Dr Stan Williams gives you the low down on English Charcoal, a traditional product which is making a comeback

Black is back

Charcoal was widely known by stone age man while throughout the ancient world charcoal was one of the essentials for practical alchemy and was used to supply clean, smoke free heat and by its reducing power to chemically transform ores to liquid metals.

The blacksmith's forge and the smoothing iron were also dependent on the product before the advent of gas and electricity and to meet these needs the charcoal maker, cum woodsman, was once as familiar as the proverbial butcher, baker or candlestick maker. Not surprisingly the uses of charcoal to improve soils and growing conditions for all manner of plant life were discovered and experimented with over the ages by the charcoal maker's farming and gardening neighbours.

With the increasing mechanisation of rural Britain between the world wars, this labour intensive craft went into decline and many uses of charcoal in horticulture were forgotten as it became less and less available.

In recent years, however, it has revived and with increasing awareness of environmental issues charcoal production has followed their lead to serve a large modern leisure market, which imports over 40,000 tons of charcoal annually to feed barbecues. Unfortunately there is a considerable ecological price to pay since much of this import is made from sensitive rain forests and mangrove swamps in clear fell operations. By contrast the traditional harvesting techniques in England exemplify sustainable woodland management.

Charcoal was made from hardwoods such as oak, beech, ash or alder, regularly harvested as coppice or pollarded wood in a sustainable way. Great areas of woodland were carefully managed over long periods of time to this end. The seasoned logs were stacked into clamps covered in turves and fired with careful control of the air supply, so that the fire at the base of the stack baked the wood to charcoal without burning it away. Today the same process is carried out in large steel kilns like giant wood stoves or else in large ovens called retorts. Both are used in small businesses, often as a diversification of a woodsman's primary business.

The equipment is not excessively expensive but a lot of timber is needed. At least four tonnes are needed to make one tonne of charcoal in a retort and as many as six in the more traditional ring kiln.

English charcoal is distinct from that imported from the tropics. It is lighter and more porous. Partly this is because of the species of timber being used, but mostly it is because English charcoal is completely carbonised. This gives it all its distinctive properties including those which can aid the turf specialist.

Charcoal, when properly made, is virtually pure carbon. It is granular, is very porous and has an incredible surface area. The total area of the micropores can be as high as 300 square metres per gram. This surface has a strong tendency to stick to other molecules large and small and will therefore bind metal ions from solution and even trap fungal or bacterial spores. These properties can be useful to horticulturists and also underlie its use for all sorts of purification processes in industry.

Botanists might be interested to know that the micro structure within charcoal accurately reflects the structure of the cells in the timber from which it was made. A tiny chip of charcoal under microscopic evaluation by the experts at Kew can reveal the species of tree and even the diametre of the original log. Given that charcoal is completely non-biodegradable and is unchanged by anything short of burning, this property has been very useful to archaeologists.

Our forebears discovered the properties of charcoal as described by accident. This led to various traditional uses in horticulture all based on the ability of charcoal to remain porous even when compacted and to allow gases and liquid water to diffuse up or down in a controlled fashion. Just what any badly treated root zone is crying out for. To complement sharp sand charcoal grains have the following properties:

- lighter and easier to apply
- porous even when compacted
- retain moisture
- suppress spores
- sterile
- evenly distributes nutrients
- almost neutral pH
- does not biodegrade
- locks up poisons

There are several post war books offering practical guidance on how to apply these principles.

Dawson's Practical Lawncraft, first published in 1939 (latest edition 1977) states that charcoal is excellent as a top dressing and at the rate of 0.25 - 1Kg per square metre the colour of the grass deepens. For firm well established turf a fine grade, 1.6 mm to dust, is recommended and for wet places larger grains 6.4 - 3.2 mm should be used. In either case the dressing must be worked in with harrow, chain mat or drag bush. This view is endorsed in J. R. Escritt's book the ABC of Turf Culture (1978) who states that "when surface conditions tend to be too moist and airless a proportion of a material such as granular wood charcoal may be useful in the top dressing".

