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## Interpreting Water Quality Reports

A water quality analysis encompasses fundamental water properties like pH, electrical conductivity, and dissolved ions. Six ions comprise the majority of dissolved constituents in water. The major positive charged ions (cations) are calcium, magnesium, and sodium. The major negative charged ions (anions) are bicarbonate, chloride, and sulfate. Additional common ions are potassium, iron, and nitrate.

**pH:** pH is the measure of hydrogen and hydroxyl ion activity in water. Water pH below 7 is acidic, at 7 is neutral, and above 7 is alkaline. Water pH determines the solubility and reactivity of dissolved ions, minerals, and chemicals. For pesticide carrier water, the pH may need to be adjusted for optimal pesticide activity and efficacy.

**Hardness:** Hardness is the measure of calcium and magnesium in water. It is reported in milligrams per liter of calcium carbonate equivalent (mg/L CaCO<sub>3</sub>). To convert units from mg/L CaCO<sub>3</sub> to grains/gallon, multiply mg/L CaCO<sub>3</sub> by 17.1. In general, household water sources should have hardness less than 100 mg/L CaCO<sub>3</sub> or about 6 grains/gallon.

**Electrical Conductivity (EC, soluble salts):** The total concentration of salt in water is measured as the electrical conductivity (EC). It is reported in deciSiemens per meter (dS/m) or millimhos per centimeter (mmhos/cm). It may also be reported as total dissolved solids (TDS) in the unit parts per million (ppm). The TDS level of a water sample can be estimated by multiplying the EC by 640. Electrical conductivity is a general, nonspecific indicator of water quality, where the lower the value, the better. In the upper Midwest, typical well water sources have EC ranging from 1.0 to 2.5 dS/m. High-quality irrigation water should have EC less than 0.75 dS/m. In general, water sources with EC greater than 2 dS/m are not recommended for irrigation.

**Sodium Adsorption Ratio (SAR):** High sodium in irrigation water can impair soil structure and create water infiltration problems. The sodium adsorption ratio (SAR) is the proportion of sodium to calcium and magnesium, indicating the sodicity risk. In general, water sources with SAR greater than 6 are not recommended for irrigation.

**Nitrate-nitrogen:** Nitrate-nitrogen in water exceeding 10 ppm NO<sub>3</sub>-N is a human health concern. High nitrate concentrations are also a concern for livestock and poultry drinking the water. For human drinking water, a certified laboratory should test for other parameters such as coliform bacteria.

**AMS Requirement:** The ammonium sulfate (AMS) requirement is the amount of AMS added to condition spray water and overcome antagonistic ions (e.g. calcium, magnesium, potassium, sodium, iron) that may reduce pesticide efficacy. Some pesticides require AMS or UAN (28-0-0) to enhance pest control, even if the salt (EC) concentration is not high. Always read and follow the pesticide label for proper AMS or UAN usage.

## Resources for specific water uses:

### Spray Water

- North Dakota Weed Control Guide, pages 85 & 132 (NDSU, 2021): <https://www.ag.ndsu.edu/weeds/weed-control-guides/2021%20nd-weed-control-guide-1>
- The Impact of Water Quality on Pesticide Performance (Purdue Univ., 2009): <https://www.extension.purdue.edu/extmedia/ppp/ppp-86.pdf>

### Irrigation Water

- Irrigation Water Quality Criteria (CSU, 2014): <https://extension.colostate.edu/topic-areas/agriculture/irrigation-water-quality-criteria-0-506/>
- Soil, Water, and Plant Characteristics Important to Irrigation (NDSU, 2017): <https://www.ag.ndsu.edu/publications/crops/soil-water-and-plant-characteristics-important-to-irrigation>
- National Engineering Handbook, Irrigation Guide: Quality of Water Supply (USDA-NRCS, 1997): <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17837.wba#page=562>

### Livestock Water

- Livestock Water Quality (NDSU, 2021): <https://www.ag.ndsu.edu/publications/livestock/livestock-water-quality/as1764.pdf>
- Interpretation of Water Analysis for Livestock Suitability (SDSU, 2008): [https://openprairie.sdstate.edu/cgi/viewcontent.cgi?article=1329&context=agexperimentsta\\_circ](https://openprairie.sdstate.edu/cgi/viewcontent.cgi?article=1329&context=agexperimentsta_circ)