Coast and the teeth-chattering contrast of mid-European winter temperatures plunging to –20°C or more.

In Germany, melting snow and continuous rains combined to flood his Schloss Weitnburg course to the point where, as the waters subsided, trout were discovered swimming in the bunkers.

On the face of it then, Tony Gadd's move to the English south coast appeared to offer many advantages; a pleasantly mild climate, a team of professional sub-contractors at his disposal plus the bonus of established support in the shape of a six-man team led by head 'keeper Bob Parsons.

The reality was different! The Barton project turned out to be the biggest challenge of his life, he told me. "But I don't regret a moment of it."

One of Tony's main headaches was – and still is – wind erosion. During one particularly stormy night, high winds blowing in off the sea shifted an inch of carefully laid seeded soil. Within days, freshly sanded bunkers turned a pale shade of green.

"I didn't use covers. If I had, they would only have ended up floating in the bay".

Storm-force winds are not the everyday norm at Barton but the Solent channel can be fickle. Light winds suddenly turn into squalls gusting to a strength four or five; enough to cause soil movement.

When this happened, Tony and his team had to forget whatever they had planned. For a period, raking, over-seeding, light rolling and watering were daily necessities.

Yet just a few paces further inland, where the course was extended away from the crumbling cliffs, heavier farm soil resisting the affects of the winds threw-up another challenge. Weeds.

Classified as Grade 'D' farmland, the soil was alive with camomile, white flowering clover, plantains and a botanists' book full of other species. On top of that, the owner, a local farmer had, in Tony's estimation, only paid lip service to drainage. "That was a whole new ball game," he commented with a wry smile.

Water was an important priority. Acknowledging his scant knowledge of the technicalities of irrigation system design, Tony readily agreed to let ISS (Irrigation Contracts) take responsibility for this aspect of the development.

They had installed Barton's original system; they knew the ropes. "We had to plan and re-plan the new system depending on the various stages of construction and seeding," says Gary Parker, whose company adapted and extended old with new over a twelve month period.

In addition to setting-up a temporary pump station, repositioning pipelines and re-assessing application rates on a weekly basis, the ISS installation team was not helped when the odd JCB dug-up newly laid pipe or, in one heart-stopping escapade, pulled up what seemed like miles of cable!

There was a time when even Tony admitted he was desperate for water – for seeded fairways not included in the irrigation plan. "I was seriously thinking of hiring bowsers but then it rained – and rained."

Talking of seeding, Tony told me that he planted a traditional mixture of fescue and creeping bent on the greens and tees, pre-mixed fes-

The new club house at Barton-on-Sea

BARTON LOGISTICS

Rebuilding the Barton-on-Sea golf course involved the following statistics – according to Tony Gadd's records; dated May '91–June '92.

Earth: 250,000 sq yds moved
Stone: 5,000 tons used for drainage and stone carpets
Water: 2.5million gallons stored in six lakes of varying size
Machinery: five bulldozers, eight slewing excavators, one mini-digger, two JCB wheeled excavators, one wheeled shovel, four 22-ton dump trucks, two continuous trenchers, five agricultural tractors
Fuel: 24,167 gallons of diesel
Labour: 43 operators – plus one water diviner
Man hours: 14,970
Accidents: None

COURSE EQUIPMENT

MOWERS
Huxley – two 358 greens mowers
Huxley – one 358 for tees and approaches
Ransome – one 180D for surrounds
Brouwer – one hydraulic 5-gang mower for fairways
Brouwer – one trailed gang mower
Ransome – 350D for semi-rough and rough
John Deere – Front line rotary for rough
Ransome – one 24in motorised mower
Auto Certes – Three motor mowers
Allen Flymo – four brushcutters

BUNKER RAKES
John Deere – one bunker rake
Ransome – one bunker rake

In addition to the above, a (very old) Ransome 171 model is used for verti-cutting.

TRACTORS
John Deere 1750 with powerloader
Ford 3600
Massey Ferguson

TRUCKSTERS
Cushman – three vehicles with attachments

IRRIGATION
27 greens, tees and approaches – Toro 650 independent head control sprinklers, computerised AquaFlow control system designed, installed and maintained by ISS (Irrigation Contracts) Ltd.

cue bent and smooth stalk on the fairways.

