



October 1990, pre-construction: a view looking north over Hetton from top of shale heap. Part of the heap is still visible on the left. Below: work in progress showing red and black shales in heap and stored topsoil pile in background

posed Great North Forest the perfect choice was to combine a new area of woodland with a variety of recreational activities, golf being one of the main amenities to be provided for.

The Great North Forest is one of the country's leading environmental initiatives, a partnership of several bodies and organisations including The Countryside Commission and Forestry Commission, Sunderland City Council and other local borough and district councils. Now two years old, the venture has already achieved the planting of the first 100 hectares of trees and wild flowers and has managed to raise awareness of the project by actively involving schools and community groups in their substantial events programme. Being committed to this project, and with the cost of tree planting adequately covered by Forestry Commission grants and the Government's Derelict Land Grant, the council has allowed for 13 of the Elemore site's 55 hectares to be planted with trees. Integrated with the planting will be a network of footpaths and bridleways providing important links with already established long distance walks.

This combination of benefits in providing a golf course on the site – the improvement of the environment alongside the provision of much needed mixed recreational facilities – was reinforced by the financial facts of undertaking the work: Central Government provides a 100% grant for reclamation works; tree-planting grants were assured; they have applied for a grant from the Sports Council for developing the golf course. Once in play as a municipal course the council stands to make good profit on the use of the amenity. They also had the option of selling it off to a private developer, although this defeated the object of providing a golf course for the community and has been rejected.

A year ago last January, work started on the major job of regrading the spoil heap to create a new landscape.

One pressing reason for getting the works underway as soon as possible was that with each bout of



heavy rain some of the houses on the south side of Hetton bordering the site were flooded due to the great amounts of run-off from the spoil heap. The flooding is an indication of just one of the particular problems very specific to the reclamation of colliery sites, namely the nature of the material, coal shale. It is a very dense material, impermeable and subject to compaction and therefore has a low water holding capacity. During the large scale reclamation works, heavy machinery can exert over 70lbs of pressure per square inch causing a surface density higher than that of an asphalt road. On top of this, the compaction limit beyond which grass roots will not grow is easily reached under the wheels of a box scraper.

So the design of the new landform, onto which a golf course layout would be drawn, tried to take account of this characteristic and directed water by the use of careful featuring and mounding away from south Hetton and into a balancing lake which would act as an irrigation source and a strategic feature of play.

The shifting and reshaping of the spoil has been no mean feat. Since the work started in January 1991, 500,000m of material have been moved by the experienced local contractors Andrew Golightly Ltd of Shildon, County Durham. The main colliery spoil heap to be regraded consisted of fragmented burnt, par-

tially burnt and unburnt red and grey shales. Some areas of combustion were in excess of 100°C making handling rather difficult. The bulk of the material was shifted by Caterpillar D8's with box scrapers and Caterpillar 837 box scrapers weighing over 50 tonnes each but with the high temperatures in parts of the shale heap the machines had to keep moving to avoid their tyres melting. Golightly's can console themselves that they avoided this expensive loss and that none of their machines were swallowed up altogether, as it has been known for burning shales to disintegrate and completely engulf a machine working on them!

'A year ago last January work started on the major job of regrading the spoil heap to create a new landscape'

Another problem was caused by large amounts of dust created by the movement of materials during spells of dry weather which upset local residents in the housing estates adjoining the site. To counteract this as far as possible water bowlers were used but it was difficult to eliminate the annoyance altogether.

At the planning stage, careful consideration was also given to the areas chosen for spreading the burning materials and the position of the balancing pond as part of the site as an area of nature conservation interest. The Nature Conservancy Council identified three areas adjoining a small stream on the western side of the heap which are particularly noted for acid grassland with gorse and hawthorn scrub which repre-

sent the best and largest example of a rare habitat within the County of Tyne and Wear and this area has been carefully incorporated into the golf course design.

Such were the main physical problems encountered but the chemical problems related mainly to the establishment of vegetation on the site. The most important factors limiting plant growth in most types of colliery spoil are acidity, salinity and deficiency of nitrogen and phosphorus.

