Education Update

Greenkeeper Education and Development Fund

BIGGA GOLDEN KEY and SILVER KEY MEMBERSHIP

Unlock the doors to progress through BIGGA's Education and Development Fund - the key to a great future for greenkeepers, golf clubs and the game of golf.

Golden and Silver Key Membership is available to both companies and individuals.

For details, please contact Ken Richardson on 01347 833800 or via ken@bigga.co.uk

Golden Key Supporters

Golden Key Company Members

Company	Tel: Head Office
Gem Professional	01254 356611
John Deere Ltd	01949 860491
Kubota (UK) Ltd	01844 214500
PGA European Tour	01344 842881
Rigby Taylor Ltd	01204 677777
Scotts UK Professional	01473 830492
Ransomes Jacobsen Ltd	01473 270000
The Toro Company/Lely UK	01480 226800
TurfTrax Group Ltd	01722 434000

Golden Key Individual Members

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Silver Key Individual Members

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BIGGA Golf Environment Competition

Following my news about the BIGGA Environment Competition in the April Edition of Greenkeeper International, I can now confirm that the new joint sponsor alongside Scotts UK Professional and Syngenta Professional Products is the Waste and Resources Action Programme (WRAP).

WRAP is a not-for-profit company supported by funding from DEFRA, the DTI and the devolved administrations of Scotland, Wales and Northern Ireland.

It is working to promote sustainable waste management by creating stable and efficient markets for recycled materials and products, including glass, wood, plastics, organics, paper and aggregates.

The aims of the Competition, the aims of BIGGA and the aims of WRAP fit well together and the support of WRAP, Scotts and Syngenta will ensure the continuation and expansion of this important competition. This will allow more golf clubs to benefit from the visits and the advice from STRI Ecologists and from the significant prizes offered.

Full information on how clubs can apply for the 2004 Competition has been sent to all golf clubs in Great Britain so make sure that your club is in the running to win a prize by applying today. Prizes include:

- A Scotts' Weather Station and a cheque for £2,000 for the winner
- A cheque for £500 for each regional winner
- A cheque for £500 for the most impressive newcomer
- A cheque for £500 for the best overall environmental initiative
- And this year, a cheque for £500 for the best use of recycled materials

Judging will commence from July onwards with ecologists from the STRI assessing all entries.

Golf clubs will be judged on their commitment to environmental management and will be assessed on:

- Nature Conservation
- Energy Efficiency and Purchasing Policies
- Landscape and Cultural Heritage
- Education and Training
- Turfgrass and Pest Management
- Communications

Water Resource Management
Public Access and Awareness
Waste Management

Golf Environment Competition

Many golf clubs have gained a great deal from entering the BIGGA Golf Environment Competition. It gives all golf clubs the opportunity to learn from others, to improve their golf course, to improve the environment and, perhaps to win a prize.

Whether your golf course is large or small; rich or poor, it provides an important link in the environmental chain, helping to achieve long-term ecological benefits.

Let your members, local residents and the general public see what you are doing to improve the environment by entering this year's competition.

Continue to Learn 2005

Planning for the Continue to Learn Week, held in at Harrogate next January, has continued this month. With an extended education programme, there will even more opportunities to expand your knowledge by attending a workshop or some or all of the seminars.

The theme for 2005 is 'Back to Basics' and the week will start on **Sunday 16 January** with 3 two-day workshops. Each workshop will be limited to 20 delegates and will cover:

- Golf Course Design
- Soil Science
- Tournament
- Preparation

Continue to learn

Monday 17 January will see the three two-day workshops continuing and the start of two one-day workshops. Each one-day workshop also will be limited to 20 delegates and will cover:

- Irrigation
- Communications and Negotiations.

Tuesday 18 January sees the start of BTME & ClubHouse, that will be held in the Harrogate International Centre.

The exhibitions will be reinforced by a wide range of seminars for all types of delegate plus the TORO sponsored careers fair, the exhibitions banquet and a Master Greenkeeper Seminar. Further details will follow in subsequent editions of Greenkeeper International.

The 21st Century Manager

Plans are progressing for a new, high-level conference that will be held in the spring of 2005. With support from the R&A, EGU, STRI and the GTC, this Conference, with the theme the 21st Century Manager will include speakers from the UK, Europe and the US. Watch out for more details in the next edition of this magazine.

TORO Student of the Year Competition

TORO STUDENT GREENKEEPER of the year AWARD

The deadline for the TORO Student of the Year Competition is fast approaching with all entries due at BIGGA House by the end of this month. Regional interviews will be held in early July.