Rooting zones comprise a 80/20 sand-soil mix fifteen inches deep over a stone carpet and herring-bone drains.

Constructing a new golf course was one thing but equally important, the day-to-day task of maintaining the 18 holes in play kept everyone on their toes!

In the event, this was achieved by the use of just two temporary greens. Nevertheless, the integration of existing holes with new ones was, as Tony described it, "Most difficult but we won through – thanks mainly to Bob's local knowledge – and the rest of the team who got stuck in and produced the required results."

In the final analysis, only seven of Barton's old greens were retained to meet the design mapped out on golf course architect Hamilton Stutt's blueprint. Twenty new ones were constructed as part of the main development programme which lasted for around 14 months.

Water storage was another vital consideration. This problem was part and parcel of the thinking which lay behind the excavation of a large ornamental lake alongside the new clubhouse.

But this was not any old ornamental lake. It features an island green – the 18th when played in competitions – surrounded by something like two million gallons of water. Before it was filled, the ISS installation crew lined it with a pressure resisting PVC-based liner. £20,000 worth, according to Tony Gadd's inventory.

Interestingly, a water diviner was brought in to help source natural supplies. He quickly found an underground lake which, with a nearby spring, provides enough 'liquid gold' to keep both the ornamental lake and five other, smaller lakes dotted around the golf course and its perimeter, full.

Not that water was at much of a premium this winter! For the first time in recent memory, the course was closed for 16 days after a couple of months' rainfall fell in a matter of days. Even the free draining clifftop soil couldn't absorb that amount. It was then that the prevailing wind – the cause of many other troubles, suddenly became a friend indeed…

From day one, Tony Gadd kept club members fully informed about the progress of the extensive work taking place. "There were a few grumbles but generally speaking, we achieved our dual objectives of creating a new golf course and keeping 18 holes open for play – without any major disasters," he says.

Traffic is heavy at Barton. They (the members) are a hardy breed, I was told. Many play seven days a week and but for an 8am start embargo, popular opinion has it that some of them would be out there at sunrise.

What do the members think of Tony Gadd? Without exception, all those I asked – from management and club captain downwards, undoubtedly have a healthy respect for what he – and his greenkeeping team – have accomplished.

When Richard Branson – he of Virgin Airways fame – dropped in (by personal helicopter) to officially declare the whole project open, last September, Tony and his team were given a special mention coupled with a vote of thanks. But then, that's the way they do things at Barton-on-Sea.

Barton's gang of five: from left, Tony Gadd, course manager, Chris Parsons (greens and fertilisers), Stephen Harris (tees and surrounds), Bob Parsons, head greenkeeper and Robert Hollier (spraying specialist)

The challenge of a lifetime

One of the small lakes built to conserve water supplies

Route to Barton-on-Sea was via Germany and the Ivory Coast

Always a keen golfer, Tony Gadd was playing off 2 at the New Zealand Golf Club, West Byfleet, Surrey as a youngster, but quickly realised he couldn't afford to become a pro. "Family finances would not stretch that far," he remembers.

Instead, he walked out of his banking job – "I hated being walled-in" – to study engineering "while playing as much golf as was possible."

This combination led Tony into greenkeeping. He became an assistant at the New Zealand Club specialising in the maintenance of the club's tractors, mowers and the like.

Moving on to Fulwell, South London, Tony later joined the John Lewis partnership, who were involved in the construction of a new course at Winter Hill, Cookham, Berks, in the mid-'70s.

At Cookham, Tony teamed-up with Winter Hill's head groundsman, Pat Ainsworth. Describing Pat as a "great greenkeeper who put me on the right road," Tony learned much about golf course management.

When the chance came, Tony applied for, and obtained, the head 'keepers position at the 18-hole Kingsdown Club, at Box, a delightful small village near Bath. Three and a half years later, in the early '80s, Tony joined the King Norton (Birmingham) Golf Club, "To sort out thatch problems. It was 1 1/2ins deep in places!"

