wellcare® information for you about

Testing Water for Gardening and Lawn Irrigation

Within a household, water may serve many functions beyond everyday household uses such as drinking, cooking, laundry, and plumbing needs. Other-than-household water uses may include lawn and garden watering, car washing, crop irrigation, fire protection, and more. This wellcare® information sheet discusses factors that must be evaluated when testing the quality of water that is used for gardening and lawn irrigation.

Testing Water for Gardening and Lawn Irrigation

In testing the quality of water that is used for gardening and lawn irrigation, several specific measurements will help determine the effect the water will have on soil and plants. For example, water containing high concentrations of soluble salts or toxic levels of sodium can decrease plant growth.

Other substances present in water may cause household irrigation systems to become clogged, resulting in less efficient systems. These include physical solids such as sand and silt, and chemicals or dissolved solids such as iron, manganese, and ph. Hard water can also increase the potential for clogging problems.

When evaluating water quality, factors such as climate and soil quality must also be considered. It should also be noted that various types of plants are affected by these parameters differently. Some are more tolerant to the presence of these substances, while others are more susceptible to the deleterious effects these substances can cause in plant growth and health. The sections that follow list the levels for each chemical or substance that are considered ideal or acceptable, and/or levels that are considered unsuitable, in most situations.

pH

The pH, which measures water's acidity or alkalinity on a scale of 0 to 14 (with pH 7 being neutral, ph 0 being most acidic, and pH 14 being more alkaline), is rarely a problem in itself, but may signify the presence of other chemical constituents. Water with a pH between 6.5 and 7 is most desirable. Levels greater than 8.5 and less than 5.5 should be evaluated to determine the reason for the abnormal values. Corrosion problems can occur when pH levels are below 6.

Chloride

Chloride is a necessary nutrient to plant growth. Chloride concentrations below 70 ppm are safe for most plants. However, higher levels of chloride may be toxic to plants and contribute to the total soluble salt concentration. When applied to foliage, chloride levels greater than 100 ppm can damage sensitive plants; if absorbed by the roots, concentrations above 355 ppm may be toxic.

Boron

Even in concentrations as low as 1-2 mg/L, boron can cause leaf burn and is poisonous to most ornamental plants. Plants are more sensitive to boron than turfgrass, which can usually tolerate boron levels as high as 10 ppm.

Salinity

Water salinity can be reported as Total Dissolved Solids (or total dissolved salts), as electrical conductivity (ECw), or as the individual components of salinity (e.g., sodium). Dissolved mineral salts and chemicals are present to some degree in all water. Some are considered beneficial to plant and grass growth, while others may be harmful in high concentrations.

Higher salinity decreases the plant's ability to obtain sufficient water from the soil, and can also break down the soil's structure. The impact of salts on plants and soil depend on a number of factors, including their concentration in the water, the amount of water applied each year, annual precipitation, and the physical and chemical characteristics of the soil.

In general, electrical conductivity levels should be less than 1.00 decisiemens per meter (dS/m). Levels at or below 0.25 dS/m are considered excellent; 0.25-0.75 dS/m are good; 0.75-2.00 dS/m are permissible, and levels greater than 3.00 dS/m are unsuitable. When levels exceed 0.7 dS/m, there is a *slight* risk for plugging problems. Levels exceeding 2.9 dS/m indicate a *severe* risk of clogging.

Sodium content

Sodium can be absorbed by plant roots, or directly by plant leaves, where it can cause injury to the plant. Plants are at a greater risk for sodium toxicity than turfgrass, likely because excess sodium is removed during mowing. Most plants can tolerate sodium levels as high as 70 parts per million (ppm).

Sodium Adsorption Ratio (SAR)

High levels of sodium in water can also damage soil structure by reducing its permeability. In general, a SAR value below 3 is considered safe for most gardening or lawn irrigation situations, while levels above 9 can cause severe problems in some soil types over time. To determine the Sodium Adsorption Ratio (SAR), use the following formula:

$$SAR = \frac{Na}{\sqrt{(Ca + Mg)/2}}$$

SAR should be evaluated along with salinity, because calcium and magnesium can actually counter the effect sodium has on soil. That is, toxicity can occur in some plants when water contains medium to high levels of sodium and low levels of calcium and magnesium. See the chart below.

