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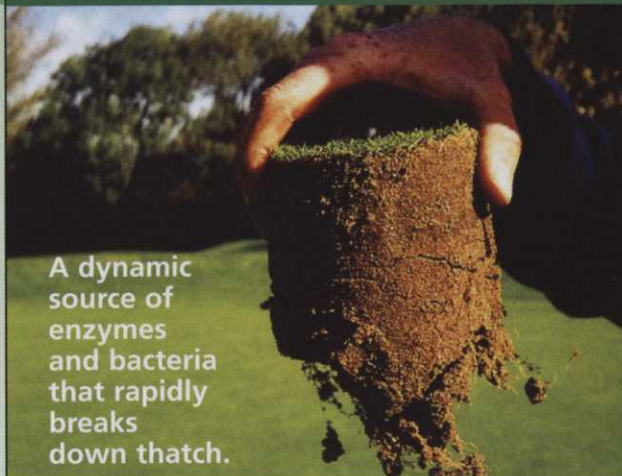


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The Physics of Aeration

In his last article, before his death, Jim Arthur explores the history of vertidrainage and the best aeration practices.

One might have thought that everything that needed to be said about aeration of golf courses had been written. Maybe, but obviously it has not all been read by all!

Clearly all good greenkeepers and perhaps most mediocre ones will accept that one cannot successfully manage any turf subjected to traffic without aeration. The old true story of what course management at all levels is up against bears repeating - for the umpteenth time! In my presence, many years ago, an irate peppery member accosted the respected Head Greenkeeper about slits in the green. "Can't you leave the greens alone for five minutes," he complained. The response, made in a measured and polite manner was: "Certainly sir, if you stop playing on them."

Aeration is primarily, of course, to correct the consolidation caused by traffic, both pedestrian and machines, and with ever increasing play, this has never been more intense. Such compaction destroys soil structure; reduces pore spaces, which roots as well as air and water occupy; impedes drainage; discourages root growth, causes stagnation and moss invasion but above all it encourages that age old enemy of consistent all year round good playing conditions, *Poa annua*.



Wiedenmann's Terra Spike XF is now a regular on many golf courses

This is acceptable where there is little or no winter golf, tell me where that is, save on courses where tarting them up in summer to produce those shaved, overfed and watered monstrosities - the Green is Great School pampering the professionals and so admired by many television viewers. *Poa annua* is really good for less than half the year and too often is unplayable in late winter.

The mark of excellence is to play to full greens all year round. In passing, we do seem to have progressed from my early advisory days, when it was standard practice on many inland courses to switch automatically to temporaries in late autumn and not to go back until just before Easter. Then of course few played winter golf except on links and heathland.

Of course, deep frequent regular aeration is probably one of, if not the most, important routine management tools but there is much more to it than merely sticking holes in the turf. For one thing there are very varied



Toro's ProCore 648 can aerate 18 greens in just over seven hours according to the company

types of 'hole makers' and it may be helpful to discuss what tines should be used where, when and how deep.

Perhaps the most misused form of aeration is hollow tining. The first tine to extract cores of soil was designed and produced by Paul's of Paisley in 1919. It was a great improvement on the old solid tining by hand forking which compressed the soil laterally, even if it did break up compacted layers and improve stratified soils, showing root breaks at changes in the soil structure derived from changing the type of top dressing. In passing, deep sections taken with a hole cutter reveal the past history of any green as effectively as the examination of annual rings exposed when trees are cut down.

Aeration was always recognised as vital, even a century ago.



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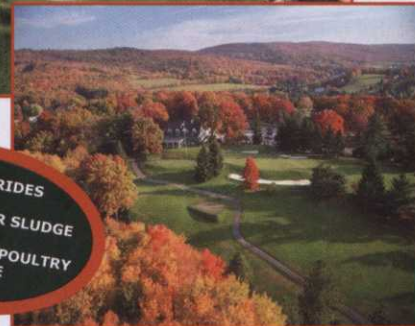
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The Physics of Aeration

Until the entry of Wm. Hargreaves into the manufacturing of aeration machinery - he started Sisis in 1932 - such work was slowly and laboriously carried out by hand. Long lines of stalwart greenkeepers progressing backwards over greens in a rhythmic pattern of thrust, lever and withdrawal.