That accomplished, he joined Golf European Construction, a move which led him to Africa and the Ivory Coast.

"I was appointed – by the president of the Ivory Coast government – to manage the construction of new courses designed to attract tourists."

During his five-year spell in Africa, Tony was responsible for building and developing the Yammousukro and Abidjan courses.

In 1987, Tony moved to Germany and became involved in the construction of Golf Klub Schloss Weitnburg, Stuttgart, an 18-hole plus 9-hole academy complex.

Now a family man with two young children, Tony decided that perhaps it was time to come home.

That decided, he was appointed course manager of the Barton-on-Sea golf club, Hampshire, in 1991. His first objective? "To take an ageing 18-hole clifftop course into a new era of golf."

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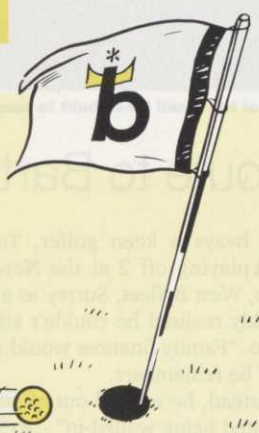
AD REF 455

Heriot & Bardot

Favourite bentgrasses for fine, close grown turf outscore* the usual

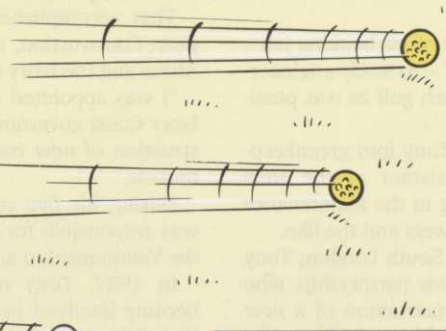
Although 'Highland' browntop bent is generally acceptable for most UK situations, for very fine turf such as golf and bowling greens the STRI now advises finer and denser cultivars like Heriot and Bardot.



HERIOT 7.7

BARDOT 6.5

HIGHLAND 4.8



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* The STRI 1994 list shoot density figures.

AD REF 172

Mike Canaway of the Sports Turf Research Institute looks at what's best for new greens which have to be ready in a hurry.

Comparison of seed versus turf for greens establishment – trial plots at the STRI

SEED OR TURF?

With increasing commercial pressure to bring newly established golf courses into play as quickly as possible, it is often no longer feasible to allow long periods for greens to establish following sowing. Temptation, or indeed the necessity, is to use mature turf for establishment of new greens to minimise the time needed before play can take place. However, the use of mature turf carries with it risks.

Modern methods of golf green construction involves the use of rootzones with a very high sand content, for example in the USGA method of green construction, or indeed sometimes pure sand, to provide free-draining conditions and hence the ability to play even after heavy rain. Importation of turf onto such rootzones brings with it the indigenous soil on which the turf was grown and with it the risk that fine silt and clay particles within this soil will cap the sand rootzone, much reducing its capacity to remove water from the surface.

An experiment carried out a few years ago at Bingley with football type turf showed that even turf grown on pure sand could cause a great reduction in infiltration rates due to the importation of an organic layer at the rootzone surface. On golf greens such layers can become buried by applications of top dressing to present an intractable problem in subsequent years. A further risk is that weed grasses such as annual meadow-grass, present in the turf production fields, will also be imported along with the turf. Ways of minimising

Why do we get these gross differences in water

these problems include the use of turf grown on soil compatible with the rootzone, the use of washed turf where the soil is washed away from the turf before relaying using high pressure water jets, or by the use of juvenile turf typically grown on soil-less media and harvested 6-8 weeks after sowing. The juvenile turf studied at Bingley was a product known as Coronet Turf, which is grown on a thin soil-less mulch placed on polythene sheeting on the field. Various grades can be produced for different purposes.

In 1990 and 1991 we carried out an experiment at Bingley to compare different establishment methods for newly laid golf greens, including seeding at two seed rates, the use of mature turf (2 grades), the use of washed turf and juvenile turf (Coronet Turf). The effects of these different establishment methods were studied on grass ground cover, annual meadow-grass ingress, playing quality in terms of hardness and green speed and water infiltration rate of golf green turf established on a sand rootzone.

