The Mystery of Hard & Soft Water, Acidification & Liquid Feeding

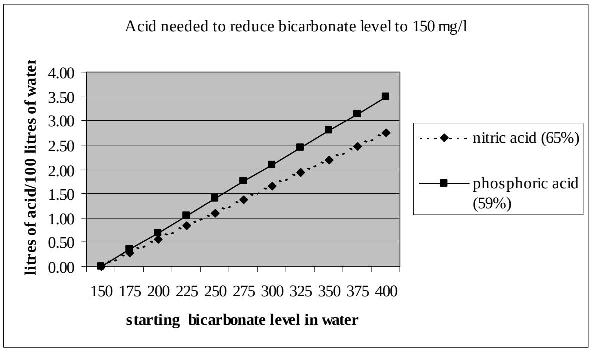
Rainwater is a relatively pure liquid with little if any dissolved salts or what might be described as contamination. However, once the rain hits the ground, it filters through the soil and rocks, picking up minerals as it flows into rivers and into reservoirs or percolates, down into underground reservoirs. The bedrock of the UK and Ireland is made up originally of granites, over which deposits of sandstone, millstone grits, or shales can be found in the west and north, and deposits of limestone and chalk can be found in the middle and east. This is over simplistic but assists the story that there are two distinct sources of water available from different parts of the country for use by growers, known as soft and hard water. Water percolating through sand and granite picks up few salts and remains relatively pure and is known as soft water. In comparison, water passing through calcareous rocks carries a lot of calcium carbonate which makes the water hard.

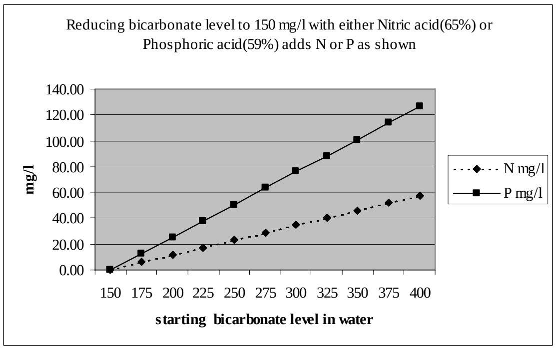
It is important to know which water type is being used as this has a great bearing on the approach to liquid feeding of plants. There may be hard and soft water available on the same nursery as rainwater collected from glasshouses, and roadways tends to be soft, whereas borehole water or mains water may be hard. This day and age mains water may vary from day to day depending on source. Following the droughts and water shortages a few years ago (I know it seems a long time ago with this years flooding!), water authorities built pipe ring mains to enable them to draw water from areas with plenty of water to areas with little water. A quick indication test of soft water can be seen when washing. Soap readily froths in soft water but it's very difficult to get a lather in hard water. The kettle is a good indicator of hard water as it furs up with limescale. Of course, the best water test is analytical and a laboratory test will show how hard or soft the water is by looking at the bicarbonate values (HCO_3) sometimes described as the 'alkalinity'. Values below 150mg/l indicate soft water and those above 150mg/l indicate hard water. Values of 350mg/l and above can be found in some south coast areas producing very hard water. Bicarbonate acts as a buffer for other nutrients.

It will be noticed that I have not mentioned pH so far. This is because the pH of water is not directly related and can be misleading especially with mains water. This is because the water authorities artificially raise the pH of drinking water, without affecting the bicarbonate level, in order to avoid the risk of dissolving lead pipes in old properties which would create a health hazard.

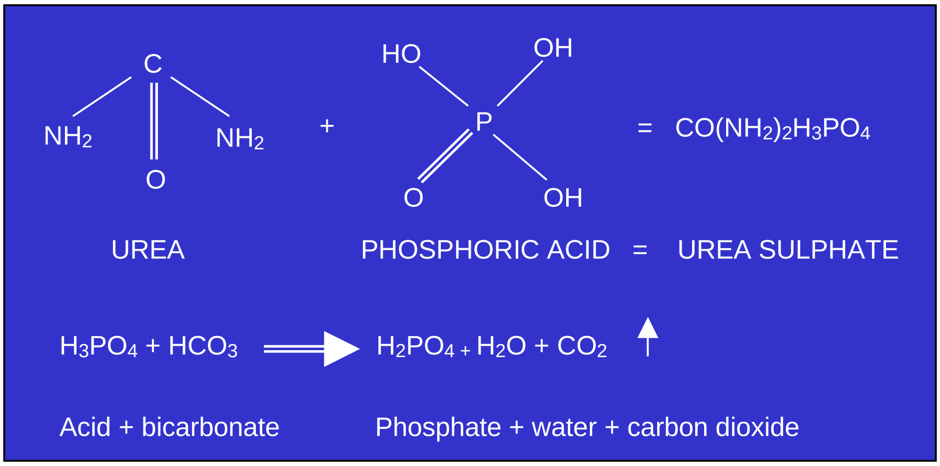
What effect can water type have on growing plants? Hard water can lock up and precipitate out trace elements so essential as plant metabolites. Even more serious is the precipitation of phosphates in water containing high bicarbonates. Anyone irrigating through drips will understand the problems of blocked nozzles when feeding phosphate fertilisers. How can this problem be overcome? There are two ways of reducing bicarbonate levels. Firstly, any acid will break down the bicarbonate to form water and carbon dioxide and the latter bubbles off into the air. There are two areas where acid can be dosed. The most common is in-line acid injection, preferably with sensors, which check correct dosage. The problem with this method is that the chemistry is reversible, which means the bicarbonate can reform in long feeding lines as the carbon dioxide cannot escape until it reaches the nozzle.