This is exactly the pattern on which the vertidrain was designed by the de Ridders in 1980. Though few remember it, I am proud to have been the introducer of this now universally used and valued deep aerator - with the help of a small plant hire firm, Charterhouse, who then had a small factory a mile or so from where I then lived. I well remember getting the first few courses, including Sunningdale and Walton Heath, to aerate all their greens.

Let us revert to the problems of aeration and especially the limitations of hollow tining. More harm than good results in using hollow tines at the wrong season or for the wrong reasons. You may guess that I use hollow tines only for specific reasons. Used at other times or as a routine hollow lining often does far more harm than good. I am naturally a great advocate of the benefits of aeration and also believe that what is discovered, as the best programme for one course is not necessarily the best for another.

What then are the snags as opposed to the benefits? First and foremost is that hollow lining was invented 85 years ago as a soil exchange procedure. When greens were unimproved and generally on heavy soils, it made sense to extract a small percentage and replace it with sandy compost. On sandy soils, e.g. links and heathland and on perched water table sandy rootzones, one certainly does not want to remove physically ideal rootzones. It is not only very wasteful even if cores are broken up and brushed back in, but alters the consistency of rootzones.

A second problem is that the holes are necessarily large. If they were not, breakages of very thin tines would be prohibitively expensive. These large holes provide ideal invasion points for weeds but especially for *Poa annua* to enter erstwhile tightly knit turf that effectively barred seeds getting a foothold. Far too often I have seen previously 'pure' bent/fescue greens spotted like dominoes with small seedling *Poa annua* growing in every tine hole - yes even years ago at St. Andrews' Eden Course, when unadvisedly hollow tined in spring, just when *Poa* is starting to seed vigorously.

If you must hollow tine for soil removal reasons, it must be in winter, given suitable soil and weather conditions. One sees greens being intensively shallow hollow tined prior to overseeding with bents and fescues. Yet the optimum conditions for establishing introduced seed are exactly the same as for *Poa annua* to gain a foothold.

I often question the cost effectiveness of such overseeding programmes, special cases excepted, and often they are counter productive in 'letting in the *Poa*' as many an old links greenkeeper told me so many years ago - just as true today. All in all, there are so many



An early Sisis tractor mounted aerator. Scant protection from the elements both above and below



Sean Reilly, Loch Lomond Golf Club, tackles compaction with a S500 pedestrian aerator manufactured by Dennis of Derby

snags, including poor depth because hollow tines are structurally weak and snap if too 'pressurised' that I would reserve hollow lining only as a rare part of a soil exchange programme.

It is unproductive to compare aerators because the only criterion is that they should be capable of piercing very deep without damaging the turf or the tines. The main requirements with aeration are to carry it out frequently, regularly, periodically and at varying depths. Aerating at the same depth all the time risks creating a 'plough pan' - a consolidated level just below the depth of aeration, which has to be broken up and lifted by deep vertidrainage.

If you want to explode air under the surface, inject high pressure water by jets or even, in extremes, correct compaction by lifting, rebuilding and relaying, then used in conjunction with tried and tested deep solid/slit lining - never on its own - then I am the last to object.

Remember however that one always has to achieve a balance of depth with minimum disturbance to surfaces; maximum air exchange, which is why slits are favourites with their greater soil/air interface, and frequency, with some of the members getting hot under the collar over marks on putting surfaces which cannot affect their putting for more than a few hours. As with all things in greenkeeping there are more ways than one of achieving the desired aim.

There are no set rules, only predictable results from specific actions, which have to be balanced, good against bad. All I ask is that all those making decisions know what the downside is. I can but repeat that good greenkeeping is common sense, it is not rocket science and is based on botany with a little physics and no chemistry. Aeration is physics! Get stuck in there!



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APPLICATION RATES

A normal spring or autumn top dressing application would be around 3-6 kg/m². This would equate to around one and a half to three tonnes for a golf green of around 300 square metres. Three and a half to seven tonnes for a football pitch.

Jim Arthur 1920-2005

Past BIGGA Chairman Gordon Child pays personal tribute to his friend and mentor Jim Arthur.

