GROWERTALKS

Features

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Thoughts on Water Quality

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Have you ever wondered why a crop or landscape perks up after a good rain? There are at least four reasons for this. Number one, rainwater has almost no minerals in it. It's what I call "hungry water." Relatively pure rainwater is more efficient at pulling nutrients off of soil-binding sites than mineral-laden irrigation water.

Number two, rainwater tends to be acidic, whereas in many parts of the country irrigation water is alkaline. (More on that later.) The acidity and low mineral content the rainwater helps release puts nutrients into the soil solution, where plants can absorb them.

Number three, raindrops hit the ground at 20 mph. Irrigation drops hit the soil at generally 5 mph. Therefore, for the same amount of water, rainfall tends to penetrate the soil or media more deeply.

Number four, rainwater has generally fallen through thousands of feet of the atmosphere prior to landing. Rainwater is saturated with air, unlike well or lake water. It oxygenates the root zone like no irrigation water can do.

Water quality

There are other general terms used to describe water quality, such as "hardness." Hardness simply refers to the quantities of calcium and magnesium in the water. Most waters contain far more calcium than magnesium. A water softener simply substitutes sodium for the calcium and magnesium in hard water. You don't want to use "softened" water to irrigate plants.

There's a difference between high pH and alkalinity. pH, of course, is the quantity of hydrogen ions or protons in a water source. Alkalinity refers to the quantity of carbonates, bicarbonates and hydroxyls (OH-) in water. The carbonate ion CO3- generally doesn't exist below pH 8.3. Since most irrigation waters have a pH lower than that, carbonates aren't normally an issue, except in desert areas. You can have 10 different irrigation waters with a pH of 8.0, but they may all have different levels of alkalinity.

What are bicarbonates (HCO3-)?

You hear a lot about these. In parts of the world where you have underground limestone deposits, bicarbonates can be an issue. Limestone is primarily calcium carbonate. When irrigation water travels through underground limestone

deposits, some of that calcium carbonate dissolves in the water. At room temperature, about 80% of the calcium carbonate dissociates or splits. The calcium ions and the carbonate ions are in solution, surrounded by water molecules. The CO3 carbonate ions will tend to bind with a hydrogen ion, forming HCO3 or bicarbonate.

Bicarbonate ions tend to be directly toxic to root cells. They also tend to interfere with iron and manganese availability—two essential plant nutrients. Acid injection into irrigation water directly reduces bicarbonates. The HCO3 bicarbonates react with the acid, ultimately giving off CO2 (carbon dioxide).

Too salty

In some parts of the country and the world salt in the irrigation water can be an issue. Straight seawater contains 15,500 ppm sodium and 19,000 ppm chloride. Both sodium and chloride are considered to be high above 70 ppm and very high above 300 ppm in irrigation water. Plant tolerance to salinity is, of course, variable by species. It only takes about 2% “salt intrusion” to significantly damage irrigation water quality.

So what do you do if you’re dealing with salty water? Small reverse osmosis (RO) systems remove salt effectively, but large reverse osmosis systems are expensive. Assuming RO isn’t an option for you, there are a few things you can do. Number one, irrigate a bit less often, but for longer duration when you water crops. Watering a little longer helps leach salts through the soil profile.

Number two, keep potassium up in your fertilizer program. Plants will often absorb sodium as opposed to potassium when potassium is low in the soil. You don’t want this. Increasing the potassium in the feed program will help reduce sodium uptake. Sodium is only known to be an essential nutrient for a few plants, most of which aren’t ornamentals.

Number three, you can add gypsum (calcium sulfate) as a top dress or a soil incorporation to reduce salt effects. This is slightly over simplified, but here’s how gypsum works: Calcium has a double positive charge, while sodium has a single positive charge. Effectively, the calcium pushes the sodium off of the soil binding site. The sodium leaches through as sodium sulfate. It’s through the use of gypsum that enables agriculture to be undertaken in salty parts of the world such as the Middle East and the American Southwest.

Other mineral problems

Iron can sometimes be a problem in horticultural irrigation water. When water is alkaline, it’s often present in the form of iron hydroxide. You can sometimes see this as a purplish color on leaf surfaces. The iron hydroxide will convert to iron oxide, which is rust. Iron oxide isn’t available for plants to make chlorophyll. Acid injection is one way to combat high iron in water. The iron will not stain under acidic conditions. Another way is to pump the well water into a lake or pond. The iron will precipitate in the body of water, rather than on the surfaces of your plants.

Sometimes hydrogen sulfide (that rotten egg smell) can be a factor in irrigation water. Normally, this isn’t a problem for plants, though it may be unpleasant to growers. I used to live on a property where my well water had a hydrogen sulfide smell. (Not fun when taking a shower.) Being a chemist, I learned to inject hydrogen peroxide from the beauty supply store into my house water. It totally took out the rotten egg smell.

Fluoride in your irrigation water can be a problem in certain parts of the country. Some plants are fluoride sensitive, while others are not. Fluoride-sensitive crops generally include those in the lily family, as well as those with long tapered leaves. Fluoride accumulates in leaf tissue as fluoroacetic acid. Fluoroacetic acid prevents the closing of the stomates.

Plants don’t want fluoride and they don’t need fluoride. It simply enters the plants in the transpiration stream as plants absorb water. Plants can direct ions in the transpiration stream. This is a fancy way of saying that when a plant absorbs something, it can largely put it where it wants to. Plants will generally place fluoride in the leaf tips and margins of the older leaves. With this “strategy,” the plant will eventually shed those leaves, thus reducing or

eliminating the toxicity. This is why most nutrient toxicities in plants occur in the older foliage.

In certain areas, alkaline irrigation water will tend to form white stains on foliage with overhead irrigation. Basically what's happening here is that calcium in the irrigation water will bind with bicarbonate ions as the irrigation dries. This forms as calcium carbonate or lime on leaf surfaces. If this is an issue for your nursery, acid injection will neutralize the bicarbonate and stop the white stains.

As growers, it'll help you make better decisions to know what quality of water you're dealing with. While irrigation water quality is fairly consistent, it'll help to monitor your water with lab tests once or twice a year, preferably in spring and fall. In areas with alkaline irrigation water, adding acid, such as phosphoric or sulfuric acid, will help improve the efficacy of many crop protection products. Usually, a couple of ounces of acid per hundred gallons will be enough. **GT**

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