Turning on

With two years of drought conditions still fresh in the mind and the prospect of still further water restrictions in the offing for 1991 and beyond, the subject of irrigation is one that remains uppermost on any priority list. Consultant Agronomists JOHN HACKER and MIKE HARBRIDGE cast a thoughtful eye over problems associated with applying both too little water, and too much...

Dry patch disorder – an increasing problem

Too little water

It is taken for granted by most that a lack of water is detrimental to grass growth and quality. Indeed a severe water deficit can lead to a number of changes to grass growth including:

- Increased root depth.
- Increased root/shoot ratio.
- Decreased tillering.
- Decreased leaf number.
- Reduced shoot elongation.
- Decreased size and total area of leaves.
- Thicker cuticle.
- Smaller cells, intercellular spaces and xylem cells.

Not all of these are necessarily bad for the greenkeeper, indeed we would all like to increase the rooting depth of our greens as it enables the roots to exploit a much greater area for water and nutrient reserves. Overall, however, a severe water deficit over a prolonged period is bad for grass growth, wear tolerance and appearance.

Drought – Just what do we mean?

So what do we mean when we talk of drought? Jim Beard, in 'Turfgrass; Science and Culture', identifies two types of drought which he defines as "a prolonged water stress that limits or prevents turfgrass growth." Drought can be divided into two main types:-

Atmospheric Drought – This is where the transpiration rate exceeds the absorption rate even though available soil water is adequate.

Soil Drought – In this instance there is a water deficit causing drought due to a lack of available soil water. This can be due to several reasons including:

- A prolonged period without rain.
- Soil type.
- A high evaporation atmosphere

A sand/soil mix suitable for a golf green – free draining

The only practical way of treating atmospheric drought is by syringing (applying light sprays of water) during periods of high temperature, usually around mid-day. This increases the water vapour near the grass surface and therefore reduces the amount of water drawn out of the grass. Such periods are uncommon in Britain although last summer was probably the exception to the rule. In continental Europe and the USA atmospheric drought is much more likely because of their higher summer temperatures. Drying winds may also induce atmospheric drought although the only real treatment for this it to plant windbreaks, thus reducing wind speed. This is only really an option with greens or other areas which regularly experience such problems.

Soil drought is the usual reason we apply water to greens although physiological drought can also occur. Physiological droughts are caused by high external salt concentrations which induce a water deficit within the plant. This can be caused by saline conditions or, in the seedling stage, by large fertiliser applications. Large concentrations of salts on the leaf and stem caused by fertiliser application also causes foliar burn. This is why it is recommended that irrigation be used to wash in certain fertilisers, i.e. Ammonium Sulphate, if rain does not occur within 48 hours.

Dry patch disorder

Dry patch disorder is a soil drought and has been found to occur on sands and sandy soils. A soil exhibiting dry patch is very difficult to wet as the soil becomes hydrophobic and fails to retain moisture. The soil then dries out and the sward wilts. The hydrophobic condition of the soil is thought to be due to either a coating of the sand grains by fungal mycelium or by calcium or magnesium soaps and is found to occur at the sand/thatch interface. Dry patch can be overcome by spiking and applying a wetting agent before thoroughly soaking the affected area.

Wilting

How then do we know when drought is occurring? The first sign of drought on most plants is wilt and it is unlikely that anyone reading this article will not be familiar with the flaccid leaves associated with drought, even if only on the house plant that you forget to water whilst away on holiday.

Wilting is increased by high temperatures, wind movement, solar radiation, low active humidity and impaired water absorption. It is the latter factor – impaired water absorption – that many forget or ignore when thinking of drought. For even if water is present in reasonable amounts, the plant may not always be able to take it up. So before you accept that irrigation is necessary after a week of dry weather, check to see if there is any reason why water is not being used by the plant. Water absorption may be impaired by either a lack of available soil moisture or by a limited, non-functioning root system. The latter can be caused by a number of factors, including:

- Lack of aeration.
- Compaction.
- Waterlogged soil.
- Excessive nitrogen fertiliser.
- Severe leaf defoliation.
- High soluble salt levels in the soil.

the taps

Many of these are commonly found on golf greens and relieving compaction or aerating the soil may do wonders for drought resistance by increasing root depth. Swards with high levels of thatch are also more likely to wilt due to shallow rooting. The following maintenance and play practices will therefore greatly effect drought tolerance.

- Amount of play on the area.
- Turf maintenance practices.
  i.e. renovation, fertiliser and mowing practices.
- Soil structure and texture.

If your greens are regularly subject to drought perhaps you should take a good look at these aspects. You may not be able to affect the amount of play but you can alter maintenance practices and, if necessary, improve the greens soil by either topdressing or reconstruction.

