There is a vast range of soil types in the UK dependent on the parent material from which they are derived and influenced by climate and elevation. Other significant factors are the effects of mechanical weathering, i.e. expansion and contraction due to heat and cold, erosion and chemical weathering: whereby soluble minerals are released and new minerals created through chemical reactions whilst others become soluble. The whole complex process is influenced by plants and animals, in particular those living within the soil. The process is continuous and certainly does not stop when the material we describe as 'soil' has developed.

**Texture**

All soils are made up of sand, silt and clay, the relative proportions of which determine soil textural class. Quartz is the usual mineral in sands with particle sizes ranging from 2 mm to 0.05 mm. They have a low surface area to weight ratio (S/WR), minimal chemical activity and low moisture retention. Because sand grains are resistant to further breakdown and compaction, selected grades are frequently used to modify soils.

Silt particles are intermediate in size with limited S/WR and chemical activity. Water retention is high and soils with a high proportion of silt can be weakly structured, thus compacting more readily so that drainage rates suffer.

Clays have a very large S/WR and are active chemically. Water retention is high, although much of this is unavailable to plants. Clay soils are particularly subject to compaction and smearing, which affects drainage rates.

**Soil structure**

Soil particles are normally arranged into larger aggregates, referred to as soil structure. Clay, and to some extent silt, particles combine through the action of organic matter, colloids, and clay materials to form a granular or clump like structure. This contributes a great deal to favourable soil conditions for both turf growth and better playing conditions, due to improved drainage via the large pore spaces between soil aggregates.

It is likely that over 90% of the soils we encounter on golf courses rely almost entirely on soil retention for good drainage, aeration, and adequate moisture retention. Such soils can and do perform well in the golf situation, but only whilst structure remains good. Increased golf traffic and essential maintenance operations combine to gradually compact soils, breaking down aggregates and reducing air and water movement. Ultimately, these factors must affect both turf and playing quality that any given soil can support, it having long been appreciated that turf grass species are just as important to year round playing conditions as the drainage properties of the soil.

**Links**

Over thousands of years grasses have adapted to particular types of soil, depending on drainage, moisture retentive properties and the relative fertility of the soil. Thus on sandy links soil the grass species naturally present are predominantly the finer leafed fescues, both Chewings and creeping reds, together with some browntop bent, creeping bent and other minor species. All are adapted to conditions of free-drainage, good aeration and infertility, where summer drought is part of the yearly cycle.

That such soils are capable of growing excellent turf and can
because water as such is bad for grasses, but simply that applications have often been too excessive. The perceived answer to a decline in playing surfaces through spring and early summer. All too often a significant amount of hand watering is required on featured greens. Top dressings need to be very sandy in character, promote deep rooting, the relief of compaction and aid thatch breakdown. Top dressings need to be very sandy in character, ideally using local soil and sand compatible with that existing on the course. Fertiliser use should be kept to a minimum and water applied in just sufficient quantity (and in the right places) to maintain slow, steady growth. Inevitably a significant amount of hand watering is required on featured greens.

It is important to appreciate that there are fairly strict limitations in the amount of use golf links can take whilst continuing to provide first class swards and playing conditions. It is widely recognised that turf consisting predominantly of fine fescues with relatively small amounts of brown top bent will provide firm, resilient and uniform playing surfaces year round, with excellence in summer when swards are closer mown and are dry, fast and true. Such systems are essentially low input and therefore relatively low output. They cannot support high levels of play both winter and summer.

Increase inputs of fertiliser, water and aeration to sustain higher levels of play and there are alterations in sward characteristics. Brown top bent becomes more vigorous whilst fescues decline to perhaps 25-30% of ground cover. Even so, playing qualities can remain first class throughout the year. Such an approach based on moderate input will still only support moderate output and a fairy tight rein should be kept on rounds played, say 50,000 to 40,000 per annum.

Heathland Courses established on heathland are frequently based on sandy soils which have naturally free-draining characteristics. These soils are often acidic and basically low in fertility, again encouraging a sward dominated by fine turf species like fescues and brown top bent. Management must aim at preserving free-draining, well-aerated soils through a sound programme of mechanical treatments. This will include frequent slit-tining and either Verti-draining or hollow coring in alternate years. Top dressings must be compatible with the existing sandy soil and should not be too acidic, thus maintaining soil pH levels more or less where they are. For similar reasons, limit the use of acidifying fertilisers, substituting chelated iron preparations (without added N) for sulphate of iron sprays in autumn and winter.

Parkland Medium loam soils are frequently characteristic of parkland courses. These may be slightly acidic, are often of moderate fertility and can support excellent brown top bent swards, though often with a good deal of Poa annua and some coarser species, notably Yorkshire fog grass. Such soils rely entirely on soil structure for drainage and the maintenance of good structure is of paramount importance. Compaction from over play leads to a reduction in soil air content and slows down drainage quite dramatically. This can quickly initiate a cycle of deterioration, especially where attempts are made to escape the situation with excessive inputs of fertiliser and water. If this path is followed, typically there is increased thatch accumulation in surface layers, a further slowing down of drainage and production of a soft, spongy, moisture-retentive turf which becomes dominated by Poa annua. Not only is this bad for golf, it also encourages fungal disease. The effects of winter die back - and dead patches due to disease - produce disastrously weak and uneven playing surfaces through spring and early summer. All too often the response, perhaps in desperation to escape criticism from members and committee alike, is to reach for the fertiliser bag! A shot in the arm from high analysis complete fertiliser, or worse still Nitro-chalk, may at best provide temporary relief, but like the drug addict, you have to keep going back with more!

On such soils golfers must realise there are limits to the amount of use putting greens can take, especially during the wetter months of autumn and winter when the compacting effects of play on moist soil are at their worst. There comes a...
'New constructions should follow modern practice on greens and tees, providing drainage carpets of stone with emptying pipe drains. A sand/soil mixture with drainage rates determined by lab tests must be provided as a growing medium.'