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As sure as night follows day, greenkeepers can expect those bare areas which have received harsh treatment in the latest of several drought summers – areas shredded by spiked shoes, slashed by hackers and pounded by pull-carts – to turn in winter to a sea of glutinous mud, taking merciless and seemingly irreparable extra punishment and, no matter how skillful the renovation, effectively transforming them into 'no-go' areas.

Of course, the pundits will tell you to re-route, to ban pull-carts, even dare to suggest the use of that dreaded golf apology – the temporary mat. But nothing short of dynamite will stop the lemmings, who will always follow the shortest route, pacing and posturing like pro's once they arrive. It is feet, clubs and wheels which cause golf course damage, aided and abetted by sun, wind, rain and burrowing animals. No course is totally immune.

Seeking remedies, I've turned to the wizards of modern technology for information of the ingenious systems which will provide more than mere temporary relief. Greenkeepers can be assured that help is at hand: there is a better answer than banning winter golf altogether!

To begin, I asked Tim Fell to expand on the use of Tillers Fibreturf, which I knew had won approval in the soccer world and which Walter Woods had specified on the Old Course at St Andrews. Tim commented:

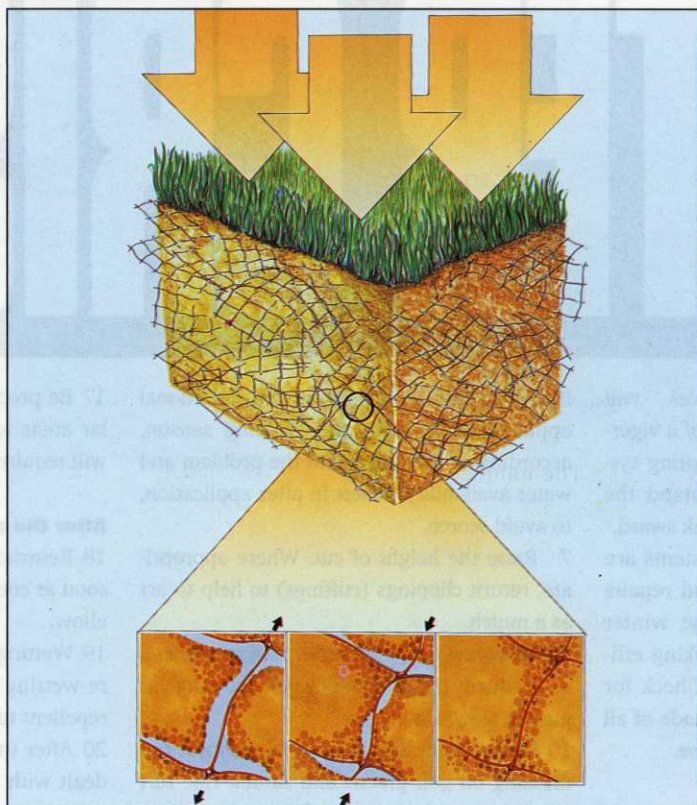
"Healthy roots are the key to healthy plants. Compaction and divoting are two common factors on golf courses which act to limit root growth, leading to poor quality turf-grass surfaces. The objective of rootzone reinforcement, as far as turfgrass quality on tees and aprons is concerned, is to reduce compaction and divoting. In other words, we're in the business of root protection.

Rootzone reinforcement will not prevent the temporary destruction of leaf on the surface under severe wear. What it will do is protect the root mass underneath and retain soil structure, so that regrowth is rapid. Roots will suffer when the rootzone is compacted because the air has been squashed out – and roots need air to survive. Divoting causes physical destruction of roots by shearing. Sports rootzone reinforcement systems should, therefore, aim to address these two problems.

In the development of Fibreturf we decided to copy nature by mixing polypropylene fibres (artificial roots) into the rootzone. The fibres themselves are 35mm long, and



Erosion problems at Sceptoft Golf Club. The pictures show the appalling state of a high wear area and VHA carpet being installed below the surface, through which natural grass will grow. Photographs courtesy of Notts Turf



As the turf is trafficked, mesh elements flex to create and maintain air voids around the Netlon filaments. The flexing action ensures that the rootzone remains healthy and does not suffer from soil compaction

similar in diameter to grass roots. There are approximately 80 million fibres per cubic metre of rootzone. Polypropylene is not affected by rain, sun, fertiliser or herbicide, and is therefore rot resistant and very long lasting.