How grass copes with drought

Drought, of course, is a common natural event and the extensive grasslands of the world often only exist because grass is able to withstand prolonged periods without water and can therefore live where other plants cannot. Grasses have developed a number of strategies for surviving drought periods:

a) Seeds – seeds are very drought resistant and many grasses are able to exploit this by having very short (ephemeral) lives ending in seeding i.e. Poa annua.

b) Dormancy – grasses also have other dormancy strategies. They often produce stolons or rhizomes which lie dormant in times of drought. Grass crowns are also very drought tolerant.

c) Water absorption capability – Certain grasses are more able to survive drought because of physical characteristics that allow a greater water absorption capability. These include:

- Greater root depth.
- Larger number of roots and greater degree of branching.
- Greater root growth activity.
- Larger root hair growth.
- Mycorrhizal associations.

The drought resistant hard fescue is quite deep rooted while the root system of a bentgrass mown sward may be only 50 – 100mm deep.

d) Xeromorphic features. – In addition to increasing their water absorption capabilities, many turfgrasses also possess inherited structural modifications that reduce water loss by transpiration. These features include:

1) Decreased leaf surface area.
2) Altered size, spacing, number and location of stomata.
3) Increased cuticle thickness.
4) Surface hairs.
5) Less intercellular spaces.
6) Diminutive conducting tissues.
7) Rolling or folding of leaves.

e) Drought Hardiness – Drought injury to turfgrasses has been attributed not to lack of water but to mechanical injury to cells resulting from drying and re-moistening processes. In view of this some grasses have developed ways in which injury can be minimised. These include having small cells which suffer less mechanical injury from drying and re-moistening and having a high carbohydrate content. Factors which reduce drought hardiness include:-

- High nitrogen fertiliser rates.
- Potassium deficiency.
- Shading.
- Intensive traffic.
- Excessive irrigation.

So bad maintenance practices, such as excessive nitrogen or irrigation, can effect the grasses own natural hardiness to drought.

Many of these natural survival techniques are, however, unacceptable to the greenkeeper, as survival may mean a yellow or even dead surface. This is, of course, not desirable on a golf green and so supplementary water must be applied. Turfgrass species and cultivars are,however, being selected and bred for their drought hardiness and thought should be given to sowing appropriate grasses where drought is likely and irrigation is not possible or prohibitively expensive.

Too much water

While water deficits are often our main concern, water in excess can also bring problems. Standing water on playing surfaces not only disrupts play but can also affects plant growth. Excess water may be due to a number of causes including:

- Poor drainage.
- Excess rainfall.
- Excess irrigation.
- High water tables.
- Flooding from adjacent rivers or sea.

Such excess water can deplete soil oxygen levels within 1 – 2 hours and lead to an increase in carbon dioxide concentrations. this can lead to restricted root growth, thatch accumulation and a decline in turfgrass quality and vigour.

localised drought on a high spot

Turf diseases

The activity of many turfgrass diseases are increased by a high atmospheric water vapour content which can be increased by irrigating at the wrong time of day. These include diseases such as brown patch, fusarium, powdery mildew, slime mold, pythium, copper spot, dollar spot, red thread and typhula. dew on turf can also increase disease incidence by permitting fungal spore growth and spread. While dew can provide as much as 6" – 10 " (150 – 254mm) of water per year in a cool humid climate, this benefit is greatly outweighed by its disease promoting properties. As all greenkeepers know, switching is commonly undertaken to remove dew and encourage the surface to dry quickly. Early morning watering which removes dew has been found to substantially reduce brown patch disease on bentgrass.

However, water excess is not always at fault where disease spread and development are concerned. Soil moisture stress (drought) has been shown to increase susceptibility of Poa pratensis to dollar spot. in addition, drought has also been shown to favour the crown and root rot phases of Helminthosporium disease, although water stress does reduce the leaf spot phase.

Nutrient losses

Excess rainfall or irrigation will, on freely draining soils, lead to nutrient losses by leaching. The prime nutrient lost in this way is Nitrate, which is not held by soil colloids but is freely available in a soluble state in the soil. Such leaching will lead to poor growth and low wear tolerance unless nutrient losses are replenished.

Scald

In hot climates turfgrasses can collapse and turn brown under standing water and intense light. This is known as scald and is, fortunately, not commonly found in Britain.

What's the answer?

Too much water is bad and yet too little is worse, so what is the answer? How much water do we really need to apply? That is the tricky question we shall investigate in "Estimating Water Needs", which will appear in the June issue of Greenkeeper International.

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