The world of greenkeeping and the turf industry as a whole lost a giant of a man on Saturday May 14 2005. I first met Jim Arthur in 1952, when he still worked for the STRI. He was one of the lecturers who came into Leeds College of Art and Technology, and I was sitting a turf culture course at the time, we have been in contact ever since. I was sad to see him on the morning of his passing, fighting to the end.

It is impossible to go through Jim's life in full as I would need a book to do him justice, but briefly Jim was trained at Reading University to be a farmer and then went on to be a Captain in the forces before joining the STRI. Here he changed tack and concentrated on fine turf and one of his sayings to greenkeepers was: "Listen to the farmer and do exactly the opposite."

He briefly managed a seed company before becoming a freelance agronomist advising over 500 golf courses and being advisor to the R&A. I write this as a personal tribute to a very good friend.

Although I had known Jim for over 50 years, it was the last 25 or so we became very close, living only 30 miles apart. We were very often in daily touch either by phone or meeting, and I have spent hundreds of hours in his conservatory putting the world to rights. Those who knew him well would know how much he disliked grey squirrels, and he always had his air rifle at the ready.

He would jump up in mid sentence to take a pop at one in the garden, though I never actually saw him hit one. So it was ironic that the first day he moved into the hospice, the garden was full of them, but after a day or so none were to be seen. The word must have got around.

The enthusiasm for his work never left him, and his beliefs never changed from the time I heard him in 1952 to the day he died. Jim was a traditionalist and he fought everything and everyone vehemently who opposed those ideals. Few people in our industry escaped a tongue lashing at some time or other, so strong were his beliefs, but one thing you could always rely on was that Jim, if asked, would always try to help.

I well remember that when I was fighting at Cannington College to build a golf course to train young greenkeepers on and being told: "We'll give you the land, but we have no money." So I turned to Jim for help and, within a short time, with his expertise and persuasive manner, the course was built, a course that hundreds of students have benefited from over the years.

Jim was a very generous man, I know lots of greenkeepers who rang him for help and without hesitation he would offer free advice. He would give talks to greenkeepers, Sections and Regions without ever charging a fee, such was the stature of this man. He was equally at home talking to top experts as he was to students and he enjoyed every minute of it.

Some of my fondest memories of Jim came during the time he started

to write Practical Greenkeeping, a book which had taken us years to persuade him to do, but once started it took over his life and some others too. He would ring three or four and even more times a day, not just to me but a few others, just to run something past you.

His dedication was unbelievable, and when you take into account his age and the fact that Audrey, his wife, was ill and needed constant attention, it was amazing that the book was completed. Practical Greenkeeping was funded by the R&A, and that is a measure of the high esteem in which his knowledge and expertise were held. We must all be thankful that the book will always be there to refer to and I am sure it will be used as a tool in the education of greenkeepers for a long time to come.

Jim Arthur's name is known the world over; his advice was sort after by the best. He had many critics, particularly from those who wished or tried to make a fast buck from encouraging the wrong grasses, which he waged constant war on. Jim was also very fond of making predictions, and what was irritating to many was that he was nearly always proved right.

He always said that in time the bulk of golf clubs would have to go back to traditional management of courses because finances would not be available for the high cost maintenance methods some used. How right he was. Finances in most clubs have now dipped and this, coupled with pesticide and chemical legislation, are forcing greenkeepers and clubs to go back to the more austere methods that Jim always called for. So it is sad in some ways that it has come about at this time.

He had many interests outside that of agronomy and one such interest was wildlife. His love and knowledge for animals and birds, apart from grey squirrels, was excellent. Not very long ago he correctly identified two Egyptian Geese, which came into our field at home, when no one around seemed to know. So I think it is fitting that I should end this small tribute to him with this little story from his son, Richard.

Jim always used to feed foxes which came into his back garden and when he was taken into the hospice they had not been fed for five days. When on the Saturday, the day Jim passed away, Richard went out to feed them and for the first time a young fox cub came to the dish to feed. A new life came in as one went out.

Jim Arthur will be sadly missed and I for one will always be very grateful for his friendship and help over so many years. We who were his friends were very privileged.



Dressing to Thrill

Mike Brear explores the important process when it comes to top dressing.

WHAT IS IT?

Top dressing is a blend of hydraulically classified silica sand and organic matter, which is normally in the form of a sandy loam soil and sometimes peat, which has been heat treated and to all intents and purposes sterilised.