If acid is used to reduce bicarbonate levels then the best place to apply is in a vented reservoir. This allows the carbon dioxide to escape. Acids themselves are very corrosive and not user friendly to handle. The common acids used are nitric acid and phosphoric acid or a combination. If using these acids, growers must take into account the amount of nitrogen or phosphate given and adjust the feeding as appropriate.

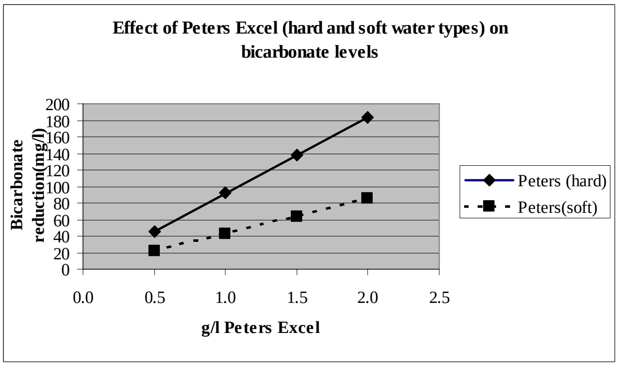




A much safer way of reducing bicarbonate levels is with acidifying fertilizers. Scotts produce a range of these under the Peters Excel water soluble fertilizers brand. The nitrogen and potassium levels vary according to requirement but the acidification remains the same. This fertilizer combines urea with phosphoric acid to form urea phosphate. When the granules are mixed with water it breaks back down and the acid part reduces the bicarbonate as normal phosphoric acid would but without the handling risks. For the chemists the formula is shown below.



The urea and phosphoric acid separate out when dissolved in water and the acid reacts with the bicarbonate to form water and carbon dioxide as a gas, which escapes into the air and can be used by plants in photosynthesis.



For most purposes Peters Excel would be added between 0.5g/l and 1.5g/l. For the hard water types this means the bicarbonate can be reduced by 46-137mg/l. This is adequate for most water to avoid lock-up of iron but in the very hard water areas some acid dosing may still be necessary. It does not matter whether the feed is high nitrogen, balanced, or high potassium, the effect is the same. Care must be taken not to increase the dose too high otherwise the conductivity will also rise. This could affect rooting especially with salt sensitive species like New Guinea Impatiens.

Soft water presents another set of problems in that calcium and magnesium can be limiting. It will be noted in the chart on the previous page that even Peters Excel soft water soluble fertilizers reduce the bicarbonate level though to a much lesser extent. This does not present a problem providing the level does not fall below about 80mg/l. To counter the lower nutrient status of soft water, Peters Excel has enhanced quantities of both calcium and magnesium as well as the normal NPK and trace elements. Some plants such as Poinsettia like a lot of calcium and even in hard water areas benefit from the soft water Peters Excel with the extra calcium.

Where bicarbonates are not an issue, through either the water having only moderate levels or the bicarbonates having been removed with acid, then a non acidifying fertilizer such as Universol can be used to provide all the nutrients required for plant growth.

Scotts do considerable amounts of trial work at the Levington Research Station testing the benefits of different feeds in different water types.

In conclusion it is important to know the type of water used in irrigation. Hard waters should be softened to avoid trace element and phosphate lockup, and to keep lines clear of phosphate precipitation causing blockages. This can be done using either acid dosing or an acidifying fertilizer.

Soft water should have extra calcium and magnesium added to compensate for the lower levels associated with this type of water and it is easier to do this with a ready formulated water soluble fertilizer.

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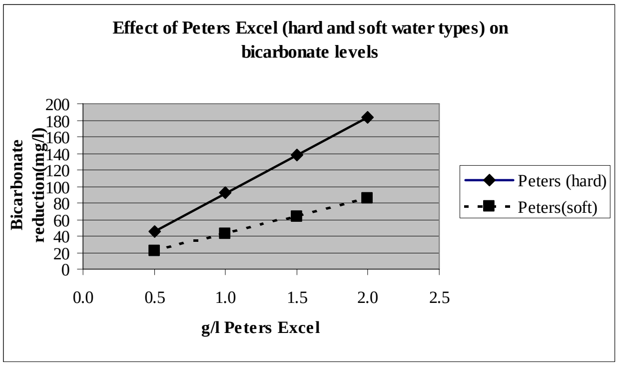

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