The Root to Victory on the Golf Course

Tim Fell of Tillers Turf, explains the ins and outs, the whys and whens of using rootzone turf on the green

There are two scenarios where turfing a green might be necessary: the renovated green, and the new green.

Renovation is required when the old green fails to support both the quality and quantity of play demanded by the golfers. The main season for renovation is September to March, when the old green is taken out of play. The members play on temporary greens until the renovated green comes back into the system in the spring.

So, there is an obvious need for speed, and no time to be wasted. Thus, turfing is the only option. If you seed, the green won't be back in play the following spring.

Where new holes are concerned there is a bit more flexibility. New holes will be part of a new 18-hole/9-hole development. They are sometimes seeded, sometimes turfed, depending partly on budget and partly on opening date. For cost comparisons, seeding works out at roughly 50p per square metre, while turf is about £7 per square metre. Clearly, there is a substantial difference, although that difference is much smaller when growing-in costs after seeding are taken into account.

But the case can be made for turf if the conditions are right. It means the course can open 6 months earlier, which in turn means earlier revenue in membership fees and green fees. Indeed, in the United States, sometimes entire courses are turfed, all 50 ha, so they can open soon afterwards.

THE OPTIONS AVAILABLE

Topsoil turf

This is turf which is grown on indigenous topsoil. It has been the main commercial source of turf for the golf industry, and the landscape industry, for the past 30 years.

However, now that most greens are constructed using high-quality imported rootzones, the use of topsoil turf has fallen dramatically. Waterlogging is a major problem on some greens, and is often caused as a result of incompatibility between topsoil turf and imported rootzones.

Incompatibility arises from the fact that there is a wide difference in particle size distribution between the two. In particular, the percentage of clay, silt, and very fine sand in most topsoil is too high, resulting in poor drainage of rain and irrigation water through the green profile. A distinct topsoil layer can often be seen in sections of a green where this type of turf has been used, and it is here that water is retained.

The general advice on overcoming problems associated with topsoil turf has been to hollow-core regularly and then to top-dress, to try to effect soil exchange.

This is labour intensive, expensive, slow and disruptive to the playing surface. The results are often far from satisfactory.

Sea-washed turf

This is turf which grows naturally on the edge of river estuaries, and was popular for golf and bowling greens up until the 1980s because of its very pure and fine mix of grasses.

It is not used now, due to the fact that the soil it grows on is silt, and contains an even higher percentage of fine particles than many topsoils. Accordingly, waterlogging would be an inevitable consequence of laying sea-washed turf onto a quality imported rootzone.

Re-using old turf

Obviously this does not apply to a new build, but existing turf can be stripped off and used on a renovated green.

There are two arguments for re-using - the first is cost. It is seen to be cheaper than buying in new turf. However, the costs are often underestimated - the old turf must be lifted, laid out on plastic sheets, kept alive and re-laid.

The second argument is that by using the turf again, the new green has the same playing characteristics as other greens on the course that haven't been renovated.

This argument loses its validity when you consider that the objective of a renovation is to improve the playing surface. It could be said that a better approach would be to accept a difference in the short term, with the aim of bringing all the greens up to the same high standard as the new ones.

▲ Close-up of turf grown on Tarmac USGA rootzone

▲ Precision lifting is necessary for accurate laying

The main argument against re-use is that it can bring problems associated with thatch (a major issue on greens), including increased disease potential.

Re-use is not always an option, particularly if the new green is larger than the old.

Washed turf

This was developed ten years ago to answer criticism associated with turf grown on topsoil, where problems arise from the material the grass is grown on. So, by washing away the topsoil, the problem of incompatibility can be eliminated.

The theory behind it is sound. The problem is that it is a product which needs careful handling and aftercare. The degree of skill, and the amount of aftercare, needed by the greenkeeper is much higher than with other sorts of turf.

This is because in the early stages after lifting, it is very fragile. It can dry out easily, and it's prone to disease because it doesn't have any of the benefits of buffering from the soil it's grown in.

There is a need for copious top-dressing and brushing to get rootzone back into the turf mat. Additionally, washed turf remains soft for at least a year after it has been laid. Some say the washing process damages the roots. It is also very susceptible to overheating in transport. The cost of washed turf lies somewhere between topsoil turf and rootzone turf.

