Water management ...a structured approach

Neil Mackenzie, Specialities Product Manager at Rigby Taylor, looks at understanding soil structure and the dynamics of water management

Water applied to a turf surface, either by rainfall or through irrigation, is only effective when it is able to infiltrate into the soil. Any remaining water on the surface will either be lost through run-off or evaporation.

Once in the rootzone, water will fill empty pore spaces and move downwards under the force of gravity through the micropores, eventually leaving them drained and refilled with air.

The micropores on the other hand will retain their water against the force of gravity because of the adhesive and cohesive nature of water.

Micropores vary in size with the larger ones only able to apply a weak hold on the water against the pull of gravity but not enough to resist the 'pull-force' of the roots to extract water from them.

The smaller micropores however can hold onto water much more tightly and resist water being extracted by the roots.

Moisture Availability in the Soil

Following heavy rainfall, pore spaces will become filled and the soil becomes saturated with water. Dependent on soil type, this may represent 60% of the total soil volume.

There are several states of moisture capacity in a soil:

Field Capacity: This is after drainage has removed the water from the macropores, but all the micropores have retained their water volume.

Water holding capacity is essential but not to a point where the soil becomes saturated

Permanent Wilting Point: When the available water has been removed from the micropores and all that is left is water, tightly bound, and no longer accessible by the plant roots. At this point the plant will start to wilt and growth will be affected.

Available Water: The amount of water between Field Capacity and Permanent Wilting Point. It's the aim of greenkeepers and groundsmen to ensure an optimal level of water in the root zone is achieved between these two points; typically at 50% of available water, see graph below.

It is therefore important to understand the soil characteristics

when making assessments of adequate soil moisture levels.

How Much Water Is In Soil?

Water holding capacity is largely dependent on soil type. As mentioned earlier, clay soils will hold greater amounts of water than sand soils as they have significantly more micropores to hold water. Conversely the number of micropores in a sand rootzone allows gravity to take away much more water. However, the important measurement in both cases is the 'Available Water'. Sand may allow much more water to drain away than Clay soils but it also does not have so many of the small micropores that inhibit its uptake by roots.

Root Depth Significance on Plant Available Moisture

The depth of roots in a sward will significantly affect the amount of water available to the plant and consequently the irrigation intervals necessary to maintain a growing plant.

For example, if your rootzone was described as a sandy loam with 22% Field Capacity and a Permanent Wilt Point at 8% (water volume) and, you wish to maintain a manageable water volume around 17%, that would be 9% volume above the permanent Wilt Point.

Every square metre to a depth of 10cm therefore would contain nine litres of available moisture for the roots.

Typically in summer a full sward can transpire three to four litres of water per sq m per day, which would mean sufficient water for a maximum of just three days before wilting occurs.

If the roots extended to a depth of 20cm, there would be 18 litres of plant available water, so as many as six days before wilting occurs.

In reality, as the amount of available moisture decreases then the plant will reduce its uptake and thereby extend the point at which the Permanent Wilting Point is reached.

At this point of reduced water consumption however, the turf plant's metabolism will have been reduced, together with its ability to maintain healthy growth.

A programme of selected wetting agents introduced into the water management programme between March and October will ensure the distribution of moisture throughout the soil is even.

This will help maintain a plant usable reserve of naturally applied or irrigated water available to the rootzone.

Four things to consider regarding moisture availability and wetting agent applications:

1. Type of turf – Fine turf (greens/tees/fairways/pitches etc) will comprise of differing grass species, each having variable evapotranspiration rates, and in diverse growing situations, have different root penetration and levels of water availability.

2. Soil structure – Knowing the characteristics of the rootzone is vital to understand its ability to store, and more importantly deliver, water to the plant.

3. Climatic changes – Recording and being aware of weather patterns are important to be prepared for periods of 'drought' before the soil becomes critically affected by having insufficient available moisture.

4. Root Depth – Regular core sampling will help to assess frequency and quantity of applied irrigation and will assist in determining the type of wetting agent required.

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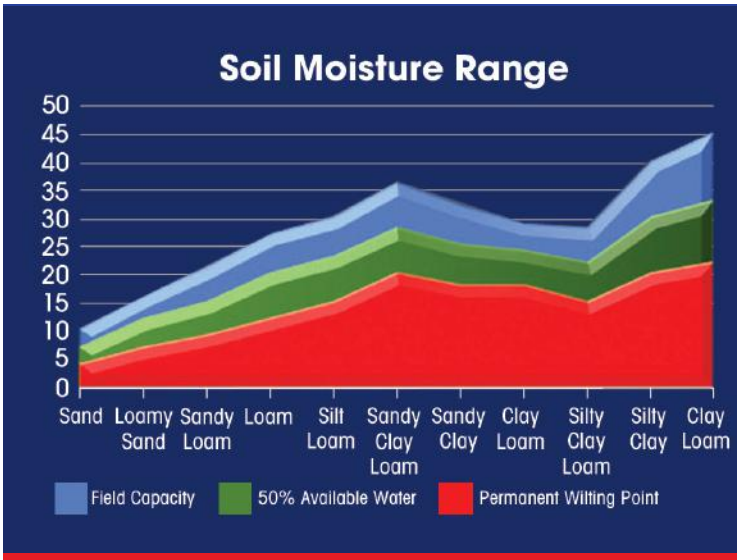
TOP RIGHT: Knowing the characteristics of the soil is vital



The Field Capacity (blue section) of sand is just 10% of the volume of soil, whereas with clay it is 45%. However the Permanent Wilting Point (red section) of a clay soil is reached when there is still 22% of water tightly bound in the soil but unavailable to roots. This is more than twice the Field Capacity of a sand rootzone.