Acidity is more acute in the black shales, whereas red burnt shale is only acidic for short periods and is considered more fertile. It was therefore ensured that the red spoil was spread to create the upper layers of the landforms with the less fertile black spoil buried underneath. This acidity actually worsens with weathering so that, whereas fresh colliery wastes tend to be neutral or alkaline, on exposure to air and water acid production takes place and, over the years, the pH of the spoil falls.

Acid conditions down to pH 4.0 are not directly harmful to plants, but they can interfere with the uptake of phosphate and calcium causing infertility problems. Below pH 4.0, as was the case at Elemore, the acidity is directly harmful to plant roots and may result in aluminium and manganese toxicities. Alongside this action, as iron and aluminium become soluble, they 'fix' phosphorous making it inaccessible to plant roots. The presence of metal salts tends to increase osmotic pressure sufficiently to make it difficult for root hairs to obtain water.

To counteract the acidity and compaction, the landforms first underwent the process of 'deep rip-

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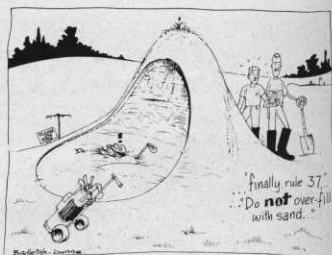
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More than

A good bunker is not a simple hole in the ground. If a bunker is to perform well in play, careful pre-planning and construction is essential: covering location; orientation; size; style; angle of face, cross sectional profile and provision for free drainage. However, before getting into any technical detail in planning, everyone has to ask a simple question - is any new bunker necessary or valid? Bunkers are expensive to build (a contract price in 1992 is likely to be £750 to £1000 each, plus sand), are time-consuming to maintain and are not vital to every golf course or every hole on a golf course. There are still a few good courses with no bunkers at all!

If though, after deep and careful thought, the decision is made to proceed to the next step, then consideration has to be made of exact location, orientation, size and style. Of the first three items much will depend upon how it is intended to control the strategy of play, and which group of players the bunker is intended to penalise.

There are management considerations to be accounted for too, especially how the new bunker will affect



flow of play through the green. Many a new bunker has been spoiled by a track of bare ground around, due to funnelling of play. Orientation will also have an influence on whether or not grass can be grown on the face of the bunker. This is often difficult if the face is steep and exposed to a southerly aspect.

Turning to style, there are lots of different ways in which to build a bunker, but methods tend to tie in with the special management problems of different types of golf course. At the seaside, bunkers tend to be deep and fairly narrow to help keep the sand in, though hopefully not so deep that the water table is exposed for long periods each winter.

REMOVING THE SCAR

ping' - which is the action of cutting drainage channels diagonally across contours - followed by the application of a 250mm layer of ground dolomitic limestone. The ripping process relieves compaction and aids the incorporation of the neutralising limestone. Deep incorporation also increases the permeability of the soil. On top of the limestone was spread a sealing layer of clay subsoil stripped from surrounding areas of low grade agricultural land and finally the topsoil layer was spread. The phosphate and nitrogen deficiency was treated at this stage by applying a fertilizer treatment and this was followed by a final application of powdered lime to counter the possible build up of acidity in the topsoil layer. By these methods the burning is gradually extinguished, the acidity is reduced enough for plant growth to begin and the site is ready for its 'fallow year' during which the vegetation and the new landforms will have the chance to establish themselves and take on a new permanence. That year begins about now as the contractor finishes off the painstaking job of stone picking.

Local people seem happy with their new pathways and the new surroundings. They are perhaps less happy with the fact that the steep sides of the lake prevent their dogs

from climbing out once they have gleefully leapt in after a stick! They have put up with a great deal but even at this early stage you can see it has been worth it. The City Council certainly thinks so now that the preparations for the golf course are getting underway. They have been very happy with the contractor and especially pleased to see that Golightly was prepared to undertake featuring and mounding work that would normally be part of the golf course construction. His willingness to do this extra shaping has saved Sunderland City Council a considerable amount of time and effort as an important part of the formation work for greens and tees has already been done. The Leisure Services Department will take over the remaining work of drainage and irrigation installation and final shaping in April 1993. They will be working under the supervision of Jonathan Gaunt, the golf course architect who has designed the course, a challenging 6,250 yard 18 hole pay-as-you-play.