The experiment was carried out on a pure sand rootzone overlying a gravel drainage carpet, the rootzone consisted of 250mm of medium-fine sand overlying 50mm coarse sand, which formed a blinding layer above the gravel drainage carpet. The aim of the experiment was to simulate conditions where a newly laid golf green was intended to be brought into use as soon as possible. Therefore we aimed to impose artificial wear using a "wear machine" fitted with golf spikes just four months after seeding or laying of turf on the new greens.

The construction was done in the early part of 1990, final seedbed preparation taking place in mid-April 1990. Alginure soil conditioner was applied to aid moisture retention and also to supply micro-nutrients. A proprietary fertiliser was applied to the seedbed. This contained a slow release form of nitrogen (IBDU) to prevent or reduce the potential leaching losses of nitrogen from the seedbed. Both the Alginure and the fertiliser were raked into the upper 50mm of the seedbed.

After this the different experimental treatments, which comprised different methods of establishment of golf green turf, were applied to the experimental area. These were:

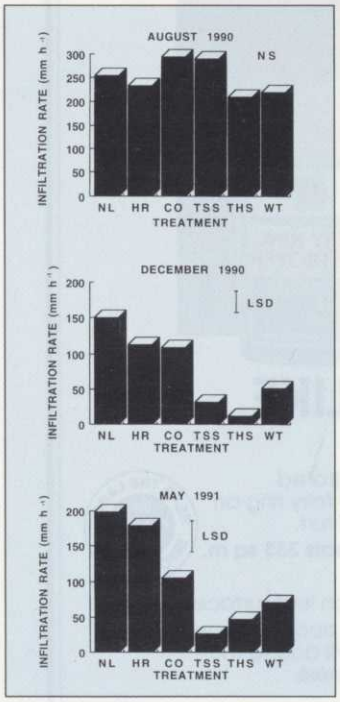
1. Bent/fescue mix sown at 35 g/m^2. This mix contained 40% Chewings fescue, 45% slender creeping red fescue and 15% browntop bent split between two cultivars, 'Bardot' and 'Highland'.
2. The same seeds mix sown at 100 g/m^2 – a much higher than normal rate.
3. Coronet Turf. This is a commercially available product and it was grown on a netted, organic, soil-less mulch and delivered typically at 6-8 weeks after sowing. The plastic mesh netting was incorporated by the grower to facilitate lifting and handling of the juvenile turf.
4. Turf grown on sandy soil. This was a mature turf sown with a mixture of 80% Chewings fescue and 20% browntop bent. On delivery it comprised about 50% bent, 40% Chewings fescue, 8% dead matter and traces of meadow-grass species. The soil attached to the turf was defined as a sand in textural classification.
5. Turf grown on heavy soil. This was a mature turf which consisted on delivery of 65% fescue, 15% bent, 7% annual meadow-grass and 1% smooth-stalked meadow-grass, the remaining 12% comprising dead matter and bare ground. The soil attached to this sod was described as a clay loam, ie a heavy soil, comprising 35% sand: 33% silt: 32% clay.
6. Washed turf. This was the same turf as described in (4) above, but with much of the soil removed by washing using high pressure water jets.

The trial was given intensive maintenance to encourage the grass to establish as quickly as possible with a target date for the start of "play" four months after the initial sowing and laying of the turf.

Much data was collected from the trial as mentioned above, however, in this article I want to draw attention to the effects of the different treatments on the ability of the turf to remove water from the surface, ie. water infiltration rate. Clearly the purpose of a sand-based green is to provide free-draining conditions. If the turf supplied caps the rootzone then clearly much of the effort which has been put into the golf green construction has been wasted. The diagram, right, shows the water infiltration rate at three different stages during the experiment.

