A Comparison of Water Drainage and Storage in Putting Greens Built Using Airfield Systems and USGA Methods of Construction

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Objectives:

1. Investigate potential for clogging of geotextile pores from fines migrating out of the rootzone mixture
2. Investigate the changes in the temporal distribution of drainage and spatial distribution of water holding capacity of a green constructed with a geotextile compared to a green constructed with gravel.
3. Investigate construction methods designed to reduce down-slope movement of water in sloping greens.
4. Develop criteria for selecting appropriate rootzone mixtures for putting greens constructed with geotextiles.

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Airfield Systems, LLC - $59,108

This research investigates the dynamics of water movement through, and storage within, the rootzone of putting greens constructed using a geotextile atop a plastic support acting as the drainage structure (Airfield Systems design) compared to the same dynamics and storage in a green constructed with a gavel-based drainage structure (standard USGA design).

Constructed with a 100-mm layer of gravel to meet USGA recommendations, sand-based rootzone mixtures placed over gravel can hold water at the rootzone-gravel interface at tensions between 0 and 100 mm when watered to such a degree that drainage occurs. The Airfield Systems design replaces the gravel with a geotextile atop a 25-mm deep porous plastic support for drainage. The range of tensions at the rootzone-drainage structure in the Airfield Systems design is limited to between 0 and 25 mm water after drainage.

Sixty-three test columns were constructed from 332-mm (13-inch) inner diameter PVC pipe attached to a PVC sheet-lined plywood base. Twenty-seven of the columns were 420-mm tall and contained 100 mm of gravel the bottoms. The remaining 36 were 335-mm tall and had Airfield Systems' AirDrain covered by a geotextile in the bottoms. Two tensiometers to measure the tension at the bottom of the rootzone were placed on top of the gravel or geotextile in each column. The columns then were filled with 300-mm deep rootzone mixture.

The treatments in the columns consisted of three rootzone mixtures, three gravels, and four geotextiles. The rootzone mixtures and the gravels ranged from the coarser to the finer sides of the USGA recommendations. The geotextiles consisted of one woven, two spunbond, and one needle-punch fabric. All geotextiles had an apparent opening size of about 0.2 mm. The three rootzone mixtures were placed over each of the three gravels and four geotextiles. There were three replicates of each treatment.

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TDR probes from 21 columns could be monitored simultaneously, so we monitored each rootzone mixture across three gravels, four geotextiles, and three replicates. To test the water holding capacities, the test greens were watered in quantity sufficient to produce drainage, then the profile-averaged water contents were monitored at half-hour intervals for three days using a Campbell Scientific CR1000 datalogger. Tensions at the bottoms of the rootzones were monitored visually several times each day. Rootzone mixtures in the columns were sprigged with 'MiniVerde' dwarf bermudagrass and watered and fertilized as recommended. 300-mm long TDR probes were inserted vertically into the rootzones to monitor the effects of the treatments on the profile-averaged water contents.

In test runs conducted to date, greater tensions were always observed at the bottoms of the rootzones in the test greens containing the gravel treatments compared to those containing the geotextile-AirDrain treatments. Little differences in tensions were observed at the bottom of the rootzones of the three individual gravel treatments. Insignificant differences were observed in tensions at the bottom of the rootzones of the four geotextile-AirDrain treatments.

We observed greater water holding capacity of the AirField Systems designed green compared to the standard USGA test green. The differences in water holding capacity increased slightly with the coarseness of the sand in the rootzone mixture.

Summary Points

- Considerably greater water tensions developed at the bottom of rootzones in standard USGA gravel-based greens compared to Airfield Systems greens.
- Considerably lower water contents were observed in standard USGA greens compared to Airfield Systems greens.
- Airfield Systems greens held about 12 mm more water in the rootzone than the standard USGA greens--about three days more water for the grass to utilize.