Soils become weak when they are wet. Weak soils are prone to compaction, and that is why a free-draining rootzone is essential to maintain sportsturf quality. The use of high proportions of graded sand in rootzone mixtures gives the required drainage characteristics, but sand has the inherent disadvantage of lacking structural strength. You only have to grab a handful of

dry sand to see what I mean. The result of this structural weakness is most easily seen on short hole tees where divot damage from irons can be severe. The three-dimensional structural effect of the fibres further enhances the ability of the rootzone to resist compaction.

The fibres in Fibreturf physically prevent the club blade digging into the tee surface and chopping out deep divots. By retaining the root crowns near the surface of the rootzone, regrowth from surface scarring is rapid.

Rootzone reinforcement generally gives a very firm surface, even under wet conditions, and load

bearing characteristics are greatly increased. This feature is being used to good effect on heavily used paths and tracks on golf courses. Fibreturf is currently being installed on the pathways between greens and tees at the new Moatlands Golf Club, Kent.

Fibreturf has proved itself in football goal mouths – probably an area of sportsturf that gets more wear and tear than anywhere else. Alan Ferguson, grounds manager at Ranger's Ibrox stadium, has found that Fibreturf has given him flat, dry and clean goal mouths throughout the season. For a town that gets 40" of rain per year, most of which falls in the football season, Alan feels that Fibreturf has performed exceptionally well. By the nature of reinforced rootzones, they are more difficult to handle than normal rootzones. In particular, getting a good level on tee surfaces can take a long time. I have always felt that the use of these materials would be restricted until an easier way to handle them had been found. It is, therefore, good news that we have found that the BLEC rotary sander gives an excellent finish to the tee surface in a very short time".

I well remembered the enthusiasm Woburn's Neil Whitaker displayed when showing me his Netlon tees last January. I'd also seen a very convincing demo at Stoneleigh, so to get the technical low-down I turned to Gordon Rolph, Netlon's national sales manager. He provided this information:

Netlon Advanced Turf is a patented rootzone system which gives vastly improved resilience, durability and health to natural grass. It consists of thousands of small pieces of polypropylene mesh, the size of playing cards, randomly blended with a selected rootzone media to form a deep, anchored root system. This stabilises and reinforces natural turf, leading to

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reduced divoting and a much greater resistance to heavy usage, whilst damage recovery time is halved. As a result, a top quality playing surface is possible year round. The unique properties of the mesh elements resist soil compaction. Problems such as black layer and poor infiltration are significantly reduced and the need for deep aeration is virtually eliminated.

The benefits of this system are being acknowledged by greenkeepers worldwide – particularly in the USA. Indeed, it was here in 1984 that the potential for the mesh system was first recognised by Dr James Beard of Texas A&M University. Dr Beard's studies commenced in 1985 and identified a number of important properties, including damage resistance, accelerated damage recovery, increased infiltration which is maintained long-term, enhanced moisture retention and greater ball bounce consistency. After four years of monitoring plots, Dr Beard identified the 'self-cultivation' action unique to Netlon Advanced Turf rootzones. He found that when the turf is compressed, the mesh elements act as thousands of springs. This flexing resists compaction of the soil and ensures aeration to the full depth of the rootzone – leading to a healthier, more resilient turf. The research at Texas A&M has been continuous over a seven year period and the latest work has demonstrated the benefits of mesh elements in a wider range of rootzones.

The improved playing qualities and enhanced infiltration rates have been confirmed by studies carried out by Mike Canaway of the STRI. Netlon are currently funding further research by STRI, specifically related to golf applications.

