Irrigation Scheduling of Turfgrass

How can you spend less time watering and mowing ?

Irrigation is one of the largest management inputs into turfgrass systems. More efficient use of water by turfgrass managers will be necessary if current levels of turfgrass quality are to be maintained in the face of increasing scarcity and rising price of urban water supplies. Turfgrass managers interested in optimising water use need to irrigate on schedules based on the soil moisture status rather than on a regular preplanned schedule.

The Neutron Probe

The neutron probe is universally recognised as the most reliable and rapid source of digital data of the subsurface moisture content. The soil moisture status is measured at different depths by lowering a source of fast neutrons down an aluminium access tube installed in the ground. These fast neutrons enter the soil surrounding the tube where they collide with other atoms in the soil. The neutrons are dramatically slowed down when they collide with hydrogen atoms of which the most variable source comes from the presence of water. The reduced neutron energy is detected by the probe and using a simple calibration equation the slowed neutron count is converted to moisture content.

Irrigation Scheduling

On a 3 to 5 day schedule readings are taken at regular depths to measure the current soil moisture status. Frequent readings will identify the full and refill points of the profile. Hence at any stage the turfgrass manager will know the daily water use, the amount of water available to the turfgrass and thus know how many days it is to the next irrigation.

Turfgrass Irrigation Management

Correct irrigation management of turfgrass requires an understanding of how the soil water content effects turfgrass growth. Figure 1 shows relative photosynthesis and leaf expansion on the vertical axis, and the soil moisture status on the horizontal axis.

1. The Full Point - Represents the wettest soil water profile that can be regularly obtained after through drainage has ceased.

2. The Refill Point - Represents the driest soil water profile prior to the turfgrass quality falling below an acceptable standard for its intended purpose.

3. The Wilting Point - Represents the moisture content in the soil profile when plants permanently wilt.

With turfgrass at the full point, cell elongation and photosynthesis are occurring at a maximum rate. As the water content in the soil profile declines, there is almost a linear decline in cell expansion which is evident in a reduction of turfgrass growth. Thus less mowing for the turfgrass manager.

Photosynthesis stays relatively constant until the soil water content of the profile reaches the refill point. When the turfgrass is actively photosynthesising it remains green and of acceptable quality. Maintaining the soil moisture content closer to the refill point than the full point, the turfgrass will be actively photosynthesising and hence green and of acceptable quality, with reduced cell elongation and thus turfgrass growth.

Turfgrass managers will therefore have to spend less time watering and mowing resulting in a saving of water, reduced nutrient leaching, reduced disease problems and considerable cost savings.

