

FERTILISATION

Based on soil analysis and discussions we agreed to concentrate on growing-in initially with monthly applications of balanced fertiliser - 12-3-9 at 35 g/m². The common mistake that people make when growing in new turf is that they begin to maintain it as fine turf too early. We would save the greenkeeping for later.

IRRIGATION

Early spring 2004 was dry for a time and the cores quickly became dry and dusty and needed to be watered. The organic matter in the cores makes the surface prone to drying out extremely quickly. We made sure to irrigate as much as possible to keep the surface moist and bring the new sward through.

MOWING

It was recommended that mowing be undertaken as often as necessary at an initial cutting height of 12mm. Very soon, this turned into every other day.

WHAT HAPPENED NEXT?

From then on everything went pretty much as planned. Tony took full charge of the maintenance operations and Henry popped in at regular intervals to discuss the progress. It was a very interesting time for us both.

The cores began to regenerate and establish a cover almost immediately. In using cores we are sowing mature plants. This was mainly the annual meadow grass rather than the bentgrass component of the sward. Tony commenced mowing within the month using a hand mower set at 12mm boxing off the clippings.

Next came the bentgrass establishment from seed, which was truly amazing. By early June, the base of the sward was thick with newly emerging seedlings. It seems that the protective cover given by the annual meadow grass coupled with the contact with the moist cores below provided the ideal environment for the establishment of the bentgrass seedlings.

Our discussions from this time emphasised the need to keep growth moving with regular fertiliser and irrigation inputs. We kept the irrigation input high and, during the day, through the dry May/June weather to keep the establishment moving and prevent wilting of the new seedlings. The monthly fertiliser applications also maintained good growing conditions. Mowing at 12mm was required four times a week. An additional overseeding was made in June to ensure the establishment of a balanced sward dominated by the finer grasses.

It is interesting to note that the turf base was never actually thatch by nature. Even though we were irrigating regularly from the outset, the cores seemed to break down nicely right from the start. The turf base was nice and open and the cores were well integrated with sand and so broke down well. The use of cores from established greens may have brought with them a fully functioning microbial environment. There seemed to be no adverse affect from using the cores. Rooting was strong and down to 10cm by the start of July.

From then on, it was all very straight forward. Through the summer we kept growth moving and continued mowing at 12mm. We weren't really tempted to fine down too early and just kept concentrating on growing in. We had to hold back Tony's greenkeeping instincts through this time.

Irrigation wasn't necessary in the summer of 2004 but regular feeding was required as and when. There was some minor Fusarium patch disease activity but no Take-all. We used fungicide to keep disease activity at bay.

It was such a good establishment that the decision was made to change the emphasis this autumn. We double verticut and topdressed in mid September to begin the greenkeeping. The green was also overseeded at this time and an autumn feed - 4-6-8 + fe at 35 g/m² - applied to sustain healthy, rather than lush, growth.



▲ The green at the start of August



▲ The sward at the end of the first year

The surface was already very fine by now and could have easily been brought into play. The sward comprises a tight and even mix of predominantly bent with annual meadow grass species. The strange thing is that it already looks mature rather than being new. It appeared consistent with the others and I am sure will play the same given time. We have the whole of 2005 for the greenkeeping.

Up to the end of October, the green was being mown three times a week at 10mm. The plan for the upcoming winter was to sustain turf health and harden off the sward by using low NK + Fe turf tonic type products. Mowing will be undertaken when necessary at a cutting height of 10mm. Frequent switching will be carried out to remove dew. We will keep monitoring for disease activity and treat when necessary.

CONCLUSION

We are both very pleased with the initial results of this method. The second new green was surfaced in the same way in autumn 2004 without any qualms. We used this technique for a specific reason - to retain consistency. It was the right option for our situation because we had time on our side. It will be interesting to see how long it takes for the autumn sowing to fully mature. Overall, this is certainly a good method for establishing turf nurseries and in special cases playing surfaces.

