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Project Abstract

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Quantification of Denitrifying Genes and Leachate Quality of Turfgrass Irrigated with Tailored Membrane Effluent

Abstract

A significant portion of water usage within the United States is used to irrigation turfgrass every year. Turfgrass covers roughly 163,800 ± 35,830 km^2 of land area in the US and is one of the most irrigated crops. This demand on water for irrigation to maintain and grow turfgrass strains urban water supplies and infrastructure. Traditional methods for irrigation rely on potable water with surface-applied granular fertilizer to provide nutrients to grass. However, the use of tailored reclaimed wastewater for irrigation would alleviate stress on urban water supplies and could minimize nutrient leaching while improving nutrient delivery for grass growth and appearance. Both treatments for irrigation were tracked by chemical, microbial, and visual analysis on a field site with two types of grass, Kentucky Bluegrass Colorado Blue™ and buffalograss. Chemical analysis occurred on a monthly basis over the course of the project and tracked changes in pH, electrical conductivity for ion build-up, and nitrogenous compounds in leachate samples taken at 10, 20, and 60 cm depths. From this data collected over the course of two years, there appeared to be no significant differences in pH or electrical conductivity readings for either potable or tailored water irrigation plots. With the exception of elevated levels of nitrogen and nitrate during the winter of 2013 for tailored water irrigation plots, there were also no significant differences between nitrogen persistence in the leachate samples between treatment types (Figure 1).

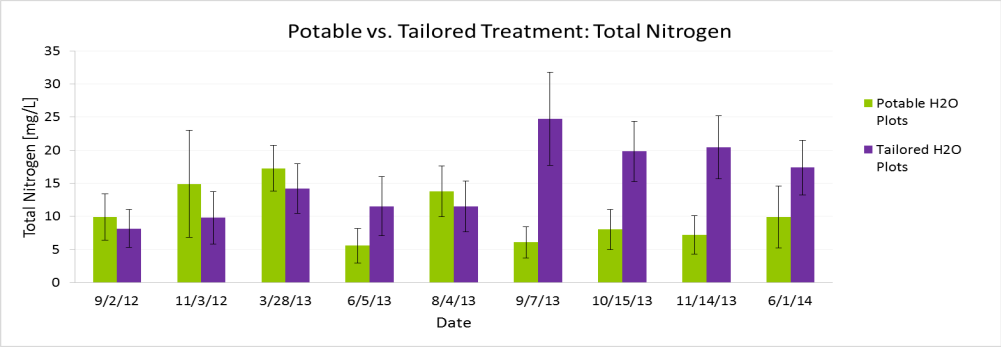

Figure 1. Plot of total nitrogen concentrations in leachate samples collected at 10, 20 and 60 cm depths. Concentrations averaged over depths and types of turfgrass. Error bars represent 95% confidence intervals

Visual analysis was also carried out to track changes in grass health, appearance, and turf coverage. Analysis was performed on visual inspection as well as using the program Sigma Scan to analyze and rate turfgrass. It was determined that there were no significant differences in turfgrass health and appearance between irrigation with potable water and fertilizer or tailored reclaimed water, as seen in Figure 2.

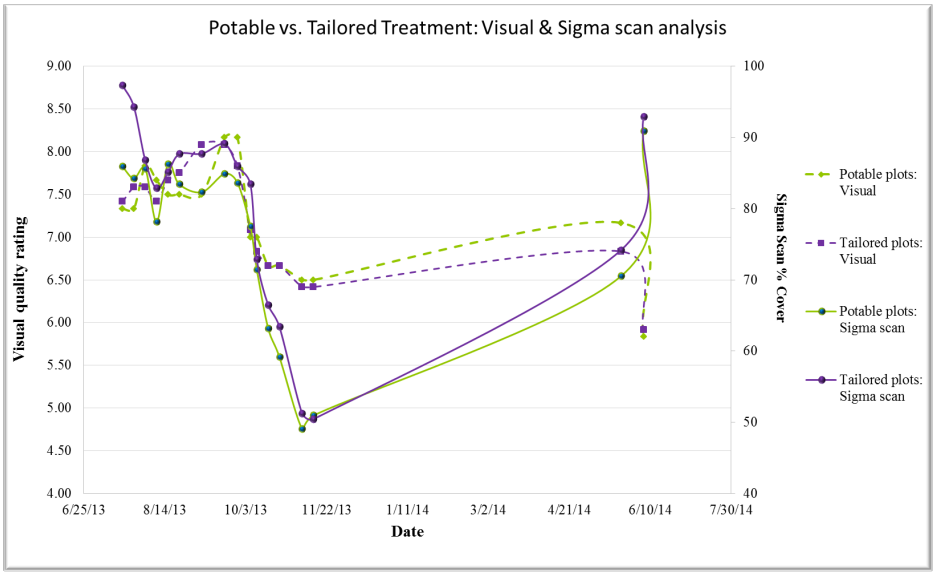

Figure 2. Turfgrass health and appearance evaluated on a 1-9 rating scale and percent coverage. Analyzed by visual inspection and using the program Sigma Scan.

Finally, microbial analysis was carried out on soil samples taken at 10, 20 and 60 cm depths on a monthly basis for each plot. Soil samples were analyzed using quantitative polymerase chain reaction (qPCR) to quantify the denitrifying genes nirS and nosZ. Soil samples from the first two months of testing in 2012 were fully analyzed for nirS. Further analysis will need to be carried out to determine if trends exist in nirS concentration in microbial communities between irrigation treatments and soil sample depths. Initial testing of soil samples for nosZ suggested negligible concentrations of this gene in the microbial communities.