Recycling. Never a Waste of Time

Maggie Newton, explains how compost can provide an environmentally sustainable and cost effective solution

wrap
Creating markets for recycled resources

Recent years have seen a transformation in turf management, and one development, which is generating increased interest, is the use of compost as a key component of long-term turf management. Maggie Newton, Marketing and Awareness Manager (Organics), at WRAP (Waste & Resources Action Programme) explains why compost can provide an environmentally sustainable and cost effective solution to many common turf management concerns.

Providing safe, hardwearing and attractive playing surfaces for recreational activities such as golf, requires intensive turf management. Turf grasses are exposed to extensive wear and tear, making them difficult to manage, and liable to soil compaction, poor drainage and turf diseases. Faced with these concerns and mounting pressure to identify materials that are both cost effective and environmentally sustainable, greenkeepers are steadily turning to compost as a material of choice for turf management.

WHY CHOOSE COMPOST?

Compost is a natural product made by composting biodegradable materials under managed conditions. Produced mainly from garden or landscapers' prunings, grass cuttings and leaves, compost is an environmentally sustainable, cost-effective alternative to peat. When used in turf establishment and renovation, compost offers a variety of benefits.

IMPROVING SOIL QUALITY

Perhaps most significantly, compost has the unique ability to improve the chemical, physical and biological characteristics of soils or growing media. Compost supplies organic matter that improves soil structure, water infiltration rates and water holding capacity. It also provides nutrients such as nitrogen to the ground in a slow release form which stimulates turf establishment and 'greens up' grass without leading to excessive grass growth. Compost also provides a good supply of potassium which aids grass hardiness.

Compaction is a key concern in sports turf due to the sheer amount of surface 'traffic', particularly during wet weather. Compacted soil hampers healthy turf establishment by inhibiting the movement of air, water and nutrients within the soil. While traditional methods of alleviating soil compaction are labour intensive, expensive and often only a short-term solution, compost can be incorporated into compacted soils to improve turf establishment and root penetration, providing a more permanent solution. Used in conjunction with aeration techniques prior to adding topdressing, compost can also lead to increased water absorption and drainage and enhanced resistance to pests and disease.

SUPPRESSING DISEASES

Compost can help to suppress many turf grass diseases because it is a biologically active material. Studies carried out on golf courses and sports pitches in the USA and Canada have demonstrated a reduction in the severity and incidence of a wide range of turf diseases such as fusarium patch, red thread and grey snow, particularly when compost was applied as a top dressing or used as a root zone amendment.

QUALITY GUARANTEED

Quality is of paramount importance for greenkeepers when specifying materials for use on their courses. National standards for compost are defined by the British Standards Institution's Publicly Available Specification for Composted Materials (BSI PAS 100), a benchmark which resulted from collaboration between The Composting Association and WRAP in 2002.

The scheme provides independent verification of compliance with BSI PAS 100, which means greenkeepers can be confident that the compost they purchase from producers on the scheme will be high quality, reliable, traceable and safe. Throughout the UK, there are now 41 sites manufacturing compost in line with BSI PAS 100, producing approximately 250,000 tonnes of composted products in a variety of grades.

MAKING THE MOST OF COMPOST USE

When using compost in turf management applications, it is important to ensure that the compost used is of the right quality which is where the BSI standard can provide reassurance. It should not contain any stones or physical contaminants and should be mature so that it helps support healthy turf establishment. The optimum time to spread compost is during the autumn or spring, when the weather is warm and the soil is moist.

To get the most from using compost in turf establishment, it should be applied at 25-50mm deep and then incorporated to an approximate depth of 100-150mm. The compost application rate will vary depending on the soil conditions, compost characteristics, and the turf species to be established. A soil analysis test should be undertaken to establish the quality of the site soil.

Once incorporated, a proper seed bed should be established and the seed lightly brushed into the surface using a drag mat or rake. Turf may be applied directly on to the soil surface either manually, or with specialised equipment. Once planting is complete, the area should be fertilised if necessary and watered on an ongoing basis to ensure adequate rooting.

TOP DRESSING AND DIVOT REPAIRS

Compost can also be used as topdressing for all areas of turf, either as a component of a mix, or on its own. Topdressing with compost is usually more successful when the compost is first mixed with sand as the added bulk density from sand helps the compost to penetrate better. Typical topdressing mixes for

golf courses are comprised of 70% to 90% sand and 10% to 20% organic matter.

Compost can also be blended with various other materials such as sand and loam to produce a product that matches requirements, especially closely mown fine turf and sand dominated, free draining sports turf root zones. When used as topdressing, compost should be applied to the turf surface at a rate of 6mm to 12mm, and should be brushed in and watered if necessary.

A lower application rate of compost should be used on sports turf and lawns, whilst a higher rate should be used on low maintenance grass and roadside verges. Core aeration techniques can also be used and the compost should be moist but flowable to facilitate application.

Divots can also be fixed effectively using a blend of compost and grass seed mix. The compost contains nutrients and holds moisture and the dark colour can also absorb heat from the sun, speeding up germination in cooler periods.

