

Growing pressure to avoid the use of chemicals has led to

FACED WITH INCREASING PUBLIC ALARM AT the use of pesticides, a diminishing armoury of chemicals and ever more legislation and restrictions relating to their application, amenity and turf managers up and down the country are looking for alternatives.

And alternatives there are. Weed-suppressing bark mulches are now a familiar sight in the landscape. Companion planting and the use of bedding plants which still host biological agents from nursery production are other techniques which are finding favour with councils seeking to cut insecticide use.

In many cases, as part of their pesticide reduction strategies, local authorities trying to minimise spraying are making judgements as to what levels of pests, diseases or weeds are acceptable.

But there are areas where such problems just cannot be tolerated. Sports turf is one. Disease and insect infestations can soon make a surface unfit for its purpose, increasing the risk of injury and making golf and football matches into lotteries rather than games of skill.

In an attempt to reduce their reliance on chemicals, many groundsmen and greenkeepers are turning to microbiology – the use of microbes and biostimulants. But what do we really understand about the science and the potential for use in the amenity industry?

We already know that certain species of bacteria and fungi are beneficial to plants. Plants which have their roots in such communities are generally more healthy, grow more quickly and show greater resistance to disease and drought.

"One of the things these microbes do is release nutrients from the soil itself and they decompose organic matter, turning it into nutrients which the plant then takes up," says Dr Alan Gange, lecturer at the School of Biological Science, Royal Holloway College, University of London. "If microbes are present, a plant is better able to cope with drought and pathogens – the fungi that attack it.

"We don't fully understand the physiology, but, if soil has a really good microbial content, grass is better able to withstand the things that happen to it, like being trampled on and cut."

Gange has been undertaking microbiological studies of sports turf for about two years. As an independent researcher he does not promote particular products, although he has received funding from Cargill, Symbio, Green Releaf and



Growth

renewed interest in "biotechnology", writes Sally Drury

Humate International. His studies have shown that, on intensively managed turf, the numbers of beneficial bacteria and fungi are significantly lower than you would expect to find in natural grassland communities. Gange is investigating why this is so and how populations can be promoted.

There are two schools of thought. One approach is to feed those microbes that are already there so that they multiply and do their work more efficiently. The second is to add more microbes. A market is now rapidly developing, with new companies and products entering the arena each year.

Feeding those bacteria present in the soil can be achieved by applying carbohydrate-type products, such as Fulcrum blade from Cargill. This is a new-generation supplement for turf

which works by supplying the naturally occurring microbes with a readily available source of energy and essential nutrients.

Research is reported to show the product can increase microbial counts by over 100 per cent and root mass by up to 40 per cent. Duncan Bawcutt of Bowood Golf Club, Wiltshire, has used Fulcrum Blade and noticed rooting depth increase from seven centimetres to 15cm, accompanied by an improvement in turf health, when he applied the product over a nine-month period.

Cargill also claims Fulcrum Blade results in a harder-wearing playing surface, better turf colour and texture, improved resistance to disease and drought and reductions in black layer and thatch. As well as the carbohydrate-type feeds, there is also a range of

"biostimulant" products – such as those supplied by Maxicrop and Humate International – which are intended to encourage and promote the microbial population of the soil.

There are advantages and disadvantages to most things, and the feeding or stimulation approach is no exception. Gange explains: "The advantage of feeding is that you are feeding a native population – you are feeding something that is already in the soil so you are bound to see a good effect."

Another advantage of feeding lies within carbon science. Most eco-systems are "carbon limited" – there simply isn't enough carbon in them. Photosynthesis may be clever, but it's not efficient.

"At best, photosynthesis is only about 20 per cent efficient. Plants are remarkably

Feed your microbes: new products offer a harder-wearing playing surface, better turf colour and texture, improved disease and drought resistance and reductions in black layer and thatch



potential



Ward: breaking the fertiliser/disease cycle

◀ inefficient at fixing carbon, so throwing on some carbon is bound to have an effect, because it is adding a nutrient which is in limited supply."

This is an area of much debate. The question is whether throwing on carbon also helps to feed pathogens. Gange, as yet, has not seen any evidence that this is the case, although he admits he has heard greenkeepers say that disease has followed some applications. He thinks that, biologically speaking, it's unlikely to be the stimulant that is directly to blame.

"Most pathogens feed on living tissue, not non-living material," says Gange.

The disadvantage of the feeding method is that, clearly, there is no point in feeding populations that are not there. If the populations are low, feeding may be a waste of time.

So what about adding bacteria and fungi to the soil? A number of products, such as those from Symbio, Biotal, Humate International and Plant Health Care's BioPak and Complete, contain beneficial bacteria.

Martin Ward, managing director at Symbio, explains the science behind such products: "When a greenkeeper applies a pesticide or fungicide, it kills the pest or disease he is trying to eradicate but, as such products are not specific, they also kill off beneficial bacteria, such as those that fix nitrogen from the air. As a result, the greenkeeper has to apply more fertiliser – but more fertiliser equals more nutrients on which the plant disease will live. It is this cycle of using more pesticides and then having to use more nutrients which we are trying to break by putting the beneficial bacteria and fungi back and by reducing the amount of fertiliser used," he says.

Ward claims success primarily in controlling fusarium and takeall patch and good results with fairy rings and diseases such as anthracnose. There are also products which contain mycorrhizal fungi, such as Plant Health Care's Flex and Turf Saver.