Rootzone turf

Rootzone Turf is turf that has been grown on imported rootzone. Some believe it presents the best way of overcoming problems of incompatibility of soil types. The main objective is to match the underlying materials of the construction. By growing it on the same material the turf is to be laid on, the problem of waterlogging due to layering is overcome.

When building a green, laying anything other than rootzone turf could lead to a reduction in performance, or even failure, of the whole green at a later stage.

When you consider that a new green can cost £20-30,000 it pays to get it right first time.

In simple terms, the benefits from rootzone turf are clear. Firstly, it is very easy to use with no particular complications. Second, the green will be free-draining and firm. After all, the biggest problem on a green is waterlogging, which is normally associated with poor rootzone profiles.

HOW ROOTZONE TURF IS GROWN

Prior to establishing a crop on our nurseries, we, at Tillers, treat the soil to ensure any weed seeds in the top four inches are killed. This gives us an exceptionally high degree of purity. Following that, the seedbeds are levelled to a billiard-table standard. A layer of rootzone is applied, using a drop spreader. Then we sow a mix of fescue and browntop bent, and irrigate immediately afterwards to give a quick, even emergence.

In terms of a 50/50 mix, this gives a much higher proportion of the smaller bent seeds than fescue seeds, because the proportion refers to distribution by weight. So the crop is predominantly bent as it matures, which is what the majority of inland golf courses are looking for.

Then we start mowing the sward, over a period of months bringing the height down gradually to 7-8ml. Once it is at 7-8ml, we will topdress it regularly. Top-dressing is brushed in after it has been applied.

The benefits of topdressing are to give a really dense, firm sward, and to reduce the build-up of thatch.

We mow, sometimes every day during the height of the growing season, with a Toro triple mower 5200, which gives us a very fine quality cut. We give it a programme of fungicides to ensure we protect the crop against take-all and other diseases. We verticut regularly too, to cut out lateral growth and stimulate dense growth.

The whole process is similar to growing-in greens on a new course, and in fact we employ an experienced Greenkeeper to manage it.

▲ Mowing at 7mm with Toro 5200

AFTERCARE

The establishment of a rootzone turf after it has been laid is like any normal turf, and considerably more straightforward than washed turf. Because it has been mown at 7-8mm, and regularly top-dressed, it can very quickly be brought into play.

BUGS AND ALL THAT - Do they work or don't they?

Stella Rixon follows up her questionaire of last month with an examination of how biologicals can be utilised.

This is my second article following the introduction of the STRI's national survey on use of 'biologicals' (see last month). A questionnaire has been sent to many Clubs around the UK with the aim of studying the exposure of bio-products, how, why and where they are used, what percentage of users have had positive results and where they have failed.

I will discuss the findings in future articles and the results will be made publicly available. In the meantime I'd like to examine how, when and where they might be successfully employed.

Firstly, we should address the use of the word 'they'. There are a number of 'bio' products on the market, referred to in all manner of ways such as biostimulants, microbial inoculants, organic products, bacterial liquids, bio-solubles, microbial composts, etc.

Each formula contains different ingredients, some may contain fertiliser components such as nitrogen and/or organic material, they may have one type of bacteria or a whole host of microbes (bacteria and fungi) and others may not contain any microbes at all.

Therefore, it is very difficult to discuss all these products under the single heading of 'biologicals'. The first step to understanding their possible use is to know WHAT you are using and WHY. For this we need some definitions:-

MICROBIAL INOCULANT vs. BIOSTIMULANT

Microbial Inoculant - contains living microbes (bacteria or fungi), specifically chosen for their beneficial properties, cultured up and put into the product in a stable form (i.e. inactive).

There are a range of formulations on the market but it would be fair to say that most manufactured microbial products contain bacteria as they are generally easier to culture and some species can remain dormant for several years, thereby giving the product a reasonable shelf-life.

Bacillus and Pseudomonas are the most common groups used, chosen for their plant growth promoting activities and as competitors to fungal plant diseases.

A few inoculants contain fungi eg mycorrhiza fungi (discussed later). Another beneficial fungal species - Trichoderma spp. are used quite extensively in horticulture - in both lab, glasshouse and field as they can repel diseases by producing anti fungal agents (no known Trichoderma-specific commercial products available in this industry as yet).

