Importance of Particle Size Distribution and Sand Depth in Developing a Fairway Topdressing Program.
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Introduction

This study is designed to determine the effects of sand particle size distribution and topdressing layer depth on moisture retention and soil temperatures. The objective is to improve current fairway topdressing recommendations regarding topdressing material selection and the target depth of the topdressing layer.

Materials and Methods

Sod was removed from a portion of a golf course fairway located at Blue Fox Run Golf Course in Avon, Ct. Large undisturbed soil cores (10 in. diameter) were extracted to an 8 in. depth to preserve soil structure. Three different sands (fine, USGA, coarse) will be compacted on top of the undisturbed native soil at three depths (2, 4, and 6 in.) simulating 4, 8 and 12 years of topdressing. These treatments will be compared to a control without topdressing (Figure 1). Data collection will include infiltration rates, moisture retention by depth and soil temperature. Soil moisture levels will be measured using ECH2O EC-5 soil moisture sensors (Decagon Devices, Inc., Pullman, WA) which measure the dielectric constant of the soil to determine volumetric soil moisture. Soil moisture sensors will be placed horizontally at multiple depths within each lysimeter to monitor water retention by depth (Figure 1). Soil moisture levels will be recorded following several simulated precipitation events at selected time intervals. To determine the effect of topdressing material and topdressing layer depth on root zone temperatures, soil temperature probes will be placed in each lysimeter at a depth of 2.5 in.

Progress to Date

- Lysimeters were cut and constructed from 10 in. SCH-40 PVC pipe (Figure 2). A removable cutting edge was designed and built to assist pushing each lysimeter into the soil (Figure 3.)

- Lysimeter bottoms designed and machined to create a concave bottom to assist drainage (Figure 4).

- Hydraulic press brace was designed and machined to prevent the three point hitch from raising as the press pushes the lysimeter into the soil (Figure 5 and 6).

- Soil moisture and temperature sensors selected, ordered and received (Figure 7).

- Sands have been identified, tested, and selected for use in this research.
  - Fine – Mason Sand (Desiato Sand & Gravel, Storrs, CT)
  - USGA - #40 Sand (Holliston Sand, Slatersville, RI)
  - Coarse – 3mm SeasideSand (Green Cycle Grillo Services, Milford, CT)

- Large soil cores extracted (Figures 8, 9, and 10).

- Bottoms of lysimeters installed (Figures 11, 12, and 13).

- Preliminary testing of sands and organic matter source completed (simulate OM accumulation).
Figure 1. Experimental design - Importance of Particle Size Distribution and Sand Depth in Developing a Fairway Topdressing Program

**Legend**
- 30 - Lysimeters
- 87 - EC-5 Probes
- 30 - Temp. Probes
Figure 2. Lysimeters cut and constructed from 10 in. PVC

Figure 3. Removable cutting edge designed and built to assist soil penetration.

Figure 4. A) Lysimeter bottoms were machined to create a concave bottom to assist drainage. B) Lysimeter bottom attached with handle in place.

Figure 5. Specialized equipment was designed and built to press the lysimeters into the soil.

Figure 6. Three-point hitch mounted hydraulic press designed to press lysimeters into the soil.

Figure 7. A) Soil moisture sensor. B) Soil temperature sensor.
Figure 8. PVC lysimeters were forced into the soil using a large hydraulic press.

Figure 9. Blocking was used to ensure the lysimeters were inserted into the soil at the same precise depth.

Figure 10. Each lysimeter was extracted individually to preserve the soil sample.

Figure 11. Following extraction, each lysimeter was turned upside-down and cleaned to a uniform depth.

Figure 12. Gravel was installed, prior to securing the bottom.

Figure 13. Bottoms were secured with stainless steel screws.
Schedule of Activities

2006-2007

• Design and construct lysimeters
• Identify suitable golf course fairways containing a fine-textured, poorly drained soil containing few stones and obtain permission to extract samples
• Identify and test three different sands that have different particle size distributions (fine, USGA, and coarse), but similar coefficient of uniformity values
• Insert soil moisture and temperature probes into lysimeters and compact sand into appropriate treatments
• Obtain and set-up multiplexer and appropriate datalogging equipment to begin recording data
• Begin wetting and drying trial cycles to determine appropriate data collection points

2007-2008

• Conduct several wetting and drying cycles to determine the effects of particle size distribution and sand depth on moisture retention by depth and soil temperature.

2008

• Conclude trials and use resultant data to improve recommendations concerning fairway topdressing.

Itemized Expenses to Date

ECH2O Soil Moisture Sensors ................................................................................ $5220.00
ECH2O Temperature Sensors ................................................................................ $1170.00
10” PVC pipe ............................................................................................................. $320.00
½” PVC sheets for lysimeter bottoms ....................................................................... $321.00
Hexagon screws (assist portability of lysimeters) ...................................................... $60.00
Machining of lysimeter bottoms ............................................................................... $500.00
Machining of brace for hydraulic press ..................................................................... $500.00
Total ......................................................................................................................... $8091.00

Other Funding Sources

Connecticut Association of Golf Course Superintendents (Grant-in aid) ............. $2500.00