Greenkeeper International examines the relationship between the soil you have and the turf you can expect — and how to improve quality if nature's condition is not ideal

DOWN

by DAVID BOOCOCK

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, ie. 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 crumb 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.

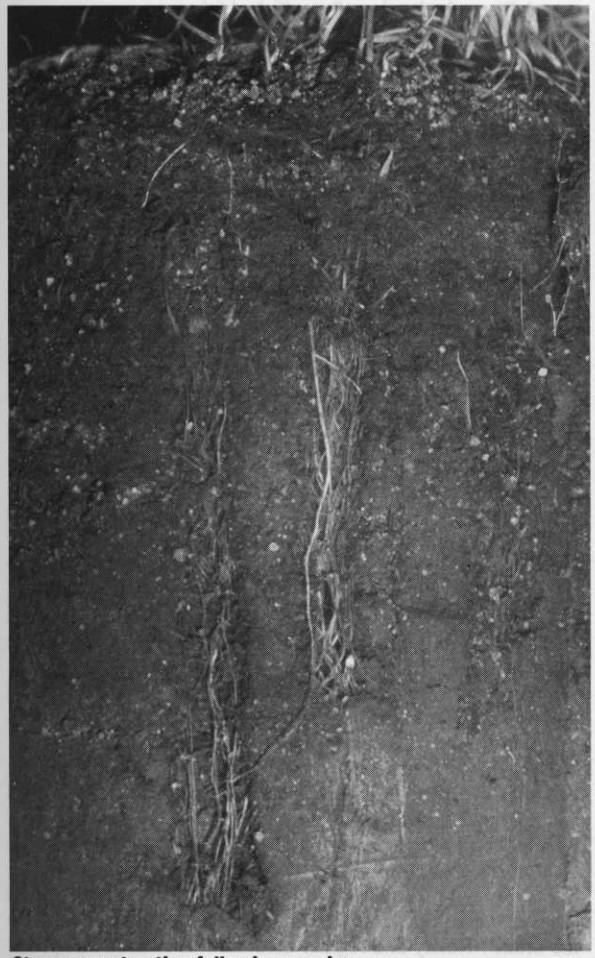
It is likely that over 90% of the soils we encounter on golf courses rely almost entirely on soil retention for good drainage, aeration, and adequate moisture retention. Such soils can and do perform well in the golf situation, but only whilst structure remains good. Increased golf traffic and essential 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

TO EARTH



Stronger root action following coreing

provide first class playing conditions virtually year round is well established. In more recent times the increased popularity of golf and consequent greater pressures from play, especially on the free-draining links soil, has led to some deterioration. Much of this is due to the build-up of compaction and sheer wear and tear. In these circumstances the finer grasses are at a disadvantage. Root systems become shallow in compact, airless soil and recovery from wear is much slower, leading to a more open turf and inviting weeds, moss and free-seeding weed grass species, particularly *Poa annua,* to invade and bring a decline in playing conditions.

The advent of pop-up sprinkler irrigation has all too often been another nail in the coffin of fescue/bent swards, not because water as such is bad for grasses, but simply that applications have often been too excessive. The perceived answer to a thin sward was often more fertiliser and even more water. With high-pressure salesmen pushing high analysis N:P:K mini-granulates as hard as the could, (and in past times there was barely a single nitrogen only proprietary fertiliser on the market), there can be little wonder that soil fertility levels and thatch increased. Both practical experience and trials have shown that fescues are less successful with increased water and fertiliser use. Initially, the more aggressive bent grasses take over, but if high levels of play continue and aeration remains unsatisfactory, even they suffer. Thatch build-up and an increased spread of *Poa annua* completes the cycle of deterioration witnessed on far too many formerly excellent links courses.

Fundamental to the management of links is adequate provision of machinery and manpower and the correct deployment of both. Regular aeration, involving a combination of occasional Verti-draining or hollow coring treatment along with regular slit tining, particularly during autumn and winter, is essential to 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 browntop 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. Browntop 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 30,000 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 finer turf species like fescues and browntop bents. 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 browntop bent swards, though often with a good deal of *Poa annua* and some courser 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 ➡

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point when even vastly increased aeration work becomes counter-productive, and, of course, ground conditions limit what can be achieved mechanically anyway. Where necessary, it is surely better to restrict play to temporary surfaces when the main greens are saturated with moisture in winter, or when they are affected by white frost of just thawing. In that way, the majority of members benefit from playing surfaces which have some chance of improving quickly in the spring, once weather conditions become suitable.

