My Week as a BIGGA Delegate

Mike Gash reviews his trip to America and the GCSAA Show through the BIGGA Delegation, sponsored by Bernhard.

The journey started back in August 2004 with the wrap round on the magazine. Thinking this is only for Course Managers, Master Greenkeepers (MG’s) and members of Regional and National Board Members/Committees, I still thought: “If your not in it you can’t win a place on it,” and sent it back. I received a form back with five questions plus a request for a little personal information. I filled it out and sent it back, then, towards the end of October, I received a letter telling me I had been short listed and asking if I would attend an interview. A week after the interview I received another letter to say I was off to Orlando Florida. Game on!

I attended a ceremony at BTME to pick up the tickets and to meet the other nine guys who’d also been selected and meet other lucky attendees that had gone in previous years. They were there to talk of their experiences.

On a cold Sunday morning, the first week in February, we all met up at Gatwick Airport ready to jump on a Virgin flight bound for Orlando, Florida. With five hours time difference, on landing, it was a very nice sunny and warm 70 degree Sunday mid afternoon, the English weather was a distant memory.

After getting settled into the excellent hotel, which was to be home for the next seven nights, we were given details of the courses to which we will all visit first thing Monday morning.

MONDAY

Eagle Creek Golf Club

The first course was Eagle Creek Golf Club, a new 18 hole course, measuring 7,198, par 73 Championship public course. Designed by Howard Swan and Ron Garl, their concept was to design a course that had a European and American feel about it, this was an interesting concept and worked fairly well. The course had a nice open feel about it but, as American courses go, the obligatory homes on the boundaries are being developed as I write. This will also include two schools, a shopping mall and will virtually become another small town.

Buck, the Superintendent, had a budget of $800,000 - nearly £500,000 - and spent $135,000 - £75,000 - just on fertilisers. They had 45,000 rounds a year.

The one thing that made this course stand out from the rest was it had been sown with Mini-Verde, a high shoot density, ultra dwarf Bermuda grass, for production of high quality golf greens. It tolerates continuous close mowing, about 2mm, has a dark green genetic colour and excellent low temperature colour retention. Mini-Verde will tolerate relatively high amounts of sodium and therefore is adapted for use with reclaimed water, it also tolerates soil pH levels from 5.5 to 9.0, but will perform best at pH 6.0 to 6.5, it also has few pest problems, which is useful in the US.

The club is also proud of its five par 5’s, to this it has five tees per hole, all square.

It had over 90 bunkers, some resembling Scottish reverted bunkers, which didn’t quite look at their best, something to do with the temperature and construction I think.

The clubhouse was equally as good, designed to mimic a vintage New England manor with a European feel. The complex has already received five accolades within 12 months of opening, quite an achievement, especially as there are about 200 courses within a 45 minute drive of Orlando. Our thanks to Buckner Marlon, the Superintendent, for taking the time to answer all are questions and to Howard Swan for the guided tour.

Grande Pines Golf Club

This was the second course of the day, redesigned by Steve Smyers and Nick Faldo, within the last couple of years. This undulating course with very sloping greens was challenging, especially with six large lakes, the course measured 6776 from the back, par 72. This course has also received numerous accolades from Golf Week’s 100 Greatest Modern Courses.

TUESDAY

We were scheduled to attend a Communication Seminar at the Convention Centre, this ran from 8am until 5pm. Presented by Mike Jousan, this seminar covered Philosophy and Principles of Communication, Specific Communication Skills, Negotiating and Selling Your Ideas and Handling Difficult Questions. This was an excellent day and I am glad to say seven out of the ten strong contingent stood up and held their ground.

These Americans aren’t that keen on coming forward and we flew the flag. It was also nice to see a fellow Brit, not part of the BIGGA Delegation, though Murray Long, from Coombe Hill Golf Club, who also joined in.

WEDNESDAY

This bought another seminar, a Field Trip visiting three Florida Courses and a wetland project.

Hawk’s Landing Golf Club

The first course of the day was Hawk’s Landing Golf Club, reputed to be the Marriott’s flagship course. Director of Grounds was John Kopack and this course was built in 1986 by Jo Lee, but was redesigned with the whole course being dug up and re-laid in 1998 by Robert E Cupp. It’s now standing at 6800 yards, par 72, with water being in play for 15 of those holes. All of the greens were seeded with Tiff Dwarf during the winter.
The course had been heavily over seeded, except the rough, throughout the year they sprayed virtually every week with a cocktail of liquid fertiliser, fungicide, herbicide or wetting agent, the fertiliser was mainly fed through the irrigation system, which is reclaimed water.