Products may contain a single species of bacteria or fungi or several species. Remember that many subspecies or isolates also exist so one product containing Bacillus subtilis may be different from another containing Bacillus subtilis in the same way as there are several varieties of browntop bent grass, they are all Agrostis capillaris but we have Lance, Heriot, Sefton, etc all with slightly different characteristics.

Attempting to manipulate an existing microbial community in an established soil by introducing new microbes is difficult. Studies using DNA tracers on introduced bacteria have shown that the indigenous population will quite quickly out-compete the newcomers. Nevertheless, in the short-term, ~2-4 weeks on average, it is possible to boost numbers of the desired inoculated microbe(s).

Biostimulant – this could describe anything that boosts bacterial numbers or activity – aeration is a very effective biostimulant!

In terms of products, biostimulant usually refers to those containing organic components such as seaweed, amino acids, composts, yeast extracts, molasses and even simple sugar which are all food for microbes and can increase their numbers.

If this organic material has not been sterilised, eg chicken manure, then it will still contain naturally occurring saprophytic microbes (those that degrade dead organic matter) and therefore actively inoculates the soil too.

If you add a biostimulant to soil, you generally see an increase in microbial numbers, e.g. via a bacteria count, in response to the increase in food supply, but as this extra food is used up, the numbers will drop again unless more is added.

However, remember that a simple increase in microbial numbers may not necessarily be a good thing – a biostimulant can be utilised by many types of microbes – some beneficial, some neutral and some detrimental to plant health.

Many formulations contain both an inoculant and biostimulant eg granular microbial products with an organic base such as seaweed. Some liquid formulations will be sold as two bottles – one containing the microbes and the other a biostimulant such as liquid seaweed/molasses, etc which are designed to be tank-mixed to get rapid reproduction before application.

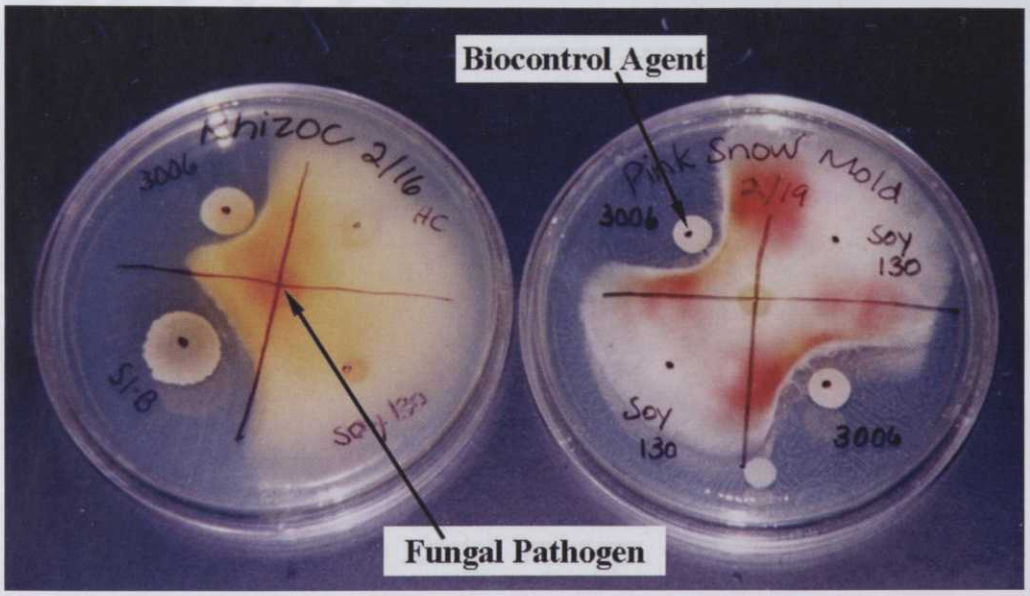
AND ENZYMES...

I should also mention that a few products also use enzymes. Enzymes are not actually living entities – they are protein molecules which are naturally produced by living organisms such as plants, bacteria, human digestive system, etc to catalyse chemical reactions such as breakdown of food.