Four months after sowing, in August 1990, the different plots of golf green turf were considered ready to receive artificial wear treatments using our wear machine fitted with golf spikes. Infiltration rate measurements were made using an apparatus known as a double ring infiltrometer. The results showed that the different methods of establishment had no significant effect on infiltration rate at this stage, although some differences were observed these were statistically not significant one from another. *(NB: key to the experimental treatments in the diagram as follows: NL = normal seeding, HR = high rate of seed, CO = Coronet Turf, TSS = turf grown on sandy soil, THS = turf grown on heavy soil, WT = washed turf.)*

infiltration rate among turf treatments?



By December 1990 when the artificial wear treatments had been in progress for some time, a dramatic reduction in the infiltration rate of the green surface had occurred. From values in excess of 200 mm/hr before the wear treatment started, infiltration rates were reduced on all treatments but most dramatically on those treatments where mature turf had been used in the construction process. The water infiltration rate on the sod grown on heavy soil was reduced from 211 mm/hr to only 12 mm/hr in December 1990. The turf grown on sandy soil and the washed turf gave higher values of 32 and 51 mm/hr respectively. The Coronet Turf and the seeded treatments both gave infiltration rates at this stage in excess of 100 mm/hr. After a further period of wear in May 1991, the seeded treatments and Coronet Turf still retained water infiltration rates in excess of 100 mm/hr, although the seeded treatments at this stage were considerably higher than the Coronet Turf. This was because these had effectively started to wear out and therefore the sand surface had become exposed, the Coronet Turf and the mature treatments, however, had resisted the action of wear following the short period of establishment to a much greater extent. Although there were some differences in water infiltration rates among the mature turf treatments, ie. the turf grown on sandy soil, heavy soil and the washed turf, statistically these differences were not significant. In studying the results for both December and May, there does seem to be some benefit in the use of washed turf if mature grades of turf have to be used. In the UK, turf washing has not become prevalent, but in other countries it is widely practised, for example in Australia. Perhaps the findings of this trial will encourage some of the turf growers to experiment with systems for turf washing.

The question remains: why do we get these gross differences in water infiltration rate among turf treatments. Part of the explanation is doubtless the mineral matter imported along with the turf as discussed above. However, one of the measurements which was made during the experiment was the depth of the organic and mineral layer at the surface present in the different turf plots at the end of the experiments in May in 1991. Thickness of this surface layer ranged from 3mm thick in the seeded treatments (at the low seed rate) to 17mm thick in the case of the turf grown on heavy soil. We found that the loss of water infiltration rate was strongly correlated with the thickness of this layer and its organic matter content. In other words, it is not just the importation of mineral matter which is important, it is also the importation of the organic matter at the soil surface which contributes to the loss of infiltration rate in the case of mature turf. The washing process not only removes much of the mineral soil matter, it also has the effect of root pruning and removal of organic matter as well and therefore this is the most likely explanation for the improvement seen in the washed turf. In the case of the Coronet Turf, because it is still at a juvenile stage, although it is grown on an organic mulch it does not have the time to form the matted, fibrous type of organic layer often seen at the surface of mature turf. You could argue that a sward established from seed or from juvenile turf will also produce organic matter and so, in time, the situation will be no different. Although this would be true if no remedial action were taken, the aim of top dressing with sandy materials, as part of a golf green management programme, is to dilute this organic matter with a permeable material as the organic matter accumulates. In contrast, in turf production fields, this top dressing would not be carried out and furthermore in many cases clippings would be returned at least at some stages of the turf growing period, further aggravating accumulation of organic matter at the surface.

In conclusion, the use of mature turf for establishment of golf greens has increased greatly over the past 20 years and it seems likely on the basis of the results presented here, that we may actively be causing problems of our own making. Even if we use turf grown on very sandy soil, very large reductions in infiltration rate can occur even in a relatively short period of time. This could lead to development of other problems, such as black layer. The problem can be reduced by the use of washed turf or by the use of a juvenile turf where there is insufficient time for establishment using seed. The Coronet Turf had no detrimental effects on playing quality, apart from some initial softness which soon disappeared. Furthermore, it was completely free of annual meadow-grass contamination which was not the case with the turf grown on heavy soil. I do not want to create an alarmist impression with this article, suggesting that we should not use mature grades of turf for golf green establishment. There are many good suppliers of turf who go to great lengths to provide the best quality turf for golf green construction, both in terms of botanical quality and the soils used in production fields. Furthermore, in the short experiment carried out, the mature grades of turf did show the greatest durability in response to the wear treatments. What the experiment does show is how essential it is after golf green construction to carry out remedial action where mature turf has been used, due to pressure of time. Such remedial action could include intensive hollow tine coring to remove some of the organic and mineral matter, together with sand top dressing to provide permeable channels for the movement of water and air into the profile.