They had 40,000 rounds a year, one year the club let it increase to 50,000 and found the course couldn’t cope with the amount of play, even with a crew of 55 staff. This course was unique because they had a plant holding area where they grow their own plants, mainly bedding. They also prepared their own hanging baskets, 300 of them, which got replaced quarterly and sold the replaced plants to the locals as a side line business.

Championsgate Golf Club

This was the second course we visited and the Superintendent was Bobby Ellis, a former GCSSA President. Championsgate GC is home to two unique 18 hole Championship golf courses, designed by Greg Norman, this is also the David Leadbetter Academy.

The first course, the National, is a typical American style, standing at 7128, par 72, off the backs.

The second, the International, course was designed to resemble the coastal wind swept dune courses of Australian and the British Isles, also standing at 7363, par 72. The whole resort is set in about 1500 acres plus. The courses are designed to collect all of the excess water from the Kissimmee area. This water was pumped into rectangular percolation basins called Rapid Infiltration Basins - RIBS - one rib was five acres in size, the whole site can cope with 12 million gallons, about seven days of continuous water. That’s 1.8 million gallons a day, during summer and one million per day during winter.

The percolation rate in these Ribs was 100mm per hour, water testing is done quarterly. It still costs the club $70,000 - £40,000 - a year to extract for irrigation, tissue testing in done monthly due to high salt content. The course has 44 staff and with an annual budget of $1.8 million dollars. They have projected 90,000 rounds a year but are only up to 65,000 at a cost of $215 - £120 - a round. Out of the 65,000 rounds, 40,000 are played in the first three months of the year, the other 25,000 in the remaining nine months.

Bobby also does a lot of testing with different grasses, by overseeding about 14 different greens: mainly the par 3 course, this enables him to experiment and see which grasses are for their course, he also has a 26-acre practice area.

This is another course earmarked for development with condos and homes dotted in and a round the course this will only boost the already $6.8million dollars a year turnover.

Wetland Mitigation

This was an area of wetland about 3.4 acres, it did actually connect to a river down stream somewhere. The idea was to set up a planting area of native wetland grasses and trees on the edge of this wetland, if they did that it could be protected by a conservation order and no one was allowed to fill it in and build on it, as like the surrounding area, which was actually ear marked for major development.

The people involved with this conservation project were Kelly Peterman, Senior Ecologist, and Mike Green, Natural Resource Professional.

Ritz-Carlton Golf Resort

The Superintendent at the course was Thomas J Schlick. This tour mainly concentrated on the ornamental planting and the grasslands in and around the hotel grounds, this included the flowers, bedding and pot plants.

Because of the sheer expanse of the resort the planting, i.e. bedding and pot plants, were changed five times a year, which is a hell of a task especially with 100,000sqft of flower borders and over a hundred pot plants not quite the 8in size either.

They had 30 staff just to maintain the interior and exterior planting and half of that number looked after the St Augustine grass and the trees around the hotel grounds. The operation budget for just the landscaping, i.e. exterior planting, was $1.565,000 and the interior planting was $118,000 and that’s not including the golf course budget, which incidentally was $1.400,000. What a dream to have a running budget of just over $3million dollars!

But the main item we all wanted to see was the course and maintenance facilities. Well, what could I say about the maintenance sheds apart from absolutely fantastic.
The locker room for the staff was better than most member locker rooms in the UK. There was not a speck of dirt anywhere, and I mean anywhere, from the chemical store to the Superintendent's office, which looked like a DFS lounge mock up. All the machines were spotless, unbelievable if I hadn't seen it for myself.

THURSDAY

The first day of the official show, we all went to the opening session. Apart from the usual thank you's for those few stepping down and the new ones coming on board the opening session was slightly overshadowed by one man.

He was being honoured by receiving the converted Old Tom Morris Award that was the Golden Bear himself Jack Nicklaus. He gave a talk and did an interview for the Golf Channel, which was being recorded for a later date. He also gave a question and answer session. That was one of the highlights of the day.

After that was over we went to the show. Yet again another very impressive setting, there was about 830 exhibitors showing of their latest products, they had 270,360sqft of exhibition hall to cover, bearing in mind that is all in one room.

