

Soil water: an introduction

Water is a solvent

Nothing can live without water. One of its important properties is that it is a good solvent. Many substances dissolve in water.

Soil particles are surrounded by water and pockets of air. The water contains many dissolved substances. Most ionic compounds dissolve in water. The solid lattice breaks down and the ions are carried into solution. Generally covalent compounds are insoluble in water however, some do dissolve. Ammonia and sugar (sucrose) are examples.

The importance of this for plants is that nutrients dissolve in the soil water and get into plants through their roots.

pH

The pH scale ranges from 0 (very acidic) to 14 (very alkaline).

- Solutions with pH less than 7 are acidic.
- Solutions with pH 7 are neutral.
- Solutions with pH more than 7 are alkaline.

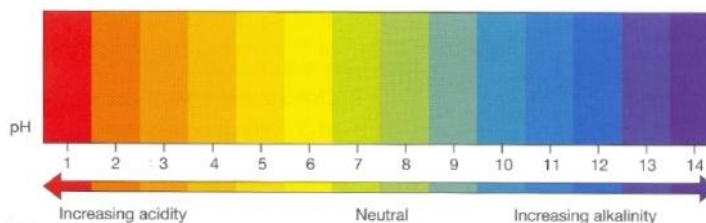


Figure 1 The pH scale.

Soil, soil water and crops

Some of the substances that dissolve in water are acids. They lower the pH of water. The pH of soil affects the growth of plants and some of their characteristics. For example, hydrangea flowers are pink when grown in alkaline soil, but blue when grown in acidic soil.



Pink hydrangeas
indicated alkaline soil.



Blue hydrangeas
indicate acidic soil.

Figure 2 The colour of hydrangea flowers depends on the pH of the soil.

The availability of plant nutrients found in soil, in other words how easily plants can obtain the nutrients they need, is also affected by pH. Availability is usually higher in acidic soils than in alkaline soils.

Farmers and commercial growers know that soil pH is important for growing healthy plants. Agricultural crops, pastures, vegetables and tree crops are grown in soils that have a pH between 4 and 8.5. Each type of plant has a preferred pH, for example:

pH 6.0 to 6.5 potatoes • pH 6.5 to 7.0 carrots, peas, tomatoes • pH 7.0 to 7.5 cabbages, onions

It is important to know the pH of soil in which crops and other plants are growing. Kits are available to measure the pH of soil. The kits actually measure the pH of water surrounding the soil particles. Nonetheless, it is usual to use the term soil pH.



Figure 3 pH test kits can be used to measure soil pH. Other kits are available that also measure the amounts of nutrients available in the soil, for example, nitrogen.

Causes of acid soil

Organic material in soil is usually slightly acidic. Soil with lots of organic material is acid (sometimes called ericaceous soil). It has a lower pH than most other soils. Peat is organic and peaty soil is an example of an acid soil

Rain is naturally acidic because it contains dissolved carbon dioxide. So rainfall increases the acidity of soil. Acidity is good as it helps the release of nutrients from soil particles. However, if soil is too acidic it can cause damage to plants.

Gases such as sulfur dioxide and nitrogen dioxide are formed, for example, when fossil fuels are burned. They also dissolve in water to give acidic solutions (acid rain).



Figure 4 Acid rain can cause serious damage to plants.

Causes of alkaline soil

Some soils (often called chalky soil) contain ground down particles of chalk or limestone, both forms of the compound calcium carbonate. This makes soil slightly alkaline.



Figure 5 Lavender grows well in chalky soil.

Finding out

It is not necessary to buy a pH test kit to measure the pH of soil. With some narrow range pH indicator paper or solution, test tubes and distilled water soil pH can be easily measured.

Using either a commercial kit or a homemade one, measure the pH of various soils.