There is still some way to go before work finally finishes and play begins in summer 1994 but the local community can already be well satisfied with the results of this reclamation scheme which would seem to amply justify others taking place or planned for the future.

● The author, Maja Mihajlovic, is a freelance journalist with a special interest in golf course architecture.

a hole in the ground

Revetting

Cutting deep into dune sand, or sometimes gravel, means that the side walls of a bunker will be unstable if unsupported. Hence the tradition of building turf walls brick fashion (revetting), packing behind mainly with sand, but using topsoil near the surface to give grass something to grow in around the bunker.

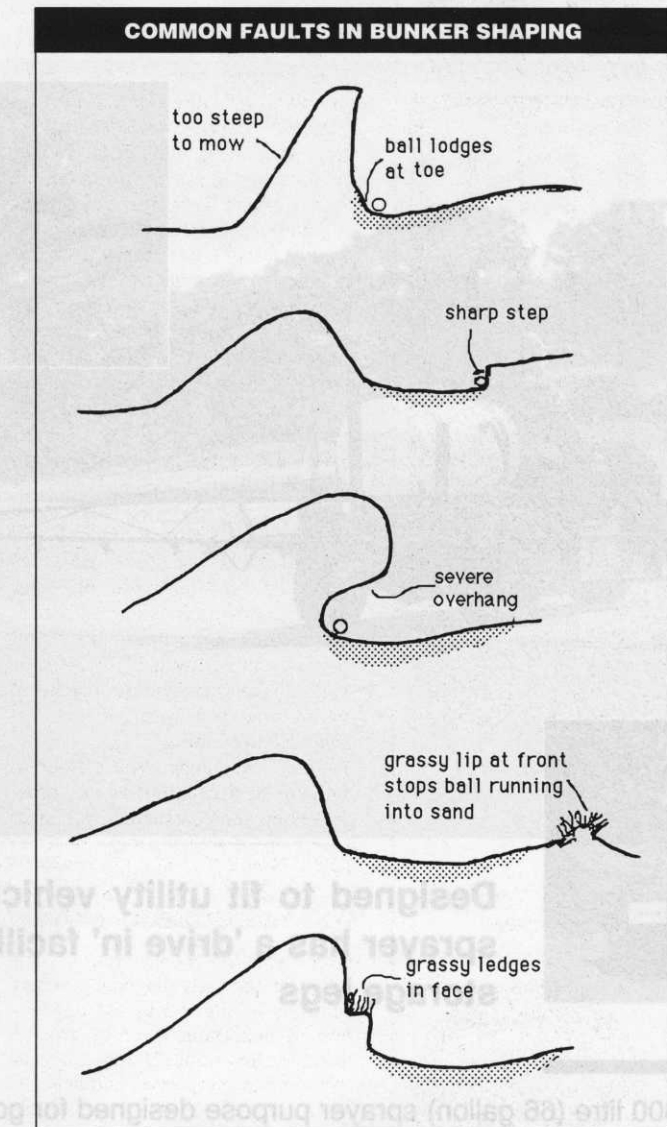
The turf used for revetting will generally come from the course, and comprise fine textured, very drought-tolerant species. So, when such fine, slow-growing turf is placed in an environment with minimal growing medium, it will knit up and survive but will not leave thick lush swards for frequent cutting on the faces.

Inland, the use of revetting can transfer well to very sandy or gravelly heaths, but is generally not a technique for parkland. The moister, richer environment, combined with the difficulty of obtaining turf of the right quality, means the faces become lush and clumpy, and the facing turf quickly breaks down under heavy management. It is worthwhile noting too that revetted bunkers which have been built inland tend to be over-steep on the sides and too flat on the bottom, giving impossible lies in the corners. Not very popular with members! Any steep-sided bunker must have a distinctly rounded floor and tight packing of the flooring sand, so that balls running into the bunker roll away from the margins.