WHY USE IT?

In order to affect the playing characteristics, as well as turf grass quality, frequent applications of an appropriate top dressing will assist the greenkeeper in the aim of providing a top quality surface by the following.

1. Helping to preserve a true and level playing surface.
2. Assisting in thatch control.
3. Enhancing the underlying rooting medium.
4. Improving drought tolerance.
5. Alleviating poor surface drainage.

The choice of which top dressing to apply really depends on the construction type of your greens. Do you have a modern green based on a sand and soil/peat rootzone or an older soil based green? A compatible material has to be the most important factor to consider when deciding what to use.

You must ensure that you choose a compatible top dressing for the greens. Take time to have samples taken from the greens for laboratory analysis, as this is the only way of choosing the most suitable top dressing. Reputable suppliers can offer this service free of charge.

By doing this it will, without doubt, help in your decision making and even more importantly prevent the build up of disruptive layering which would sequentially impede water movement through the profile and cause rootbreak. This is something that would not be apparent immediately. It would be a problem in the coming years.

COMPOSITION AND CONSISTENCY

The type of sand used in top dressing is the most important factor with the soil type following close behind. The dominant particle size range for the sand should be a medium grade that is between 0.25mm to 0.5mm in size.

Soils throughout the UK do vary in quality and not all soils are good for use in top dressing. Out of 10 different soils tested, probably only one is suitable for use as an organic fraction of a top dressing or a rootzone. The poor quality soils may appear and feel good but they have a tendency to become cohesive when wet and this causes the soil to attach to the sand particles and consequently block up air and pore spaces, which adversely affects the hydraulic conductivity of the material.

A copy of a laboratory analysis should be sought to confirm the performance of your chosen top dressing with particular emphasis on the hydraulic conductivity result. If the particle size distribution is acceptable, then the hydraulic conductivity should be well above 125m per hour, assuming the chosen blend is a 70/30 sand/soil mix or above. If not it would indicate that a 'poor quality soil' has been used and should be refused.



The importance of using a reputable supplier cannot be over estimated. In terms of a consistent top dressing the manufacturer must have a quality control system in place for checking specifications. Be aware of the quality system - ISO 9001. Any company manufacturing under this quality system can offer assurances of both quality and consistency, giving peace of mind to the end user. A lack of this kind of quality control system may be a reason for that unusually cheap price.

WHEN SHOULD I USE IT?

Spring and autumn applications are the normal times when you would apply top dressings, but as maintenance techniques develop other factors influence when you can and do apply further dressings.

The matter of 'surface hygiene' is a key issue on any green and can be managed effectively by the modern day greenkeeper. Scarification and verticutting should be carried out throughout the growing season to combat any excessive build up of organic matter, which could lead to a major thatch problem, and in turn encourage tillering of the plant.

This procedure should be followed by an application of top dressing that will help in the battle to keep the surface of the green free of any organic build up. This would mean light and frequent applications throughout the summer on top of your usual spring and autumn applications.

APPLICATION RATES

A normal spring or autumn top dressing application would be around 3-6 kg/m². This would equate to around one and a half to three tonnes for a golf green of around 500m² and three and a half to seven tonnes for a bowling green of around 1200m².

Lighter applications throughout the summer or growing season would tend to be around 1-2kg/m² equating to approximately half to one tonne for a golf green and one to two tonnes for a bowling green. In golf this lighter dressing could be applied as much as four times throughout the summer.

DELIVERIES

More often than not, golf clubs will take the deliveries of their top dressing in the form of bulk tippers ranging from 10, 20 and even 29 tonne loads. That is not always the case at bowling clubs. Access is usually poor and therefore the larger tipper vehicles would not be able to gain access in order to tip.



The most popular format for bowling green deliveries is in 25kg or one tonne bags. These are both covered and hence protected from the elements which is important when considering that in most cases not all the top dressing would be applied on the day of delivery if the greenkeeper were working alone.

The size of vehicles can still be a problem for bagged deliveries if the access is poor. To combat this problem check if your supplier's bagged deliveries come with an off load facility, such as a 'moffett mounty' - an onboard fork lift truck. This can deliver virtually anywhere and can save you

the problem of having to carry 200 or more 25kg bags of top dressing to the green.