In the turf industry, enzymes have a potential role in organic matter degradation/composting and thatch breakdown. Although they are non-living they are affected by some of the same factors as microbes such as temperature and pH.

Remember they are protein molecules.... think of them like an egg; just like an egg, if you heat an enzyme its consistency changes and for an enzyme this will mean it is no longer effective – it has to keep a particular shape to be active.

Note your biological washing powder at home will have a recommended maximum temperature! I won't discuss enzymes any further as they are only found in one or two products but keep in mind that if you do come across an enzyme product to trial ask questions such as what pH will it be effective in.



Biocontrol in labatory ▶

Picture kindly supplied by Novozymes

WHAT USE DO 'BIOLOGICALS' HAVE?

The important question is what problems are you trying to solve? You have to be clear on your objective before you can see if and how biological products may fit into that.

Sadly, there is no one 'super-bug' which can resolve all turf problems and it may be that biological products will have no benefit for your particular problems eg poor drainage. Their possible uses can broadly be separated into general turf health and biocontrol as discussed below:-

A.) GENERAL TURF HEALTH

New rootzones

New rootzones are relatively sterile; ie: little microbial content or biological activity, but they are not totally sterile unless they have recently been fumigated with a sterilant such as methyl bromide. Without good microbial activity, these rootzones are prone to three main problems:-

1. Leaching of nutrients –remember the grass plant takes in nitrogen predominantly in the form of nitrates and ammonia. If nitrogen is supplied in a complex form such as long-chain, slow-release molecules then in most instances the plant will not be able to access the potential nutrient available without microbial activity to convert it into a form which the plant can take up.
2. Thatch build-up – despite the turf managers best efforts, thatch and organic matter can quickly accumulate when there is little microbial activity in the soil to break it down.
3. Diseases –such as Take-All Patch (Gauemannomyces graminis) which is an opportunistic fungal pathogen, quick to colonise new, sterile ground but a poor competitor against other microbes. Therefore, this disease tends to decline over time as the microbial community develops, a phenomenon known as Take-All Patch Decline, however it may revive if environmental conditions favor its growth eg a rise in pH.

Therefore, it is the aim of the turf manager to stabilise and mature the rootzone as quickly as possible to avoid the above problems. Over time the rootzone will slowly establish its own microbial community but 'biologicals' can be added to speed up this process.

In this instance, the objective is to cultivate a whole community of beneficial micro-organisms rather than just one or two types and therefore if considering an inoculant - a cocktail of microbes would be more appropriate.

It will also be as important to add some biostimulants i.e. organic material to the rootzone, as a new sand environment is pretty low in microbial food sources in the first few months, until the grass plants start producing organic matter and thatch.

There are two important points to note here:-

Firstly, take care not to overload the system with organic material as the microbes will not be able to degrade it quickly enough and a build-up will occur, resulting in problems such as reduced drainage rates and anaerobic, black-layer soil conditions.

Secondly, when combating Take All Patch it is important not to increase the pH of the rootzone which would actually encourage the disease - some biological/organic products have an alkaline pH.

It is also worth mentioning mycorrhiza fungi again here as they have been found to improve grass establishment on new rootzones - most research concentrates on bent and rye grasses.

Mycorrhizal fungi are slightly different in that they actually attach to plant roots and form a close relationship with almost all plants including ~84% of all grasses. In most cases the relationship is a symbiotic one - that is both parties benefit - the fungal hyphae (fungi equivalent to roots) extend through the soil like a web and channel nutrients and water back to the fungi and into the plant. In return the fungi get sugars from the plant - a vital source of carbon.

There are 1000s of different species of mycorrhiza but those classified as endo-mycorrhiza are the only type to associate with grasses –there would be no benefit at all to putting ectomycorrhiza on turf as they only associate with certain tree species!

MATURE SOIL ROOTZONES

Although this type of rootzone is by far the most important in terms of sports turf area, it is also the field where research has been limited and results have been the most unreliable due to the large variability in soil environments.

Can 'biologicals' benefit an old soil rootzone such as clay-based, push-up golf greens or council football pitches? If the turf suffers from very few problems and has a rootzone with good oxygen levels, a low sand content, some organic matter and a thriving population of native microbes then the answer is probably very little! "If it ain't broke, don't fix it!"