OVER TO YOU

Compost is an extremely versatile product for the greenkeeping sector and there is real potential for an increase in its use. It can provide a solution to many common turf management concerns and at the same time, help greenkeepers to significantly reduce the costs associated with turf management.

Information on where to find your nearest supplier on The Composting Association (TCA) certification scheme can be found at www.wrap.org.uk.

TOP TIPS FOR USING COMPOST IN TURF MANAGEMENT

- carry out a soil analysis test to establish the quality of the site soil
- make sure site drainage is adequate before planting takes place
- if the soil has compacted layers, these may need to be ripped and this should be done when the soil is relatively dry
- ask for a sample of compost before ordering to make sure that it is the required quality
- ask compost producers for a recent chemical and physical analysis
- use the lower application rate of compost on sports turf and lawns and the higher application rate on low maintenance grass and roadside verges
- the optimum time to spread compost is during the autumn or spring, when the weather is warm and the soil is moist

BENEFITS OF COMPOST AT A GLANCE

- Nutrient rich
- Improved moisture retention
- Erosion and weed control
- Increased yielding potential and faster turf establishment
- Better plant survival and growth
- Environmentally sustainable alternative to peat
- Cost effective
- Reduced need for fertilisers and irrigation
- Increased root growth from slow release phosphate
- Improved turf density and colour

NOTES

1. WRAP is a not-for-profit company in the private sector, backed by substantial Government funding from DEFRA, DTI and the devolved administrations in Scotland, Wales and Northern Ireland.

2. Originally established to promote sustainable waste management and create stable and efficient markets for recycled materials and products, WRAP's remit has recently been extended to include a set of new programmes for England. The new work comprises: a Household Waste Minimisation Programme; an Organics Market Development programme to provide material specific support and investment to the composting sector; the development of an Advisory Service to local authorities - the Recycling and Organics Technical Advisory Team (ROTATE); and a Waste Communications and Awareness programme.

3. WRAP has laid down targets across nine programmes - six material streams (paper, plastics, glass, wood, organics and aggregates) and three generic areas (Procurement, Financial Mechanisms and Standards and Specifications).

4. Further information on all WRAP's programmes and activities can be found at www.wrap.org.uk

Rachael and Gemma from Membership Services would like to welcome 106 new members to the Association.

Where do your Subscriptions go?

It is a popular misconception among some members that their combined subscription forms the major part of the income for the Association and that these funds are used to maintain an 'ivory tower' at Aldwark Manor.

In reality the bulk of the Association's income comes from commercial activities, mainly its annual exhibition, advertising and sponsorships as shown in Chart 1 which is taken from the accounts for the year ended 30 September 2003. The profit from these ventures is used, in part, to fund a wide range of member benefits which are automatically given to members or which are available through the Association's provision for education.

These benefits include: free accident insurance, free legal help for the member and his/her household, 12 issues of Greenkeeper International magazine, access to both free and heavily subsidised training, free entry to a variety of competitions, free inclusion in a national discounted purchasing scheme, the opportunity to receive educational grants and access to specially negotiated rates on a variety of products. The average cost of tangible benefits per member for 2003 was £68.93 (Chart 2) compared with an average income from each member of £58.75, this does not include related staff and administration costs at Headquarters. The discount scheme, introduced in 2004, costs an additional 80p per member.

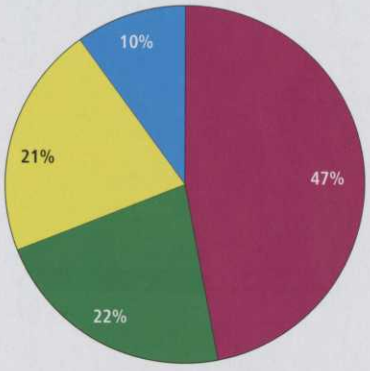


CHART 1 - INCOME ANALYSIS

- BTME/ClubHouse
- Membership
- Advertising
- Other

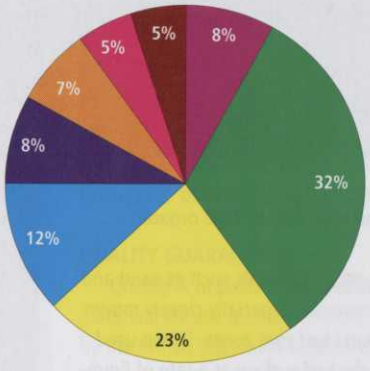


CHART 2 - MEMBER COST ANALYSIS (excluding headquarters)

- Accident Insurance
- Greenkeeper International
- Regional & Section Support
- Legal Help
- Courses
- Learning Materials
- Grants
- Directory

BIGGA welcomes...

