Salinity Management in Effluent Water Irrigated Turfgrass Systems

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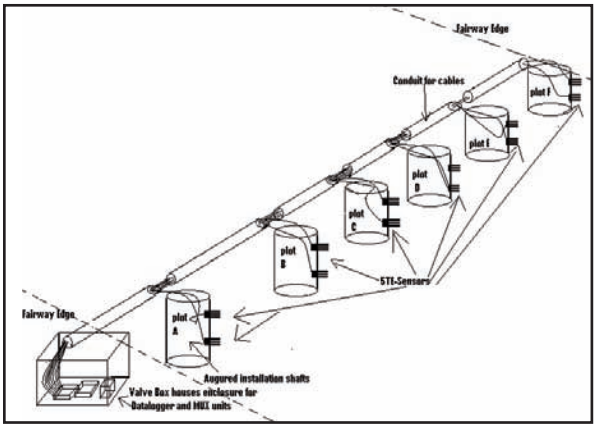
Objectives:

1. To determine spatial and temporal salinity accumulation patterns in soil profiles on a golf course fairway site with effluent water irrigation.
2. To evaluate different management practices for reducing sodium and salt accumulation in the soil.

Start Date: 2008
Project Duration: three years
Total Funding: $82,459

In many large urban areas in the arid and semiarid regions of the U.S., the population increase has not only increased the fresh water demand but also increased the volume of wastewater generated. Effluent water appears to be the only water resource that is increasing as other sources are depleted. Effluent water has emerged as a reliable and consistently available source of water for golf course irrigation. The very nature of effluent water warrants special management steps to be taken to minimize the possible drawbacks associated with its constituents. The constituents are dependent on the source of effluent water. Some of the main constituents include: salts of different types, nutrient elements, and organic compounds. Effluent water has relatively high levels of sodium concentration relative to calcium and magnesium. Golf course managers are often concerned about salinity and sodicity issues associated with effluent water irrigation. Long-term and continued use of effluent water may lead to increased soil sodicity, with a resulting reduction of soil infiltration, permeability, and aeration, especially in clayey soils, exacerbating salinity problems.



In 2008, a series of in-ground salinity and soil water content sensors on two fairways at the Heritage at Westmoor Golf Course in Westminster, Colorado were installed.

We sampled and tested soil from fairways of 10 golf courses that were near metropolitan Denver and Fort Collins, CO. Among these courses, five had been irrigated exclusively with effluent water for 5-33 years. The other five with similar turf species, age ranges, and soil textures had used surface water for irrigation. Our results indicated that soils from fairways where effluent water was used for at least 5 years exhibited slightly higher soil pH and higher concentrations of extractable Na, B, and P. Compared to sites irrigated with surface water, sites irrigated with effluent water exhibited higher EC and a higher sodium adsorption ratio (SAR) of saturated paste extracts.

In 2008, we installed a series of in-ground salinity and soil water content sensors on two fairways at the Heritage at Westmoor Golf Course in Westminster, Colorado. At each fairway, 6 plots were established. On each plot, two 5TE sensors were installed at 15 cm and 30 cm below soil surface. A total of 12 sensors were installed on each fairway. Wire leads from each sensor were buried and connected to a data logger located at the edge of the fairway. These sensors measure three parameters: temperature, volumetric water content, and the electric conductivity of the soil.

The installation process was performed over the course of several weeks followed by technical testing and calibration. Prior to automatic data collection, sensor-measured soil electrical conductivity (EC) was compared to conventional saturated paste extracted soil EC to assess data accuracy. Significant linear correlation was observed between sensor-measured soil salinity vs. saturated paste extracted soil salinity ($r = 0.77$).

After calibration, data loggers have been programmed to collect data once a day to provide information on spatial and temporal salt accumulation patterns.

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Data collected thus far showed that in early August when the weather was relatively dry, a well-drained fairway had an average soil salinity of 1.8 and 1.3 dS/m at 15 and 30 cm below soil surface, respectively, whereas the poorly drained fairway had 2.95 and 2.43 soil EC at 15 and 30 cm below soil surface, respectively. A significant thunderstorm in mid-August effectively leached soil salts. Our preliminary data indicated that the accumulation of salts appears to relate to precipitation patterns, soil texture, and drainage effectiveness.

Summary Points

- Effluent water is a reliable and consistently available source of water for golf course irrigation.
- Salinity and sodicity are major concerns associated with effluent water irrigation.
- Compared to sites irrigated with surface water, sites irrigated with effluent water exhibited higher EC and higher sodium adsorption ratio (SAR) of saturated paste extract.
- Significant linear correlation was observed between 5TE salinity sensor-measured soil salinity vs. saturated paste extracted soil salinity
- Accumulation of salts appears to relate to precipitation patterns, soil texture, and drainage effectiveness.