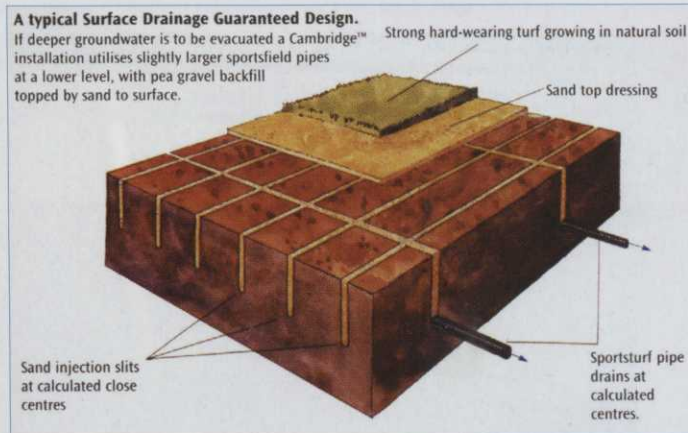
Tony Mears is Course Manager at Dinsdale Spa Golf Club and may be contacted via the club. Henry Bechelet is an STRI Turfgrass Agronomist covering Eastern England. Henry and the rest of the team may be contacted on 01274 565131, email: info@stri.co.uk, or visit the website, <http://www.stri.co.uk>.

DRAINAGE

- The Intensive Key

Geoffrey Davison unlocks the science behind effective sportsturf drainage.

It's Simple - You put in pipe drains and they take away the water! But, how many pipes, of what sizes, at what centres, at what depths and with what backfill? And, crucially, how does surface water reach the pipes and how quickly can it get there?



▲ A typical surface drainage installation

A decades long history of failures and shortcomings showed that achieving the high drainage standards needed for sports activities is not at all simple but, in fact, is a demanding challenge.

Films and photographs from only, comparatively, a few years ago show football, rugby, golf and racing taking place on badly waterlogged ground. We wallowed in mud and accepted that it was an inevitable part of outdoor sports activities, especially during winter. Pipe drains were often under the ground but even a moderate rainfall led to a mud bath on a soaked and slippery surface.

The advent of televised sport brought about a fundamental change, due to two factors. The viewing public wanted to see good green turf on their screens, and money on a previously undreamt scale became available to sport from television rights.

There was an urgent need for superior drainage and also funds to pay for it. But the necessary 'know-how' just did not exist. Existing drainage was traditionally 'agricultural' - satisfactory for farming, but totally incapable of providing the rapid drainage rates required for fulfilling fixture lists on good green turf no matter what the weather.

A new science and technology had to be created. Research and development produced valid theories and from these a practical technology has been evolved, but it has been a trial and error process. Mistakes and shortcomings were inevitable and some of the lessons have not yet been universally appreciated.

We now have formulae which provide a mathematically calculated basis for designing fully cost-effective sportsturf drainage schemes. The calculations can be applied to all aspects of any installation; the required pipe sizes, depths, lengths, gradients and spacings can all be accurately stated. The stated permeability rates for each and every one of a scheme's component elements needed for water to reach the pipes rapidly is another very essential part of a properly calculated design. Hence 'The Intensive Key'.

So many installations have not been calculated - in fact they have been installed on a hit and miss, hope to get it right, basis. Almost invariably they do not cope with the amount of rainfall, which is bound to occur, and the excuse is always that the rain has been exceptional, when in fact it was just typically

heavy, as should have been expected. With more drains and better permeability, that is if the scheme had been more intensive, it would have provided a higher drainage rate.

In designing any practical sportsturf scheme there is a choice between just two alternative principles - either a 'Designed Profile' or a 'Drainage Matrix'.

The most common use of the very expensive Designed Profile technique is in golf green construction, although in recent years some major stadia have had such installations. The existing soil is removed and replaced by layers of gravel, sand and pre-mixed permeable rootzone material. Pipe drains are placed under the gravel layer and efficient irrigation is essential. Installation is a major disruption and subsequently, very high standards of maintenance are required.

The precise composition and depths of carefully tested materials are crucial. All too often, in order to keep down costs, more 'convenient' and/or cheaper materials have been employed. Unfortunately, even minor deviations in particle size content or material depths can cause serious defects.

Golf greens constructed precisely to proven standards, such as the USGA Green specification, can be excellent, whereas there have been a number of greens which purport to be to this standard but which have been very disappointing because detailed proven specifications has not been fully complied with.