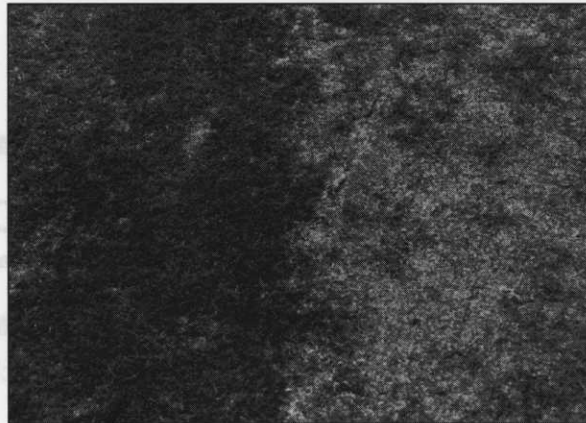
Meanwhile, a three year research project at the University of Strathclyde found that Netlon Advanced Turf's reinforced rootzone greatly improves load-bearing capacity. The increased strength was shown to be due to the interlocking of soil particles into the mesh apertures to form a composite reinforced soil. A full range of tests showed that the system can successfully support heavy loads, such as large vehicles; and resists deformation such as rutting. The research is continuing, investigating the damage resistance of various constructions which incorporate Netlon mesh elements in a USGA rootzone soil.

Many courses in the UK have already installed Netlon Advanced Turf on tees, pathways and greens. Apart from offering a consistent playing surface, it is proving particu-

larly useful on problem areas which receive heavy usage or are in the shade.

For example, at King's Norton, a badly worn walkway between the first green and the second tee had become an eyesore. After it had failed to respond to re-turfing, draining and spiking, Netlon Advanced Turf was installed. The walkway has now withstood sixteen months of heavy usage and is still in great condition. Plans are being made to extend the system into other worn areas.

Meanwhile, at Barnham Broom, Netlon Advanced Turf has been installed on four of its hardest worked tees. "Wear has been reduced and recovery time is much quicker," reports Brian Lemon. "My staff no longer have to spend time on spiking, slitting and tining the relaid tees. Members have also commented on how the tees have remained level and easy to drive from, despite heavy wear throughout the winter."



Snow mould and general distress coming to an abrupt end where Tildenet has been laid

Netlon Advanced Turf is clearly a very effective system. In the words of Dr Beard: "The bottom line is better turf rooting, more healthy turf".

The more I looked into the field of turf reinforcement and erosion control materials, the more optimistic I became. For more than a decade greenkeepers have tried laying down PVC matting that looked like green chain-link fencing, on or just beneath the surface of hard-pressed areas, with minimal success. It was, if anything, only marginally better than nothing at all and did little to convince the greenkeeper to continue with such products. But as has already been seen, hi-tech is on their side and one such new development is the Notts Turf VHAF patented system, an erosion control system that has brought forth enthusiastic endorsements. Here are T H (Bert) Patrick's comments, along with some interesting statistics:

Several products have been introduced into the golf course business,

but as yet none has caught the imagination of the game to the extent that Clubs are prepared to tackle the problem by investing hard cash. A number of British companies have spent large sums on R&D during the past decade into soil stabilisation, though the golf world has been slow to take these products on board compared to other sports and areas of environmental importance.

To fully understand the need for market research in golf with regard to problems of erosion, particularly over-trafficking, it is necessary to see how the game is developing. Unlike most other sports, golf attracts a wide spectrum of players, all with different requirements.

Golf, contrary to the image that it is a game for the better-off and the elderly, now caters to an age group averaging out at 26.6 years, which is much younger than the former age of the regular golfing population of 40.2. Much of the present demand comes from the new, inexperienced golfer. One can identify

around 4 million potential users of pay and play courses - those you will spend £10-15 per round. Even if only 20% of these were to play 20 rounds per year, that would fill a further 320 courses to capacity, assuming that one course can only cater for around 1000 regular players.

Many local authority planning committees are dealing with an avalanche of planning requests for golf facilities, of which a good percentage are on hold because of the recession and high capital costs of development. This is placing great extra strain on existing facilities and thus a major reason for erosion deterioration on heavily trafficked areas by golfers. No one likes to walk a course which is littered with erosion black spots.