'Turf can look very good at lawn heights of cut but very poor when mown down for a green'

Peter Hayes of the Sports Turf Research Institute looks at the top grasses – whether choosing turf or seed.

The STRI is the only independent organisation in the UK which conducts merit tests on different amenity grasses. The Institute has carried out such work since its foundation in 1929 and has maintained a structured grass testing programme since 1957. All commercially available grasses which are suitable for use in the UK have been tested in this programme.

At the present time 14 grass species and 365 different grass cultivars are being evaluated at the STRI. These grasses are tested for different uses in one or more of 20 separate grass trials. In total, there are in excess of 5,000 individual grass cultivar plots at the STRI. Data collected from the many grass trials are used to update the annually published 'Turfgrass Seed' booklet which lists commercially available amenity grasses in order of merit for different uses. This booklet is widely distributed to many different users of amenity grasses. No greenkeeper should be without an up-to-date copy of this booklet.

Of the 365 different grasses in trial at the STRI, 192 are commercially available and listed in 'Turfgrass Seed 1994'. Within this number there are 33 Chewings fescues, 25 slender creeping red fescues, 19 strong creeping red fescues, 13 browntop bents (including 'Highland') and 6 creeping bents. This gives the traditional greenkeeper a total of 90 different grasses to choose from for use on the golf course.

The 'Turfgass Seed' booklet also provides information on the performance of these grasses. This information should help the buyer of seed and turf to select the right grass types and cultivars for the intended use. For turf it is important that the grower has used the appropriate grasses and in this case, the greenkeeper 'hopefully' will ask about the grass cultivars from which the turf has been grown before he completes his purchase. Turf can look very good at lawn heights of cut but very poor when mown down for a green. Please note that seeds mixtures containing better quality grass cultivars and turf grown from such cultivars may cost more than those which contain poor quality grasses. However, poor grasses will limit the performance of turf, irrespective of how well that turf is managed. Cheap grasses can become very expensive if they do not perform at the desired standard and as a result require extra maintenance or, in the extreme, need to be replaced.

The effects of golf wear on different red fescue cultivars

Table 1: Combined list showing the top 10 cultivars of Chewings fescue and the top 10 cultivars of slender creeping red fescue for use in golf greens.

Cultivar	Tolerance of close mowing	Shoot density	Short growth	Freedom from red thread	Summer greenness	Winter greenness
Barcrown	8.7	9.0	7.2	8.1	MG	DG
Center	7.4	7.5	6.6	7.2	MG	MG
Lobi	7.3	7.5	6.3	6.9	DG	MG
Smirna	7.3	7.3	6.7	5.9	MG	MG
Frida	7.1	7.4	6.7	7.3	MG	MG
Olivia	7.1	7.3	7.3	6.7	DG	MG
Enjoy	7.1	7.3	6.7	6.7	MG	MG
Logro	7.0	7.4	6.2	6.9	MG	MG
Bargreen	7.2	7.2	7.7	7.3	DG	MG
Jupiter	7.1	7.1	6.3	5.9	DG	DG
Estica	7.1	7.1	6.7	5.3	MG	DG
Oriflamme	7.2	6.9	6.3	6.0	DG	DG
Recent	7.1	6.9	6.0	4.6	DG	DG
Baruba	7.0	6.9	6.4	7.1	MG	DG
Waldorf	6.9	7.0	6.1	7.5	MG	MG
Liprosa	6.8	6.9	6.2	5.8	MG	DG
Rainbow	6.8	6.9	6.5	6.9	MG	MG
Roulette	6.8	6.8	7.4	7.5	MG	DG
Horizon	6.7	6.8	5.8	6.1	DG	DG
Dawson	6.7	6.5	5.4	5.5	DG	DG