SCOTTISH REGION

Paul Armour, Central
Neil Cunningham, Central
David Feeley, West
Colin Haldane, Central
Mervyn Hernaman, West
Steven Kelly, Ayrshire
Darren McKenna, East
Marc Millar, North
Fraser Munro, North
Mark O'Brien, Ayrshire
Kenny O'Donnell, Central
Michael Robertson, Central
Neil Smith, Central
Douglas Smith, East

NORTHERN REGION

Stephen Barnett, Sheffield
James Birch, North West
Neil Bishop, Sheffield
Andrew Boyd, North West
Tony Boyd, Sheffield
Matthew Butterworth, North West
Andrew Clough, North West
Gary Curran, North West
Steven Dudley-Brown, North West
David Edmondson, North West
Stephen Hesk, Norh West
Phillip Hind, North East
Matthew Keigher, Sheffield
Alan McMonagle, North West
John Moyses, Sheffield
Ryan Stirling, North West
Matthew Stone, North West
Thomas Story, North Wales
Jody Stroud, Sheffield
Craig Williams, North West
Jonathan Wilson, North West
David Womack, Sheffield
Adam Wrigley, North West

MIDLAND REGION

Leon Brant, BB&O
Chris Coles, Midland
Ian Favell, Mid Anglia
Thomas Harrison, Midland
Paul Kendall, East Midland
Brendan Kingston, Mid Anglia
William Lewis, Midland
Andrew Marsh, East Midland
Philip Oldham, East of England
Philip Pleasance, Midland
Ivan Simmans, Mid Anglia
Peter Smith, BB&O
Michael Smith, Mid Anglia
John Tomlin, Midland

SOUTH EAST REGION

Russell Bain, Kent
John Beamont, Surrey
Ian Boothby, London
Paul Brady, London
Danni Chandler, Kent
Paul Davy, East Anglia
Richard Edwards, East Anglia
Daniel Frost, Essex
James Gill, East Anglia
Glen Holman, Kent
Jason Hunt, Surrey
Justin Hunt, East Anglia
Alvin Huxen, Essex
Alex Keene, Kent
Paul Knight, Surrey
Jason Lock, Kent
Jonathan Marwick, Surrey
John McDonagh, London
Peter Millin, Sussex
Gary Moore, Surrey
Benjamin Scrivener, Essex
Warren Torch, Kent

SOUTH WEST/SOUTH WALES

Peter Brett, South Coast
Maurice Campbell, South Wales
Andrew Edwards, South West
Paul Escott, South West
Dave Escott, South West
Peter Fletcher, South Coast
James Hallett, Devon & Cornwall
Declan Healy, South West
Denis Jay, South Coast
Kevin Maher, South West
Adam Tunmore, South West

INTERNATIONAL MEMBERS

Niklas Denzel, Germany
Alan Hess, USA
Jonathan Jennings, USA
Jon Maddern, USA
Jim McGarvey, Canada
Jim Nix, Canada

STUDENT MEMBERS

Bryan Barkley, East Scotland
Paul Blann, Midland
Vince Clegg, Kent
Darran Johnston, East Scotland
Jose Piza, East Scotland
Stephen Ridgeway, East Midland

ASSOCIATE MEMBERS

Dave Axland, USA
Geoffrey Fall, Sussex

CORPORATE MEMBERS

Peter Butler, BB&O
Chris Camfield, BB&O
Geoffrey Medhurst, BB&O
Keith Thorne, BB&O

SILVER KEY MEMBERS

Richard Freeman, Essex
Steve Haynes, Surrey

GOLDEN KEY MEMBERS

Iain Booth, East Midland
Marcus Morris, North Wales
Gwynfor Preece, East of England

MAY'S MEMBERSHIP DRAW WINNER

Just introduce one or more new greenkeeping members to BIGGA and your name will be placed into a draw to win an 0.5 litre isolating flask suitable for hot and cold drinks and soups.

Our congratulations go to John Gubb from The Bedfordshire Golf Club.

Message of the Month Winner

Each month the person who has written the best message on the BIGGA Bulletin Board, which is found on the BIGGA website www.bigga.org.uk, receives an 18 litre Gelert Rucksack featuring a multi function organiser, 2 mesh pockets and a grab handle. (Rucksack supplied may be a different colour to that featured).

Our congratulations go to May's winner, Graeme Taylor from St Andrew's Links Trust whose message was posted on the 31st March 2004 under the 'Talk about Turf' section.

Course Feature

▲ Bill Payne

Glorious Goodwood

Scott MacCallum travelled south to meet Bill Payne, The Goodwood Club's Course Manager, a man with a lot to be happy about.

Bump into Bill Payne, Course Manager at The Goodwood Club, in Sussex, at the moment and there is a fair chance you'll notice either his Cheshire Cat-like grin or his two tails. If he also looks a little taller than you remember him perhaps it's because, if you look closely, you can see that he's walking on air.

