Soil Physical Characterization of Aging Golf Greens

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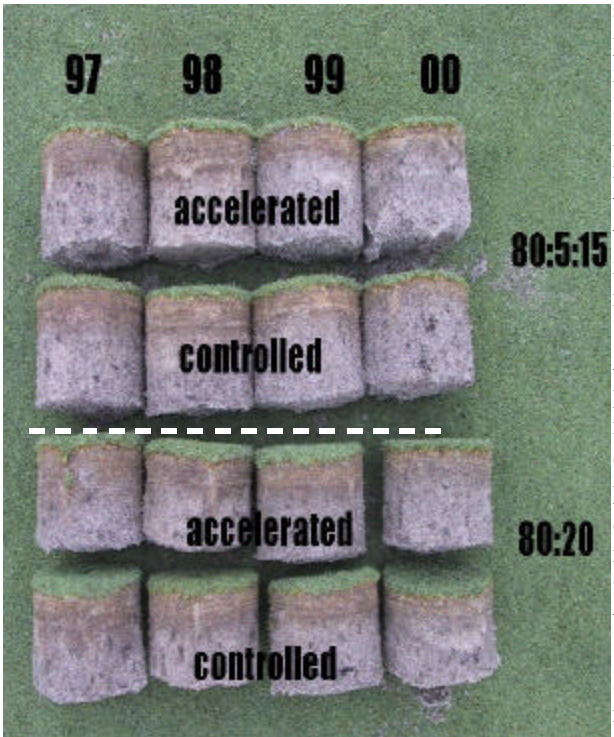
Objectives:

1. Determine long-term effects of a USGA-specification rootzone mix with and without soil on physical, chemical, and microbiological factors.

Start Date: 2001
Project Duration: 2 years
Total Funding: $53,465

The five year project is composed of three phases, One: Construction and Grow-in, Two: Microbial Community Assessments, and Three: Grow-in Procedure Impacts on the Long-term performance of the Putting Green. Phases One and Two span three year periods, while Phase Three involves data collected over the eight years of the project.

Two separate USGA-specification rootzone mixtures - one composed of sand and peat (80/20 ratio) and one a combination of sand, peat, and soil (80/15/5 ratio) - were developed in 1996. Materials used for construction complied with USGA greens recommendations for physical characteristics and organic matter content.



Cores taken from greens established in '97, '98, '99, and 2000 demonstrate the differences in organic matter buildup depending on whether the rootzone contains soil. The cores above the dotted line were taken from rootzones containing 5% (vol/vol) soil.

1997 greens were constructed in late summer of 1996, allowed to settle over the winter, and were seeded with Providence creeping bentgrass (1.5 lbs/1000ft^2). Similar procedures were followed for subsequent greens. All greens were seeded in May the year after construction. Fertilizer was applied prior to and after seeding of the greens.

Establishment and grow-in treatments were set up as an accelerated and controlled treatments. The accelerated grow-in included higher rates of starter fertilizer (16-25-12), micronutrients and seasonal applications of N, P, and K. Postplant factors for the accelerated treatment included full rates of starter fertilizer applied weekly versus half rate applications of the same starter fertlizer applied every two weeks.

Data collected on year one through year four greens were: (1) color, (2) quality, (3) ball roll distance (Stimpmeter), and (4) surface hardness (Clegg). Soil physical properties were examined annually in October. Infiltration rates were measured in the field using a 6" single-ring infiltrometer. Soil cores were sampled and analyzed for water retention and total porosity using pressure plate techniques.

A visual count of the fairy rings per plot was made in the summer of 2000 and 2001 in each of the greens. Soil chemical properties were analyzed annually, in the spring prior to treatment, and in the fall. Samples for microbial characterization were also collected in the fall. Soil chemical analyses for the 2001 growing season and microbial characteristics for 1998-2001 are pending.

The soil-containing rootzone mixture had higher surface hardness than the soil-less mix on all observation dates in 1997, 1998 and 1999. Surface hardness was not affected by grow-in treatment. In 1998, the soil-less media had a lower bulk density than the soil-containing treatment.

Soil infiltration rates in 1997, 1998, 1999, 2000, and 2001 were not significantly different between rootzone mixes. In 1999 and 2001, the accelerated grow-in treatment had infiltration rates faster than the controlled. There appears to be a trend toward a greater change in microbial biomass over time for the soil-less than the soil-containing root zone mix. The soil-less root zone had significantly higher fairy ring occurrence in 2000.

Summary Points

- Microbial biomass was not affected by rootzone mix or grow-in procedure on plots established in 1997. Microbial biomass increased over 200% from Spring to Fall and decreased 40-60% as sampling depth increased. There appears to be a trend toward a greater change in microbial biomass over time for the soil-less than the soil-containing rootzone mix.
- Water infiltration measurements from treatments established in 1997, 1998 or 1999 did not differ in establishment or subsequent years until approximately three years after grow-in. At this point, it appears that the soil containing greens K_{sat} is significantly lower than the corresponding soil-less greens. Partitioned dry matter estimates will be made to determine organic matter dynamics of this observed response.
- Establishment results were similar in greens established in all years. For four consecutive years it was found that higher inputs will initially increase cover during grow-in. This increase may not translate to earlier opening for play if environmental stress conditions occur that result in damage to lush, immature turf.