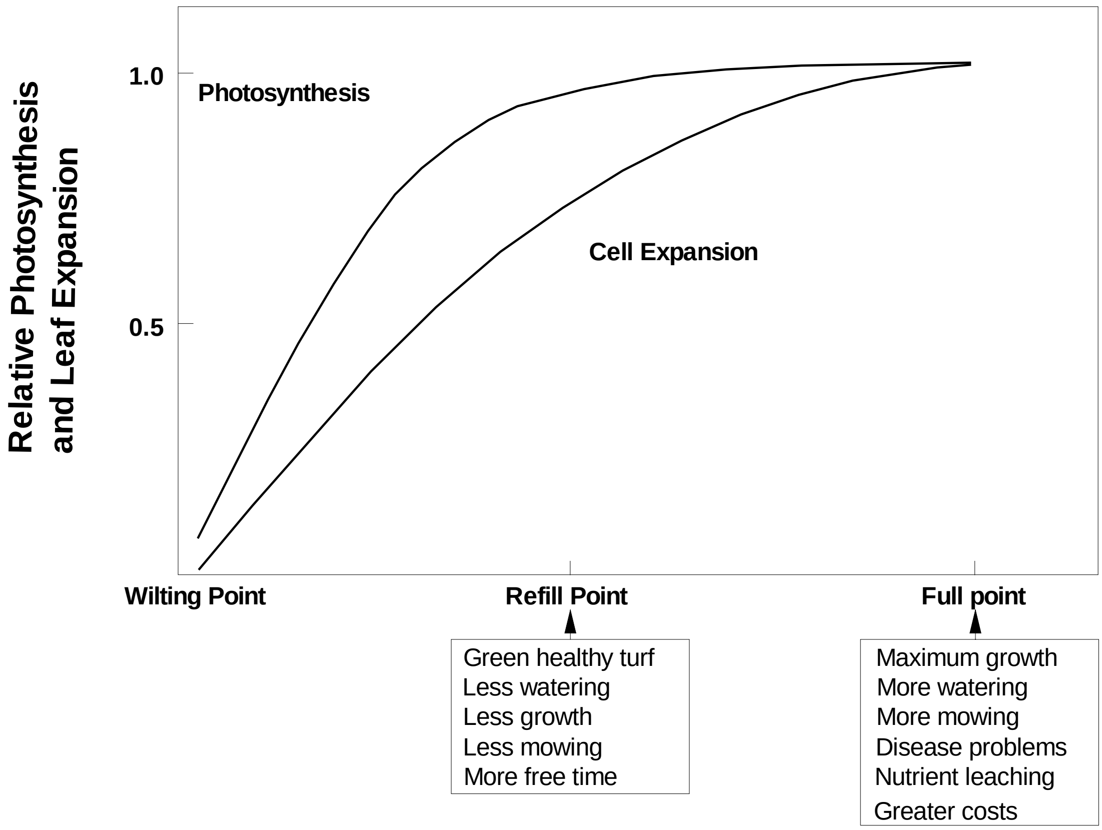

Figure 1. Soil Water Content as it effects Plant Growth and Yield.

An Assessment of Water Use, Root Extraction, and Profile Wetting Under Turfgrass in Narrabri.

An aluminium neutron probe access tube was installed in a three meter square plot of buffalo grass. On February 14th 1988, the soil profile was measured at its full point and it was decided to mow the grass and leave the plot unwatered to observe the root extraction patterns, water use, and to determine the refill point of the buffalo grass. Neutron Probe readings were taken regularly (evident by a triangle on Figure 2) to measure the soil moisture content at eight depths (10cm, 20cm, 30cm, 40cm, 50cm, 60cm, 80cm, and 100cm).

Determining the Refill Point.

No rain fell after February 14th when the profile was measured at the full point and solar radiation levels subsequently remained constant. The refill point was reached on the 6th March as shown in

Figure 2. Prior to the 6th of March the daily water use of the buffalo grass averaged 3.8 mm/day. With the onset of water stress after the 6th March the daily water use dropped to an average of 1.5 mm/day.

Having determined the refill point and knowing the full point it is now possible to manage the turfgrass at a reduced deficit. By taking regular neutron probe readings the effectiveness of rainfall and irrigations will be known. It is also possible to predict the next irrigation date.