Indeed, you wouldn't need to be Sherlock Holmes to spot that Bill is a fairly happy chap at the moment. The reason?

Well, the course is currently undergoing a complete make-over and having a serious amount of money spent on it. There are six brand new holes, a complete set of new greens, tee, fairway and bunker renovation and a new irrigation system to boot and while Bill is enjoying being a key man in the renovation process he can't wait to get his new improved course back so he can begin looking after it on behalf of the Goodwood membership.

"This is like having all your Christmas presents at once," said Bill, who also threw into the conversation that he had a complete set of new machinery and a new state-of-the-art maintenance facility.

The catalyst for Bill's current state of euphoria was the return of the golf course to the responsibility of the Earl of March at the end of its lease to Goodwood Golf Club Limited. The Earl took the decision to bring the golf course back into the fold of the Goodwood Estate which encompasses Goodwood House and its Park which holds the annual Festival of Speed; the famous Goodwood Racecourse , home of 'Glorious Goodwood ' every July; Goodwood Aerodrome, and the Motor Circuit, which hosts the Goodwood Revival each year. One of the more progressive thinking of the country's landed aristocracy, Lord March had a plan to create a unique leisure concept in an area already rich in tourist potential and the golf course fitted the plan superbly.

"It is Lord March's aim to raise the profile of the course and to make it the best downland golf course in the country. And it will be," said Bill, as he showed me around... oh yes, in his new company 4x4.

Bill has been at Goodwood for eight years and did feel that the course was in need of some investment.

"Being a 100 year old course it had been ticking along as old courses do. The irrigation had been in for 35 years and the members felt it would probably be there for another 35 years. A new mower would be purchased only when the old one had literally fallen apart!" recalled Bill.

That all changed when he was called to a meeting about two years ago and told of the plans for the course but he certainly didn't suspect that the transformation would be quite as dramatic as it has proven to be.

"I thought we might redesign half a dozen holes but the scale of the development became apparent during a series of presentations which were made to the existing membership of the club."

Howard Swan was the man chosen to undertake the design work and his plans have transformed the course.

"What the members have seen has made it much easier for them to swallow the bitter pill of disruption to their golf at the moment. They come up to me and say 'Bill, have you seen the new green on the 18th' or 'The new 2nd looks tremendous'."

One of the main challenges for Howard was the fact that the course was split by a very busy road. The car park is on one side of the road, as is the 1st hole and the bulk of the course, and the closing holes on the Clubhouse side. Bill's maintenance facility is currently on the same side as the Clubhouse.

"Every bit of kit has to be registered for the road, have a beacon and full lighting on it and be taxed which is a major headache while the health and safety concerns are considerable.

▲ It is a wonderful setting, note the race course in the top right

"That will be resolved with the rerouting of the course and the installation of a tunnel which will be wide enough for our machines."

The construction work has been carried out by John Greasley with the irrigation being installed at the same time by TIS (Scotland) Limited. The Leicester-based Greasley team and the Scottish-based irrigation installers live locally and work a fortnight on and a weekend off.

The irrigation system was designed by Bill Hawthorn, of 2iC, and he has also designed the irrigation for the rest of the Estate, a mammoth project bearing in mind the demands placed on it by the Racecourse and the huge numbers who attend the horse and motor racing events during the year. 2iC also undertook a GPS survey of the existing course, to provide accurate plans and elevations to Swan Golf Designs, and will update this for the new layout, including the new irrigation system, once all works are complete.

The course's system uses gravity rather than a pump and runs from a 200 cubic metre tank on top of the Trundle Hill and Bill has nothing but praise for it, as he does for the work of both the Greasley and TIS (Scotland) contractors.