Table 2: Commercially available cultivars of browntop (*A. tenuis* and *A. castellana*) and creeping bentgrasses for use in golf greens

Cultivar	Shoot density	Fineness of leaf	Short growth	Freedom from red thread	Summer greenness	Winter greenness
A. tenuis						
Heriot	7.7	7.5	7.1	5.7	MG	DG
Sefton	7.6	7.7	5.6	4.6	MG	DG
Lance	7.4	7.2	6.6	6.3	MG	MG
Bardot	6.5	7.2	6.7	5.8	MG	MG
Duchess	6.3	6.9	6.7	5.5	MG	MG
Saboval	6.1	6.9	5.7	5.5	MG	DG
Egmont	6.9	5.9	5.9	6.3	MG	DG
Tracenta	6.0	7.0	7.4	4.1	MG	MG
A. castellana						
Highland	4.8	3.6	3.6	3.6	LG	DG
A. stolonifera						
Penneagle	5.9	5.1	6.1	6.8	MG	MG
Carmen	5.9	5.6	5.3	6.6	LG	MG
Penncross	5.7	5.4	6.3	6.6	MG	MG
Prominent	5.5	5.7	5.3	7.1	MG	DG
Emerald	5.2	5.1	6.3	6.5	MG	MG

In the 'Turfgrass Seed' booklet there are three tables detailing the performance of red fescue cultivars, one each for Chewings, slender creeping and strong creeping red fescues. Of these grasses only the better cultivars of Chewings and slender creeping red fescues are able to withstand the very close mowing and wear which a golf green receives. At the STRI we now advise that a mixture of Chewings and slender creeping red fescues are used in seeds mixtures for golf greens, rather than the traditional 80% Chewings fescue, 20% browntop bent mixture. In this respect, we suggest that a mixture of 4O% Chewings, 40% slender creeping red fescue and 20% browntop bent is used. To help readers of Greenkeeper International choose cultivars of Chewings and slender creeping red fescue for use in golf greens, I have compiled a table for those grasses based on 'Turfgrass Seed' 1994 ratings. This table contains the best 10 cultivars of each of these types of grasses. This information is presented in Table 1.

The performance of commercially available cultivars of browntop and creeping bent grasses are described in one table in the 'Turfgrass Seed' booklet. However, this is divided into three sections, one each for: *Agrostis tenuis* – browntop bents; *A castellana* – browntop bent (Highland); and *A stolonifera* – creeping bents. Data from 'Turfgrass Seed' 1994 for established cultivars of these grasses are presented in Table 2. At present the STRI advises that only the very best cultivars of *A tenuis* browntop bents are used in seeds mixtures for golf greens.

Having selected an appropriate seeds mixture, there are two other factors which need to be considered: purity and germination. These factors are covered by the official seed regulations, which set legal minimum standards for germination and purity. For example, seed of perennial ryegrass, when sold, should have a minimum germination of 80% and an analytical purity (pure seed content) of 96%. Similarly, red fescue seed should have a minimum germination of 75% and an analytical purity of 90%. Such minimum standards may be acceptable in general use, but unacceptable for specialist uses such as golf and bowling greens. In such cases, a few weed grasses can dramatically increase maintenance requirements and as a result costs. They will also delay the establishment of a usable green. High germination rates are desirable as a greater number of the seeds sown will initially contribute to the new sward. In addition, germination is often associated with vigour. Seeds with high vigour tend to germinate faster and more evenly. They also produce, as the name suggests, more vigorous seedlings, which are better able to withstand the arduous early days of establishment. Information regarding seed purity and germination should be supplied with the seed by all good seed merchants. Buyers of seed should ask for and be prepared to pay more for seed which exceeds the minimum certification standards, especially if their particular application demands a high quality finish.

■ *Turfgrass Seed 1994 is available from the STRI at a cost of £1.50 including postage. Tel: 0274 565131 or write to The Sports Turf Research Institute, Bingley, West Yorkshire BD16 1AU.*