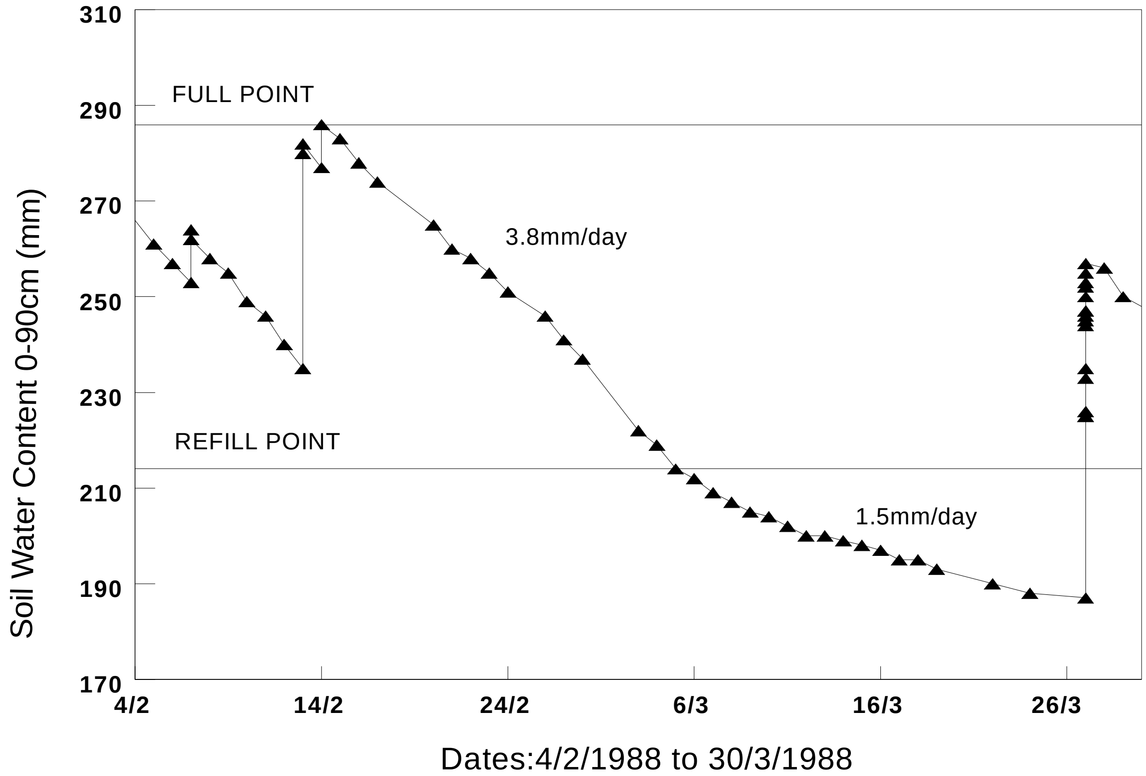

Figure 2 Soil water content for turf; Buffalo Grass, Narrabri

Deep Root Extraction

Frequent neutron probe readings enable the turfgrass manager to know how deep the roots are extracting water. In Figure 3 neutron probe readings show the soil moisture content at each of the depths measured during the trial.

On the 14th February the profile was measured at the full point. By the 17th February the profile had dried to 40cm which indicates the roots are using water at 40cm. By the 21st February more water had been used to 40cm. On the 26th February the roots had used water to 60cm, and to 80cm by the 6th March. The buffalo grass reached the refill point on the 6th March, however the buffalo grass continued to use water at deeper depths as it approached the wilting point.

Monitoring The Irrigation

It was decided to irrigate the site as it was well below the refill point on the 27th March. Figure 4 shows the re-wetting of the soil profile after the irrigation. A neutron probe reading was taken prior to re-watering at 8.00am.

After one hour of watering 38mm had been added to the soil profile and the moisture content of the profile increased at every depth to 100cm as water had moved down through cracks in the profile. A further two waterings of fifteen minutes each added another 9mm each to the profile, wetting the soil to 30cm with some redistribution between 50cm and 90cm. Although the buffalo grass appeared quite wet on the surface to the turfgrass manager, the soil profile had a clear dry zone after the irrigations which indicates a wetting up problem due to cracks and some suspected soil compaction.

