

Effect of Rootzone Material and Depth on Moisture Retention Problems in Undulating USGA Putting Greens

Kevin W. Frank
Michigan State University

Objectives:

1. To investigate if altering the rootzone depth will increase the water content near the soil surface in high areas and decrease the water content of the rootzone in low areas of putting green.
2. To investigate the effects of different rootzone materials (sand, sand/peat, and sand/soil) on water flow and soil moisture content in an undulating USGA putting green.

Start Date: 2000

Project Duration: 3 years

Total Funding: \$75,000

The USGA introduced guidelines for constructing putting greens over thirty years ago and since then the USGA green has become the standard for golf course putting greens. The concept behind the USGA recommendations for putting green construction is to build a green that provides a measure of resistance to compaction in the rootzone and drains quickly to an optimum soil moisture level. If greens lacked slopes there is little doubt that most, if not all, USGA greens would perform well. However, with the slopes present on putting greens today, the USGA greens do not always perform ideally. Two problems that have been encountered on greens are "localized dry spot" (LDS) and "black layer". These problems are primarily associated with extremes in soil moisture in the rootzone of the green.

Localized dry spot is a condition characterized by irregular areas of stressed turf which is the result of a lack of available



Michigan State University research showed that using a shallower rootzone depth at the highest locations of puttings greens reduced the tendency to develop "hot spots" and the need to hand syringe these areas.

water for plant uptake. The cause of this condition is not completely understood, but studies have shown that it is associated with hydrophobic coating of sand particles. Black layer is the term used to describe a black banding of the rootzone in sand based putting greens. The blackening of the soil is the result of metal sulfides produced by sulfur-reducing bacteria.

Specifications for a USGA putting green require that the sandy rootzone mixture be placed at a uniform depth of 12 inches across the entire surface of the green. However, the uniform rootzone mix depth does not account for the lateral flow of water in sloping rootzones. Lateral flow occurs in sloping soil profiles when gravitational and surface tension forces acting on the water become larger than the attraction of water to the soil. This lateral flow causes lower water contents in high areas of the putting green resulting in dry soil conditions and susceptibility to LDS. Water flows laterally to the lower parts of the green causing higher water contents closer to the surface in the same green. This is the location where black layer most frequently occurs.

Putting greens were constructed at the Hancock Turfgrass Research Center with the standard USGA depth rootzone of 12 inches and a variable depth rootzone of 16 inches in low areas and 8 inches in high areas. Three different rootzone mixes were used: sand/peat (80:20), sand/soil (80:20), or straight sand.

Data have now been collected for three years and several trends are evident. The variable depth rootzone greens had more uniform soil moisture content across the slope of the green than the standard USGA greens. Increasing the depth of the rootzone from 12 inches to 16 inches in low areas decreased the amount of soil mois-



Graduate student Brian Leach explains the design of the variable-depth experimental putting green to members of USGA's Research Committee.

ture near the surface of the green. Decreasing the depth of the rootzone mix in the higher areas from 12 inches to 8 inches did not decrease the amount of soil moisture near the surface. With respect to the effects of the rootzone mix regardless of construction type, the sand rootzone plots had the greatest extremes in soil moisture content across the slope of the greens. The sand/peat and sand/soil rootzone mixes had more uniform soil moisture content across the slope of the greens.

This research has shown that varying the rootzone depth in undulating putting greens results in more uniform soil moisture across the entire slope of the green and has the potential to alleviate moisture related problems such as LDS and black layer.

Summary Points

- A variable depth rootzone green 20 cm (8") in elevated areas and 40 cm (16") in low areas resulted in more uniform soil moisture across the entire slope of the green than a standard 30 cm (12") depth rootzone green.
- Regardless of rootzone depth, the straight sand greens had greater extremes in soil moisture content across the slope of the green than the sand/peat and sand/soil rootzone mix greens.