The angle of face around the margins is created by stepping back each layer of the turf wall from a firm flat foundation, well below the proposed sand floor. The amount of stepping back will depend upon height and the desired angle, but no bunker wall should be less than 15° from the vertical. The entrance and margins of the bunker must roll down towards the sand, at an angle which will collect balls with a shape such that uniform mowing will be readily achievable. A sharp step from entrance turf to sand floor must be avoided.

Drainage

Whether or not pipe drainage has to be provided in a sand or gravel subsoil is debatable, and the need will vary from site to site. On other soil types, pipe drainage is essential, leading to a positive outflow. The pipe drainage must be set into the base of the bunker some 200-250mm below floor level as a drain trench or soakaway point, depending upon the overall size of the bunker itself. The drain excavation must be backfilled with suitable aggregate and then blinded, blinding generally with a geotextile mem-



brane of adequate pore size, well overlapped to each side and securely pegged into slits.

To help water run to the drain, the floor of the bunker must be shaped and solid, to facilitate rapid water movement through the base of the sand (minimum gradient, say, 1:50).

The overall design of a bunker on parkland should also be such as to minimise the amount of water running into the hazard from surrounding land, which could well mean shaping shallow rises of turf around (swales), but not so marked as to direct a running ball away from the bunker itself.

Parkland

On parkland courses, a heavier sand is used in bunkers, and there is usually less problem with wind blow, so bunkers need not be so deep as at the seaside. This avoids the need to cut deep into poor-draining loams, clays or silts – necessary even if pipe drainage is provided. At the seaside, bunkers

will be 0.5m below ground level or deeper. Inland, the sand floor level need be no more than 100-150mm below general surround level and need not be so rounded as a consequence.

So a minimum of excavation needs to be sought on parkland courses, and careful shaping is required to provide for a minimum depth of sand (say 100mm firmed), and to avoid accumulation of loose sand at the entrance and at the toe of the face. Up the face of sand-faced bunkers, only a skim of sand is required.

The constraints of these requirements means careful shaping of the subsoil after excavation, and again after placement, to form the face and leading bank (if appropriate), so the right depth of sand can be placed and maintained, avoiding future management problems, in particular plugging.

When shaping out bunker floors and leading banks, look for flowing contours which marry in with the general topography of the site.

Nothing looks more obtrusive than a sharp high hump sticking out of flat-tish land. Make the bunker look as if it is part of the landscape, and has always been part of the landscape.

The angle of face in a parkland bunker will vary from 1:1 to 3:1 dependent upon distance from the putting surface (the further away the more shallow the angle) and how far sand is wanted up the face. For a sand-faced bunker a gradient of 2:1 would allow for sand, say one third of the way up, and if higher sanding is required, so also is a more shallow gradient.

Geotextile Membranes

Should a geotextile membrane be used to cover the whole bunker floor, rather than just the drain trench? On unstable subsoils and very stony soils, this procedure is valuable, ensuring the right porosity of material, and that this is securely pegged beneath the surrounding turf and into the base of the bunker face. Never run the membrane up the face of bunkers though – it will just pull away. In such circumstances, particularly on stony sites, use turf to pin stones beneath the face and margins.

Elsewhere, in my view, the use of geotextile membranes should be avoided. They do tend to make the bunker sand fluffier than it would otherwise be.

Having shaped out a new bunker, fill it with good sand of approved grade – one which is known to work well. Inland, bunker sands are specified as a material with at least 75% of particles in the size range 0.25 to 1mm, free of grit, silt and clay. However, this specification is a basis for selection, not an absolute truth. Not all sands falling in with the above will be good bunker sands.