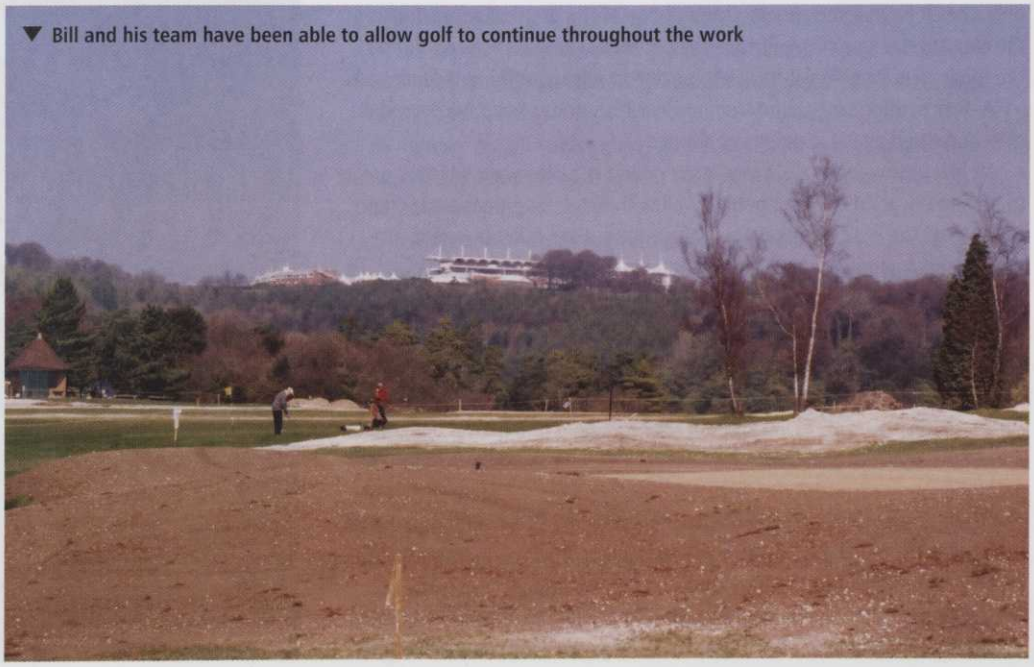
"Both teams have been absolutely superb. I think they're getting on with it as they want to go home,Ó he joked, as we watched a shaper expertly filling in a narrow drainage ditch in one of the new greens.

Bill works closely with Club Secretary, Stephanie Sherlock, Trevor Michie, Greasley's Project Manager, and Neil Porteous, of TIS (Scotland) , who all sit down every Tuesday and plan the week ahead.

"That in itself is a major operation as the biggest challenge has been to keep people playing golf.

"As you can imagine my diary has been stuffed with notes saying which hole is shutting and where we need to put in temporaries. Right at the beginning we had an overall Plan A which I worked out with my Deputy, Steve Smees, showing where we would be putting temps but, of course, what happens? There is a new bunker going in there or an irrigation pipe so you can never be too sure what's going to happen," said Bill.

▼ Bill and his team have been able to allow golf to continue throughout the work



▲ A John Greasley shaper shows some great control

▲ All the greens have been redesigned and rebuilt

In fact they put two temps on to each hole so for example they have 13A and 13B and 14A and 14B .

"It means that we can shut down two holes completely and bring in, for example 13B."

But with the co-operation of the membership it has worked out well.

"We had to shut part of the 4th to allow fairway irrigation to go in. There was an open trench and we had to get the golfers to go round one half one day, fill it in and turf it and then let them go round the other way the next day. In fairness TIS are used to working that way."

The total work project amounts to six complete new holes - the 1st, 2nd, 3rd, 16th, 17th and 18th while the rest of the holes have resculpted fairways, new tees, three or four times the size of the originals, and every green rebuilt .

"The greens are all re-designed and re-constructed with new drainage systems while we've also got 77 new bunkers. It's fairly major work," he said, with a degree of understatement.

The course has always drained well and golf is genuinely a 365 day a year pursuit while Bill and his team are getting ready to the challenge of maintaining the course to a standard befitting the work that is being carried out and expected by anything which carries The Goodwood Club label.

Goodwood is an extremely interesting site in more ways than one. Not only does it have some superb views of one of the prettiest race courses in the country it is also of significant archaeological importance and during the work an archaeologist has been on site to ensure nothing is damaged.

A deer herding compound from ancient history has been uncovered on the course and as Bill is quick to point out,

"It has always been a nice walk but now it is a nice walk which is going to be a really good game of golf as well with excellent greens and superb bunkering. The old bunkers were in the wrong place and the wrong size and even I could hit over them," he admitted.

Goodwood also boasts a fine golfing history having been originally designed by James Braid and being the venue for Bobby Locke's first ever European game of golf. Apparently, if the plaque on the Clubhouse wall is to be believed, his opening tee shot was nothing to write home to South Africa about.

Listening to him you can't help but be carried away by his enthusiasm and drive.

"How could you not be driven by something like this. I've found myself drawing on new skills I didn't know I had in me. It's been the best thing, it really has. I was definitely more hands on before but now I've taught myself computer skills and emailing while my record keeping is much more accurate," said Bill, who now attends meetings with the other Goodwood Estate managers instead of a traditional Green Committee.

"There are over 200 people working on the Estate. I will soon have a staff of seven and am enjoying being part of a larger, professional team. I'm about to give a Powerpoint presentation on the progress of the work to the other managers."

I'm sure that if the enthusiasm he showed during my visit is replicated during his presentation he will have even the non-golfing Goodwood managers itching to get out onto the course.

▼ The new tees will make a huge difference

SOIL VARIABILITY ON GOLF COURSES: THE CASE FOR BETTER INFORMATION

By Van Cline, PhD, The Toro Company, Minneapolis, USA

Soil is the foundation of all forms of agriculture. There are a few exceptions, such as the hydroponic production of certain vegetables, but by and large the quality of the soil in which a crop is grown determines the yield and quality of the product.

