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One does not see so much today of the root break phenomenon on putting greens, partly because most greenkeepers (though sadly not all) believe in and practice much more aeration, if only to counteract the compaction caused by ever-increasing play. Other sound practices, especially regarding top dressing, help to avoid the problem. Few will admit to having such a problem (unless they have inherited it) as in most cases it is the result of bad greenkeeping methods, albeit often started many years earlier.

I have, even to this day, vivid memories of this situation, dating back many years. Three in particular demonstrate the symptoms, if not the cause. First is the sight of long strips of greens being rolled up like a Swiss roll on drum-type aerators, in the absence of any anchorage, with a severe root break just below the surface.

Another is the sight of white grass leaves growing under the lifted turf, contrasting with green leaves above. The turf, finding air if not light under the sod, produced leaves not roots, presumably in some doubt as to which way up it was!

Thirdly was the sight on so many courses, so proud of their nice green greens, of the turf on a putting green lifting like an enormous blister, a foot or more above the putting surface simply by inserting a fork nearly horizontally and raising it, when the turf rose with it. When the fork was removed the blister subsided with a hiss of escaping air! All such shallow rooted greens were very drought susceptible and consequently were always heavily watered, with the inevitable result that the grass type changed, because of shallow surface rooting conditions, to annual meadow grass, making matters worse in a vicious spiral.

The cause of such root breaks is simply identified. It is almost always due to changing the top dressing in physical character and quality. This most commonly occurs when heavy sanding had earlier been carried out, often in a misguided attempt to firm up soft, soggy putting surfaces. There is one golden rule in top dressing and that is that it should be consistent. Ideally it should be the same as the root zone, but in our less than perfect world this is not always possible or sensible. With new greens built with specially mixed, sandy, humus-enriched root zones, it is sensible and easy to use the same mix for top dressing to ensure a consistent and uniform profile right down to the stone carpet. If however, as I have seen recently, the root zone is very unsatisfactory (in a specific case something like 25% of fines and virtually no humus, poor draining and root inhibiting) what do you do? It would be silly to use a humus-enriched sandy top dressing, as the roots would have no incentive to delve deeper for nutrients, and improved surface conditions would encourage shallow rooting annual meadow grass. Using the same awful root zone mixture would seal the surface and cause flooding, poor drainage after rain, and soft putting surfaces. Pure sand is the alternative - and inevitably causes root breaks.

Worse still, when heavy sanding starts to show problems, advice is unwisely proffered to change the mix - and then one really is in trouble. After a fairly short time, the grass lives on the top. There is no attraction for roots to penetrate sterile and often compacted (because humus-free sands and soils become destructured and consolidated) layers beneath. This in a way is comparable with a perched water-table green where successive layers 'fill' with water, and when the total water holding capacity of that layer has been reached then the water can flow to the next layer (as its weight

THE UNWELCOME BREAK

by JIM ARTHUR

overcomes the surface tension of the strata above). In this case, however, we are upside down! The largest particles are on the surface and there is no attraction for water or roots to penetrate inhospitable compacted lower levels. Roots cease, or move laterally, there is no anchoring or stability and a clear root break shows. Such root breaks persist for many seasons. Intensive deep aeration may help, but is often counter-productive because the turf is so weakly anchored that it tears up. Anyone who has Vertidrain greens with a root break will have all too lasting memories of the disturbance, especially if there has been some slitting beforehand. But one has to be cruel to be kind and persist, which means telling one's members well in advance what to expect – and the reasons why they should be understanding.

As with so many problems in greenkeeping, this is self-inflicted – and the tragedy is that those responsible for the disaster (be they ignorant advisers, inexperienced greenkeepers or interfering green committee men) will have moved on – often to repeat their heresies on other courses.

In severe cases, when frequent deep aeration would leave the greens looking like a battlefield, it may be necessary to lift the turf, (if it will lift mechanically, which is not always the case), cultivate the turf bed (taking the opportunity to ameliorate a structure-less soil with humus worked intimately and deeply into the root zone) and then after proper preparation of a turf bed replace the turf (or improved quality turf).

If your greens have been mismanaged by predecessors, e.g. by heavy sanding, then it is not always wise to switch to an organic rich top dressing, as in a year or so the buried sand layers will cause a break.

In the case of new greens it is sensible to match the top dressing with the root zone 'analysis'. If you have been silly enough or unlucky enough to have taken over American type pure sand greens, then you must stick to pure sand of the same physical analysis – and this means that such greens have limited powers of retention of water and nutrients and if not 'fed and watered' regularly and intensively, they will die. If you feed, you will end up with *Poa annua*. The moral is don't start with the wrong foundations – wrong because this type of green is designed for conditions (e.g. desert) which do not occur in temperate Europe.

Equally, if you have old greens built without stone carpets on local clay soils (and many built in the sixties were) then clearly you do not top dress with clay (or sand) but build up as quickly as you can with a root zone of good sandy humus rich top dressing and aid drainage by intensive, deep frequent aeration.

Another cause for root break on new greens is where a totally unsuit-

able, poor draining, de-structured soil has been used as a root zone; inhibiting anything other than shallow rooting. Then, if in an attempt to improve levels or thicken up the grass cover, generous top dressings are applied; the better the quality of the top dressing in relation to the root zone, the worse the problem. Then the turf lives in that surface zone, there being no inducement for the roots to penetrate lower into 'hostile' country and the surface layers will lift when aerated.

Root breaks are much easier to avoid than to cure. The secret is to catch them early and aerate like mad. If you find the hole cut plug starts to break off in clearly defined layers – no roots to hold them together – then get cracking. If you can hold a full depth plug by the turf and it holds together, with roots coming out of the bottom of the plug, then you will never suffer from root breaks.

Looking at the profiles of hole cuts can be very revealing. It is like the annular rings on a tree trunk. Look, 20 years ago, there is a thick black band when old so and so was 'peat mad'. There, even longer ago, is the time when we were using the wrong sand – or charcoal. One can even date the 'rings' and say with confidence that 30 years ago 'someone' was doing the wrong things but that 'someone' is probably not any longer capable of being got at! Ah well, such is life. But beware of being the same miscreant being criticised in 30 years time! Follow sound greenkeeping practices and do not chop and change and the grass will thank you by developing a deep, uniform root system, with no trace of root-breaks and all their attendant problems!

■ Especially written by agronomist Jim Arthur, this article appears in response to specific requests received from greenkeepers, in particular those who have experienced root break problems of some magnitude on new course constructions where unsuitable root zone materials have been employed.

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