Chemical and Physical Stability of Calcareous Sands Used for Putting Green Construction

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Objectives:

1. *To examine changes in particle size distribution, hydraulic conductivity, and calcium carbonate chemistry in calcareous sands used for putting green construction.*
2. *To qualitatively examine mineralogical properties of calcareous sands with scanning electron microscopy, both prior to and following weathering.*
3. *To survey existing golf courses of varying ages for variations in physical and chemical attributes of the greens mix.*

A calcareous sand can be defined as any sand that contains at least 1% $CaC0_3$ (calcium carbonate, or calcite) by weight. These sands exist in various places around the U.S. and the world, and are often used for construction of golf course putting greens and other sand-based root zone media. However, their use is discouraged because of suspected yet unconfirmed problems associated with their long-term stability. It is suspected that calcareous sands may break down, resulting in restricted or plugged pore space. The result is poor drainage, restricted rooting due to root zone saturation, and eventually severe thinning or death of the turf. To date, there are no reported systematic investigations into the occurrence or cause of this problem. Two primary approaches are being used in this project: controlled studies using simulated golf green profiles to study the weathering process of these sands; and a field survey which involves collection of intact cores from putting greens constructed with calcareous sands, with subsequent examination of the physical and chemical properties of these soil cores. Our objectives are to determine (1) if the use of calcareous sands results in eventual failure of the putting green to support healthy plant growth and playability, and (2) to determine the mechanism of this process, and if current management practices contribute to the problem.

A series of laboratory experiments have been conducted using small PVC columns to simulate putting green profiles. The columns were filled with several sands of varying calcite content. Dilute acid was added to the columns on five day intervals, and water was added on the days in between. The addition of acid simulates some of the reactions that occur following fertilization. Chemical properties of the drainage water were measured, as well as physical and chemical properties of the sand at the conclusion of the experiments. These studies confirmed that calcium carbonate does break down in response to acidification of the soil. A more in-depth long term experiment is currently underway that will evaluate the impact of different fertilization rates and irrigation water quality on this weathering process. Measurements of physical properties of the sand

columns will be made to determine whether or not drainage or water holding capacity are impacted.

Samples have been collected from a number of golf course greens built with calcareous sands. Because these have only been evaluated at one single time, it is difficult to determine if properties of the sands are changing over time. The results from some of these samples indicate that calcium carbonate may be breaking down on these putting greens, which could eventually lead to problems in soil physical properties. Some of these golf courses will be monitored over time, and additional courses will be sampled. Controlled experiments as described above will also be continued.