The Drainage Matrix is a valid lower cost alternative to the Designed Profile, providing that the 'Intensive Key' is applied. With appropriate variations, the Matrix principle can be successful for all types of sportsturf, including golf greens and fairways, football, racing and rugby.

A calculated drainage facility is imposed into what may be a fertile but fairly impermeable in-situ soil. Instead of water being required to pass through the soil to get to the pipe drains, it is provided with a very effective and quick bypass route. Again an appropriately intensive design is the key to success.

On a golf green, a good scheme would provide not less than four linear metres of drainage for every one metre of surface area. A similar degree of intensity may be needed on areas such as soccer goal mouths, centre circles,



▲ Cutting wheel for neat narrow trenching

AN OUTLINE OF THE MATHEMATICAL BASIS OF DRAINAGE DESIGN

MAXIMUM LENGTH OF PIPES TO DISCHARGE POINTS

$$M = \frac{F}{V S}$$

M = maximum length in m
 F = pipe manufacturer's flow rate in L/hr
 V = scheme design rate mm/hr
 S = distance between pipes in m

DESIGN BASIS

Accepting the established formula

$$S = \sqrt{\frac{h^2 4K}{V}} \therefore V = \frac{h^2 4K}{S^2} \therefore K = \frac{V S^2}{4h^2}$$

The notations which are applied must be varied for each component part of a drainage design and varied again for each different type of design

APPLYING THE FORMULA FOR SUB-SOIL EVACUATION

S = distance between pipes
 h = depth of pipes (or depth at which the permeable back-fill over the pipe meets a different soil)
 4 = a constant
 K = hydraulic conductivity of the in-situ soil
 V = designed drainage capacity

APPLYING THE FORMULA FOR SAND-SLITS

When applied to the slits of an inter-connecting sand/or sand-gravel matrix, the same equation requires the notations:
 S = distance water travels laterally in the slits to reach discharge
 h = depth of slit
 4 = a constant
 K = hydraulic conductivity of slit back-fill material
 V = designed drainage capacity which needs to be adjusted by the fraction of the width of slits in proportion to the distance between them, ie

$$V = \frac{\text{width of slit}}{\text{Distance between slits}}$$

THE SIZE AND SURFACE AREAS OF SOIL PARTICLES

Particle type	Diameter (mm)	Approx number of particles per gram	Surface area of particles in 1g (cm ²)
Very coarse sand	2.00 1.00	90	10
Coarse sand	1.00 0.50	700	20
Medium sand	0.50 0.25	6,000	50
Fine sand	0.25 0.10	50,000	100
Very fine sand	0.10 0.05	750,000	250
Silt	0.05 0.002	6,000,000	500
Clay	less than 0.002	90,000,000,000	8,000,000

Note the huge difference in size between clay and other particles



▲ Profound aeration creates countless millions of tiny cracks and fissures

the bends of race courses and individual wet patches, whereas areas such as fairways may generally need rather less intensive treatment.

A high proportion of the Drainage Matrix schemes which have been installed have not been sufficiently intensive to achieve the hoped for results. There are examples where, under the general description of sand-slitting and without any calculations being made, trenches at perhaps 3m or even 5m centres have been dug across existing drains at 10 or 20 metre centres and then back-filled with building sand, selected because of a low price and without regard to its permeability.

There may be some little benefit to the drainage, but this does not start to compare with the performance achievable from a correct design. Unduly, low budgets certainly have often prevented fully effective installations being carried out, but two other factors have also been responsible; namely the lack of relevant expertise and the non-availability of suitable specialised equipment.

Technology has moved on. Effective machines are now available and there is a much better general understanding of the problems and remedies. The crucial importance of the right sand is now recognised. Some machines cannot place and consolidate sand into narrow trenches and therefore the manufacturers have claimed that grit or granules can be used.

This may be good sales talk but it is not sound technology. The short term drainage benefits rapidly decline as fines easily infiltrate into the larger pore spaces of such materials. Furthermore, the addition of grit, fine gravel or granules is seriously detrimental to a soil's texture, whereas the systematic addition of good sand steadily improves it.

