
# pH Up or pH Down?

**by Rick Weller, Founder of Organically Done Plant Products**

First, the basics... pH defines the concentration of hydrogen ions versus hydroxide ions and is measured on a logarithmic scale with a range 0-14. A solution with pH=7 is considered 'neutral' (equal amounts of each ion) and is roughly equivalent to the pH of pure water at room temperature.

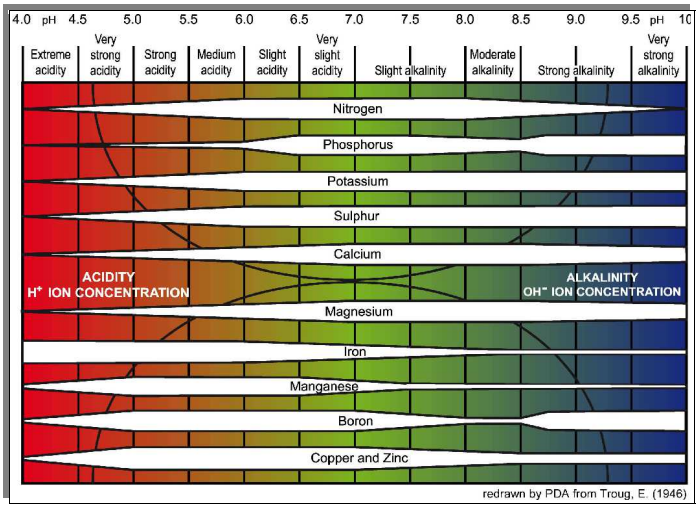
A solution with pH<7 is considered 'acidic', a solution with pH>7 is considered basic (or alkaline). A logarithmic scale means that a solution with pH=1 is twice as acidic as a solution with pH=2, a solution with pH=2 is twice as acidic as a solution with pH=3, etc..

Most of us learned about pH in high school chemistry and probably haven't thought about it much since unless we are interested in growing environments where pH plays a significant role in soil and plant health.

All growing environments are constantly evolving with decomposing organic material, nutrient cycling, microorganism activity, addition of fertilizers, etc., and each of these changes may impact your soil's pH. In-ground soil has a relatively 'normal' pH that remains consistent over time – if you modify this natural pH level, it will return to its 'normal' state after your amendments have broken down. The pH of container soils can vary widely and change quickly due to planting mix components and the small volume of material.

Some fertilizers may impact your pH (typically lowering) by leaving salts or reacting to form acids. This is more often an issue with synthetic fertilizers - most organics are neutral although there are some exceptions like cottonseed meal. Your water supply can also change your soil's pH.

**pH Impacts Mineral and Nutrient Availability** - before a nutrient or mineral can be absorbed by a plant, it must be dissolved in the soil solution. This solubility is affected by pH levels, with each element having its own solubility range.




The chart indicates the 'sweet spot' for several of the primary minerals and nutrients. Some elements like nitrogen and sulfur are available (soluble) across a wide pH range and others, like phosphorous, have a much narrower range. Other elements, like iron, can even become toxic to a plant when it becomes too available at a certain pH level.

While pH is not the only governor of mineral and nutrient availability as described below, it is very influential. One method used to overcome this pH influence is to use foliar applications - while not a primary mechanism for plant feeding, it can be very effective in some cases.

The pH for optimum plant growth varies across species and sometimes across varieties within a species. Luckily, most plants tolerate a fairly broad range of pH conditions.

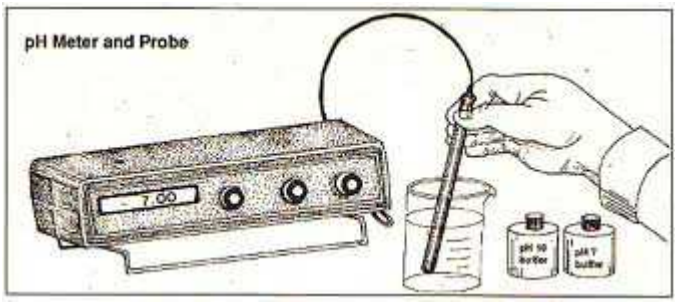
As discussed in previous articles, soil microorganisms play an important role in soil health, plant health and plant growth, particularly in an organic environment. Soil pH levels affect both the population (size) and function of these organisms. As you would expect, pH ranges that are appropriate for strong plant growth (typically 6.0-6.8) are where we find the most active populations of soil organisms. When soil pH falls below 4-4.5, most of these organisms become dormant and begin to die as pH continues to fall.

Soil types effect the impact of pH on nutrient availability. Soils with higher Cation Exchange Capacities (CEC – the ability to retain and supply nutrients to plants) are able to bind more nutrients and buffer pH changes. Soils with higher clay content

and/or organic matter will typically have these higher CEC and buffering capabilities, therefore, a greater pH range where nutrients are more available. Soil-less planting mixes, because of their low CEC and density, may have a much narrower pH range of nutrient availability.

Components used in container planting media have their own pH tendencies. Peat (pH neutral), sphagnum peat moss (pH ~4), coir (pH `6), rice hulls (pH ~6) and perlite (pH neutral) to name a few. Compost and worm castings (excellent sources of soil biology and organic matter) are produced using a wide variety of inputs, making their 'standard' pH levels difficult to define.

Testing soil pH is a straightforward process and typically done with either pH strips or a pH electronic meter. Strips work fine and are relatively accurate but do not give you much resolution, i.e., you won't get a decimal point reading. Inexpensive pH meters are relatively accurate if you calibrate them but I have rarely found one as accurate as the manufacturers' profess. That said, either of these will give you enough accuracy and reliability to manage your soil growing environment.




While measuring the pH of your inputs or soil run-off may be an interesting exercise, it does not necessarily tell you the pH of your soil. Instead, take a small amount of dry soil (1/8 cup or so) from your container and add an equivalent volume of distilled water. Shake thoroughly and let stand for 10-15 minutes, allowing the soil particles to fall to the bottom of the container. Using strips or your meter, test the top portion of your mix - this is the pH of your soil (at least in the spot the soil sample was taken from).

If you are using a pH meter, it is a good idea to perform a two-point calibration on a regular basis. Not only does this ensure more accuracy but it also gives you more confidence in your measurement results. You need to purchase calibrating solution for this. Distilled water is inappropriate to use for testing 'neutral' because it does not have a high enough concentration of ions to give stable results.

**PH Control** - we've discussed what pH means, what factors can effect it and how to test for it. So how do we best control pH and its impact? Start with your soil components – what you decide to use in your soil mix has its own unique impact on pH levels and buffering capacities. I typically recommend that you consider including 'real' soil as one of the components because of its excellent buffering and CEC. Once you have your mix prepared and ready to use, do an initial pH test and amend if required.

Organic amendments to effect pH include lime (pH up), ground oyster shell (pH up) and elemental sulfur (pH down) – the finer the particle size, the faster you will see an impact. If you need to add amendments to modify pH, do not try to make large changes all at once. Other amendments like humic acid can help buffer the effects of pH by binding with nutrients to improve their availability.

As an organic grower who uses a decent amount of soil in my planting mix, I have found that this is usually the last time I need to worry about pH. However, my water source is neutral and I use organic fertilizers that are essentially pH neutral and leave little salt residue, so your situation may not be the same. Once you have determined your needs and are using soil and fertilizer products consistently, you should be able to maintain a consistent approach to your pH management.