They were expecting 25,000 to 28,000 people to visit the show, before that there was already 7,329 people who attend the education seminars and I don't know how many entered the golf tournament that was played over five top Orlando courses over three days.

The show was categorised into seven main areas; the building of a green, agronomic solutions, clubhouse solutions, driving range, electric vehicle test track, equipment and maintenance, and water solutions. This was the first ever building of a green in the middle of an exhibition, it was built to full USGA spec, probably about 300m2 with all the surrounds. Turfing could have been better, though.

That evening bought one of our first big engagements, the President's Dinner, hosted and sponsored by Stephen Bernhard. This involved meeting and dinning with some of America's top 100 Superintendents and some of the GCSAA hierarchy.

This was an evening not to forget, the networking potential was enormous, we all met so many inspirational people and by the end of the evening we had made some new friends.

FRIDAY

This was another day at the show, meeting up with reps and fellow UK greenkeepers and college lecturers, including a certain Wayne Roberts, from Myerscough. That evening we were to attend another reception to see the old President, Mark Woodward, handing over to Tim O'Neill, the new GCSAA President. By the way, congratulations to Mark on his new appointment in San Diego. Good luck.

SATURDAY

We had finished off at the show because it closed at 2pm, so just time to pick up a few bargains at the GCSAA retail shop, after the show a little retail therapy at one of the many retail outlets. That night most of us went to downtown Orlando to see a free open air concert by Bruce Hornsby and the Range, an 80's group if your wondering from around '86 with a number one hit "The way it is" and many others. Thanks to Sami, from BIGGA, for hearing where they were playing.

SPECIAL THANKS

I would like to thank Stephen Bernhard for his support in sponsoring us all, also Sam, Kim and all of the Bernhard crew, thanks everyone for making it a great trip.

Also, to all the fellow cricketers who travelled with me. You all made it an unforgettable week, also thanks to John Pemberton, Sami, and Rosie. Nice to see you all in action; Howard Swan for making the first day so enjoyable. Finally congratulations to Chris Maynard for his new appointment at Pirates Cove.

My personal thanks to all of you.

Chris Maynard, of The London Golf Club, one of the ten BIGGA Delegates tries out some of the new technology and equipment at the GCSAA Show in Orlando, Florida.
With its bright green course and colourful flourishing backdrop Augusta National is the bane of most greenkeepers' lives.
With April heralding the annual outbreak of Augusta Syndrome Scott MacCallum speaks with a man who has been a feature of Augusta for nearly 40 years.

So here we are again. April, and the Masters will be filling the television screens with spectacular golf on a course which fits every club member’s vision of what a golf course should be.

Augusta National is perfection personified. Very few of us have ever been lucky enough to visit but we all know the course, particularly the back nine, as if it were our own.

A little draw to get the big bounce down the 10th fairway; a deep breath for Amen Corner - avoid the lake to the left of the 11th; vital club selection on the 12th and hitting a perfect right to left drive on 13 to give a chance of making the green in two - Amen to that; but then there is the terrifyingly slopey 14th green; the 15th where you can find water both in front or behind the green; up comes the 16th where every well struck tee shot feeds down to the hole and looks a dead cert to go in; the 17th with a well positioned tee shot giving a chance to just clear the bunker guarding the green and leave a birdie putt; then a deep breath before attempting the claustrophobic drive up the last, hopefully missing the bunkers, gives a chance to leave a makeable putt on the famous last green.

The colours are amazing. The caddies’ white overalls setting off the vivid green of the fairways and greens; the stunning rhododendrons and azaleas; the carpeted bridges, the pure white sand in the bunkers and the blue water of Rae’s Creek and the many lakes.

Then there’s the greens themselves. Is there anything more extraordinary than watching a player strike a putt away from the hole and then waiting 40 seconds for it to find its way all around the green to the hole side or sometimes, miraculously, in?

Now, if you just spent a little more time preparing your own course properly, surely you could come up with something nearly as good. I’m not so stupid as to expect something exactly the same, after all I know the weather’s always better in America and from what I see there are a few more staff at Augusta than at your place, but how much sun or people does it need to get greens to stimp at 14?

It’s the same every year. The US Masters is the bane of greenkeepers’ lives but you do have a champion out there and he comes from an unlikely source.

“For people to think that their own courses should be like Augusta is like dreaming of living in Buckingham Palace. It is completely unobtainable.”

“Practice your putting every day and don’t let your greens dry.”

