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A REVIEW OF IRRIGATION WATER QUALITY

Irrigation water quality plays a major role in the successful management of turfgrasses. Of prime importance are the effects of irrigation water on turf-soil-water relations and on the soil's chemical and physical properties, particularly as these factors relate to turfgrass quality. Therefore, assuming proper irrigation practices, the concept of irrigation water quality for turfgrass is generally based on interpretations of the chemical analysis of a given water.

All irrigation waters contain appreciable quantities of soluble salts and traces of other materials. These may include sodium, potassium, calcium, magnesium, chloride, bicarbonate, sulfate, nitrate, borate, fluoride, iron, silica, aluminum and other elements. Because these elements may accumulate in the soil in quantities which are injurious to turfgrasses, potential problems from the use of irrigation water can sometimes be anticipated by a laboratory chemical analysis. The most important of the items determined in the analysis for judging water quality are:

1. total salt content
2. sodium hazard (permeability)
3. toxic iron levels
4. bicarbonate
5. pH

Salinity problems, most pronounced on heavy soils, occur when the salts dissolved in irrigation water accumulate in the grass root zone to levels intolerable to the species being grown. A high salt level in the soil may affect turfgrasses by increasing osmotic pressure of thesoil solution, thus making water less available to the plants. Where salinity is very high, grass roots wilt and plants may eventually die. Nutritional imbalances and mineral toxicities may also occur at high salinity levels.

Sodium concentration is also a very important criterion of irrigation water quality. Although high levels of sodium may accumulate in grasses and become toxic, it is sodium's indirect effect on turfgrass growth via its deteriorating effect on soil structure which is of concern to the turf manager.

High irrigation water sodium content causes deflocculation of the soil colloids which in turn severely reduces both soil aeration and water infiltration into and through the soil. In other words, soil permeability is reduced when waters containing high levels of sodium are used for irrigation. Relative permeability is often expressed as SAR (sodium adsorption ratio), the ration of sodium ion concentration to that of calcium plus magnesium.

Irrigation water usually contains a wide variety of elements in small concentrations. Problems can occur if certain trace elements accumulate in the soil to levels toxic to turfgrasses and other plants. For example, although chloride is not particularly toxic to turfgrasses, most trees and shrubs are quite sensitive to a chloride content of 10 meg/(355 ppm).

Boron on the other hand, is a more likely cause of toxicity in turfgrasses. The major symptom of this toxicity is necrosis at leaf tips, where the highest boron concentration occurs. Since turfgrasses are mowed regularly and accumulated boron is thus continuously removed from the leaves, most regularly mowed turfgrass can tolerate high concentrations of born in irrigation water. However, this high boron content of poor quality irrigation water poses a greater toxicity problem for non-turf plants, e.g., trees, shrubs, ground covers, etc. Most landscape plants show injury when irrigated with water containing more than 1.0 mg/(ppm) of boron.

An irrigation water's bicarbonate content can also affect soil permeability and must be evaluated along with the sodium, calcium and magnesium content of both soil and water. The bicarbonate ion may combine with calcium and/or magnesium and precipitate as calcium and/or magnesium carbonate. As calcium and magnesium precipitate out of the soil solution, the SAR of that solution, and consequently the exchangeable sodium percentage (ESP) of the soil, increases. (When dealing with poor water quality irrigation water, many analytical laboratories adjust the calculated SAR to include a more correct estimate of the calcium that can be expected to remain in the soil water

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