How Does Irrigation Water Quality Affect Soil Chemistry of Sand-Based Rootzones?

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Objectives:

1. Determine if accumulation of calcium carbonate results in a detectable decrease in porosity or air permeability under different fertility regimes.
2. Determine the pedogenic distribution of calcium carbonate in sand-based rootzones of various ages across different regions of the USA.
3. Determine how various base cation saturation percentages affect saturated hydraulic conductivity and soil solution composition of sand mixed with various rootzone amendments.

Start Date: 2011
Project Duration: 2 years
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The use of alternative, non-potable water sources for irrigating golf courses is becoming more common as pressure increases on water resources. These water sources and the associated agronomic challenges that arise from using these waters have traditionally been restricted to the arid southwestern U.S., but are now expanding throughout the country.

It is a widely held belief that water high in bicarbonate can result in calcium carbonate precipitation in the soil, sealing of soil pores, and decreases in water infiltration rates. However, very little research has been done to examine carbonate precipitation in soils, especially as it relates to soil physical properties.

Sand-based profiles (10 cm diameter, 30 cm length) were built to USGA-specifications in PVC columns. Cores were seeded with creeping bentgrass (*Agrostis stolonifera* L.) in August 2011 and are being irrigated at approximately 90% of evapotranspiration by the weighing method. The water sources used are calcium carbonate saturated, calcium-magnesium carbonate saturated, and deionized water. The carbonate waters are enriched with ^{13}C-bicarbonate in order to accurately track carbonate accumulation. Cores are fertilized at 0.6 lbs N/M/month with either an acidifying or a basic fertilizer.

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Air permeability is measured biweekly to determine whether there is a decrease in porosity or air infiltration rate due to accumulation of carbonate. After 12 months, the cores will be sliced into 2-cm sections and analyzed for total carbonate and ^{13}C content. These results will help to determine the effects of carbonate accumulation on physical properties of sand-based rootzones.

Water samples and full-profile soil samples have been collected from golf course putting greens throughout the U.S. and are being analyzed for carbonate content. This information will lead to a better understanding of the pedogenic distribution of carbonate in different regions throughout the U.S. Sample collection and analysis will continue through summer of 2012 with the goal of collecting samples from at least 35 golf courses.

During winter of 2011/12, USGA-recommendation rootzone mixtures (10 cm diameter, 10 cm length) will be amended with calcined clay, sphagnum peat, zeolite, and silt loam soil. The profiles will be saturated in different solutions of increasing sodium and varying base cation saturation percentages.

Hydraulic conductivity will be measured using an automated falling head permeameter, and soil solution composition will be analyzed using both immiscible liquid displacement and saturated paste extraction. These results will help to determine the effects of various base cation saturation percentages on soil physical and chemical properties.

The results from this experiment will provide a better understanding of the effects of irrigation water quality on the chemical and physical properties of sand-based rootzones. This information could ultimately serve to provide better recommendations to golf course superintendents who are using alternative, non-potable water sources

Hydraulic conductivity will be measured using an automated falling head permeameter.

Summary Points

- The findings of the study will help to determine the effects of calcium carbonate accumulation on the chemical and physical properties of sand-based rootzones and the natural distribution of calcium carbonate in sand-based rootzones across the U.S.
- The results will help to determine the effects of differing base cation saturation percentages on chemical and physical properties of sand-based rootzones.
- The findings of the study are expected to result in improved recommendations to golf course superintendents who are using alternative, non-potable water sources.