Layers in Golf Green Construction

Sports Turf Research Institute

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Objectives:

1. *To examine particle migration from the rootzone layer into underlying gravels of increasing size in situations where no intermediate layer is present.*
2. *To assess the effects of different intermediate and drainage layers on moisture retention in the rootzone layer.*
3. *To review the particle size criteria for the selection of intermediate layer and drainage layer materials.*

The USGA recommendations for putting green construction allow for a two-layered profile (i.e., a rootzone layer over a drainage layer) or a three-layered profile, which includes an intermediate layer between the rootzone and drainage layers. The main purpose of the intermediate layer is to prevent finer particles from the rootzone migrating downwards and blocking the pore space within the drainage layer when relatively coarse gravels are used. The objectives of the current study were, firstly, to examine how variation in particle size and shape within the intermediate and drainage layers affected moisture retention in the rootzone. Secondly, to assess rates of particle migration from the rootzone into the drainage layer in relation to particle size differences between the two layers.

For two layered profiles, constructed in 300 mm diameter columns under laboratory conditions, increases in the size of the underlying gravel caused a slight increase in water retention in the rootzone after gravitational drainage. For example, water retained in the upper 150 mm of the rootzone after 48 hours drainage averaged 25.1 mm for the finest gravel (D_{I5} = 2.2 mm) compared with 27.4 mm for the coarsest gravel (D_{I5} = 5.6 mm).

In a second study, the effects of different intermediate layers were examined, using a 1-4 mm grit with increasing amounts (0-50%) of either coarse sand (0.5-1.0 mm) or medium-coarse sand (0.25-1.0 mm). Although increases for fine material within the intermediate layer caused greater water retention in the intermediate layer, this had no significant effect on the moisture content of the rootzone.

In the two layered profiles, particle migration from the rootzone into the drainage layer was examined after the application of 3000 mm of water over a period of thirty weeks. Plaster of Paris and epoxy resin containing a fluorescent dye were used to stabilize the profiles so that they could be sectioned and photographed under ultraviolet light. Particle migration was minimal except when a very dry rootzone based on a medium sand (89 % < 0.5 mm) was placed over coarse gravel (D_{15} = 4.4 mm). Even for these profiles, no more than 34 percent of the pore space within the gravel immediately below the rootzone/gravel interface was blocked by rootzone material. At depths of more than 25

mm below the interface, no more than 10 percent blockage of the pore space was recorded.

Based on the results, it is proposed that in two layered profiles criteria for the bridging factor between the rootzone layer and the drainage layer should be relaxed. Furthermore, the amount of material between 0.25 mm and 1.0 mm within the intermediate layer can be increased when three layered profiles are used.