There speaks a man who has been attending the Masters for over 40 years and whose voice is synonymous not just with the Masters but every top golfing event of the last 30 years - Peter Alliss.

In other words at Augusta - It’s golf, Jim, but not as we know it.

“There is a lot of falseness about Augusta. It’s a bit like preparing for the Chelsea Flower Show, where plants are forced on and arrive in buckets and everyone is desperate to keep the plants alive for a week. A lot of that happens at Augusta where they do supply the rhododendrons and azaleas in pots if the weather hasn’t been conducive to bringing them on, just so that it looks wonderful,” explained Peter.

And if your members get a little depressed, as they gaze out of your clubhouse window onto a deserted putting green and a fourball trudging towards the 18th green, at the thought of Augusta members sitting in their colonial style clubhouse perched high above the course taking in a view that is golf’s equivalent of the Hanging Gardens of Babylon, listen to Peter.

“When you look out from the Augusta clubhouse all you can see are acres of mown grass without a feature on it. Put all the people there, though, and it looks completely different.”

Peter has been the voice of BBC Television Golf for many years, taking over the mantle from the great Henry Longhurst, and he has described many of the finest Masters’ moments.

He was there in 1980 when Seve burst on to the scene and became the youngest ever champion. In ’86, he described Jack Nicklaus’ incredible back nine to become the oldest man to win the title. He was the man who, in ’88, coaxed Sandy Lyle’s amazing fairway bunker shot down the green towards the hole to give him the birdie chance that made him the first ever British winner. The very next year he peered through the gloom to see Nick Faldo win the first of his two Masters titles.

“Practice your putting every day and don’t let your greens dry.”

“For people to think that their own courses should be like Augusta is like dreaming of living in Buckingham Palace. It is completely unobtainable.”
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A Word with Alliss

He is also an advocate of traditional golf and is left open-mouthed by some of the new style courses which are being built, particularly in the States.

"Some of the courses in the States are like ornamental gardens. For example, I went to see the new Donald Trump course last year and it had some wonderful, but ridiculous, waterfalls. Great feats of engineering and silliness. It's like playing golf in an artificial world."

He also feels that there are a lot of golf developers who live in a fantasy world with every new golf course supposed to be a par-72.

"You produce a wonderful golf course with a pair of 70 and people think it's Mickey Mouse, because it's only par-70 - God forbid if it were to be par-68. But I maintain the most difficult course in the world would be four par-3s between 200 and 225 yards and 14 par-4s at 470 yards long. It would be a par-68 but you could bring Tiger Woods over and he'd go round all day long and not break par."

So here's a chance for Peter, with the ear of the greenkeeping profession, to get anything of his own off his chest.

"Sand in the bunker! I would like to start a campaign at every golf course in the country to have bunkers forked over on April 1. Everywhere I go I see bunkers with no sand in them, probably because of the raking system. I don't want a foot of sand but you could tickle the sand to loosen up a couple of inches. That's the one criticism I'd make," he said.

Warming to his theme he laid out his blueprint for a well run golf club.

"I'd try to get the very best greenkeeper I could, but also the best steward; the best cook - you don't want a chef; a good Secretary; a good pro and a good assistant. If you've got all those ingredients it will work. The course can be very ordinary but if you keep it neat and tidy with a good attention to detail people will say how nice it looks and keep coming back. It's like having a cheap pair of shoes, if they are clean and looked after they will be fine but if they are dirty and neglected they look awful," said Peter, who has great respect for greenkeepers.

"It's a hell of a job for greenkeepers. It's not a thankless task as it is very rewarding but I don't think in all honesty enough good greenkeepers get enough praise. They are the hub of any club.

"As for the Augusta Syndrome. It's silly and unobtainable."

Photographs supplied by Getty Images and Brian Morgan
### Talking Heads

**Compiled by Gareth Jones**

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**TELEVISION GOLF**

**Does Augusta National or other courses which appear on television influence your members'/clients' perception on how a course should look?**

**To be honest, not since I moved to Cardrona. I have experienced that in the past, but here it has been different. Having a small membership helps in that and it is important to have good communication to tell them why the course looks and plays like it does.**

**It is hard to say. On the one hand the American courses on TV don't do us Brits any favours as members see them and want our course to look the same in the middle of winter, which just isn't possible. On the other hand they are just happy to see the course looking and playing well.**

**There is an influence, but I wouldn't just put it down to Augusta. In the past that might have been true, but with so much TV golf nowadays the golfer sees so many courses that they will be influenced. I also think that today's golfer travels a lot more and sees courses across the globe in different climates and that influences their opinions.**