On parkland, allow for a minimum depth of sand of 100mm firmed, spreading in two 50mm layers, each trampled in wet to pack tight. Then just loosen the immediate surface and carry out raking to achieve a marry-through with surrounding turf. Up sand faces, a skimming of maximum 50mm depth should be aimed for. Post-maintenance must be geared to maintaining this uniformity.

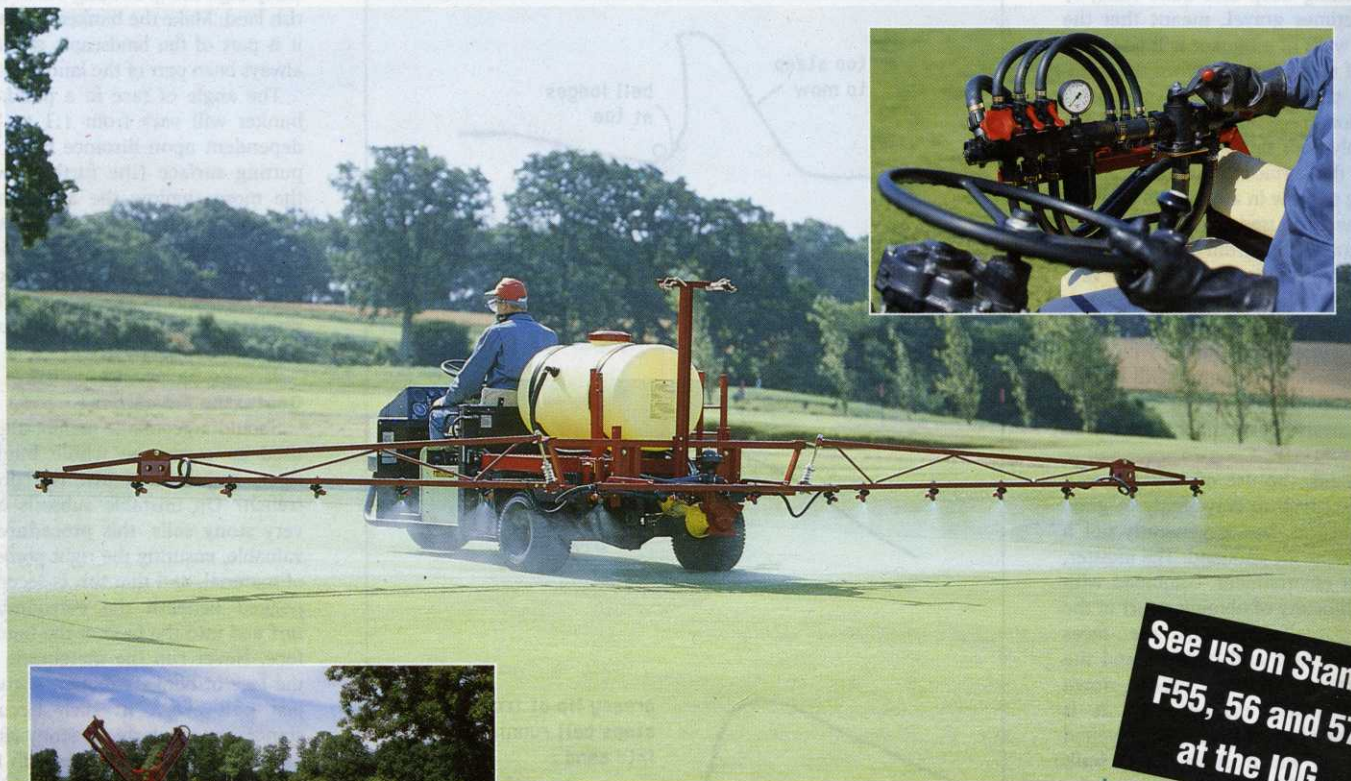
At the seaside, new sands must also be placed and packed tight, shaped to give a distinctly rounded floor. Use dune sand for preference, giving a step down in grading from that detailed above, so the sand will be predominantly within the range 0.125 to 0.5mm. A lime content is permissible at the seaside – but not inland.

● The author, David Stansfield, is a senior agronomist with the Sports Turf Research Institute.