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Mike Brear is Northern Area Sales Manager for Rigby Taylor Limited and can be contacted on 01204 677777.

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Seeing the Green

A look at the stewardship of pesticides and the shared responsibility of the whole turf industry in this.

Maintaining good quality, high performance turf is not an easy task. To do it well requires a greenkeeper with excellent training, personal dedication and resourcefulness. It also requires commitment to integrated turf management programmes and access to suppliers and products, which support and add value to greenkeepers' efforts and management skills.

While greenkeepers' techniques around the world may vary, they all share the same goal: To create an exceptional golf experience for their customers. But it is also a shared goal - one shared by turf industry suppliers.

A SHARED CHALLENGE - RISING INDUSTRY PRESSURES

Well maintained greens, tees and fairways enhance the playability of a golf course and, in the end, lead to improved player satisfaction. Studies have also shown that properly maintained golf courses have environmental benefits, offering a sanctuary for local flora and wildlife. Despite these benefits, the golf course industry continues to come under pressure from environmental and misinformed groups. At the same time, pressure to ensure golfers satisfaction also continues to grow.

Recognising the value of turf as well as greenkeepers' need for unique solutions to these industry issues, pesticide manufacturers have committed to investing the necessary resources to bring to market new products and technologies. These are specifically developed, formulated, and packaged for professional turf management so that they are useful, practical, reliable, cost effective, and pose negligible risk to applicators, consumers and the environment.

A SHARED RESPONSIBILITY - TURF INDUSTRY STEWARDSHIP

Pesticides have proven that they can contribute and play a valuable role in an overall disease, weed and pest management programme. However, to make certain that pesticide manufacturers can continue to invest in the development and support of turf products and that greenkeepers can continue to deliver on the full value of well managed turf requires stewardship.

Correct stewardship of turf pesticides is a responsibility shared by pesticide manufacturers and greenkeepers alike.

COMMITTED TO BRINGING PRODUCTS TO MARKET

For pesticide manufacturers, stewardship comes in the form of product innovations, regulatory compliance, industry involvement and customer support and education. New active ingredients (AIs) are difficult to find, time consuming and costly to develop. On average, a new AI may cost in excess of £85 million and take 10 years to get from research to the marketplace. On top of this already substantial investment, there are specific additional costs associated with the development of turf products.

Before they can actually get into a greenkeeper's hands, new turf products must meet strict regulatory guidelines related to toxicity to non-target wildlife and lack of short or long term environmental impact, including surface



water, drinking water and soil. As stewards of the turf industry, pesticide manufacturers have invested significantly to ensure that turf products meet these requirements - a benefit to the environment and to customers.

Turf specific formulations are another way in which pesticide manufacturers act as industry stewards. Specifically designed for turf use, turf products are formulated so that they remain stable during storage and are easy for greenkeepers to mix and apply. These improvements in the formulation and packaging of products make them more convenient for greenkeepers and improve safety in handling.

Pesticide manufacturers also continue to seek performance and technical advancements, which extend the range of pests controlled or the range of situations in which existing products can be utilised. While these enhancements and additional testing require further investment - regulatory authorities require that any new uses are registered in every country where they are to be used - pesticide manufacturers continue to innovate because such use extensions increase the value of turf products for greenkeepers.

DELIVERING VALUE BEYOND PRODUCTS

Pesticide manufacturers know it isn't enough to deliver innovative, dependable turf products. A high value, intensely managed market, like turf, also demands expertise, continuing education and innovation. Pesticide manufacturers support professional turf management in a variety of ways, providing both financial support and the expertise of their staff. This investment - helping to ensure the future of the industry - is a necessary part of doing business.

As mentioned earlier, new turf products are hard to find and expensive to develop. Once available, it is important that they be used wisely and

knowledgeably. To that end, good stewardship on the part of pesticide manufacturers includes commitment to building greenkeepers' professionalism through provision of technical training, information on integrated turf management practices and overall support for the professional turf industry.

Leading pesticide manufacturers sales and technical representatives are well equipped to provide greenkeepers with product training, problem solving skills, integrated solutions to turf management issues and the ability to resolve product use issues. Manufacturers also sponsor other educational resources for greenkeepers, including industry and university research with the aim to develop the best turf agronomic practices.