GTI HILITES

Water Availability in Sand Root Zones

Introduction

The availability of water to turf species growing on sand root zone mixes has generally been estimated from laboratory procedures using small cores and pressure inducing apparatus. The development of Time Domain Refractometry (TDR) procedures has allowed the direct measurement of soil moisture content, *in situ*, on a volume basis. GTI researchers, R.W. Sheard, D. E. Elrick and Peter von Bertoldi of the Dept. of Land Resource Science, U. of G., used this new technique for measuring soil moisture to examine the dry-down of the U.S.G.A. greens at the Turfgrass Institute during 1995 and 1996.

It is hypothesised that the United States Golf Association - Greens Sections (U.S.G.A.) design for the root zone mix will rapidly drain excess water following rainfall or irrigation so that within hours a moisture content at apparent field capacity can be achieved. The U.S.G.A. specifications recommend the use of 40 mbars (millibars) to represent the apparent field capacity. It may be more appropriate, however, to use a tension of 30 mbars which is the tension exerted by the 30 cm of sand overlying the pore size discontinuity created by the "choker" layer of course sand used in the U.S.G.A. design. The wilting point for the sand root zone is assumed to be 100 mbars as that is the point beyond which there is very little change in the moisture content of the sand mix as the tension is increased. The available water in the sand root zone mix, therefore, would be defined as the moisture content between 30 mbars and 100 mbars.

Data does not exist, however, to confirm under field conditions that the apparent field capacity for turfgrass growing on U.S.G.A. designed greens exists at 30 mbar and that moisture stress will occur at 100 mbars tension.

In contrast, under normal soil conditions, the plant available water, also defined as the water held between apparent field capacity and the permanent wilt point; is that held between 330 mbars and 15,000 mbars. Obviously these limits do not apply to U.S.G.A. greens. Irrigation is recommended when 50% of the available water has been consumed.

This report summarizes the TDR data collected on a bent grass green during an extended dry period in two seasons, 1995 and 1996. The objective was to monitor the moisture content as the green was allowed to dry-down and to relate the moisture content to visual signs of moisture stress and the laboratory determined moisture constants.

Results:

Initially the green was saturated with water as indicated by the free flow of water from the tile system. TDR measurements were commenced as soon as the irrigation was stopped. The moisture profile confirms that the moisture content, particularly in the upper 5 cm was near saturation or 0 mbars tension. The data also show that there was very little change in moisture content after three hours of drainage and that all the excess water had been removed from the U.S.G.A. root zone mix within six hours of saturation of the root zone. The data further indicate that the appropriate tension for apparent field capacity should more appropriately be set at 20 mbars.

TDR measurements were made at least twice each day over the following 10 days during which no rain occurred and no irrigation was applied. Visual observations for moisture stress were recorded. The first observable symptoms were observed late on the fourth day in 1995 and on the fifth day in 1996. Symptoms of moisture stress increased each day thereafter; however, even at ten days, water stress had not reach a non-reversible point and was eliminated within 24 hours of irrigation.

The point at which incipient moisture stress was observed coincided with a moisture tension of approximately 30 mbar, reached between day 4 and 5. Therefore the plant available water in the sand root zone mix may be considered to be that held between 20 and 30 mbars. It may be calculated that the amount of plant available water held in the root zone was equivalent to 14.4 mm of water. The average evapotranspiration over the four days, therefore, was 3.5 mm. Using these two limits would avoid the arbitrary correction to irrigate when 50% of the available water had been consumed.

Although there may be a slight indication of a perched water table at the end of the first day, the vertical orientation of the moisture profiles suggest a true perched water table does not exist.

Furthermore, the vertical profile indicates water was consumed uniformly over the entire 30 cm of root zone material. Although it was observed that roots extended the full 30 cm, the main mass of roots was still concentrated in the upper 15 cm. It must be assumed that the capillary rise of water was sufficiently rapid to replenish the water to where the main mass of roots was found.

In conclusion, the GTI researchers found the U.S.G.A. specifications for the sand root zone mix to be very efficient in providing for the storage of available water for grass. When recharged through rainfall or irrigation to apparent field capacity (20 mbars tension) a properly selected root zone mix may be expected to provide sufficient water for optimum growth for at least four days. This information applies to all sites using the U.S.G.A. design: greens, tees, sports fields, race tracks, etc.

Selecting Bluegrass Cultivars

Kentucky bluegrass is the preferred species for use in most sports field situations. However, when a new field is being seeded or an overseeding operation is planned the sports field manager is in a dilemma as to which variety he should select.

There are over three dozen bluegrass varieties in the list of bluegrass seeds available from suppliers in Ontario (see *The Sports Turf Manager*, Jan. 1997). Which one should he select? He can develop his own ranking by examining the data presented in the annual Research Reports of the Guelph Turfgrass Institute. Ranking tends to fluctuate within ranking each year so it is best to check at least three years of the reports. He can call the OMAFRA turf specialist at the GTI or use the advice of his favourite seed dealer.

Unlike field crops which can be quantitatively ranked on the basis of measurable yield, turf species are qualitatively ranked by one or more observers on the basis of subjective parameters such as density, texture and colour. The personal preferences and the training and experience of the observers have a significant impact on the rating of the variety.

Prof. Steve Bowley of the Crop Science Dept., U. of G., devised a novel system, a fashion show for bluegrass, which he used at the 1996 GTI Field Day. Dr. Bowley removed the names from one replicate of the 1994 bluegrass variety trial and replaced them with numbers. Visitors to the field were allowed to nominate one plot that was, in their estimation, the "best looking" variety. A total of 150 ballots were received and the results were tabulated as a percentage of the total ballots received.

The results show that Ascott, Unique and Julia were considered the "best looking" by the greatest number of field day visitors in August, 1996 (Table 1). The three varieties had an overall rating of 8.1, 7.8 and 7.1, respectively, by Prof. Bowley's staff as reported in the 1996 GTI Progress Report (pp. 21). The next three "best lookers", Bartitia, Asset and Allure were ranked 8.0, 7.4 and 5.6, respectively,

Table 1: The percentage of the 1996 GTI Field Day visitors who nominated the bluegrass variety as the "best looking" in the 1994 seeded bluegrass variety trial (total respondents = 150)

Variety	% of Vote
Ascott	31.5
Unique	23.1
Julia	11.5
Bartitia	5.4
Asset	3.8
Allure	3.1
Liberty	3.1
Alpine	3.1
Abel I	2.3
Sydsport	2.3
Touchdown	1.5
Shamrock	1.5
Limousine	0.8
America	0.8
Midnight	0.8
Opal	0.8
Chateau	0.8
Eclipse	0.1

by the staff.

Other attributes of the varieties, however, were not available to those taking part in the fashion show, such as spring green up which is important to the sports turf manager. Therefore varieties such as Cobalt and Adelphi were overlooked. While the fashion show gives a quick ranking as to the quality of two year old turf in August, other attributes should be investigated in making your selection.

A significant attribute of bluegrass for sports fields is wear tolerance. None of the evaluations conducted at the GTI include this aspect. It would be valuable to the sports field industry if Dr. Bowley would subject a cultivar evaluation seeding to simulated wear and evaluate the effects under medium to high management.