Electrical Conductivity	Degree of Restriction on Use
For SAR values of 0-3	
Less than or equal to 0.7 dS/m	None
0.7 to 0.2 dS/m	Slight/Moderate
Greater than 0.2 dS/m	Severe
For SAR values of 3-6	
Less than or equal to 1.2 dS/m	None
1.2 to 0.3 dS/m	Slight/Moderate
Greater than 0.3 dS/m	Severe
For SAR values of 6-12	
Less than or equal to 1.9 dS/m	None
1.9 to 0.5 dS/m	Slight/Moderate
Greater than 0.5 dS/m	Severe
For SAR values of 12-20	
Less than or equal to 2.9 dS/m	None
2.9 to 1.3 dS/m	Slight/Moderate
Greater than 1.3 dS/m	Severe
For SAR values of 20-40	
Less than or equal to 5.0 dS/m	None
5.0 to 2.9 dS/m	Slight/Moderate
Greater than 2.9 dS/m	Severe

Adapted from M.A. Harivandi. University of California Division of Agriculture and Natural Resources. (1999). *Interpreting Turfgrass Irrigation Water Test Results.*

Bicarbonates and Carbonates

High levels of bicarbonate in water can increase the concentration of sodium in water, raise soil pH, and have a negative impact on soil permeability. The presence of carbonate can compound the effect of bicarbonate on soil's pH. Carbonate exists in water with pH levels of 8.0 or higher.

To determine the effect of bicarbonate on water, the Residual Sodium Carbonate (RSC) is calculated and expressed as milliequivalents per liter (meq/L):

$$RSC = (HCO_3 + CO_3) - (Ca + Mg)$$

An RSC value below 1.25 meq/L is generally considered safe for gardening and lawn irrigation, while water containing levels above 2.5 meq/L is probably not suitable.

Other Considerations

Other tests might also be advised in some situations:

- The amounts of some ***nutrients*** in water – such as nitrogen, phosphorus, and potassium – may be helpful in considering fertilization needs.
- ***Potassium's*** effects are similar to the effects of sodium, though this element is typically found in only trace amounts in water.
- ***Chlorine*** toxicity only occurs if high levels of chlorine (usually levels above 5 mg/L) are applied directly to plants or grass.
- Clay, silt, plant material, and other ***suspended solids*** may plug sprinkler head openings or valves at levels above 50 ppm, but can be removed by filtration.
- ***Hardness*** in water at levels above 150 ppm can lead to clogged pipes. Testing for the hardness of water can also help in determining the compatibility of pesticides and fertilizers in a particular situation.
- ***Iron and manganese*** can stain plant tissue at levels higher than 0.3 ppm, and present a slight risk for clogging at levels above 0.1 ppm.
- Severe toxicity can occur in plants when levels of ***Nitrates and Ammonium Nitrogen*** exceed 30 parts per million (ppm).
- ***Sulfate*** can be a factor in the total salt content of water. See related sections above.

Options for managing less-than-desirable levels of these and other elements in your water are discussed in other wellcare® information sheets. See the information sheets on "Total Dissolved Solids," "Sodium," "pH in Drinking Water," "Chlorine," "Hardness in Drinking Water," "Iron" (which also includes suggestions for manganese), "Nitrate and Nitrite," and "Sulfur."

There are some special considerations to keep in mind, when treating water that is to be used on plants and lawns. For example, reverse osmosis is effective in treating soluble salts, but can also remove nutrients from water that are necessary to plant growth (blending treated and untreated water may be optimal, when reverse osmosis is used). Chlorine disinfection may not be advised with some irrigation systems, due to the potential for chlorine to react with certain metals and plastics. Check with a water treatment specialist and/or the manufacturer of your irrigation system components for more information.

For more information about Testing Water for Gardening and Lawn Irrigation

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For more information on your drinking water

The following websites provide up-to-date information on efforts to protect drinking water supplies and steps you can take as a private well owner. In addition, you may contact the wellcare® hotline at 1-888-395-1033.

Underwriters Laboratories Inc. Drink Well™ Well Water Testing	www.uldrinkwell.com
U.S. Environmental Protection Agency	www.epa.gov
Water Quality Association	www.wqa.org

For more information about wells and other wellcare® publications

wellcare® is a program of the **Water Systems Council (WSC). WSC** is a national nonprofit organization dedicated to promoting the wider use of wells as modern and affordable safe drinking water systems and to protecting ground water resources nationwide. This publication is one in a series of wellcare® information sheets. There were more than 60 available at the time this document was published. They can be downloaded FREE from the WSC website at www.watersystemscouncil.org. Well owners and others with questions about wells or ground water can also contact the wellcare® **hotline** at **888-395-1033** or visit **www.wellcarehotline.org**

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