However, it may be that, although the rootzone is mature, it has become unbalanced eg through over-use of pesticides, over-use of organic matter/fertiliser or through repeated sandy top-dressings the surface has become more akin to a new sand rootzone where microbial activity is lower and hence problems such as thatch build-up occur.

In these instances, there may be some benefit to using a 'biological' as part of an integrated programme, but remember - none will resolve a problem with underlying drainage or a poor aeration programme.

The most common problem is build-up of thatch - when the rate at which the grass produces organic matter exceeds the rate at which the microbes can degrade it (or the turf manager can remove it!).

◀ Fusarium close-up

In this instance, adding an organic biostimulant may be useless and could actually worsen the situation as the existing microbes are already over-loaded with organic material/thatch which they require oxygen to degrade.

If oxygen is the limiting factor, then adding more organic material is likely to create anaerobic soil conditions. The best solution for this problem does not lie in a packet but rather in your aeration machinery!

Inoculating the thatch with additional saprophytic microbes can increase the rate at which it is degraded, provided oxygen is not limited and obviously only if the introduced microbes survive and are active for a sufficient period.

If the environment into which you are adding them is not suitable e.g. too acidic (pH of < 5), too cold (<100C) or anaerobic then results will be poor. It should also be noted that some turf managers have experienced worse Fusarium (Microdochium nivale) disease following a late application of saprophytic microbes as the flush of growth resulting from the thatch degradation has promoted soft, lush grass growth which is then more prone to disease-attack.

B.) BIOCONTROL

Biocontrol is basically about using one living organism to control another and in the turf industry the aim is to identify antagonistic microbes which can prevent the growth of disease-causing fungi and then apply that specific microbe, as you would a fungicide, to actively control the spread of a disease. This is quite easy in a laboratory situation as the control agent and fungal pathogen are in ideal conditions for their growth and in close proximity to each other in a Petri dish!

However, in the real world the soil environment varies considerably - it may be unsuitable for the growth of the control agent or simply that conditions are particularly suited to the growth of the disease-causing organism, meaning that disease pressure is high.

Under these circumstances it is difficult to get sufficient numbers of the control agent to blanket cover the soil in order to stop the growth of the disease throughout.

However, for low to medium disease-pressure, biocontrol agents can be very effective, provided they are applied very regularly (every one-two weeks) through the disease period.

They can also be used in rotation with standard chemical fungicides to ensure complete control of the disease thereby avoiding the build up of tolerances within the disease population to a single product.

One such bacterial inoculant has been registered as a pesticide against Dollar Spot in the States and to gain registration the company must have proved its efficacy and safety for use in the environment. Trials are underway in the UK to gain sufficient data to register similar 'biofungicides' but as yet none have been released.

THE ROUTE TO SUCCESS!

As you may have gathered by now, dealing with living organisms is not an exact science and there is still much we have to learn about the world of soil. As research continues, we will understand more about this complex environment and how better to manipulate it to our advantage.

However, in the meantime if you are considering trying a 'biological', first ask yourself the following questions:-

- Q. What do you want to achieve by using such a product? Can you do a trial to actually assess the results with and without?
- Q. What's in your chosen product – does it actually address the problems you have? Check it cannot actually make them worse!
- Q. Is your soil environment suitable for microbes? Overly acid pH (<5) or anaerobic soil conditions are not suitable and require other cultural methods to resolve.
- Q. Are there underlying problems which need addressing first e.g. drainage, improved aeration programme? Remember the majority of microbes beneficial to plant health are aerobic, that is they require oxygen.
- Q. Consider the timing of the application – the soil needs to be warm for microbial activity (>50C).

Don't forget to fill out the questionaire which appeared in the May magazine and return it to Stella; whether you are a user of biological products or not.

