



METER
ENVIRONMENT

SC-1: BEST PRACTICES FOR MEASURING VINEYARD STRESS

STOMATAL CONDUCTANCE, DEFINED

To use the SC-1 leaf porometer correctly, it is important to understand what it measures. A porometer is a tool used to gauge water stress in a plant by measuring the leaf's stomatal conductance. Stomatal conductance is the main component of gas exchange in most plants. Stomates or stomata are small pores on the surface of leaves. In grape leaves, the stomata are on the underside of the leaf, but if a leaf had stomates on both sides, you would measure the stomatal conductance by taking readings on both the top and bottom of the leaf.

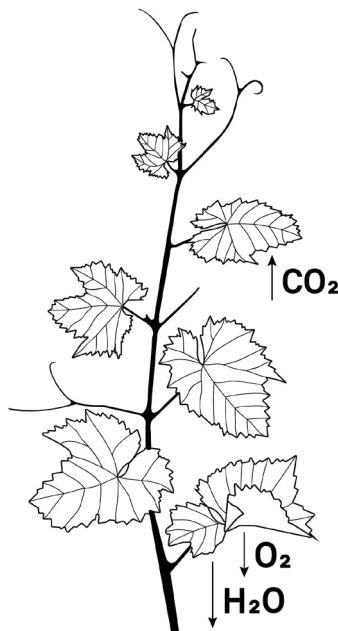


Figure 1. Stomatal conductance is the main component of gas exchange in most plants

When stomata are open, CO₂ can enter, and water and oxygen are allowed to escape, which helps the plant to breathe and grow. When the leaves or plants are hot, they open the stomata to release water. Too much evaporation from the leaves will lead them to become desiccated or dried out. When leaves and plants become stressed, the stomatal conductance (or rate of evaporation and ability to cool itself) decreases, and the porometer will show lower numbers.

KNOW THE NUMBERS

It is important to remember that each type of plant will have a different range of numbers that indicate stress. This is a quick reference scale for leaf porometer readings and plant water stress in wine grapes:

Plant Water Stress	Porometer Readings (units are in mmol/m ² /s)
Extreme stress	0-50
Stress	50-100
Moderate stress	100-150
Slight stress	150-200
Mid-range	200-300
Luxury	300-500

Figure 1. Vineyard stress reference scale

For white varieties of grapes, which don't require much water stress, porometer readings should be between 150 and 200. This means the plant has sufficient water for the stomata to open and cool down without stressing the system. The ideal range for "moderate stress" in red varieties would be between 100 to 150.

Numbers from 0-100 indicate higher levels of water stress within the plant. When this happens, the stomates don't breathe as efficiently, causing the leaf temperature to increase and the conductance to decrease.

BEST PRACTICES IN THE FIELD

The following are a few best practices for taking porometer measurements in a vineyard. For in-depth information on calibration and use, refer to the [SC-1 manual](#). You can print this guide, laminate it, and use it in the field.

BEFORE YOU MEASURE

1. Before heading to the field, check porometer batteries, desiccant level, and the supply case to ensure the SC-1 is ready to measure.
2. It's best to take measurements around midday: between 12 and 2 pm, and it's important to be consistent when taking these measurements throughout the season.
3. Be aware of weather conditions. Overcast skies will lower conductance readings. If it's very hot, photosynthesis can stop and plants will display very low readings.
4. When in the field, designate a small area you can return to for future measurements.
5. Choose and label approximately five random vines on which to take leaf measurements. Use the same vines each time you sample, so you can compare results.
6. Depending on the size of the field, you may need multiple sample locations, for example, one known stressed location and one high-vigor location. For each location, average your results.

WHAT TO REMEMBER

NOTE: It is important to perform calibrations in the field near the measurement site. It is not necessary to calibrate at each new location or even every day.

CALIBRATION

For more detailed calibration instruction, watch our [calibration video](#), or refer to the [manual](#).

1. Check the desiccant chamber. If it's purple, dump out desiccant and replace.
2. Turn on the porometer.
3. Press Menu twice.
4. Press Enter when the Calibrate option is highlighted.
5. Press Enter if you have already entered the model code (located on tag on porometer) until you get to screen labeled Stability Test.
6. Shake clip in vertical motion until screen labeled "Attach Sensor Head" appears. This means that both sensors inside the clip have reached equilibrium.
7. With tweezers only, select one piece of filter paper.
8. Wet paper with 1 drop of DI water. Shake any excess water off with a flick of the wrist.
9. Position wetted filter paper over the hole on the calibration plate.
10. Slip calibration plate on to clip when screen directs you to do so. (This will appear automatically after the clip has reached equilibrium). Shaking in a vertical motion helps to speed equilibration.
11. The clip will auto-calibrate and repeat this process four times until it is ready to take leaf readings.

MEASUREMENTS

NOTE: When taking measurements keep the black desiccant chamber facing toward the ground.

1. When choosing a leaf, follow these rules:
 - Measurements should be made on the youngest, fully developed leaf. This is usually the fourth or fifth leaf down from the meristem.
 - Make sure it is exposed to sun and not shaded.
 - When clamping the clip on a leaf, be sure the inside sensor of the clip is fully on the leaf and the leaf is green, dry, and intact with no signs of disease.
 - Remember, grape leaves only have stomata on the underside of the leaf,

so make sure to position the clip so it monitors the abaxial, or underside. If you are testing both sides of a leaf, gently turn leaf over to take a reading.

2. When ready, place clip on leaf and wait for reading.

NOTE: Do NOT save first reading, these are not always accurate.

3. Be aware of hand placement on clip. See manual for correct holding instruction (pg.11).

4. After you have taken a reading, choose an action for your data:

- Choose to Save data if you wish to upload on to a computer
- Choose to Annotate to enter an ID for the reading (keep track of multiple fields/ areas)
- Choose to Discard to delete reading

5. If the porometer asks to re-equilibrate to environment, do so by shaking clip until Press Enter to take Next Reading screen appears.

6. For further troubleshooting, [see manual](#).

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