In football there has been much press comment on the state of some pitches, which mid season resembled mud heaps and obviously give concern to the authorities. The

League Pitches Committee gave consideration to a variety of products and asked the STRI to carry out trials. Jeff Perris, the Institute's assistant director, believes that whilst there have been significant improvements during the past 25 years, there are problems of goal mouth and centre spot erosion, along with linesmen's tracks. Of the products tested by STRI, Perris has told the League Committee that the Notts product, VHAF, was ahead of others. Notts Sport VHAF was installed at Luton Town's pitch when the synthetic grass was taken out last summer. It has been used on the heavily eroded Pennine Way and around the whole of Stonehenge. Unfortunately, golf has been much slower in getting its act together despite erosion problems and the example of successful applications outside the golf course.

Practically every course in the country is showing ugly patches of heavy wear and soil erosion. Bob Moreton of The Berkshire says that from his experience heathland and links courses in particular suffer badly from erosion – "Once golfers have cracked the surface you immediately start to lose soil", he explained. Derek Ganning of The Belfry admitted there are areas on his two courses that always create a problem through heavy traffic and use. "The ground reinforcement materials offer an interesting way of repairing these areas", he said.

VHAF is a patented system that stabilises soil and sand particles using a fabric manufactured by the needlepunch process. This provides a three dimensional material which is flat on one side and the pile structure on the other. The direction of the fibres is vertical, horizontal and angular, hence the name VHAF. In turf culture VHAF can be described as a method of stabilising particles, particularly soils and sands, enabling a grass plant to grow within a medium which is supported by fibres. It offers protection to the lower portion of the plant, protects the root system from direct foot and other traffic and in certain situations it helps to conserve moisture below the structure. Above all, it stabilises particles.

Its greatest property is its ability to preserve an even surface which makes it suitable for a wide range of applications on golf courses. The system can be installed on level or undulating ground as well as banks.

It is best laid onto a prepared seed bed and after further seeding and top dressing, a healthy sward can be established. With the root system now protected by the fabric, most of the grass will recover after

damage, thus reducing maintenance by the green staff. Normal maintenance is required and the ground reinforcement material can be cut and spiked in the same way as unprotected grass.

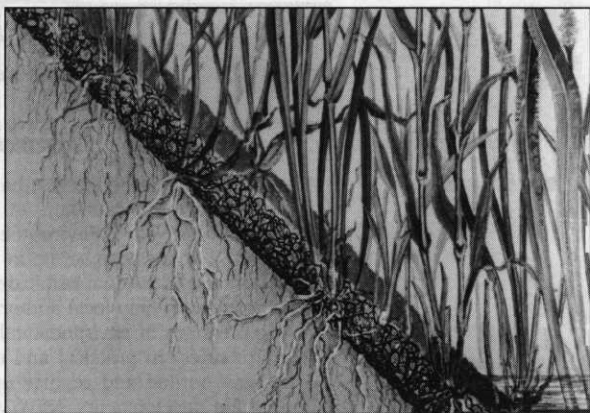
VHAF can be used either with a natural grass sward or as a synthetic turf, which ever best suits the particular need. Used as a reinforcement material, a grass sward is cultivated in the fabric creating a natural appearance. On the other hand, used as a synthetic turf, routine maintenance is eliminated which makes it ideal for replacing materials used on pathways or steps. In each case the VHAF fabric distributes the load caused by golfers over the soil structure below, enabling a true surface to be maintained even in the highest used areas.

Of course, all golf courses have their own peculiar attractions and problems and one such course, Golf du Pont d'Arbois in Megeve, spectacularly situated in the French Alps, has a reverse side to its coin, which is that the course, and more importantly the greens, are skied over each winter, taking months to recover from the damage.

The main agents of destruction are the tracks of the piste-bashers, the effects of compaction of snow under the constant pressure of skis, and, not least, snow-mould, a disease which damages grass, leaving unsightly bare patches.

After such punishment re-seeding is often needed, for until new grass has been grown, the course is unusable. This was a situation with which the Bristol-based company Tildenet found itself ideally equipped to cope:

Tildenet's products are used in a wide variety of ways. In sport they have been found particularly valuable in protecting playing surfaces against frost – the majority of Scottish Premier League soccer clubs use it successfully, as do Leeds United, Chelsea and West Ham, while the



Detail showing bonding of Enkamat to the soil with the vegetation's root system

Rugby League now recommends it.

