Don't get salt stress from measuring salinity

STOP! DON'T TURN THE PAGE! Living close to the coast is not the only place where a turfgrass manager needs to be concerned about salinity. Irrigation water and soils can be influenced by salts in more ways than you think: (a) in arid environments where there is not adequate rainfall to leach salts through the soil profile; (b) in cold climates where snow is melted from roads by salt deicers; (c) in the High Plains and in coastal regions, where water from naturally occurring saline aquifers is used for irrigation; (d) using treated effluent as a water source; (e) saltwater intrusion into naturally freshwater wells; and yes, (f) using irrigation water from tidally influenced creeks and rivers, or on the East Coast, from an intracoastal waterway. Convinced? Good! After reading this article you will be able to easily navigate the sea of salinity units that are commonly used. If want more information WHY you should monitor salinity, see **SportsTurf** May 2012 page 32.

Let's start off by defining "salinity." Salinity is a measure of the salts dissolved in water (or a soil). Before we get into the many reporting units for salinity, it is important to understand how salinity is typically measured.

MEASURING SALINITY

You may have heard of using refractometers to measure salinity. Refractometers measure the change of direction or bending of the light as it passes from air to water. When we first began to measure salinity, it was common to use a refractometer. While still used, precise refractometers come with a hefty price tag. Furthermore, they are not automated, thus cannot be deployed to determine salinity continuously.

And that leaves us with the following two techniques commonly used to measure salinity:

1. The first involves *using a conductivity meter to measure the electrical conductivity (EC) of a solution* in the field. The electrical conductivity of a solution is a measure of the total dissolved solids (TDS) within the solution. These dissolved solids are generally made up of inorganic and organic compounds that have passed through a 2 micrometer (µm) sieve. TDS is typically a measure of the concentration of *salts* that have dissociated (split) in the water to form both positively (cations) and negatively (anions) charged ions. The idea behind using EC as a measure for salinity is that the more salts present, the more electricity conducted, and the higher the EC reading.

2. The second method, *measuring TDS directly*, can only be performed in a laboratory and is generally the method by which laboratories report your salinity value. To measure TDS, a specific volume of sample is weighed, filtered through a 2 µm sieve to remove any particulate, gently dried until all water has evaporated, and the remaining salts/solids in the sample weighed. The dry weight of salts remaining divided by the original weight of the evaporated sample tells us the sample salinity.

Salinity Conversion Table
µ = micro, m = milli 1 µmhos/cm = 1 µS/cm 1000 µS/cm = 1 mmhos/cm = 1mS/cm = 1 dS/m
ppt = part per thousand, ppm = part per million 1 g/kg = 1 ppt = 10,000 ppm = 1.0%
ppm = dS/m x 550 (water with high proporation NaCl) ppm = dS/m x 700 (hydroponic solutions, other salts dominant)

THIS TABLE makes it easy to convert reported salinity units to those you are familiar with:

REPORTING SALINITY

How does TDS relate to EC and what can both measurements tell us about the salinity of a given water sample?

Salinity is discussed with many different units. It is common to see salinity expressed as a concentration (from the direct TDS measures) – such as 35 g dissolved salt / kg sea water = 35 ppt (part per thousand) = 35,000 ppm (part per million) = 3.5%. For irrigation purposes, many labs report salinity as TDS. Values below 500 ppm are generally not of any concern; values between 500-2000 ppm are considered an "increasing" concern and should be monitored, and > 2000 ppm are considered a severe problem.

To get a TDS or concentration measure of salinity, you have to submit an irrigation sample to an analytical laboratory and wait for results. If you need a more immediate measure of irrigation water salinity in the field, using a conductance meter to measure EC is an accurate and inexpensive (once the meter is purchased) method. While there is not exact relationship between EC and TDS, there is an approximate relationship. In water with a higher proportion of sodium chloride (water typical to SC) to get to ppm multiply the dS/m reading by 550; for other water sources (like hydroponics solutions) multiply the dS/m reading by 670 or 700 to convert to ppm. For the most part, turfgrass managers would use the 550 conversion factor.

EC is generally reported in deciSiemens/meter (dS/m), milliSiemens/cm (mS/cm), or millimhos per centimeter (mmhos/cm), which are numerically equivalent to each other. Here is a piece of trivia for you: as mentioned above, EC is a measurement of conductivity that is commonly measured in mmhos/cm. The opposite of conductivity is resistivity, which is measured in ohms. Ohms spelled backwards is mhos! When using an EC meter to determine relative salt levels, the recommended EC range of irrigation water is generally <0.75 dS/m for seedlings, or propagation areas and 0.75 – 3.0 dS/m for general irrigation purposes. If concentrations are less than 0.5 dS/m or greater than 3.0 dS/m, severe problems can occur. ■

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