lead to an increased sodium hazard when used for irrigation because these residual carbonates will bind with available calcium and magnesium in the soil, eliminating some of the effect those minerals could have in neutralizing any sodium surplus. High residual carbonates have the effect of adjusting the effective SAR to even higher levels than actually measured. RSC is reported in units of milliequivalents per liter (meq/l).

Table 1. Irrigation Water Suitability.

<table>
<thead>
<tr>
<th>Water Quality Factor</th>
<th>None</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC (µmho/cm)</td>
<td>750</td>
<td>750-3000</td>
<td>&gt;3000</td>
</tr>
<tr>
<td>SAR</td>
<td>&lt;6</td>
<td>6-9</td>
<td>&gt;9</td>
</tr>
<tr>
<td>Boron (ppm)</td>
<td>&lt;0.75</td>
<td>0.75-2.0</td>
<td>&gt;2.0</td>
</tr>
<tr>
<td>Chloride (ppm)</td>
<td>&lt;92</td>
<td>92-230</td>
<td>&gt;230</td>
</tr>
<tr>
<td>RSC (meq/l)</td>
<td>&lt;1.25</td>
<td>1.25-2.5</td>
<td>&gt;2.5</td>
</tr>
</tbody>
</table>

Rating Water Quality

Your irrigation water test report will have printed recommendations based on the measured levels of total salt, sodium, and boron. There are a number of different ways of classifying the suitability of water for irrigation use. The suitability is often the accumulation of several different factors, most importantly total salinity, sodicity, boron, chlorides and residual carbonates. Moderate hazards in several factors may be tolerable, while a severe hazard in one area may be enough to make water unusable for irrigation. An online interactive water test interpretation is available at: soiltesting.okstate.edu/water-test-interpretation-program.

Nitrate

Nitrate (NO₃⁻) in irrigation water is not a quality problem for plants. It can be a health concern in drinking water, however. To avoid the possibility of leaching excess nitrates to ground water, it is a good practice to account for any nitrate added through irrigation water when calculating how much nitrogen fertilizer to apply to achieve your yield goal. Applying 1 inch of irrigation water with a nitrate content of 1 ppm NO₃⁻ as N adds 0.23 pounds of nitrogen per acre to your crop.

Related Extension Publications

PSS-2912 Drinking Water Testing
L-256 Understanding Your Livestock Water Test Report
L-296 Understanding Your Household Water Test Report
PSS-2401 Classification of Irrigation Water Quality

Hailin Zhang
Director, SWFAL Laboratory

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UNDERSTANDING YOUR IRRIGATION WATER TEST REPORT

The OSU Soil, Water and Forage Analytical Laboratory (SWFAL) provides an inexpensive but comprehensive analysis of water to evaluate its suitability for irrigation of crops and landscape plants. Water testing is an important first step in irrigation development to determine if your water source contains salts which could damage your soil, reduce crop yields, or even kill your plants.

One pint of water is enough for testing. It can be collected in any clean plastic container. Take the sample to your county Extension office. They will collect your payment and send your sample to the laboratory. Results of the test are normally returned within one week.

Your water will be tested for the following factors:

1. Sodium (Na)
2. Calcium (Ca)
3. Magnesium (Mg)
4. Potassium (K)
5. Nitrate (NO₃)
6. Chloride (Cl)
7. Sulfate (SO₄)
8. Boron (B)
9. Carbonate (CO₃)
10. Bicarbonate (HCO₃)
11. Hardness
12. Alkalinity
13. Total Dissolved Solids (TDS)
14. Electrical Conductivity (EC)
15. pH
16. Percent Sodium (Na%)
17. Residual Carbonate (RSC)
18. Sodium Adsorption Ratio (SAR)

TDS and EC

Total dissolved solids (TDS) are an indication of the total salt content of water. It is measured in units of milligrams per liter (mg/l) or parts per million (ppm). Both EC and TDS evaluate the overall effect of salinity and do not indicate the concentration of individual salts.

The effect of total salt content makes it more difficult for growing plants to take up water from the soil. The additional energy the plant must exert to overcome the pull of the salt on the water in the soil around its roots reduces the performance of the plant, leading to stunted growth, lower yields and in extreme cases, death of the plant.

The severity of salinity effects vary widely among plant species. Plants such as Bermudagrass and cotton are very tolerant, being unaffected until the electrical conductivity of soil water reaches about 7,000 µmho/cm. In contrast, strawberries and green beans are salt-sensitive, experiencing yield reductions when the electrical conductivity reaches 1,000 µmho/cm.

Sodium

Sodium (Na⁺) is one mineral that requires special attention in irrigation water. Sodium can become toxic to many plants at high concentrations.

Sodium toxicity usually is seen as a burning along the edges of mature plant leaves. The toxic effects of sodium accumulate over time, so the burning effect in older leaves will eventually move toward the center of the leaf as the leaf ages. Woody perennial plants like citrus, deciduous fruits, and grapes experience toxic effects when the boron concentration in the soil reaches 1 ppm. Even the most tolerant plants, such as asparagus and alfalfa are affected once the soil boron concentration is 4 ppm. Boron toxicity symptoms are similar to those of sodium, with the burning effect beginning at the edges of older leaves. Woody perennial plants are generally most sensitive to boron.

Chloride

High concentrations of chloride ions (Cl⁻) can cause injury to woody perennials, burning the edges of mature leaves. Other plants can also be injured by high-chloride water, especially if leaves are wet by sprinkler irrigation when the air temperature is high and humidity is low.

Residual Carbonates

Water with high concentrations of carbonate and bicarbonate relative to the concentrations of calcium and magnesium has a high residual carbonate level (RSC). This type of water can...