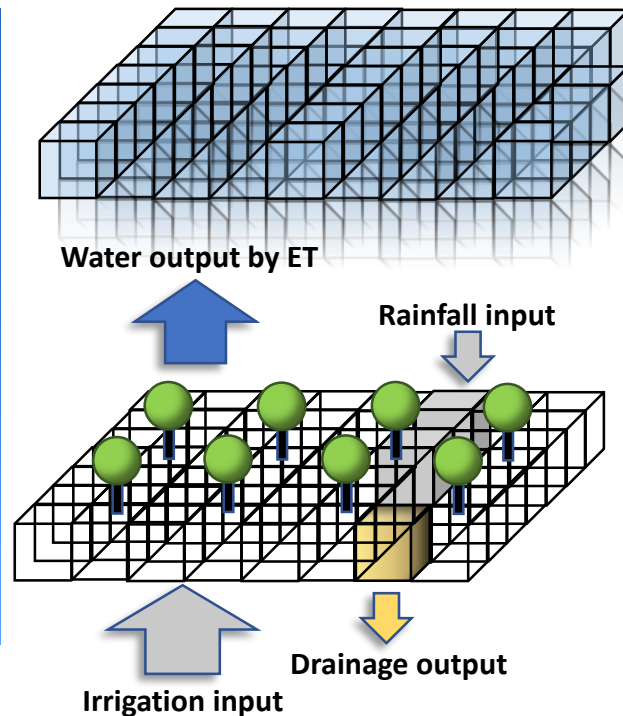
Table: Midday 'Baseline SWP' (in bar) for hazelnut

Temperature (°C)	Relative Humidity (%)						
	10	20	30	40	50	60	70
19	-7.8	-7.3	-6.8	-6.4	-5.9	-5.4	-4.9
22	-8.4	-7.9	-7.3	-6.8	-6.2	-5.7	-5.1
25	-9.0	-8.4	-7.8	-7.2	-6.6	-6.0	-5.3
28	-9.6	-8.9	-8.3	-7.6	-6.9	-6.2	-5.5
31	-10.2	-9.5	-8.7	-8.0	-7.2	-6.5	-5.7
34	-10.8	-10.0	-9.1	-8.3	-7.5	-6.7	-5.9
37	-11.3	-10.4	-9.6	-8.7	-7.8	-7.0	-6.1
40	-11.9	-10.9	-10.0	-9.1	-8.1	-7.2	-6.3
43	-12.4	-11.4	-10.4	-9.4	-8.4	-7.5	-6.5
46	-12.9	-11.9	-10.8	-9.8	-8.7	-7.7	-6.6

Future outlook: Combine direct tree measurements of ΔSWP with orchard monitoring of evapotranspiration (ET) to schedule irrigation events and develop sustainable irrigation practices.



Figure: Tower to measure ET in an hazelnut orchard (Van Maren Farms, Chilliwack)



Determine the orchard water balance of water input (irrigation & rainfall) and water output (ET & drainage). Save irrigation water by combining measurements of ΔSWP to determine when to irrigate and your **orchard water balance to determine how much** to irrigate.

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