Consider Using Citric Acid
by Donald Lester

Knowing the ways citric acid works in a variety of situations can bring you closer to understanding its benefits in greenhouses, indoor gardens or protected cropping systems.

Citric acid has many uses in hydroponics and greenhouse environments. In greenhouses and farming operations, citric acid can be used to acidify water or nutrient solutions—and remove calcium deposits, scale and other hard water buildup from tubing, pipes, drippers, tanks, cooling pads, nozzles, glass, equipment and other surfaces. If run through the irrigation or drip system citric acid not only clears and removes hard water, calcium and scale deposits, but over time it can reduce the pH of the soil as well.
Citric acid is responsible for the sour taste we experience when eating lemons, limes, grapefruits, oranges or other citrus fruits. As an ingredient, citric acid is used in many industries you would not expect. Citric acid is a good general cleaner, and is the active ingredient in many bathroom and kitchen cleaning solutions—a solution with a citric acid content of six per cent will remove hard water stains from glass without the need for scrubbing. In industry, citric acid is also used to dissolve rust from steel. Here is another example: tobacco is a leafy green plant with high levels of chlorophyll, which is alkaline or high pH. This alkalinity gives cigarette smoke a harsh flavor. Citric acid is added to tobacco during processing to reduce the alkalinity of the leaves. Citric acid is also added to cigarette paper to control the rate at which it burns, allowing the paper and tobacco to burn at the same rate.

Many people confuse citric acid with Vitamin C (ascorbic acid), but the two are different, if only slightly. Chemically, the only difference between ascorbic acid and citric acid is that citric acid has one additional oxygen atom. Vitamin C tastes very bitter, just like most vitamins, so citric acid is used as a flavoring in many preparations of Vitamin C to mask the bitter taste of ascorbic acid.

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Acids have different strengths. The acids commonly used in hydroponics and greenhouses—nitric acid, phosphoric acid, sulfuric acid and hydrochloric acid—are all considered to be strong acids, whereas citric acid, acetic acid (vinegar) and ascorbic acid (Vitamin C) are considered to be weak acids. Citric acid may be weak, but the citric acid in a lemon is strong enough to power a clock. Those LED clocks plugged into a lemon at children’s science fairs are powered principally by citric acid reacting with the metal in the wires to create a crude battery. Citric acid is also used in beverages and candies, and although it is considered to be a weak acid, it is known to be capable of dissolving away tooth enamel over time. In fact, it is said that the citric acid in lemon juice will even dissolve a pearl.
There have been several articles written about the basic principles of pH—how low pH is acidic and high pH is alkaline (or basic)—so I will not review that here. But if a solution (or the water for the solution) is high in pH, then the way to reduce that pH is to add an acid. Citric acid products for growers and greenhouse applications usually come as pH-reducing additives, with tables supplied to assist in approximating the amount of product needed to adjust the pH from a given level to the desired level. These tables are helpful, but it is generally better to use a pH meter to ensure accuracy.

Perhaps the central issue in mixing any nutrient solution is the pH or acidity of the water and finished mix. Citric acid is ideal as an acidifier for nutrient stock solutions and pesticide solutions because it is much less likely to react with fertilizer salts or pesticides than other acids. Use citric acid for acidifying water used to make concentrated fertilizer stocks and pesticide solutions, because high-pH water can hydrolyze or degrade pesticides that are added. By adjusting the pH beforehand, pesticide solutions last longer and their effectiveness is maintained.

Some acids used for water acidification also supply a plant nutrient in conjunction with the acid. For example, nitric acid supplies nitrogen and phosphoric acid supplies phosphorus. The nutrient supplied can be beneficial to plant growth if not supplied in excess, but it can also react with fertilizer salts in concentrated stock solutions or with pesticides if mixed into spray solutions. Growers who acidify their water should adjust their fertilization program to account for any nutrient supplied by the corresponding acid. For example, if using phosphoric acid, growers need to make sure to reduce the phosphorus fertilizer they add accordingly to account for the phosphorus supplied by the acid. These calculations may be too complicated for a beginner, so using citric acid can simplify the process.

With the growth of the organics market over the years, citric acid has become popular because it is principally made from natural sources and certified as suitable for use in organic food production. Industrial-scale citric acid production originally began in 1890, based on the Italian citrus fruit industry. However, microbial production of citric acid did not become important until

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World War I disrupted Italian citrus exports. Today, most citric acid is produced commercially on a large scale by feeding sugar to the bacteria Aspergillus niger.

Citric acid is a weak acid that is relatively safe compared to the strong acids like nitric acid, phosphoric acid and sulfuric acid. Because citric acid reduces the pH of solutions it is also a good disinfectant, and it is sometimes used as a cut-flower preservative in vases to reduce the pH of the water to 3.5 to prevent the growth of micro-organisms.

Citric acid is relatively safe to use, inexpensive, versatile in its uses, natural, widely available and certified for use in organic food production. With all of these benefits shouldn’t you consider using citric acid in your greenhouse, indoor garden or protected cropping system?