Turf is no exception. The product course managers and greenkeepers strive for may be different compared to other crops. Quality and consistency of the turf surface are the criteria against which greenkeepers are judged instead of yield and produce quality, but the role of soils in the production of turf is just as important.

QUALITY SOILS COMBINED WITH SOUND MANAGEMENT PRODUCE QUALITY TURF

Soil quality on golf courses is often less than optimum. Soils are considered less important in the overall function of a golf course compared to other forms of agriculture. In golf the focus is on the overall quality of the landscape and on the experience of playing the course.

The connection between soil and turf quality is not made as strongly as with other crops. Golf holes are designed and built to make the game challenging and interesting. The aesthetic quality of a golf course is central to the overall experience. Golf courses are often considered works of art like other designed landscapes.

But the process of building a golf course can be damaging to soils. Typically, large volumes of earth are moved to create the right experience. Topsoil is stripped off and stockpiled, landforms are created through cutting and filling and the topsoil is reapplied and graded.

The construction process can dramatically alter the original soils on a site by destroying structure, creating compaction in the rooting zone and in subsoil layers, and generally disrupting natural processes that keep soils healthy.

Following construction, routine management practices combined with traffic from golf carts and foot traffic exert significant stress on soils. In addition, the use of a variety of chemicals and the tendency to over-water, keeping the root zone wet, can alter microbial processes critical for sustaining soil health.

Treating soil problems on golf courses is difficult since soils under turf are less accessible and are more difficult to modify compared to other agricultural soils. Since turf is a long-term perennial crop, soils are exposed only during initial construction or renovation.

Most agricultural soils are exposed every year or every few years, making cultivation or modification easier. In addition, what's judged as the product of the greenkeeper's efforts, a uniform, consistent, high quality surface, discourages any activity that disrupts the turf. Dealing with soil problems in turf management is a major challenge.

An added complication related to soils is the issue of variability in factors that influence fertility, aeration, water-holding capacity, drainage and susceptibility to compaction. Soil texture, or the relative amounts of sand, silt and clay, and stable soil organic matter strongly influence these qualities.

A knowledge of how soil conditions change across a golf course is central to a greenkeeper's ability to efficiently apply irrigation, fertilizers and cultivation treatments such as aerification.

Because turf is a perennial cover, the ability to see differences in these characteristics based on soil colour or other visual clues that are often used to judge variability in agricultural fields is limited.

With increasing pressure to reduce overall inputs of chemicals and water, and to manage labour and equipment more cost effectively, golf course managers and greenkeepers need more detailed information on how soils vary across their courses.

All things considered, the importance of maintaining healthy soils is indisputable in growing healthy turf. But greenkeepers are confronted with a range of soil problems brought about by the way golf courses are constructed and how the golf turf is used and maintained.

The inability to get at soils under turf only complicates the issue. And the increasing importance of efficiently applying water, nutrients and other inputs that are affected by soil conditions increases the importance of detailed soils information that is rare in the industry.

A study is underway at The Toro Company to analyse and map soils on a variety of golf course fairways to gain a better understanding of the inherent variability in conditions that typically exist.

Toro's specific interest is in the efficient control of irrigation in response to increasing pressure to conserve water in golf course management. Understanding soil variability in detail is a key to this objective. Significant variation in soils is assumed to exist on golf courses, but very few have detailed soils information quantifying this variation.

Therefore the objective of the study is to quantify soil variability in order to better understand how changes in soil conditions across large areas such as fairways affect turf management practices.

A number of golf courses have been chosen for mapping and they represent a range of several factors that ultimately have an affect on soil conditions, as follows:

1. **The amount of disturbance during construction**
2. **The amount of topographic and corresponding soil variation indigenous to the site**
3. **The age of the golf course**

The assumption is that soil conditions on a course are influenced to a significant degree by these factors. For example, a course built on undulating terrain and modified little during construction would be expected to have considerable variation in soils corresponding to patterns native to the site.

On the other hand, a course whose soils were heavily modified from grading during construction may have less variation in surface layers due to the homogenizing effects of stripping and reapplying, but may have significant differences in the subsurface layers resulting from cutting and filling.

The results presented here are from a single fairway on an 80-year-old golf course in the upper Midwestern United States, illustrating the significant variation in soil conditions that can exist from undulating terrain that was modified little during construction.

Midland Hills Golf Course is located in Roseville, Minnesota, in a naturally rolling and intermittently wooded landscape. The original nine holes of the golf course were built in the 1920s with the second nine added in the 1950s. Minimal earth-moving was done during construction of the fairways, taking advantage of the rolling natural landscape.

