Assessing Maturation of Putting Green Rootzone Mixes under Two Microenvironments

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Objectives:

1. To identify characteristics that have the potential to reduce inputs and costs associated with construction and/or maintenance of putting green turf.

Start Date: 2004 (current cycle)
Project Duration: three years
Total Funding: $75,000

Decreased water infiltration of putting greens has been a common observation as sand-based putting greens age. Some have sought to prevent or manage this problem by designing rootzone mixtures with accelerated hydraulic conductivity (K_{sat}) using the rationale that an initially high water infiltration would decline into an acceptable range as the rootzone aged. We have studied K_{sat} and infiltration in field plots over a period of nine years and have found that this concept is flawed.

Findings indicate that the decline in water infiltration occurs as result of the accumulating organic matter at the surface of the putting green rather than any deleterious changes in the original rootzone mixture. Construction of highly porous rootzone mixtures that maintained high K_{sat} over the nine years of the study were: i) more difficult to establish turf cover after seeding; ii) more likely to produce poorer turf quality once turf was established; and iii) highly sensitive to drought conditions and subsequently increased management inputs related to irrigation. Rootzones constructed at the upper end of the capillary porosity range of the USGA guidelines (i.e., more water-retentive) produced the best turfgrass quality. Rootzones constructed above the upper limit of recommended capillary porosity range could reduce irrigation inputs, but were prone to algae and moss encroachment under excessive irrigation.

Construction with un-amended sand has been justified on the concept that management of organic matter accumulation will be simplified as the putting green matures. Advocates argue that over time accumulating organic matter will "amend" the sand and, thus, eliminate the need to amend the sand during construction.

Our findings indicate that the vast

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majority of this accumulation occurs at the surface (on top) of the initial rootzone. The amount of organic matter accumulated in the original rootzone was very small (0.2-0.3% increase by weight) whereas organic matter content above the original rootzone was typically more than 4.5% regardless of the rootzone material. Thus, construction of a straight sand rootzone was not an effective method to manage organic matter accumulation as putting greens age. Straight sand construction resulted in putting green turf that was more difficult to establish, had poorer quality once established, and required more irrigation inputs to maintain the turf than rootzones containing sand amended with organic matter.

Sand amended with inorganic products can retain more nutrients and water than unamended sand. These effects were most beneficial at the time of turfgrass establishment. These effects on turf quality were less obvious (beneficial) once the turf was established and the inputs of fertilization and irrigation decreased to routine maintenance levels. The fact that inorganic amendments do not decompose is another factor often cited as a reason to consider inorganic amendments with the rationale that organic amendments will decompose and contribute to deleterious changes in the physical properties of the rootzone. We could not document any value of a non-decomposing amendment in the rootzone profile. The cost-benefit analysis should be examined closely by those constructing or re-constructing with these materials.

Compost is commonly used by those interested in "natural organic" techniques to manage turf. Two commercially available composts (AllGro and Fertl-soil) used to amend sand in field plots have performed well. Soil fertility was typically improved more with compost than other amendments. Composts also compared well to peat for the ability to increase plant available water in the rootzone.

Turf quality of rootzone plots grown in an enclosed microenvironment was often poorer than that of plots grown in an unrestricted (open) microenvironment. The most important outcome was that better rootzone mixtures in an open microenvironment were also the better rootzone mixtures in the enclosed microenvironment. There was no evidence that would justify selection of rootzone mixtures based on microenvironmental conditions.

Summary Points

- The decline in water infiltration occurs as result of the accumulating organic matter at the surface of the putting green rather than any deleterious changes in the original rootzone mixture.
- Soil fertility was typically improved more with compost than other amendments. Composts also compared well to peat for the ability to increase plant available water in the rootzone.
- Construction of a straight sand rootzone was not an effective method to manage organic matter accumulation as putting greens age.
- There was no evidence that would justify selection of rootzone mixtures based on microenvironmental conditions.