Engineering Characteristics and Maintenance of Golf Putting Greens

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Goals:

- *Study the engineering characteristics of sands used in putting green construction to ensure a stable and agronomically sound rootzone mixture.*
- *Study post grow-in (3-7 years) changes which occur under traffic on a USGA specification putting green to two other construction methods for differences in putting green quality and speed as well as long term differences in the organic matter, rooting, edaphic and nutritional characteristics.*

Cooperators:

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Phase One: Engineering Properties

In the first phase of this research project, the primary objective is to apply engineering principles to the study of strength and stability in sand-textured root zones used for golf putting greens. In addition to completing the literature review, the second year of study allowed us to expand the types of testing. Evaluation of the properties of the six test sands which were generated in the laboratory and designed to simulate possible mix ranges found in USGA specifications was continued.

New constraints were incorporated into the testing procedures already in place. The data generated from the modified tests, along with the data previously collected, provided a more detailed picture of the properties crucial for strength and stability. The field testing portion of the study was also begun. This allowed us to compare laboratory test results with real-world turf conditions. From this we will be able to create guidelines for achieving desired soil strength.

The second year of research has allowed for extensive laboratory testing. This has made it possible to test the strengths of sands under numerous controllable parameters. Tests included the direct shear test and the California Bearing Ratio (CBR) tests. From these tests we were able to determine that although small amounts of water may cause some apparent cohesion within a sand, drier more-well compacted

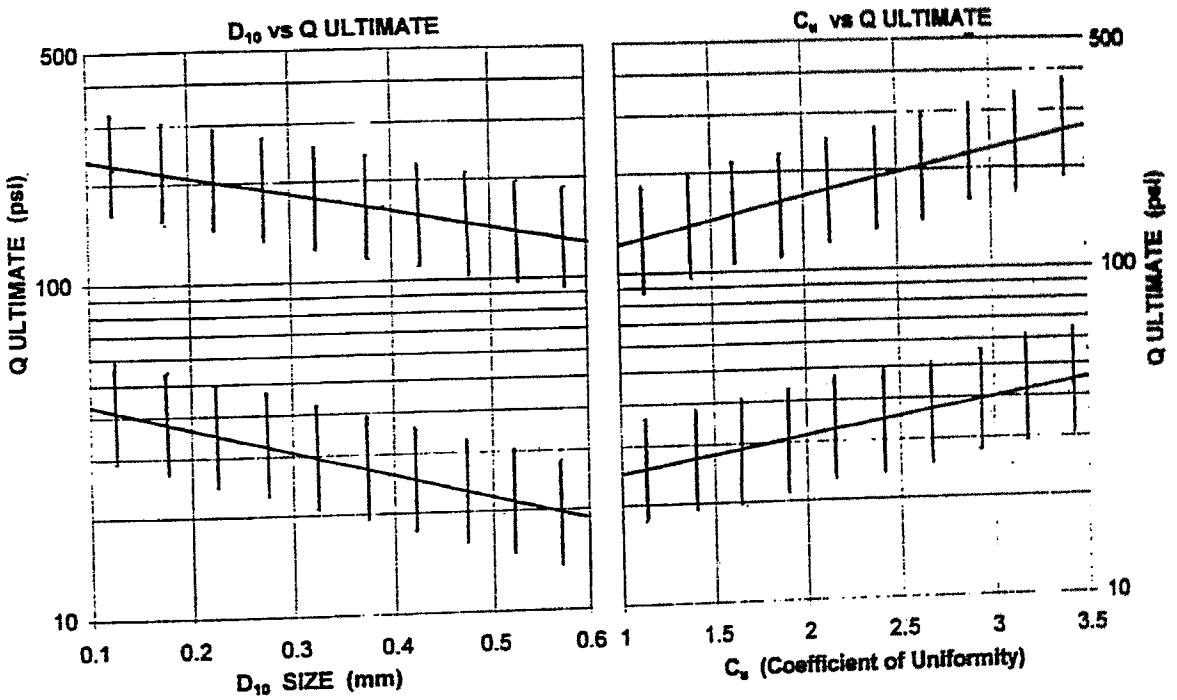

Figure 19. Trends among D10, uniformity coefficient (Cu) and ultimate bearing capacity (psi).

sands withstand a greater load before failing.

The initial phase of field testing was begun and has already produced significant amounts of information. It was possible to directly relate the field test results with the laboratory tests. The testing has shown that a rootzone will be able to carry a greater load without failure if it is comprised of particles that cover a wide range of sizes. In addition, the smaller the minimum sized particles in this wide range of sizes are, the greater load the sand will be able to carry.

For most soils within the root zone, once a large enough load has been applied to cause a given deformation, very little increase in loading is needed to cause further failure of the soil. All of this information points to the fact that significant variations in the bearing capacity and resistance to deformation can be found among similar sands even thought they are ail within USGA specifications.

The increased number of field tests that will be possible in the future will make it possible to further analyze the most crucial soil parameters for affecting strength. Once this is accomplished, guidelines will be developed so that superintendents will be able to design a sand mixture that will produce the exact results which they desire while still falling within USGA specified guidelines.

Phase Two: Maintenance

The objective of this phase is to evaluate and quantify responses of variously constructed putting greens subjected to typical maintenance practices. This five-year project has now finished its

second year and all objectives are well under way. While it is somewhat unwise to draw conclusions at this point, there are trends emerging from the research.

Specific objectives of the second portion of the proposed research were:

- Evaluate three putting greens constructed by different methods and their response to sand topdressing and season long rolling (split plot) under simulated trafficked conditions for 3 to 7 years after establishment.
- Evaluate the effects of nitrogen and potassium fertility on trafficked creeping bentgrass quality and wear tolerance on three putting green construction methods with a rolling variable.
- Determine the long-term effects of plant growth regulators on putting green speed and creeping bentgrass quality on three putting green construction methods with a rolling variable.
- Monitor the long-term changes in turfgrass rooting, soil physical characteristics, nematodes, and pathogens under three putting green construction methods.
- Monitor the long-term changes in organic matter and forms of soil nitrogen among three putting green construction methods.
- Compare topdressing with crumb rubber from used tires to sands in putting green collars of the three putting green construction methods.

General Maintenance Procedures

The area was mowed six times a week with a walk mower at a cutting height of 0.157 inches. Topdressing of the entire area with sand was accomplished on a light frequent basis throughout the growing season. Irrigation was applied on a daily light-frequent practice with acceptation of dry down periods to collect data regarding localized dry spot. Pesticides were only applied on a curative basis to allow for disease, insect, and weed data collection. Core cultivation was not performed in 1997 because the formation of the black layer began to occur in the 80:10:10 root zone mix in the late fall of 1996. Core cultivation will take place in the spring of 1998 after samples are taken from all 18 greens in an attempt to quantify the effect of the black layer with gas exchange measurements.

Traffic simulator - Traffic to simulate typical wear on putting greens was applied to the plots six times per week with a triplex greens-mower modified with spiked rollers in lieu of reel units. The rollers are 60 cm long and 20 cm in diameter. 6-mm spikes are spaced at 2.5cm intervals on the unit. Front and rear 5-cm rollers level each of the three traffic simulator units.