Amenity Update

Giving Mother Nature a Helping Hand

When water ecology is healthy, we can expect to see naturally beautiful, crystal clear water, but a healthy aquatic environment is often created with just a little help. In many cases, poor pond and lake water quality is a result of an overload of organic matter, including excess nitrogen and phosphorous. This build-up serves as a food supply for algae, anaerobic bacteria, and even certain weeds. You may not only see algae bloom and scummy conditions, but you can often smell the results of poor water quality. Today, these unpleasant and unsightly conditions are easily remedied with Aquatic Management Products from Amenity Technology. Designed to combat the problem of organic matter in the water column, Amenity has developed its range of microbial pond clarifiers known as Crystal Clear. Crystal Clear is an all-natural, microbial-based product range designed for maintaining better pond and lake water quality. Designed to protect the environment, Crystal Clear products contain absolutely no synthetic chemical ingredients, but rather, it is a concentration of proprietary, naturally occurring microbes, which act to bring pond water back into ecological equilibrium. The result is reduced organic sediment and particulate in ponds reduced sludge, enhanced conditions for aquatic life, and clearer, cleaner water.

How does Crystal Clear Work?

Crystal Clear creates clean pond and lake water through biological processes. It introduces beneficial microbes, which consume the food source supporting algae and anaerobic bacteria growth. Without the food source, the unsightly and often unhealthy conditions cease to exist, and as a result, water quality improves often within two weeks of treatment. In addition to its microbial pond clarifiers, Amenity also markets a range of Super Strength Aquatic Colorants including WSB and Lake Colorant Super Strength. Both of these products are produced from the most concentrated liquid organic colorants available today. One litre of Lake Colorant Super Strength is often as concentrated as 4 litres of other brands of colorants. The Lake Colorant Super Strength is designed to impart a lustrous blue colour to lakes and

ponds. Aesthetically pleasing, the blue colorant adds a rich, tropical look to treated waters, giving them the appearance of being deep, dark and inviting bodies of water. Both products work wonderfully well in concert with the Crystal Clear range of Pond Clarifiers. Crystal Clear is available in granular form as well as easy to apply, pre-measured 'pucks'. WSB and Lake Colorant Super Strength are available in easy application bags and one litre bottles respectively. A secondary and previously unimagined use of the lake colorant products has been devised in the USA where fishery owners are using the product to deter herons, cormorants, eagles and other predatory birds from eating their valuable stocks. The birds simply cannot see the fish clearly enough to dive in and eat them! While this might not be desired in ornamental pools it is certainly an option during breeding season when the fish become vulnerable in the shallower spawning areas.

Crystal Clear is available in no-mess Water Soluble Bags (WSBs) 12 bags per tub. Application of 1 WSB per 125m³ of water when the water temperatures reach 10°C. Repeat application 1 WSB per 500m³ every two-four weeks whilst water temperatures remain consistently above 10°C.

Crystal Clear Puck (tablet) is high in concentrations of bacteria and rapidly disperses once applied. Initially an application of one puck per 75m³ of water is recommended once the water temperature has reached 10°C. Application should be repeated at a rate of one puck per 375m³ every two - four weeks.

Lake colourant is a concentrated, easy to use aquatic colourant that rapidly disperses the attractive blue colour from the surface down to give a natural looking blue in a matter of minutes. The product is totally safe environmentally and offers the added advantage of cutting the levels of photostnthesis - thus reducing the build up of submerged aquatic weeds. Lake colourant is available in water soluble bags (WSB) and the ever popular Super Strength Concentrate. The intensely concentrated solution is exceptionally economical with 100ml being the rate required for a massive 500m³ of water to be treated.

*** ADVERTISING FEATURE ***

Poor spraying could make you dye

GORDON HOLMS, Thepowerof2, talks about the use of spray pattern dyes.

Has this ever happened to you?
You spray a selective herbicide to control weeds on a turf area then continue to see them growing a few days afterward?
How about seeing streaks of dark-green and light-green grass after a liquid-fertiliser application? Mixing errors or product selection could be the cause-but sometimes the problem is not what you spray *but how you spray it.*
Thorough, uniform coverage is essential to the success of any pesticide, fertiliser or wetting agent application. Obviously, you want to avoid situations like these as uneven turf appearance causes customers to devalue your services. Luckily, you can prevent many of these unwanted results by using a spray-pattern indicator.
In general, you add spray-pattern indicators to the spray tank in relation to the volume of water that the product label specifies. The indicator product changes the colour of the contents of the spray tank, usually to a dark blue or green. After application, this colour change is temporary, usually effective for several hours. However, some products may last up to 3-4 days or longer after application. There are also training advantages with spray-pattern indicators. They can be helpful in training new employees to use spray equipment. Simply add the colourant to a tankful of water and let the untested employee test-spray some turf areas. During this time, you can observe the effect that boom/nozzle height; ground speed and tank pressure have on output. If you don't do so, you can end up with an untrained person who basically will be "experimenting" on the job, which is potentially damaging to both the environment, and your reputation. An employee who knows how to use the equipment is a valuable asset.

