Evaluation of New Technologies in Construction and Maintenance of Golf Course Greens

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Objectives:

1. Determine the laboratory and field physical and microbiological properties of sand amended with organic and inorganic materials.
2. Determine creeping bentgrass morphological and physiological responses under low oxygen situations.
3. Evaluate soil physical and plant responses to forced-air injection and water evacuation.

Start Date: 1996
Project Duration: 5 years
Total Funding: $100,000

Some putting greens may not dry out sufficiently, due to high humidity and low evapotranspiration, and oxygen levels may remain low for extended periods. This study is designed to investigate the use of alternative construciton materials and technologies to improve or maximize aeration at lower depths in the putting green rootzone and to quantify creeping bentgrass physiological response to low soil aeration.

None of several inorganic amendments reduced nitrate leaching, although Ecolite and Profile were very efficient at retarding ammonium leaching. Rate and positioning effects of amendment on nutrient leaching indicate that incorporation at 10% (v:v) gives very effective results.

Soil water content was reduced by the presence of the gravel layer but was unaffected by gravel size. The gravel layer functioned essentially as a continuation of the sand rootzone with regards to drainage. Treating the gravel with a hydrophobic sealant reduced drainage and increased water content in the sand profile. This indicates that there is adequate continuity of water across the sand/gravel interface to permit normal drainage.

Sixty mini-putting greens were used to evaluate SubAir treatments. Air evacuation or injection had little or no effect on soil temperature. Rootzone gases were also unaffected by SubAir treatments, with O_2 and CO_2 remaining at near-optimum levels throughout the season. SubAir treatments were effective at reducing soil moisture throughout the profile, by approximately 3-4%.

New putting green construction methods and materials were evaluated at North Carolina State University.

Inorganic amendments generally improved bentgrass establishment relative to unamended sand, but not to the same degree as peat moss. There were few effects of inorganic amendment after establishment.

Infiltration, determined three years after putting green establishment, was uniformly high across the various rootzone mixtures, and was comparable to initial laboratory estimates for hydraulic conductivity. This indicates that rootzone physical properties had not deteriorated during the first three years of the study.

Soil microorganism populations increased rapidly during the first months following seeding, independent of rootzone mix, and have remained fairly stable thereafter. It appears that the concept of a sand rootzone being "sterile" and in need of microbial inoculation is suspect. Some data indicate that seasonal root dynamics may dramatically regulate microbial biomass by altering the amount of sugars and other substrates in the rootzone.

Summary Points

- None of the inorganic amendments reduced nitrate leaching, although Ecolite and Profile were very efficient at retarding ammonium leaching.
- Soil water content was reduced by the presence of the gravel layer, but was unaffected by gravel size.
- Air evacuation or injection had little or no effect on soil temperature.
- O_2 and CO_2 were unaffected by SubAir treatment; however, soil moisture throughout the profile was reduced by approximately 3-4%.
- Inorganic amendments generally improved bentgrass establishment relative to unamended sand, but not to the same degree as peat moss.
- Infiltration was uniformly high across the various rootzone mixtures, and was comparable to initial lab estimates for hydraulic conductivity.
- Soil microorganism populations increased rapidly during the first months following seeding. The concept of a sand rootzone being "sterile" and in need of microbial inoculation is suspect.