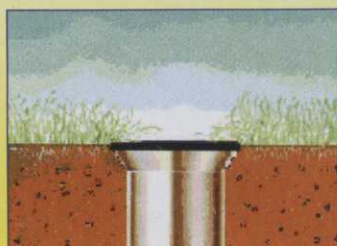
All schemes need an intensive key to be successful; under-design makes performance shortcomings inevitable. Whether it is a £1,000,000 stadium pitch, a £30,000 USGA specification green, a £10,000 improvement to a playing field or a £5,000 high capacity drainage installation in a golf green, they all need to be based on sound, suitably intensive designs which exactly state what detailed measures are required to create a defined drainage capability.

Sportsturf Drainage has been and still is my life-long work and interest. I am always happy to have a telephone discussion about any aspect. My number is 01568 797024.

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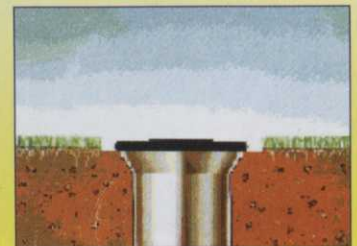
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When You Just Can't Reach

James de Havilland looks up and assess the best tools to use when cutting branches and trimming hedges from ground level.

Back in the 1960's, a children's television programme featured a character by the name of Twizzle. Able to extend his arms and legs to reach tall and obscure places without the aid of a ladder, a real life Twizzle would no doubt find a lot of work cutting tall hedges and lopping branches from trees. Fortunately, there are tools that can tackle this type of work with its non-fictional operator remaining firmly on terra firma.

Pole saws and hedge trimmer blades on the end of extension poles can make lopping small branches and cutting tall hedges much easier. There are a range of different makes and models available, but it does pay to do a bit of research beforehand, particularly when it comes to the use of pole saws.



POLE SAWS OR POWER PRUNERS

Chainsaw accidents can typically be traced back to poor operator training and not paying full attention to the job in hand. No modern saw is in itself dangerous and when used on a golf course, with the appropriate protective clothing, risks are minimised. Removing branches from a tree, however, is a different matter.

Height, ropes, chainsaws, ladders and even front loader buckets were once called in for 'DIY' tree surgery. Combining height and saws used to provide the ideal ingredients for a trip to casualty or worse. Thankfully, modern risk assessment rules these practices out. Some courses will also have trained chainsaw operators who know how to lop branches at height safely. But what about those circumstances where an overhanging branch needs tackling and there is no one on site with the training to deal with it?

It is here where a pole saw or power pruner can be useful. Used with care, these tools can remove a substantial branch without damaging the tree and, more importantly, with far less risk to the operator than using a chainsaw.

Most chainsaw and brushcutter manufacturers produce what is essentially a brushcutter power unit and pole with a chainsaw head in place of a blade or line trimmer. Indeed a number of manufactures can supply multipurpose units with hedge trimmer, brushcutter, chainsaw and other attachments.

The two main types of dedicated pole saw on offer are fixed length units with a reach to the tip of the saw to just under 3.0m or telescopic units that may extend to perhaps 4.5 to 5.0m.

The saw element, incidentally, will typically comprise a bar of 10, 12 or possibly 14". Professional backpack engine units, with a hydraulically powered saw, are also offered. These go up to 6.0m, but are not cheap at around £950 plus.

Telescopic pole saws are likely to be more versatile but also more expensive. A high quality rigid pole saw will be priced from £400, telescopic units carrying a premium of at least £50 to £100. Reach, incidentally, should not be confused with actual cutting height. For safety, the pruner needs to be operated at 60 degrees to the branch. This is to allow the latter to fall and not land on the operator.

Pole saw two-stroke engines tend to span 20 to 30cc and 0.6 to 1.5kW output. In most cases, a body harness is supplied to help support the weight of the tool when moving it around, but a support harness may also be supplied for use in work, more of which later. In terms of how they

Powered by a 23.6cc two-stroke engine, the 6.2kg Echo PPT2400 power pruner, from Countax, has a telescopic shaft that will reach from 2.74m to 3.83m. The 12" cutting unit can reach up a further 1.59m fitted with an additional extension. Price £399 plus VAT



Using a power pruner to lop a branch is both safer and easier than using a chainsaw. It would be better to cut a large branch, as pictured, in shorter sections, leaving a long stump to be cut correctly by someone who knows what they are doing.