Regular slitting and use of the Verti-drain, combined with hollow tining to control thatch, will aid rooting and will help integrate top dressings. All are important. Use of sandy top dressing material will be beneficial in breaking up and diluting thatch, as well as helping to maintain acceptable pH values and, of course, is essential to maintaining smooth surfaces. The often kinder inland climate and more fertile soil allows moderate to strong growth with good recovery throughout the growing season, though care is still necessary to avoid over-use of fertiliser and three or four dressings with a mainly nitrogen product will usually suffice. Such soils are unlikely to be deficient in phosphate or potash. Use sulphate of iron with care, particularly where pH levels are already acidic – in that situation the chelated products which are much less acidifying are to be preferred.

Clay

Courses built on clay soils pose their own special problems. These are quite often fertile, retaining nutrients by the process of cation exchange. Phosphates in particular can build up to high levels if applied regularly. Soil pH values are relatively slow to change. The more acid clays often support excellent, hard wearing and wiry swards based predominantly on bents, both browntop and creeping bent mixed with some fescue, especially on the less heavily trafficked fairways.

Neutral soils support more vigorous turf, often containing a great variety of grass species but predominantly browntop bents and *Poa annua* with paler-coloured, courser-leafed patches of Yorkshire fog on the greens.

The overriding characteristic of clay is its great moisture-retentive capacity and slow-draining properties. Surfaces readily smear and compact under the effects of play and use in winter can be severely curtailed. Where bad initial construction has destroyed what little structure there is, or has created severe compaction into the bargain, conditions in winter can become a quagmire.

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On established courses one has to make the best of what nature has provided or face up to the disruption and high costs of reconstruction. At low play levels, clay courses can provide acceptable conditions, almost year year round, but with high membership figures and a lot of winter golf, Clubs soon come to grief. It is at this stage that the know-alls start to clamour for more fertiliser, water and lime application to promote faster growth and recovery from the damage created by over-use in winter. Bow to these pressures and within a year or two the tough, acid bent grass turf has been replaced by soft *Poa annua* dominated swards, riddled with worms and often weeds, building up thatch very quickly. Winter conditions are abysmal and putting surfaces are frequently only really acceptable from mid-summer to autumn, when growth of *Poa annua* is at its peak.

Clay soils at field capacity are slow-draining. That fact of life has to be accepted. Play on them when saturated in winter and you are storing up trouble for the season. It therefore becomes imperative to provide and use temporary greens whenever necessary, especially from November to March. Pipe drainage systems can help make the most of these soils but are no magical cure. Water still has to percolate through soil in order to reach the drains. Timely and regular aeration will of course help, and it remains important to ensure there are no compacted soil layers which act as barriers to the free movement of water through the soil profile. The Verti-drain is less effective in these conditions and can make matters worse where you put water to depth and there is nowhere for it to go. It may be necessary to utilise a mini-mole plough to form channels which can help lead such water more quickly to outlet via pipe drains. Hollow tine coring can certainly help, and by a process of soil exchange it is possible to develop a sandy top profile that can support play better without severe smearing or surface compaction.

I am not in favour of pure sand top dressing. Too often there is no integration with the underlying soil and root systems are confined to the immediate surface. The turf becomes shallow-rooted, highly susceptible to drought in summer, and demands heavy watering and feeding with the inevitable spread of *Poa annua*. In winter the top may be firmer but drainage is often worse, due to the perched water table at the interface between the fine capillary pores of the clay and the sand layer. There are no simple answers on clay soils, especially where there are high levels of play.

In summary, adopt a management style which will suit the soil type on your course, with an emphasis on 'lean greenkeeping'. Committees and members must be prepared to back up their head greenkeeper with adequate levels of manpower and machinery. It is also essential that members recognise that whilst our mild climate *may* permit enjoyable golf almost 12 months of the year, soil conditions are always a limiting factor. Abuse putting surfaces through overplay in the winter and the inevitable result is poorer surfaces through the main competition season of spring and summer.

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