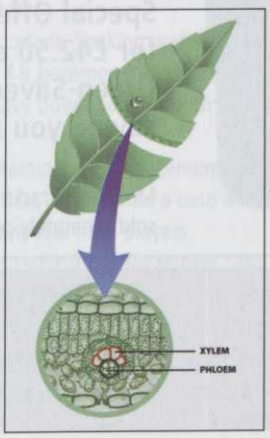
A spray-pattern indicator is useful in other situations as well, such as on unfamiliar sites where the potential for spray drift is unpredictable.
You typically can't determine wind patterns around trees until you've had several years of experience. Using a spray-pattern indicator can help you identify which areas are subject to influence by wind effects. While no manufacturers claim it as a direct pest-control benefit, the use of colourants when applying pesticides in areas with pest damage can cosmetically mask the damage. In these situations, you may want to consider the use of longer-residual colourants. However, as with any product you apply, the possibility of undesirable results exists. With cheaper colourants, you occasionally hear reports of undesirable staining. For example, protective clothing, irrigation heads, paths, tree trunks, and posts are all possible non-target items that cheap colourants could adversely affect.
As a precaution, always use quality brand indicators that are manufactured from quality materials. All in all, spray-pattern indicators can be quite useful. Indicators can help to improve product effectiveness, indicate potential for pesticide drift and save time and money.

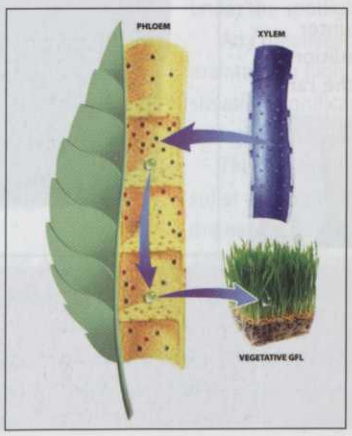
Manniplex - the nutrient superhighway

Intake is not a micronutrient. Intake is not a standard complex. Intake is not even a chelate. Intake uses Manniplex technology - a delivery system designed to deliver micronutrients to the part of the plant where growth is formed - nothing new in that? No, but unlike other, more conventional micronutrient products, Intake is produced from a unique sugar/alcohol blend that provides four significant advantages:

- Spreading and adhesion agents for enhanced foliar contact.
- Intake has the smallest molecular size of any micronutrient carrier ensuring more initial uptake.
- Once taken into the plant, Intake is the only delivery system that directly feeds nutrients to the phloem and xylem.
- Intake is great for use with post-applied herbicides.

With conventional micronutrient products simply spraying them onto a plant is no guarantee of the nutrients being absorbed through the foliar feeding action of the plant. The system employed in the Intake range is different - it works. Because it is smaller in its molecular structure than all other micronutrient products, Intake is able to enter the plant via the stomatal openings and transcuticular pores.
Put simply - Intake can get into a plant easier and more efficiently than any other foliar feed, it really is that simple. And yet, there is more. Once the nutrients are in the plant they have their main task to complete - the transfer into the growth forming regions; to do this the nutrients are mostly conducted through the xylem and phloem. The plant does not readily allow this to happen - these 'transport arteries' have to expend energy and time breaking down nutrients in order to let them pass into the system. This is NOT the case with Intake - the unique sugar/alcohol employed by the Manniplex technology is seen as a native ingredient and the plant lets it straight into the phloem. Thus a 'Passport' to growth is the best way to view Intake. This passport is the single most important element of Intake - for the nutrients to do any good they have to be able to get into the plant - intake does that, few others come even close because they do not have the benefit of Manniplex technology. The Intake range comes in various formulations giving different nutrient delivery with varying levels of: calcium, nitrogen, potassium, iron, manganese, magnesium, boron, copper and zinc - all of these in differing combinations and quantities.