▲ When fully extended, a power pruner can access branches that would otherwise be difficult to reach. Light trimming is easy with this type of tool and helps keep tree branch growth under control economically.

work, think of a brushcutter, with a right angle gearbox transmitting drive to the saw.

Shaft strength on telescopic pole pruners is a point to consider. Some use flexible steel shafts, others, like STIHL, using a lightweight alloy. The way the shaft slides is similar to a PTO shaft; the difference is that the outer sections are strong enough to support the weight of the cutting head. To prevent the driveshaft fouling the tube, movable bearings support it as the tube is extended.

It takes practice to use these tools, and knowing where to start a cut is every bit as important as being able to use the machine to avoid getting tired. A key is using the harness as much as possible; it is possible to work without one, but the operator will soon get arm and back ache.

The basic shoulder strap that typically comes as standard is only really aimed at providing limited support. This is fine for occasional use, but it will not be as effective as the more complete harness designs that can be supplied by some manufactures as an option. These bear the weight of the engine and allow the operator to pivot the saw from the attachment point and onto the branch. A big advantage of this system is that it spreads the weight of the pruner across both shoulders. When dealing with higher branches, however, the saw will still need to be raised out of the support to provide the necessary reach.

Working a pole saw is straightforward for thin, lighter branches. These can be cut in one action from the top down. Thicker and heavier branches need cutting with care. It is best to cut back towards the trunk progressively in sections to reduce both the weight and volume of material falling. This will help protect the tree and prevent a long branch swinging back and clouting the operator.

£95 plus VAT circular saw for larger branches



For a clean cut at the trunk, larger braches should be undercut by a third before sawing through from the top. The aim is to produce a clean cut that allows the 'wound' to heal quickly and prevent disease entering the tree. As a guide, keep the cut close to the trunk but retaining enough branch bark at its base to grow over and heal the 'wound'. In practice, getting a clean cut from a pole saw is not easy simply because the saw element is a long way from the operator.

Capacity wise, most pole pruners will tackle a 40cm diameter branch if the saw chain is sharp. Tackling a branch of this size is not necessarily recommended, but it does show engine power is not the key issue but a good sharp chain is the key. As a rule, it is always better to prune lightly and leave a cleanly cut truncated large branch. In most cases it is best to leave cutting branches right back to the trunk to a trained arboriculturist, particularly on specimen trees.

EXTENDED HEDGE TRIMMERS

Although it is stating the obvious, the two key elements to a good hedge trimmer are the power unit and the blade. But a vital aspect that turns an effective tool into one that is easy to use and not over tiring is good ergonomics. This assumes added importance when it comes to using an extended unit; a heavy, poorly designed trimmer will soon fatigue the operator.

It is tempting to simply list a range of extended trimmers on offer, but the key to choosing a machine is to look to its potential versatility. The ability to adjust the cutting head to a different angle enables one unit to be used to cut the sides' top and possibly the upper reaches of the offside of a hedge with one unit worked from the same positions.

Dedicated extended reach hedge trimmers will come with a choice of double or single sided blades and cutting widths of up to about 0.60m or 24 inches. The length of these trimmers will vary, but as a guide 150 to 250cm is typical, with retail prices ranging from £400 to £500 for a dedicated unit. A longer blade will weigh more and may not be more productive.

MULTI-PURPOSE UNITS

Arguably the best option to look for is a unit that has interchangeable tools; these can include a saw, trimmer, brush and light cultivator, the latter possibly being an ideal tool for fluffing up a bunker. Such units are priced from around £400 and make a versatile choice for a golf club.



Echo HCA 2400 hedge trimmers, at £399 plus VAT, can be fitted with attachments that include a 0.45m multi-position double bladed hedge trimmer. This is ideal for use of well maintained hedges; the same power unit also accommodating...



£110 plus VAT rotary blade trimmer that can cope with a less formal hedge.

Your Letters...

Derek Green 1946 - 2005

The tragic death of Derek Green, after a devastatingly short illness, which he bore with a characteristic lack of complaint, has brought many words of praise from those at all levels - with many more deservedly to come. One ventures to comment that life, like golf, is not a fair game.