An equally important use is as an accelerator of seed germination. In this area cricket groundsmen, whose pitches take a tremendous hammering from spiked boots, have found Tildenet a vital ally, among them Mick Hunt and Roy MacLaren, head groundsmen at Lord's and Worcester respectively.

When Golf du Pont d'Arbois agreed to a demo of their product on the golf course itself Tildenet recognised the size of the challenge. The versatility and all-round capability of the matting would be under the microscope: its ability to protect turf from frost, snow and regular pounding from skiers and piste bashers; followed by proof of its power to accelerate germination significantly. The results of the test were extremely impressive.

Tildenet use matting of specific gauge and weave which not only doubles the speed of germination but also ensures evenness of growth by protecting newly-seeded areas from the effects of wind and the attention of birds.

With the recovery period now reduced by up to two months, Alpine clubs can expect significant financial gain, for possible playing and earning capacity has been increased by 25%.

The problems confronting Tildenet at Bidford-on-Avon, where a new course is being constructed, were very different. Here, difficulties were being caused by a combination of light, sand-based soil and prevalent strong winds. Though the greens were sown last autumn, there was scarcely any growth, due to the wind which continually

whisked away seed and soil together. In this case the dual qualities of Tildenet Germination Sheets were immensely effective. The laying of the mat over the seeded area provided vital protection against the effect of the wind and predators. At the same time the periods of germination was being greatly reduced, helping to make up time lost over the winter. Head greenkeeper, Dave Hemming informed that the period between sowing and first mowing was only 10 days.

Successful as these operations have been, Tildenet seek to improve and modify their range of products, and to this end they work closely with the STRI, whose confirmation of the efficiency of different types of matting by scientific testing has proved invaluable.

Finally, I talked to Mike Cooper of MMG Civil Engineering Systems Ltd, a company which specialises in reinforcing 'difficult' areas such as steep slopes, ponds and river banks. I was reminded of the collapsing tee at Muirfield, caused by rabbits burrowing. Mike talked of the specific use of geotextiles in golf by saying:

"Geotextiles specially developed for turf reinforcement offer greenkeepers plenty of opportunities to use environmentally acceptable products to overcome many of their soil erosion problems in a cost effective and often very straightforward manner.

When light duty turf reinforcement is called for, perhaps on steep slopes, road bunkers or in ponds or watercourses experiencing low flow velocities, Enkamat three-dimensional polyamide matting can be used. Enkamat is designed to

encourage strong grass growth and together with the roots it acts as a permanent and natural protection against erosion.

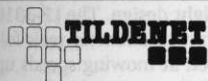
In locations where grass establishment may prove difficult, or where a Club may prefer an immediate natural green appearance, pre-grown Enkamat reinforced turf - Enkazon - can be installed. Since Enkazon is grown to order it gives the greenkeeper the opportunity to be involved with the selection of the grass seed mixture best suited to his application.

Banks of rivers, lakes and watercourses that experience strong water action can best be safeguarded with heavy duty Enkamat A. This is a special matting that is factory filled with bitumen bound gravel, thus giving good protection both below and above the waterline. Surfaces are pre-seeded before the installation of the matting and a full natural grass growth is readily achieved through this permeable material.

Most geotextiles are light, clean and easily to handle and installation is very simple using unskilled labour and readily available tools. The Enkamat has no nutritive value and its tangled structure is unpleasant to small mammals, therefore, areas of reinforced turf will act as a strong deterrent to burrowing animals and rodents who, in themselves, can often cause extensive damage.

The stabilisation of steep slopes, cliffs or earth walls can also be achieved using various different geotextiles and the suppliers of Enkamat, MMG Civil Engineering Systems Ltd., complement its product range with design advice and field support to maximise the benefits of their geosynthetics".

● **The editor acknowledges assistance in preparing this feature from Tillers FibreTurf (0652 650555), Nettleton Limited (0254 262431), Notts Sport (0533 720222), Tildenet (0272 669684) and MMG Civil Engineering Systems Ltd (0553 617791).**



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