**It certainly does have an influence on our membership, but I don't let it influence how I manage my course. Satellite TV has a lot to answer for as the majority of golfers judge the course's quality on its colour, which is wrong. Personally I don't like these bright green courses that you see on TV, they look too artificial.**

**Fortunately I have a very well travelled membership, who are fully aware of the climatic differences let alone the financial ones. I pity anyone who has members who feel their course should resemble Augusta in any way. It would break my members' hearts to have manicured gardens on their golf course.**

**I definitely think so. You get the fair weather golfers coming out around this time of year and they expect to see the course looking exactly how they see courses on TV. They forget that this club doesn't have the huge budgets that other clubs have and that it is just not possible to meet those unrealistic standards.**

**Yes, especially here in Switzerland where there is little or no knowledge of links style courses. The course is built on a sandy soil with wall-to-wall fescue. In the early morning it looks very green but with the Mediterranean climate we have here its usually looking very brown by midday.**
### Is there pressure to make your course greener in colour and inline with many of the courses seen on TV?

We don't have a huge problem with that. I am lucky in the fact that I am clearly in charge and we have total responsibility of the course. We are a business and we do have to think along those lines, but that doesn't put pressure on us to change the course.

### What do you do to meet your members'/clients' demands but at the same time keeping the course in a realistic and healthy state?

It is difficult to get that balance, but crucial to do so. We have Q&A sessions with the membership, which helps a lot. Some suggestions we get just won't work, and you have to be very careful to explain why it wouldn't work. We have to treat everyone, including members, as clients, and you can't afford to upset or lose them.

### What is the biggest tournament you have held at the Club and how did you set up your course differently for it?

We hosted the 2004 PGA European Pro Tour Cardrona Classic. Over the last 10 years, as BIGGA has become more respected, the PGAs attitude has changed, they now ask you to change things, rather than tell you. We had the greens faster, stimping at 11 feet. We also narrowed the fairways and changed the par from 72 to 73, having five par-5's on the course.

### Did the course take time to recover after peaking for these events?

After the PGA Tournament we have no problems. We also hosted the Bankerke Match Play in October and we were unlucky with the weather. We had so much rain that the final day had to be cancelled. What caused the problems was that the officials, TV crews, etc insisted on still using golf buggies and this really damaged the course.

It does take time to recover. We normally don't touch the course for a week after major events, we just let it rest. It depends on the weather and what has taken out of the course.

Typically we use balanced fertilisers to make the course up and we bring the cut height up so the turf is less stressed.

### Our course appears on television so the pressure comes from having the course up to the high standards required by the European Tour. So the pressure is on us to get the course right. We have ours set up similar to the US Open, so the focus is on developing the course into that type of state and standard.

There is no pressure applied to me by the club. I have been here 18 years and I have a course policy in place that the members respect. I focus my attention on the playing characteristics of the course, as that is the most important thing. Obviously we make the course as presentable as possible, but how the course actually plays is crucial.

Not at all. A luminous green heathland course is the last thing anyone wants here. In contrast they love to see it really brown off in the summer. The pressure comes from corporate/visitor golf, they often relate to what they see on TV.

When you visit courses on TV you realise that producers can make anywhere look good with filters and camera work.

To a certain extend yes. The problem is that golfers don't know about grass types and the health of grass, they just like to see good colour. We installed a new putting green and we got complaints that it wasn't green enough in colour and looked unhealthy, while it actually was in great condition and very healthy.

The biggest gripe is about the lack of definition compared to the American style courses but I am fortunate that the Architect, John Chilver-Stainer, lives locally and spends a considerable amount of time at the club explaining his concept to the players. It is a sad reality, but his word carries a lot more clout than mine, except among the regular players.

### Did the course take time to recover after peaking for these events?

After last year's event we had a lot of problems, which were mainly caused because of the large amount of rainfall we had. The course can cope with the extra play, however it is the spectator damage that hurts the course. Having that extra traffic around the place and having things like tents and marquees put up takes it toll.

We speed up our greens by top dressing, verti-cutting and maybe lightly rolling, rather than dramatically dropping our cut height. This allows the course to recover quicker. We also use stress relieving methods when needed.

### It uses to be like that, but attitudes are changing. My Chairman travels around the world and plays a lot of high profile courses. He picks things up which he wants to see on ours. We used to fertilise just to make the grass greener, but this also increased the amount of thatch we had, so we don't fertilise as much now.

