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Calibrating and Caring for your pH Meter

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Whether in soil, water or a hydroponic solution, measuring pH levels is a critical aspect of successful gardening.

Healthy plant growth depends on properly synthesizing the perfect environment for your fruits, veggies and decorative plants. And just as correcting the pH level in soil or water can help a plant thrive, an incorrect pH level can lead to disease or potential death.

What is pH?

PH is the abbreviation for 'potential of hydrogen' which indicates a substance's acid or alkaline (base) properties. The standard pH scale (occasionally referred to as the acidity or alkalinity scale) goes from 0 to 14, although it is possible to exceed these levels. The higher the pH, the more base or alkaline a substance is. The lower the pH, the more acidic it is. And a pH level of 7.0 is of neutral acidity and alkalinity.

A note to all you beginning gardeners: "Acid" often has a dangerous connotation, but a substance that is too alkaline can be just as dangerous for people and plants. Did you know that bleach has a pH level of 12.0 to 12.6?

How can you measure pH?

Although it is impossible to visually determine the pH level of a liquid, the pH of soil will often affect its color. A greener shade of soil is typically more alkaline, while a yellow or orange tinted soil tends to be more acidic. Soil pH can be measured with a pH test kit or a meter that is specifically designed for soil testing.

The pH level of a liquid can be measured using reagents incorporated into paper strips or liquid drops or with a digital pH meter. Reagent testing strips and drops incorporate color-matching techniques. While they are initially inexpensive, they will ultimately cost more than a pH meter. More importantly, strips and drops have a shelf life, do not provide pinpoint accuracy, and the color matching is open to interpretation. For example, most strips will show an increase of pH levels by increments of 0.5. Therefore, when using a pH strip, the difference between pH 7.0 and pH 8.0 will only be two different shades of pink. And what about the roughly 7% of males in the United States that are color blind? A digital pH meter, on the other hand, provides a pH level display screen, so there is no interpretation required: a user simply inserts the meter into a solution and views the digital reading.

It is important to note that soil and liquid pH meters have very different probes and should always be used accordingly. Make sure you have the right one for your needs.

How do pH meters work?

Even though there are a variety of pH probe types, ranging from inexpensive handhelds to laboratory models that cost tens of thousands of dollars, the most common pH meters incorporate a glass sensor and a reference tube. The pH probe measures the activity of hydrogen ions by generating a small amount of voltage across the sensor and the reference tube. The meter then converts that voltage to a pH value and displays it on a digital screen.

Also, many digital pH meters have a built-in thermometer that automatically adjusts for any discrepancies off the baseline of 77ºF (25oC). This function is called automatic temperature compensation (ATC).

What is calibration and why is it necessary?

Calibration is akin to tuning, and just as a musical instrument must be tuned from time-to-time, a

scientific instrument must be properly calibrated to achieve accurate test results.

While some humans may have perfect pitch and can tune a musical instrument without the use of a tuner, the only certain way to determine if a pH meter is calibrated properly is by comparing it to a laboratory-certified standard reference point, more commonly known as a 'buffer solution.' Buffer solutions are liquid, but can also be purchased in powder form and mixed with distilled or deionized water to create a fresh batch each time.

Any scientific instrument should be calibrated as close as possible to the level that will be tested. If testing a range, then the meter should be calibrated in the middle of that range. For example, if testing an acidic solution, a pH meter should be calibrated to pH 4.0 to achieve the most accurate results. Most waters fall into the range of pH 6.0 to pH 8.0. Therefore, to test the pH of water, calibrating your meter to pH 7.0 will suffice. The three most common pH levels for calibration are 4.0, 7.0 and 10.0. These points cover the pH range of 0 to 14, but other values are available.

A pH meter will require single-, two-, or three-point calibration for accurate results. Some meters can be calibrated to a single point, but the manufacturer will recommend at least two points for optimum testing. The differences will depend on the technology of the meter and the type of sensor it uses.

Once you have a pH buffer solution, calibrating a pH meter is typically a simple process.

A pH meter, whether analog (a needle points to the pH level) or dialog (displays the pH level as a number on the screen), will incorporate either analog or digital calibration. Analog calibration is done by using a small screwdriver to adjust the reading until it matches the value of the buffer solution. Digital calibration is done by pressing up and down buttons until the reading matches the value of the buffer solution. A digital pH meter can have analog calibration.

Some meters also offer automatic calibration, in which case the meter will automatically recognize the value of the buffer solution and calibrate itself to that value. This is by far the simplest method of calibration, but it is important that these meters also have manual calibration for fine tuning and/or troubleshooting.

Many brands of pH meters are factory calibrated and ready to use right out of the box. However, the factory calibration should only be considered a convenience for a few uses; the calibration could shift during shipping, and it's also possible that the factory calibration may not be ideal for your needs. And as mentioned above, all pH meters will need to be recalibrated at some point.

Regardless of what method of calibration your meter employs, always carefully read your meter's instructions and perform calibration according to the manufacturer's recommendations.

For best results, a pH meter should be calibrated:

- With regular use—at least once per week
- If not used—at least once per month
- If you think the readings are incorrect
- If testing aggressive liquids (very acid or basic liquids)
- If testing a wide range of liquids (going back and forth between acids and bases)
- Whenever the sensor is replaced

How should a pH meter be properly cared for?

Although there are general maintenance techniques for pH meters, each brand and model will have its own requirements. Always follow the directions for your meter and you will enjoy it for a longer time, with fewer issues.

In addition to frequent calibration, properly maintaining the pH sensor will ensure a longer life and more accurate results. Many pH meters incorporate glass sensors and reference tubes that must be stored in specially formulated solutions. If using a handheld meter, the storage solution will often be in the meter's cap. Don't spill this solution … you need it! For most pH sensors, it's critical that the sensor be stored wet in the appropriate solution.

To clean most pH sensors, rinse in distilled or deionized water. Shake off any excess water and return the sensor to its storage solution.

The majority of pH sensors have a lifespan of approximately 1–2 years. If you are experiencing erratic readings and having difficulty calibrating, it may be time to replace the sensor (or your meter,

if the meter doesn't have a replaceable sensor).

Tips and tricks

- Always read the instruction manual prior to use. Sure, the instructions may be boring, but they'll answer your questions, and those answers will protect your investment
- Always be sure your pH meter is properly calibrated
- If your handheld meter includes a storage solution in the cap, store the meter upright for more effective saturation
- Never touch a sensor electrode or reference cell with your fingers: skin oils will affect readings and can permanently damage a pH sensor
- Always lightly swirl a meter in the water or solution to dislodge any trapped air bubbles
- Never store a pH meter in high heat or humidity
- Never store a pH sensor in distilled water
- A pH meter is a sensitive scientific instrument and should always be treated as such

By Rob Samborn

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[2]

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[1] HM Digital, Inc.: **http://www.tdsmeter.com/what-is?id=0006**
[2] Image: **http://www.addthis.com/bookmark.php?v=20**