▲ Aerial view of the 14th fairway at Midland Hills Golf Course

▲ A view of the 14th fairway showing its undulating terrain

As a result, the existing topography and soils are assumed to reflect original conditions. The native soils for the Midland Hills' site as described in the United States Department of Agriculture Soil Survey of Washington and Ramsey Counties, Minnesota, are made up of the Mahtomedi-Kingsley complex (loamy sands), the Hayden Series (fine sandy loam) and the Duluth Series (silt loam), all derived from glacial till.

Soils were sampled on a 9m grid to a depth of 45cm in 15cm increments (0-15cm, 15-30cm and 30-45cm). A portable GPS unit was used to record location data at each sampling point for mapping purposes.

Soil texture was analysed in the Toro agronomic laboratory using conventional methods and recorded as percentages of sand, silt and clay. Organic matter content was also analysed in the laboratory using standard methods.

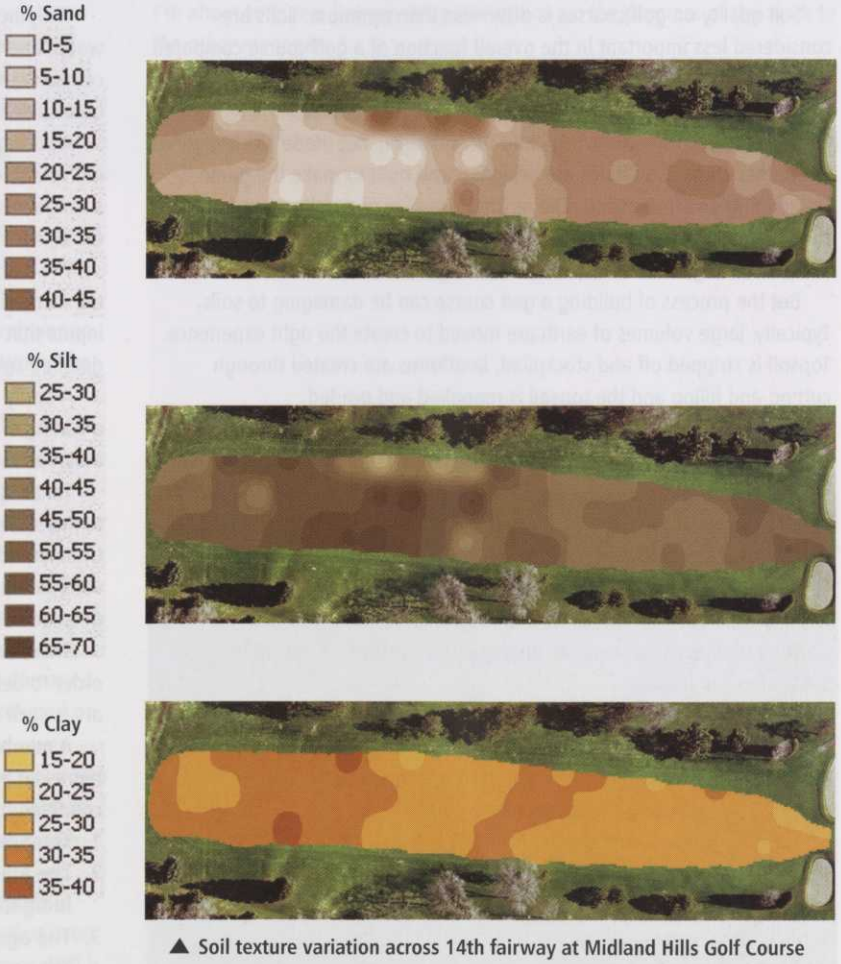
Soil compaction was measured on site using a hydraulic penetrometer. Compaction was quantified as resistance to penetration in psi at 2.5cm increments to a depth of 45cm.

All mapping was done using GIS software (ArcGIS Desktop version 8.3.0 with Spatial Analyst Extension). The maps shown here for the 14th fairway at Midland Hills illustrate variations in each factor using a colour gradient. Only maps for the top 15cm are shown since this layer represents the rooting zone.

Soil texture in the top 15cm was generally classified as silty clay loam. There was considerable variation across the fairway in each component. Sand ranged from approximately 5 per cent to 40 per cent, silt from 30 per cent to 65 per cent, and clay from 23 per cent to 38 per cent. There was a two-fold difference in organic matter in the top 15cm ranging from 3 per cent to 6 per cent.

Soil texture corresponded to topography to some degree, with heavier soils concentrated in a major swale through the middle of the fairway and coarser soils concentrated on high points and in a flat area of the fairway nearer the green.

Soil compaction varied across the fairway surface as well as by depth. The greatest levels of surface compaction



▲ Soil texture variation across 14th fairway at Midland Hills Golf Course

▲ Organic matter variation across 14th fairway at Midland Hills Golf Course