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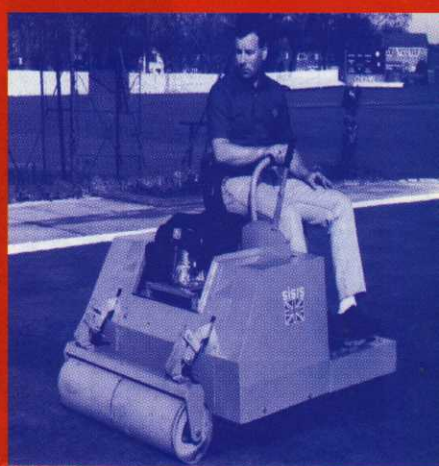
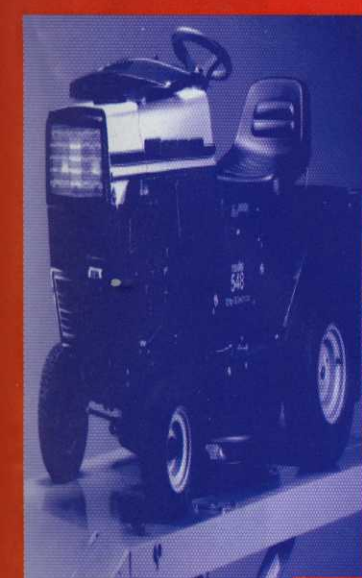
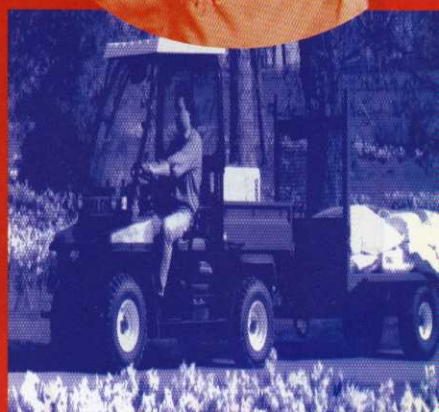
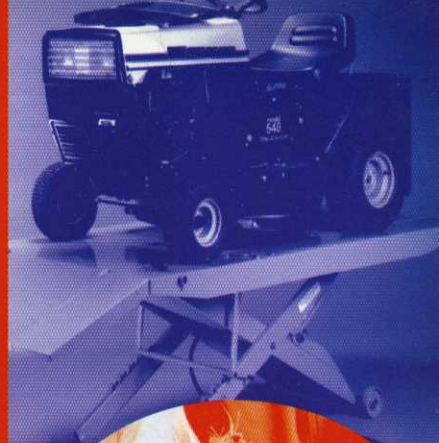
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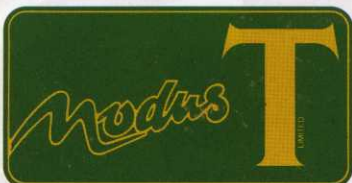
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● Bigger amenity range ● New sprayers ● Japanese collection ● Mules

Agriland has extended its amenity range since last year's show, so make a point of visiting them if you want to keep up-to-date with the latest in product development.

Agricrop liquid growth stimulant (which increases grass cover: STRI trials 1990) is now used nationwide and their Ferrogreen liquid iron (7.2% Fe, low N) has also achieved a premier position in the market.

The Classic range of liquid fertilizers, launched at the beginning of the season, has already proved a big success and the NPK plus calcium and boron product, specially formulated for light soils and sand constructions, is satisfying an important need.

As well as these leading lines, Agriland be showing their Multi-Purpose Wetter and two grades of seaweed meal soil conditioner.

They look forward to welcoming customers and friends (and competitors) on Stand K2-3.

Hardi Limited are launching their new AM range of sprayers created especially for the amenity and golf course market. These range in size from 200 to 800 litres in either de-mount, mounted or trailed form.

