Bacterial Populations and Diversity within New USGA Putting Greens

Monica Elliott
University of Florida

Horace Skipper
Clemson University

Beth Guertal
Auburn University

Objectives:

1. Determine bacterial populations associated with putting green root zone mix materials.
2. Determine bacterial populations of the root zone mixes before and after fumigation.
3. Compare rhizosphere bacterial populations on two different turfgrasses, bentgrass and bermudagrass.
4. Compare rhizosphere bacterial populations of bentgrass in two differrent locations, Alabama and South Carolina.
5. Compare rhizosphere bacterial populations of bermudagrass in two different locations, southern Florida and northern Florida.
6. Compare thatch development, rooting and bacterial population of bentgrass in relation to root zone mix and nitrogen fertilization.
7. Compare soil and rhizosphere bacterial populations of root zone mixes containing various clay sources.
8. Document rhizosphere bacterial population dynamics on bentgrass and bermudagrass over a four-year time period.

Start Date: 1998
Project Duration: 3 years (current cycle)
Total Funding: $119,997

The soil environment immediately around the root frequently has a larger number of microorganisms than soil just a few millimeters away from the root. This zone of influence is called the rhizosphere. The overall objective of this project is to develop baseline data concerning rhizosphere bacterial composition (populations and diversity) of new USGA putting greens, both during and after construction. During 1996, the best methods for enumerating specific groups of bacteria were determined.

University of Florida With only a few exceptions, there was less than two log units difference in bacterial counts, for all bacterial groups enumerated, over all dates from May 1997 through August 2000. For all groups except the gram-positive bacteria, there was a significant drop in bacterial counts in February 1999. This can probably be attributed to very cold temperatures that occurred just prior to sampling

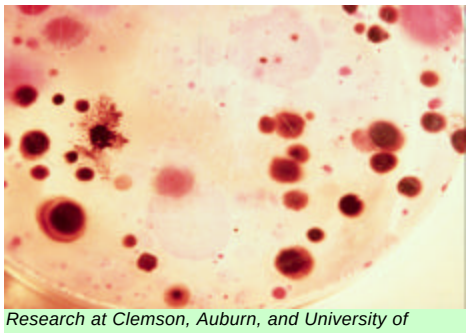
A range of culture media were used by scientists at Auburn University, Clemson University, and the University of Florida to establish the range and diversity of soil microorganisms living in sand rootzone putting greens.

While the project is not complete, it is safe to state that new USGA putting greens certainly are not sterile environments with few bacteria present. So far, there would appear to be no universal cyclic trends. Except for the drop in all bacterial numbers for February 1999, there was no discernable pattern that developed.

Auburn University At Auburn University, the objective was to evaluate the microbial diversity of bentgrass (Crenshaw) greens over time as affected by root-zone mix and N rate. Results of three years of leachate collection have revealed that after grow-in, little $N0_3$-N or NH_4-N leaches through the rooting profile of the putting greens.

If differences did exist, bacterial counts were higher in the sand/peat root zone mix or in the treatments receiving the higher rate of N. There were no obvious population trends in any microbial population over the three-year sampling period. Populations of total bacteria ranged from a low of 5.4 to a high of 8.3 log10 cfu/gram throughout the two-year sampling period.

Clemson University Rhizobacteria are being evaluated for promotion of plant growth and for biological control of weeds, insects, diseases, and nematodes in a number of ecosystems. The Charlotte Country Club Golf Course was chosen for this study because it was reconstructed in June 1996. Most rhizobacterial populations and total populations were relatively stable over these sampling periods.



Research at Clemson, Auburn, and University of Florida confirms that sand rootzone putting greens are rich in microorganisms.

Percentage of Gram-positive and Gram-negative bacteria based on the KOH method was relatively stable over eight sampling times with approximately 75+% of the bacteria being Gram-negative.

Summary Points

- New USGA putting greens are not sterile environments with few bacteria present.
- Twenty-five genera were identified from the bentgrass green. There was some shift among the populations.
- Most of the rhizophere populations were stable over the sampling period (three years).
- The management practices and other abiotic conditions may have contributed to the shifts in genera or species.
- There were greater bacteria populations in sand peat mixtures versus sand only and also in areas where a higher nitrogen rate was used.
- The only populations unaffected by nitrogen rate or greens mix were gram-positive bacteria.
- The flux of all microbial populations across all samplings was consistent.