

Measuring Saturated Hydraulic Conductivity of Coarse-textured Rootzone Mixes

She-Kong Chong
Southern Illinois University

Objectives:

1. To develop a permeameter for measuring K_{sat} of coarse-textured rooting mixes.

Start Date: 2003

Project Duration: two years

Total Funding: \$53,446

The 1993 USGA golf green recommendation, requires that total porosity (P_t), air-filled porosity (P_a) and saturated hydraulic conductivity (K_{sat}) of the sand mix should meet specific values in order to be qualified as a USGA green. Reports indicate that the variation of these parameters measured in the same laboratory seemed to be within acceptable ranges.

However, inter-laboratory measurements on the same parameters of the same material resulted in large variations, particularly for saturated hydraulic conductivity. The variation limits the utility of the data. The objective of this study is to develop a permeameter for measuring K_{sat} of coarse-textured rooting mixes. The developed permeameter can be operated



Figure 1. The permeameter developed at Southern Illinois University.

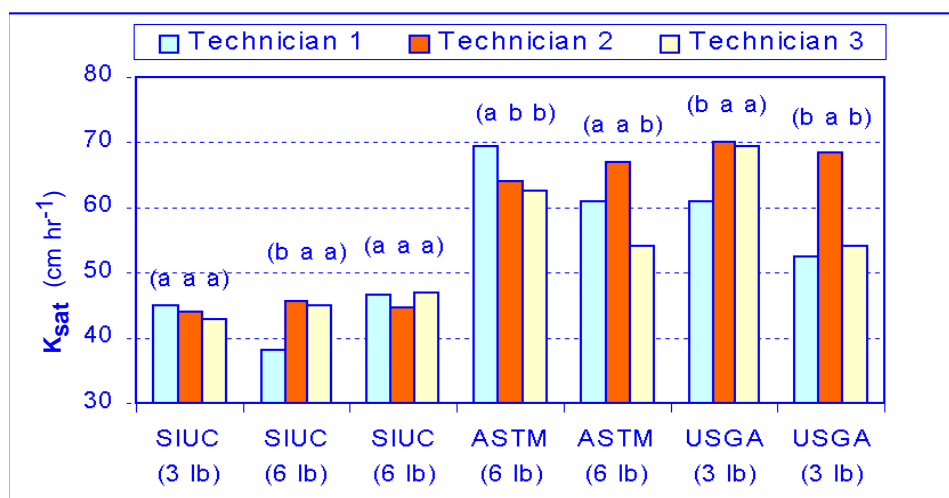


Figure 2. Preliminary results indicated that higher variation was found in both K_{sat} and porosity of soil columns constructed by the USGA and ASTM methods compared to the method developed at Southern Illinois University.

by a technician with minimum knowledge in soil physics, but produce consistent laboratory results for use in golf green construction.

At the present time, a permeameter has been constructed (see Figure 1). Three technicians measured sand mix K_{sat} using the permeameter to test the consistency of the data. In the test, three methods of packing soil column were also evaluated. The methods selected for the assessment included: (1) the 1993 USGA method, (2) the ASTM (F1815-97) method, and (3) a method proposed by the investigator (the SIUC method).

The proposed method is to construct soil column with three equal layers of sand mix rather than by tapping of the soil core as suggested by the other two methods. In the process of packing, each layer received 15 drops at a height of 305 mm (12 in) with a hammer of 1.36 and 3.02 kg (3 or 6.7 lb).

Presently, more than 250 soil columns had been constructed and tested. Preliminary results (see Figure 2) indicated that higher variation was found in both K_{sat} and porosity of soil columns constructed by the USGA and ASTM

methods. K_{sat} measured by the SIUC method was rather consistent as compared to the USGA and ASTM methods. This was not only observed in results obtained by the same technician, but also found among the technicians.

K_{sat} measured by the SIUC method were lower than the values from soil columns constructed by the USGA and ASTM methods. In addition, the coefficient of variation of porosity obtained by the SIUC method was less than 1% by all treatments. No significant differences were found in porosity and K_{sat} between soil columns packed by 3 and 6.7 lb hammers.

Summary Points

- A permeameter has been constructed. Three technicians measured sand mix K_{sat} using the permeameter to test the consistency of the data.
- Preliminary results (see Figure 2) indicated that higher variation was found in both K_{sat} and porosity of soil columns constructed by the USGA and ASTM methods. K_{sat} measured by the SIUC method was rather consistent compared to the USGA and ASTM methods.