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Farm and Garden Machinery Ltd will be showing the Japanese Shibaura range of tractors and commercial mowers on stand G32-35. Shibaura have a world-wide reputation for building excellent products, powered by their own diesel engines. The range begins with 14-16hp ride-on mowers, followed by the 'S' series 20-25hp multi-purpose tractor with mid mounted deck. Shibaura also produce two out front mowers – with 22 and 27hp engines – both of which have unique features that are well worth a second look. The 33hp and 38hp tractors are both supplied with special turf tyres – ideal for use over fine turf and cultivated land.



New pneumatic lift from the USA with 450 kg payload

With the imminent implementation of the new Health & Safety Directives regarding manual handling of loads, everybody with a workshop has a reason to visit the **R+R** stand no H64, where a range of workbenches to suit all requirements will be on display. The 'Groundsman' range of foot-operated hydraulic workbenches for servicing mowers, ride-ons etc are the ideal tool for meeting the requirements of the new directive. However, these benches are not just a means of meeting the latest regulations. Nowadays no workshop should be without a means of raising heavy machinery to a safe & comfortable working height. Added attractions include the launch of a robustly engineered and keenly priced pneumatic lift from the USA, and a new, easy to

fit pneumatic kit for the Groundsman lifts. Prices start at only £399+VAT and all units will be fully up and running for demonstration.

In this, their Diamond Jubilee year, **SISIS** will have on display a large number of items from their range of more than a hundred sports ground maintenance machines plus several new machines to be launched at the show.

Of particular interest will be the Auto-Trugreen ride-on maintenance system

for all turf playing surfaces. The Auto-Trugreen has twin split rollers, both driven by a hydraulic motor axle from an 8.5hp vertical shaft petrol engine. This provides a smooth forward/reverse traverse with variable speed control. A range of optional implements is available, including an additional roller; spiker-slitter; brush; rake and sarel type roller.



SISIS Auto-Trugreen

Leading compact tractor specialist **Kubota (UK) Ltd** is showing a series of new machines at IoG '92. The line up includes a new out front mower, a collector system, a walk behind roller mower and, exclusively for Kubota's Glide Shift Transmission tractor, the L2550 GST, a new Duncan Cab.

From the existing Kubota range, the revolutionary FZ2400 ride-on mower is highlighted together with models from the ride-on mower and compact tractor ranges.

Kubota's industrial division will show the OC Series and Super 5 Series of diesel engines together with the GS and GH Series of petrol systems.

Quality outdoor power equipment from Dolmar, Fuji Robin and Powerman, will be central to the **Outdoor Power Products** display at IoG '92. The stand contact will be OPP's sales director Chris Hindle.

On stand J51-53 you will see Dolmar's state of the art clearing saws, the MS 3300 and MS 4000. These combine the advantages of modern technology with ergonomic design and have been developed for safe use by professionals. In addition, the range of Dolmar chainsaws will be displayed.

The Fuji Robin brand will be well represented by brushcutters and hedgetrimmers, all designed to the highest engineering and safety standards. Fuji Robin hedgetrimmers offer a petrol engine solution to those who need to cut hedges in locations remote from electrical power supplies, and the range of versatile brushcutters are available in engine sizes 16 to 51.7cc to suit all needs. Powerman products will include the premier Rotary lawnmowers.

Since its introduction, the **Kawasaki Mule** utility vehicle has succeeded in establishing a niche in the ground care industry, where its low ground pressure and integral tipping cargo bed make it ideal for carrying awkward loads across rough, boggy or hallowed terrain.

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Also shown will be the new road use conversion kit – which enables the Mule to be registered as an agricultural motor vehicle or works truck – and the Weather-break cab (designed for weather protection only, and NOT manufactured to safety cab standards).

**The
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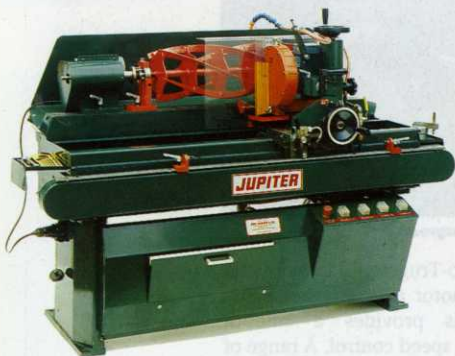
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The
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PREVIEW



Weather break cabs are now available for the Mule range

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Kawasaki's generator range and a selection of two and four-stroke petrol engines will also feature.