Foliar feeding, the next generation utilising Manniplex technology

INTAKE Ca

Intake Ca

Rapidly corrects Calcium deficiencies in plants, and will provide readily available Calcium with virtually no leeching.

INTAKE Fe

Intake Fe

A unique chelated Iron foliar feed, designed to rapidly correct Iron deficiencies within plants.

INTAKE Mg

Intake Mg

A chelated Magnesium foliar feed, designed to rapidly correct Magnesium deficiencies.

INTAKE Micro

Intake Micro

Micro is unique and it provides Iron, Manganese, Magnesium and Zinc more effectively than any other micronutrient product available.

INTAKE Macro

Intake Macro

Macro is a unique supplement that provides calcium and magnesium more efficiently than any other product thanks to Manniplex technology.

*** ADVERTISING FEATURE ***

More in Fore

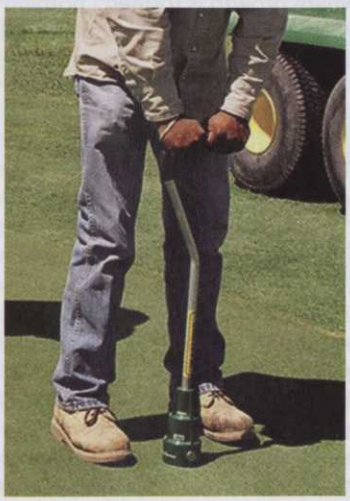
Green-Saver has developed the first ball-mark-repair tool that actually incorporates the PGA recommended repair procedures. Unlike other ball mark repair tools, this patented motion prevents tearing of the root system, which causes even more damage or scarring of the greens. There are a total of eight prongs, four that close the hole and four that lift and flatten the hole. The prongs enter the soil, flatten the ball mark and retract out of the same holes as they travel in an arc like motion. In addition, when you tap the putting surface, four prongs protrude straight out and aerate the ball mark, enabling additional air and moisture to the area, which accelerates the healing process. This unique patented tool provides the very best repairs possible for the professional maintenance staff, mowers, course marshals and even the players. Many private courses are plaing a Green-Saver on each of the par threes for the players to use during the day to help prevent scarring. "A ball mark that is not repaired properly in the first three to four hours, take three to four weeks to heal." The Green-Saver is designed to work in all types of soil environments, from the very wet and soft European turf to the dry and hard surfaces of sandy Desert turf.

What is the Green-Saver?

The Green-Saver is a revolutionary ball mark repair tool that was developed by scientists working on the NASA Space Shuttle program - science, materials and technology from the most advanced space program on earth is available for your golf course!

How is it used?

Simply place the Green-Saver over the ball mark and press the handle down. The eight prongs enter the ground around the ball mark; lifting and compressing the indentation back to a smooth and beautiful putting surface. It is impossible to do it wrong. You can fix 10 ball marks in about 30 to 40 seconds.



Why not use a hand tool?

Unfortunately, most golfers, (unknowingly) cause more damage trying to repair a ball mark with a hand tool, which tears root system. Many players even turn the ball marks inside out by using too much force. For many people, it is difficult to bend over or crouch long enough to repair a ball mark properly. As a result, many don't bother or worse, they cause more damage by trying.

GREEN-SAVER CAN SAVE YOU MORE THAN JUST YOUR GREENS WITH OUR SPECIAL OFFER FOR ONLY £95.00 SAVING YOU £100.00 WHEN YOU PURCHASE 4 "MOUNTED" LITTER BINS

Your Tees may be green but with a stylish Bayco Ballwasher it will add a splash of colour.

Available in Classic Cooper Vein, Classic Silver Vein, Hunter Green and Bayco Traditional or any colour from the range.

The Green "Mounted" Litter Bin with Lid will compliment your existing ball washer unit and sure to impress your most discerning golfer.

Special Offer: Buy 4 Litter Bins for £42.50 each and get a Green-Saver for just £95.00 saving you £100

Mounting Bracket for wall or post mounting sold separately order code GC746

For further information on any products please contact Amenity Technology Ltd.

ALL PRICES QUOTED ARE SUBJECT TO VAT

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*** ADVERTISING FEATURE ***