Understanding the Hydrology of Modern Putting Green Construction Methods

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Goals:

- *Examine the effects of rootzone composition and putting green construction method on water drainage and redistribution within the profile.*
- *Examine the effects of rootzone composition, soil depth and degree of water perching on turf water use and irrigation management.*
- *Examine long-term changes in physical, biochemical and microbiological properties of the rootzone; and relate these changes to the long-term hydrologic behavior of modern putting green designs.*

Cooperators:

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The two most prevalent putting green construction specifications are the United States Golf Association (USGA) and the California (CA) green construction techniques. This research is directed toward a more complete understanding of how profile design, rootzone composition, green slope, drain spacing, and irrigation protocol impact the hydrology of these modern putting green construction methods.

This research program was initiated in the spring of 1996. The principal scheduled activity was the setup and preliminary testing of an experiment to examine water infiltration and movement within USGA and CA putting green soil profiles. Additionally, each soil profile design contains either a high or low water permeability root zone, resulting in four, soil profile/rootzone composition treatments for the overall experiment. Three replicate profiles were constructed for each treatment combination.

The unique feature of this experiment is the provision for variable slope adjustment in these experimental greens. As such, 12 experimental units were constructed with each containing a 4 by 24 ft section of each putting green treatment supported 1 ft above ground level. The soil profiles were contained within wooden boxes supported by a legged, metal framework and placed on a cement pad. Slope adjustment is accomplished by raising one end of each unit until the desired slope is attained.

Additionally, simulated drain lines are built into each unit to allow for variable drain spacing of 10, 15, or 20 feet. Fifteen

soil moisture probes were installed at 3 depths and 5 distances along each unit for detailed monitoring of water movement within each profile.

Finally, devices to deliver controlled rainfall and record drain line flow were designed and constructed. PENNCROSS creeping bentgrass was established on each experimental green and, after grow-in, will be maintained as an actual putting green.

A preliminary experiment revealed that the four soil profile/rootzone composition treatments exhibit different hydrologic behaviors. As expected, the low permeability mixes exhibited higher water contents than the high permeability mixes. There also were substantially higher water contents with depth and particularly at downslope locations with the greens set to a 4% slope. Further, the measurement and control systems for this experiment were shown to perform within their design specifications. A preliminary statistical test conducted from the data of this experiment suggests that valid treatment comparisons will be achieved from the experimental protocol.

Finally, baseline analyses of the soil physical, chemical and microbiological properties of the soil profile root zones are in progress. These observations will be combined with subsequent measurements to monitor changes that occur in these properties with time.

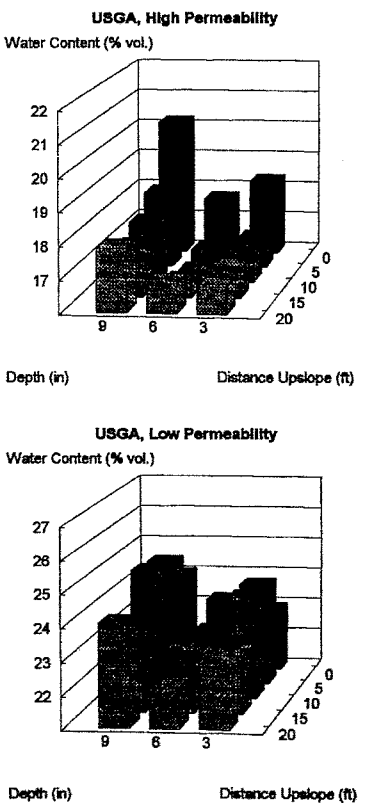

Figure 19. Mean soil water contents as a function of soil depth and distance up slope for the USGA method.

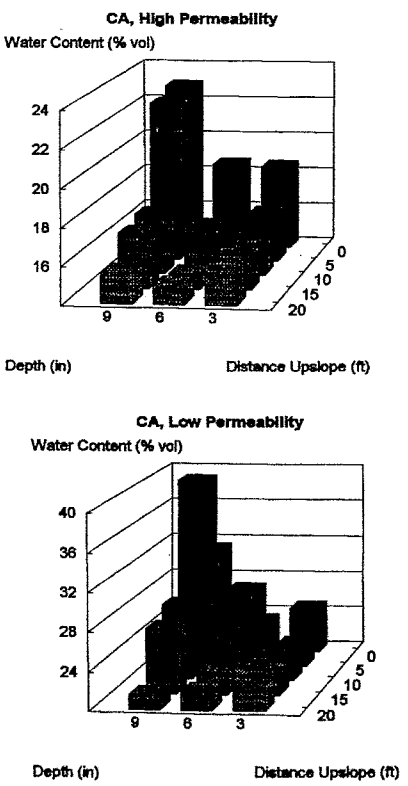

Figure 20. Mean soil water contents as a function of soil depth and distance up slope for the California method.