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Technical Bulletin 1: Effects of irrigation water quality on pH

The quality of irrigation water from aquifers varies depending on the source formation of the aquifer structure itself. For example, in southern areas along the coast many aquifer structures have minerals in the form of salts present. These salts may or may not have an impact on plant growing conditions based on; plant tolerance, dilution of salts in aquifer water, type of salt, or total concentration of minerals in water (electrical conductivity).

It is also important to realize that just because the proximity of the aquifer is not currently close to the coast that you can still have mineral problems. For example, in a number of aquifers during the formation period the original aquifer was in an old ocean bed or near an ocean. These effects can be seen in numerous places far away from current coastal settings such as the southern Ogallala aquifer.

What does all this mean and why is it important? The current drought situation has brought on some effects from varying water quality. As a drought occurs a number of things change: 1) depending on the size of the aquifer the mineral load (salt load or EC) in the water can increase as water is pumped out at a higher rate, 2) again depending on the recharge of the aquifer mineral concentrations can increase due to inflow or recharge reductions, 3) water usage for irrigation drastically increases concentrating minerals in water on the soil, 4) pH can change depending on the type of minerals, and 5) availability of macro and/or micro nutrients may change with pH changes and concentration of certain minerals.

Here are a few examples. First, a number of calls have been coming into the lab from irrigated growers in the mid south and delta areas. These growers are all experiencing one thing in common; magnesium has dramatically increased in the soil tests. This magnesium increase to “very high” levels has two direct effects. One, the pH generally increases 1 to 2 points due to the concentration of Mg as a base. Two, the Mg base saturation increases depressing the K saturation (which is needed for all plant development) and also the calcium saturation. What impact does this have? A soil test can indicate optimum to high potassium levels (K) on the chart based on the number itself, but actually still call for K fertilization because the saturation level of K is not at the proper level (normal: 5 to 7%). The second impact is that due to the increasing pH the micronutrients are not as available moving above the 7.0 pH. The second example has been seen in the turf industry where high frequency irrigation and low volume are used or municipal effluent is blended with irrigation water. In all cases the level of sodium (Na) and EC have been a problem causing a burn on the green where non-tolerant turfs are grown, but leaving the Bermuda grass roughs or fairways not with no impact due to it’s tolerance for this problem. The symptoms are desiccation even with normal irrigation, bronzing or burning of leaf tips and eventually the whole plant, and root death.

What are the solutions for these situations: 1) test your water (all wells) to determine if water quality varies (some aquifers will cause variation in wells as close as 100 feet), 2) if sodium is the problem a gypsum or liquid need should be determined and used to flush Na from the soil, 3) if wells are a problem management strategies should be developed to replace or minimize the use of the well to some level depending on the mineral concentration of the water and the environmental conditions (drought and heat), 4) if Mg, other bases, or bicarbonates are a problem then adjust fertility program to offset impacts, 5) check for tolerance of

plants or crops being grown to determine if there will be a problem, and 6) manage the situation so that minimum impact is made using annual testing during drought situation of wells and soil test.