I add my tribute, not just because he was one of the greatest 'keepers of the green', but because we became a team in 1973 when he came to Woburn to take charge of the new project. Our friendship has lasted from these early days and we made a great team, debating and discussing but never falling out. He was always happy in his quiet unflappable way to help all whom he felt had the interests of traditional greenkeeping and the highest greenkeeping standards at heart.

When he went to Royal Liverpool, in 1985, at my instigation, that friendship continued.

Days at Hoylake were amongst the happiest and most rewarding of times, and not just because the links were always in superb condition. Not only did I, with countless others, enjoy the fruits of his vast experience and skill and his unflinching help given to all, from novice to top men, but he had many other shared interests, from steam locomotives to the wild life of his beloved links, as well as deep involvement in education, including his invaluable direction at North Wales College. He was also a very skilled engineer.

I have always maintained that he had no equal as a producer of supreme quality links turf all year round. I am perhaps better placed than most to give him this accolade, as I was working in parallel as a team with those looking after virtually all the larger links within the UK.

He was indeed a legend in his own lifetime, and few would quibble with my belief that he was the best all-round links manager of his generation. It was largely due to the consistent top quality all year round, which he achieved, year in year out, that earned his beloved Hoylake their forthcoming Open Championship which sadly he will not be there to see.

Goodbye to an old friend and team mate, with all my thanks for his unflinching support and endorsement of traditional greenkeeping, which I know from our last recent talk that he was pleased to see regaining strength and acceptance. He was once asked about the use of fungicides on the Hoylake greens. After consideration he thought that the last time any were applied was five years earlier while he was on holiday (watching steam locomotives, of course) when his assistant had played safe and treated one or two greens. That says it all.

Jim Arthur, Life Member

Never to be Forgotten

A Man with the precious commodity, time. Time for anyone who asked for advice, support or even a friendly chat.

How fitting that the choice of music at the funeral was Handel's 'Zadok The Priest' for Derek, as it was Derek who was the one many of us turned to.

Gone yes, forgotten never.

Andy Peel, Bull Bay Golf Club

A Significant Greenkeeper

It was complete and utter shock when I heard the death of Derek Green, after years of complete dedication to getting the British Open back to Royal Liverpool he will not be there in person.

Derek was a man who gave me his backing, which gave me the strength to take up the Chairmanship of the North Wales Section in very turbulent times and he was always available whenever I phoned for advice. I learnt a lot from him sitting on the Golf Liaison Panel at the Welsh College of Horticulture.

An astute man, he didn't want his words in print in case he was 'misquoted', he was a mind of information!

If ever in the history of the game of golf that a Major Championship should be dedicated to a greenkeeper it is the 2006 British Open at Hoylake in the memory of Derek Green, one of the most significant greenkeepers of the 20th Century.

Dave Goodridge, Head Greenkeeper,
Denbigh Golf Club

A Tribute to Derek Green

Anyone who has had the pleasure to meet Derek Green will agree with me that he will be sadly missed not only as a Course Manager, but also as a great friend to many people throughout the UK.

I first met Derek 20 years ago when he became Course Manager at the Royal Liverpool Golf Club. My first impression of him was this wild man with a beard and a pipe sticking out of his mouth. 20 years on and that is still the impression that comes into my mind when I think of him and I am sure that all the people he has met over the years will know what I mean.

He was the most knowledgeable greenkeeper I have ever met and he was always willing to pass the time away with you sharing this knowledge. The one thing he always told me was that in this game you are always learning something new everyday, no one knows everything.

In 2006 he was to have reached the pinnacle of his career by hosting the British Open. Sadly this is now not to be. Whatever happens between now and the Open, I hope that all concerned will realise that Derek and his men have completed almost all the work required and that they will host the event in his memory.

My thoughts go out to his family and friends at what is a very sad loss. I will never forget what he did to help me in my career, and I am sure there are many people out there who feel the same.

I am not a religious person, but if there is life beyond this world then it is now going to have the best golf course ever.

Derek, Rest In Peace.