Martin Sutton's book Lawns and Sports Grounds (1962) also advocates charcoal to improve soil structure in poorly draining and aerated soils. The options suggested are to add hard structures, sand or charcoal, or to precipitate clays with gypsum. Only charcoal, however, adds a unit of structure which is more or less permanent and is in itself porous. Sutton advises that charcoal, 6mm to dust at up to 1 Kg per square metre is "exceedingly valuable for turf surfaces liable to become badly saturated". Advice is also given for sites in preparation where granules at 1-2 tonnes per acre can improve the porosity of the top soil. It might be that charcoal back filled into slit trenches gives better access to pipe drainage than sand.

Below: Showing the before (top) and after (bottom) effects of careful coppice management

Often "black layer" is the least acceptable outcome where turf has become compacted, wet and anaerobic. A. J. Turgeon in Turfgrass Management (4th Ed.) comments that this is due to anaerobic bacteria producing sulphide gases either by acting on normal soil components or perhaps on a sulphur dressing added to reduce pH. Either way the soil pore spaces are clogged with metal sulphides (iron, manganese, magnesium) and all oxygen is excluded. The addition of charcoal will trap the sulphide gases which cause the problem and provide immediate airways for a better microflora to re-establish itself. In extreme cases hollow tining and backfilling with charcoal grains could solve the problem.

Suggestions for more chemical uses are made by W. H. Daniel and R. P. Freeborg in Turf Manager's Handbook (1980) where an application of 50 - 100 Kg per acre is suggested to "tie-up" organic chemicals used to excess. If you have had a spillage of hydraulic oil on the 18th green then the rapid application of a generous cover of fine charcoal will absorb the noxious chemicals. Horticulture exploits this property in the band treatment of seed rows. Seeds are planted in rows and covered with a band of charcoal. The whole area is then sprayed with herbicide and the carbon protects the emergent seedlings. A sort of pre-GM-technology for introducing herbicide resistance!

Our product has been used at the Brampton Heath Golf Centre, Northampton, this spring to treat the worst areas of black layer on one or two of the greens. After hollow tining, charcoal fines 5-2 mm were brushed in to back fill the pores. Steven Grass, the Head Greenkeeper, reports that the charcoal definitely did the job of capturing the sulphurous gases and increasing the greenness of the sward.

This was the first application on these areas and had the desired positive effect on the symptoms of black layer. In bad cases several treatments over one or two seasons are likely to be cumulative by permanently changing the physical structure of the root zone.

When making comparisons between various materials as top dressings it must be remembered that the density of charcoal is relatively low. You get about one tonne of sharp sand in a cubic yard, but the same weight of dry charcoal fines would be four to five times the volume, the larger mesh sizes being less dense. If you are buying by weight and thinking of the volume of the spread, then this factor of four or more must be borne in mind.

Rates of application depend greatly on the needs of the turf but from the literature of traditional uses about 0.5 Kg per square metre would be a mid-range application and would equate to approximately two litres of material. If this is spread evenly the layer will be 2mm thick, just enough to make a complete cover on a hard surface. On turf, of course, the granules are rapidly distributed vertically and hidden among the blades of grass when worked, so the dressing has little if any cosmetic effect.

Charcoal has never been cheap! Carter's Blue Book of Gardening, of 1931, has horticultural charcoal at 'four shillings and sixpence for a bushel bag' i.e. about 40 litres, weighing in the region of 12 Kg. In 1931 "four 'n' six" would have bought a couple of pounds of steak, say £12 in today's money, but at that price charcoal was still considered very good value.

If the natural world is to have a future then we must all strive to contain and where possible to reverse the ecological damage that has been done over the last few decades. This will mean in practice that everyone in society must be educated on the issues and be aware of the implications of their activities.

There is no quick fix, and the optimum solution will undoubtedly combine both the old and the new. Although the idea of an organic golf course with no use of fossil fuels or man-made chemicals is a wispy daydream, it would be realistic to "teach everyone that a bit of Mother Nature, good environmental practice and above all patience and time are the keys to the future", to quote from the March 2000 issue of Greenkeeper International (Lessons Learned page 28).

This is perhaps where English charcoal fits in, both on the golf course and with its production helping the wider environment of our countryside.

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