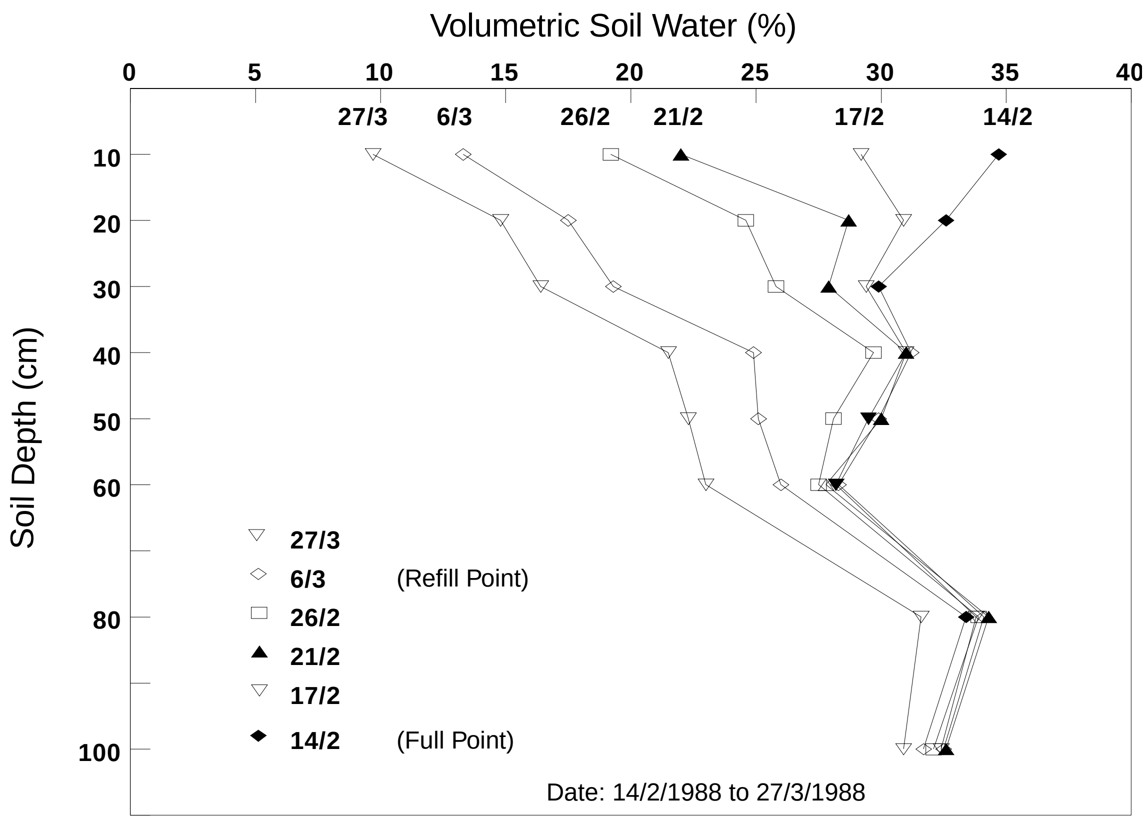

Figure 3 Soil Water Profile, Turf; Buffalo Grass, Narrabri

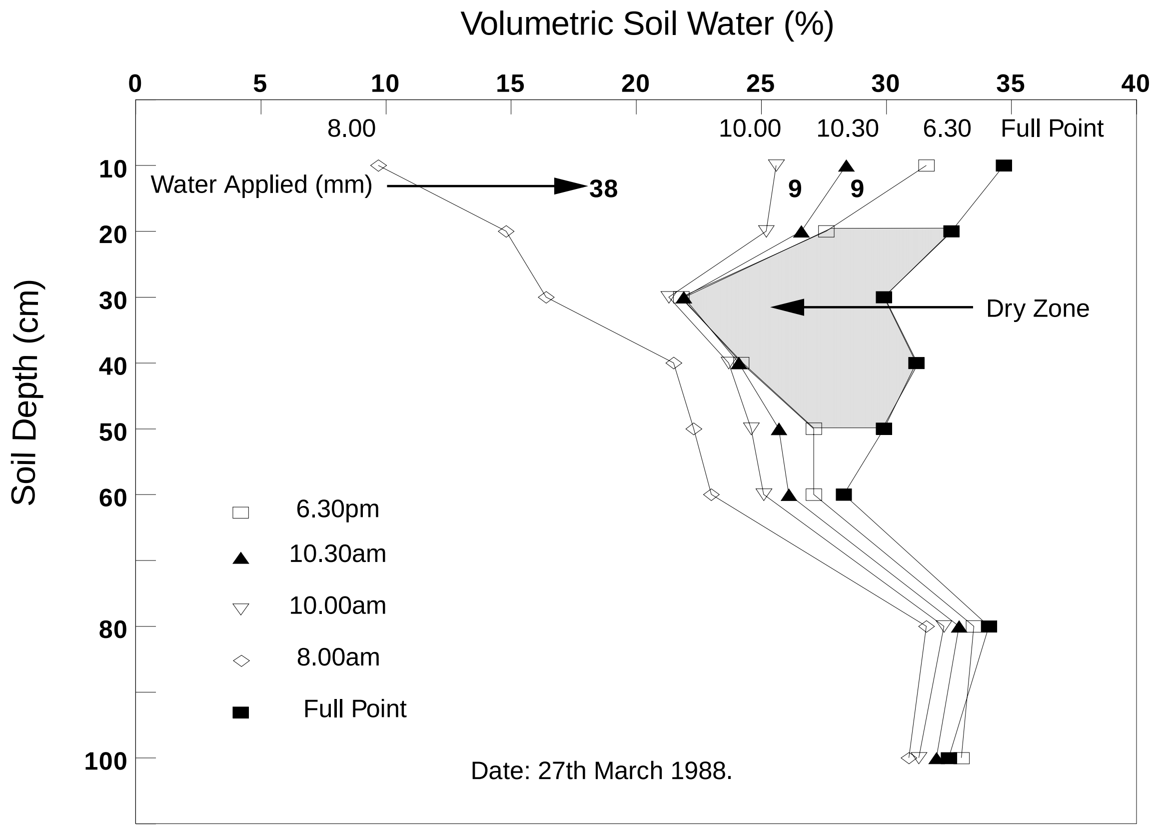

Figure 4 Soil water infiltration, turf: Buffalo Grass, Narrabri

Summary

The results show...

1. Deep root extraction of turfgrass.
2. The neutron probe can be used to calculate water use and hence schedule irrigations.
3. Soil management problems.

The implications for turfgrass managers are that by maintaining the soil moisture status at a reduced deficit and encouraging deep root development, quality turfgrass areas can be maintained with lower daily water use and reduced growth. Similar results have been found with kikuyu turfgrass this summer.

Thus turfgrass managers will -

- spend less time watering
- spend less time mowing
- save water

- reduce nutrient leaching
- reduce disease problems
- most importantly reduce costs.

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