A wide range of machinery for sportsturf drainage will be on display from **Shelton Trenching Systems**. At IoG for the first time will be the Shelton Cambridge range of Sand Groovers and Surface Slitters – machines for improving surface drainage



The Shelton Sand Groover

The proven Shelton Supertrenchers have been further developed – digging trenches from 25-135mm wide and up to 625mm deep. Some have grading capability, and all have conveyors to ensure a clean surface finish.

The popular Shelton Gravel Band Drainer for trenchless drainage, and hoppers for placing gravel and sand in narrow trenches will be featured and David Shelton will be on stand PCS 2-10 to discuss sportsturf drainage problems.

Melcourt Industries, leading UK manufacturer and supplier of specialist bark and wood based products, will be exhibiting with a new bark mulch in addition to its full range of products for effective grounds maintenance.

Melcourt's new Mulchip is a further addition to the company's expanding range of economy mulches. Produced from a mix of wood chips, bark, chipped branches, needles, leaves and twigs, Mulchip has a rich dark brown colour which is formed without the aid of chemicals by special heat treatments whereby the humic acid generated during maturation colours the wood chip.

Similar in colouring to bark, Mulchip is an effective but economical low maintenance mulch for larger areas. With a good resistance to wind and rain erosion, it is very durable and will give benefits for several years when laid to a minimum depth of 75mm. Like all Melcourt's products is 100% organic, peat-free and has no added chemicals.

Lloyds of Letchworth have taken larger stand space to accommodate their new extended range of grass cutting equipment, choosing IoG to unveil these exciting additions and introduce them to both established and new customers.

Also on display, the new Vertical Rake attachment for the Paladin is designed to help in the promotion of healthy growth through the removal of lateral growing grasses and other foreign matter. The unit has 26 specially hardened steel 10-bladed discs each set 90mm apart, is driven off the cylinder drive and can be fitted within 15 minutes.

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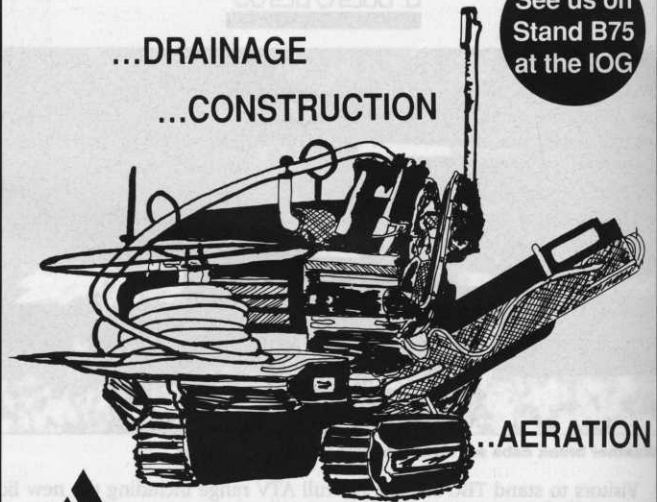
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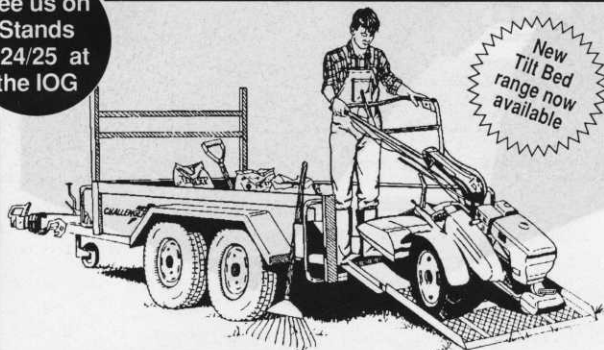
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