



## WATER ANALYSIS GUIDE SHEET

The quality of natural sources of water has generally declined over recent years. While good quality water may be used extensively, bad water should never be used. However, less than good - but better than bad, water may be used with varying restrictions and with proper treatment.

In order to use water for greater benefit, the composition of the water **and** the soil - **later** to be monitored by regular plant testing and crop logging (*Ask The Plant*®), must be known in order to maximize the resources that Nature has given you.

**Total Soluble (Dissolved) Salts/Solids** composition is important for proper management: CAT-IONS of Na, Ca, Mg, K and AN-IONS of CO<sub>3</sub>, Cl, HCO<sub>3</sub>, SO<sub>4</sub>, NO<sub>3</sub>, Fe and B. Important characteristics and their meanings are given below:

### TOTAL SOLUBLE (DISSOLVED) SALTS - TSS:

**Electrical Conductivity (EC)** measures the **Total Soluble (dissolved) Salts (TSS)** as  $\mu\text{mhos/cm}$ , (1.0 EC = 640 ppm)  
 PPM = parts of a salt per million parts of water (10,000 ppm = 1% - Sea Water contains about 3% salts).

0 - 299	Very Low	Should be no problem	1200 - 1499	High	Water and Soil management necessary
300 - 699	Low	Seldom of any concern	1500 - 1799	Very High	Emergency use - requires soil treatment
700 - 999	Medium	SAR rating is best guide	Over 1800	Extremely High	May be very harmful to soil and plants with repeated use. Treat water and soil.
1000 -1199	Moderately High	Use good water and soil management.			

The above table gives an average idea on water quality. Below are other factors, which must be considered in making practical decisions:

1. How much salt is in the soil to begin with? (Soil salt checks that identify Soluble Salts are important when mediocre waters are used)
2. What is the soil type? ("Drainability" [porosity] is extremely important.)
3. What is the rainfall between irrigations? (With good internal drainage, salts can be washed below the root zone.)
4. What is the method of application? (Pan, row, drip or sprinkler)
5. How salt-tolerant is the crop?
6. Even if TSS is low, what percentage of it is one element or compound? Does it exceed reasonable values?

- ◆ **Highly Salt Tolerant:** (> 4.0 E.C.) Bermuda grass, Beets, Spinach, many Cotton varieties, Barley, Asparagus, Date Palm.
- ◆ **Medium Salt Tolerant:** (2.0 - 4.0 E.C.) Alfalfa, Tomatoes, Broccoli, Cabbage, Celery, Peppers, Lettuce, Corn, Oats, Grain Sorghum, Potatoes, Sugar Cane, Squash, Cucumbers, Watermelons, Soybeans, Grapes, Radish.
- ◆ **Sensitive to Salts:** (< 2.0 E.C.) Citrus, Berries, Avocado, Apples, Beans, Carrots, Onions, Peas, Papaya, Peaches, Pears, Plums

**Treatments can only assist in the leaching of salts** by making chemical changes. Salts must be physically flushed below the root zone. To do this, the soil must be permeable and sufficient water must be applied. **Biological Soil Inoculants can also be extremely effective!**

**CHLORIDES & SULFATES** are the most predominating kinds of salts. Chlorides are more harmful. They are highly soluble and move easily with the water. Cl > 300 ppm may burn plants & roots on contact. Some plants are more tolerant.

**SODIUM** affects the soil in an undesirable manner. It tends to make the soil hard and impermeable, thus the leaching of salts is difficult. Soluble Calcium has the opposite effect. The amount of Sodium that will be absorbed by the soil from the irrigation water depends primarily upon **Sodium Adsorption Ratio (SAR)** - the relationship between Sodium and soluble Calcium. A high SAR requires addition of high amounts of soluble calcium. The need for calcium also depends upon total salts in the water, as well as bicarbonates and sulfates. Soil soluble and extractable calcium must also be known to manage salts properly.