### Is there pressure to change the course. Obviously we make the course green in colour and look healthy on these events?

You definitely have to have a balance. We don't go over the top on the fine turf, instead we concentrate on the rough. We fertilise the rough to get it up to the height and standard demanded, but on the fine turf we just continue to look after it how we feel fit.

### You have an excellent maintenance programme in place and we concentrate on producing quality turf and fast firm greens, which is what the members notice. I like to keep the grass looking natural, I really only use our irrigation system to keep the grasses ticking over until the wet season comes instead of watering to make the grass greener.

### Emphasis here is in keeping things realistic. I will cut the greens at 3mm for the summer and 5mm in the winter, which some might question, however with judicious watering and fertiliser usage we are seeing an improvement in the indigenous grasses. We have limited fairway irrigation, which helps keep things natural, but I think we'll need to change this to keep the visitors happy.

You do try and listen to members' needs. The only thing we try to do is cosmetic improvements. This means that we are meeting members' ideas as to how the course should look and the colour the grass should be, but at the same time by doing that we are being very careful as to not damage the course.

### With temperatures in the high 90's °F, free draining soil and a constant wind affecting the irrigation it is a losing battle trying to keep the grass green, so I don't try. I insure the course is always in a neat and tidy state. I have regular discussions with the members, put up pictures of links courses and have the support of the Pro.

### After the major events, we just let it rest. It depends on the weather and what has taken out of the course.

Typically we use balanced fertilisers to make the course up and we bring the cut height up so the turf is less stressed.

### The course is still very young but we did have the County Strokeplay here in 2003. I did not alter the course that much except for double cutting the greens and a few difficult pin placements. We had midday temperatures of 110°F and strong winds which kept the scoring high.

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NIck Harden looks at the causes of poor health in fine turf and some of the treatments and corrective measures greenkeepers can apply.

Like those who play on it, golf course turf can sometimes get run down and in need of a tonic, particularly following the depressing cold and wet months of winter. This is when greenkeepers have to take on the role of turf doctors, looking at all the possible causes of the turf's depression and establishing the best forms of treatment. Turf's requirement for a tonic may be diagnosed as needing a change of 'diet' or 'environment', or the application of a 'medicine'.

**DIET AND ENVIRONMENT**

In order to maintain turf in a healthy condition, and therefore reduce the need for treatment, particular attention needs to be given to four particular areas, one relating to 'diet' and three to the turf's 'environment'.

1. **Correct feeding**
   
   Left to its own devices, grass will survive on soils with widely ranging nutritional value. However, to provide the optimal growing conditions needed for fine turf, feeding needs to be carefully managed. The main nutrients that grasses need are nitrogen, phosphate and potassium.

   The precise requirements for nutrition depend on the grass species, time of year and the type of soil. Some diseases are encouraged by lack of soil fertility, e.g. Red Thread, while too much nitrogen in the soil can encourage other diseases such as Fusarium Patch. Again like its players, turf's diet may need a helping hand in the form of supplements, in this case fertilisers.

   When using granular fertilisers on golf course turf, a compound, although more expensive, offers distinct benefits over blended forms which often contain large proportions of grit. Grit has no nutritive value and can damage expensive mowing machinery. Additionally blends can create lush week growth and can increase the risk of scorching.

   Compound fertilisers are made up of individual prills containing the vital components Nitrogen, Phosphate and Potassium. This allows a far more even supply of nutrients to create uniform strong growth of turf type grasses. Compounds also incorporate sulphur, a component lacking in blends as well as in the atmosphere, but which is a trace element essential for healthy grass development.

2. **Soil pH**

   The optimum pH for grass growth is between pH 5.5 and 6.5, although grass can survive a much wider range than this. Outside this range, the pH will reduce plant vigour and in some cases, an alkaline pH - greater than 7 - can encourage the disease Take-all Patch.

3. **Root systems**

   Poor drainage, compaction and the build up of thatch can cut down air supply to the grass roots, reducing plant vigour. This renders the turf more susceptible to disease attack. Turf soils need to be kept aerated by regular spiking or hollow tining, and the thatch controlled by routine scarification. Optimum moisture access in the rootzone, air to water ratios, and the ability to produce chlorophyll, thereby encouraging more efficient photosynthesis and better production of carbohydrate energy reserves, all contribute to keeping the turf healthy.