Chris Peddie, Head Greenkeeper,
Wallasey Golf Club

YOUR LETTERS ARE REQUESTED!

Send to: Scott MacCallum, Editor, Greenkeeper International, BIGGA HOUSE, Aldwark, Alne, York YO61 1UF, or email them to: scott@bigga.co.uk

Letters continued on page 33...

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NEW PRODUCTS



ALLEN INTRODUCE FIRST STRATO-CHARGED CHAINSAW

The first Chainsaw to be powered by the Komatsu Zenoah Strato-Charged engine has been announced by UK KZ distributors, Allen Power Equipment Limited.

The GZ4000 is an easy-to-use semi professional chainsaw with a 40.1cc engine powering a 16in (40cm) sprocket nose bar.

Strato-Charged engines provide up to 30% fuel savings over conventional engines along with a 30% decrease in emissions. This engine design is already fitted to numerous KZ brush and hedge cutter models and now the benefits are available to the chainsaw user.

The new saw has a fuel tank capacity of 0.27 litres ensuring a minimum of refuelling down time and a dry weight of just 4.3 kgs means more cutting less tiring.

For further information Tel: 01235 515400.

KUBOTA UPGRADE MINIS

Kubota has enlarged its top-selling KX-3 Series with the introduction of two new machines. On display at BTME for the first time, the 2.6 tonne KX61-3 and the 2.8 tonne KX71-3 models replace the -2 Series machines.

Both new machines come equipped with a longer dipper, fitted as standard, for greater reach and extra dig depth. They are powered by a Kubota V1505-E2-BH engine, providing economical and environmentally clean power and a full tank gives 10 hours of continuous work.

The new models have bucket cylinder hoses routed through the arm, and boom cylinders shielded by a thick steel plate, for extra protection and safety. They are available with either a quiet, luxury cab or canopy, both of which meet ROPS/FOPS specification. Both machines are loaded with all the features necessary to tackle the most challenging of jobs.

The KX61-3 has a long arm fitted as standard to provide a 4600mm reach and maximum arm digging force of 12.4 kN (1265 kgf). The digging force of the bucket is 21.5 kN (2190 kgf).

The KX71-3 also has a long arm as standard to provide a 4770mm reach and maximum arm digging force of 16.2 kN (1650 kgf). The digging force of the bucket is 25.2 kN (2570 kgf).

The variable displacement pumps provide the optimum

hydraulic oil flow and pressure according to the workload. The result is an engine that delivers higher fuel efficiency coupled with less vibration and noise.

They are also equipped with the Kubota Intelligent Control System. This features warning indicators for engine, fuel, temperature and oil; a service mode that enables accurate troubleshooting, and standard indicators that display current working conditions such as engine rpm and hour meter, etc.

A larger cabin delivers maximum comfort. It provides more legroom, an adjustable suspension seat, a radio installation kit and improved all round visibility.

For further information Tel: 01844 214500.



AN EAGLE EYE


As part of a new range of course guides Eagle has launched Eagle Eye, which is designed to present dramatic yet completely realistic views of holes, and for using photography to market a golf course.

What makes Eagle Eye different is the use of aerial photography, angled to reveal the true nature of the challenges facing the player on the tee.

Using photography to show a hole's layout and features transforms how a player sees and understands the hole and the shots to be played. Key features such as bunkers, swales, mounds, slopes and bushes are all seen in their correct context, and the way a hole may be angled from the tee is much simpler to appreciate.

Pictured is an example of the technology, using Sunningdale's famous short, Par 4, 11th hole on the Old Course, which shows what can be achieved. Standing on the tee, the tee shot is in fact partially blind but with the Aerial Sky Guide the shot-making requirements are immediately clear. A view from the fairway helps the player to see the next part of the challenge, and with minor computer-based enhancements, features that photography tends to flatten - like sloping greens - can be accentuated.

For further information Tel: 01883 344 244.



The Drive
A classic short Par 4. The drive must be long enough to make the fairway, but kept well clear of the trees on the right and the bunker on the left.

Approach shot
A short shot that must find the surface of the green, which is raised by some 5-6', and is relatively small.

11

HOLE 11
PAR 4
▶ 325 yds
▶ 304 yds
▶ 285 yds