**BICARBONATES & CARBONATES** should be lower than Calcium and Magnesium for the following reason: as irrigation water moves through the soil, it becomes more concentrated. More and more water is lost due to evaporation and absorption by the roots. Calcium Carbonate will precipitate because it is of low solubility. The excess carbonates left in the water will then combine with the Sodium to form Sodium Carbonate - leading to the formation of black alkali. More soluble Calcium must be added to make up for the precipitated Calcium Carbonate.

Considering the various factors determining calcium needs, **TPSL®'s Comprehensive Soil** recommends the amount of Calcium needed in each case. The most suitable Calcium treatment may be Gypsum, Sulfur or other materials containing Sulfur. They can liberate Calcium from the soil, provided there is a supply of Calcium Carbonate in the soil.

## **BORON IS AN ESSENTIAL MICRONUTRIENT**

necessary for the transport of Calcium within the plant

***BUT***

***Excessive* amounts of BORON are toxic to plant growth.**

### **PLANT BORON EVALUATION TABLE**

RATINGS	SENSITIVE	SEMI-TOLERANT	TOLERANT
<b>LOW</b>	Below 0.40	Below 0.80	Below 1.40
<b>MEDIUM</b>	0.40 – 1.00	0.80 – 1.50	1.50 – 2.50
<b>HIGH</b>	1.00 – 1.80	1.50 – 2.80	2.50 – 3.50
<b>VERY HIGH</b>	Above 1.80	Above 2.80	Above 3.50

### ***Boron Sensitivity of Crops***

- ◆ **Sensitive:** Citrus, Avocado, Pecans (accumulates in leaf with age), Beans, Garlic, Onions, Cowpeas, Peanuts, Sweet Potato, Strawberry, Sunflower, Sesame.
- ◆ **Semi-tolerant:** Broccoli, Carrots, Cucumber, Pepper, Potato, Cabbage, Celery, Corn, Squash, Cantaloupe, Cauliflower, Radish, Turnip.
- ◆ **Tolerant:** Tomato, Alfalfa, Parsley, Beets, Cotton, Sorghum, Asparagus.

**BORON** in high levels is most often found in wells and lakes over 100 feet deep.

**BORON** is readily leached from the soil, ***except when there are high levels of Organic Matter present.***

Organic Matter holds Boron. Good tilth (condition / structure) from humus and soluble Calcium in the soil is essential to aid the leaching of all salts. Chemical treatment and physical flushing helps leaching.

**TOTAL SOLUBLE SALTS** for animals should not exceed:

- ⇒ 3,000 PPM ----- Poultry      7,000 PPM ----- Dairy Cattle      8,400 PPM ----- Horses
- ⇒ 10,000 PPM ----- Beef Cattle      12,000 PPM ----- Sheep

When no other water is available and cattle are forced to a certain water supply, they may adjust to 10,000 to 15,000 PPM of Total Soluble Salts (depending upon composition). Older cattle can take more salts than younger ones.

**NITRATES** NO<sub>3</sub> are toxic to Infants above 10 ppm -- Humans 15 ppm -- Cattle if found in amounts above 45 ppm.

**POTABLE (DRINKING WATER FOR HUMANS)** should additionally at least be tested for bacteria. A local correspondent lab available for bacterial analysis is:

Allergy & Indoor Air Quality Lab ♦ 711 Nolana - Suite 102-C ♦ M<sup>c</sup>Allen, Texas 78504 ♦ 956-687-3534.

### **SOIL & WATER MANAGEMENT:**

**WATER** - When watering, soak deeply but as infrequently as possible to leach salts, but avoid water-logging the plant root zone.

**SOIL** - Maintain high soluble Calcium for improved soil condition (structure) to aid air, water and root penetration. Use soil test that determines soluble Calcium to determine best and most economical treatment. Organic Matter (humus) and soil inoculants also aid soil tilth (physical condition).