Case studies

Five years ago most of Sheffield City Council's 52 bowling greens were in a very poor condition and, for a while, it looked as though re-turfing was the only answer. The combined effect of overuse, drought and a reduction in the quality of maintenance was blamed. The problems were many but most notably a layer of thatch, some six or seven centimetres deep, was preventing water getting down to the rootzone. Unwanted *Poa annua* was all that survived in the squelchy thatch. An extensive turf culture operation of scarification, hollow tining and overseeding gave good results initially but within a matter of weeks a *mycelium* culture had developed throughout the thatch, turning it white, sealing the surface again and killing off the new grasses. It was basically a slimy mess. Ernest Brewin, parks manager decided to try Symbio's programme of treatment. The results were dramatic: "I was amazed at the speed with which it worked," he says. "It began degrading the thatch and quickly allowed the water to percolate. New grasses came through and the original grasses began to be sustained. By August they looked like brand new greens." Fusarium did show itself in the autumn, but it was less serious than previously. Symbio Resister is now used as part of a maintenance

programme and no further treatments for fusarium have been necessary. Fertiliser applications have been reduced by 50 per cent. A similar experience was shared by Radcliffe-on-Trent Golf Club in Nottinghamshire. But there, as well as a five-centimetre layer of thatch, the greens were also suffering from black layer. The club tried a Symbio programme on three greens initially. "After three weeks the fifth green was transformed," recalls club secretary Les Wake. "Obviously the thatch layer was still there, and the root growth still wasn't very good, but the health of the green was greatly improved." The programme was extended to all 18 greens. "It has taken three or four years but the thatch has gone and so has the black layer. Root growth, on average, is twenty-three centimetres," says Wake. Prior to using the "bugs", the club had a budget of £5,000 just for fungicides to control fusarium. "If we saw fusarium, we sprayed it. If we saw it again, we sprayed it again," admits Wake. To treat the greens in the first year cost £5,000 but Wake says savings are now being made by not needing to spray. "We are now in profit with Symbio," he says. "And, most importantly, we give our members value for money and they can play every day of the year."



Sheffield: Symbio programme turned a "slimy mess" into "brand new greens"



Bawcutt: rooting depth doubled, accompanied by an improvement in turf health

◀ Plant Health Care's director Jason Holohan explains the difference: "Bacteria grow on the outside of the roots. They take the more complex molecules and break them down into simple molecules which the plants can take up," he says. "Mycorrhizal fungi are different. They form a symbiotic relationship, growing into the roots and growing outwards. The plant gives the fungus some sugars and in return it gets a massively increased surface area — by up to 1,500 per cent — through which to absorb nutrients."

Mycorrhizal fungi are thought to be linked to a reduction in *Poa annua* — the fungi are thought to favour the *agrostis* grasses which can then out-compete the *Poa*.

It is theoretically possible that increasing the bacterial content of the soil will increase the amount of fungus, although Gange has yet to investigate this.

Like feeding, adding microbes to the soil has its advantages and disadvantages. The advantage is that you are almost bound to see an effect. Gange again: "If you add a cocktail containing millions of bugs per millilitre of solution and take a soil sample a week later, there it's bound to work, at least in the short term, and give you a quick fix."

The disadvantage, says Gange, is that you could be adding bacteria which do not occur in sports turf soil.

"Companies have taken a whole stack of bacteria beneficial for other soils and applied them to sports turf. That probably explains why some work well at some times and not at others," he says. "If you have species x in the soil and you bung on 20 million more of species x, it will have a terrific effect. But if you've got species y in the soil and you add 20 million species x, you are not going to see such results. In fact, species x could eat species y, as there is a lot of bacterial antagonism.

"A lot of work has been done looking at communities in pasture grassland or clover crops, but no one has studied sports turf in this country so we don't really know what species should be present," says Gange. "It is dangerous to assume that the soil beneath a rye grass pasture is going to be the same as that beneath a golf green. We are working on those very problems — what bugs are there, and why."

Greens, and even football pitches, are likely to differ according to their construction.

"With golf greens we have two distinct types in the UK — the USGA-spec green and the traditional, soil-based green. I am convinced that these will have a different microbial composition and I suspect links courses will be different again. The problem is that every golf green is of different construction, age and position, and during its life will have differing amounts of water, trampling, fertilisers, pesticides, etc," explains Gange.

A second disadvantage is linked to carbon-limiting. If the soil is carbon limited, then food may be in such short supply that nothing



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Products

Blotal (tel: 01222 747414)

The Restore the Balance programme consists of the Microbalance blend of bacteria, Biofeed (based on kelp) to stimulate plant growth and Microbooster to enhance the natural microbial population. The company also offers Garden Algae & Mould Cleaner, Fountain Clear water clarifier, Refresh and Refresh Plus water treatments and biological compost accelerators.

Cargill plc (tel: 01522 556631)

Supplier of Fulcrum Blade.

Elorison (tel: 00 41 22 758 2862)

Biostimulator products which have uses in glasshouse crops, vegetable growing, floriculture, planting/maintenance of trees and shrubs, and turf culture. It works by stimulating the indigenous soil-borne microflora.

Humate International (tel: 01845 525585)

Provides humic and fulvic acids and a broad spectrum of micro-organisms with support materials to keep them operating at a high level. There are products for plant production, flowers and turf.

Plant Health Care (01442 870161)

Supplies BioPak and Compete – both are bacterial products but Compete is formulated with dry, soluble yucca extract and organic bio-catalysts – and Flex and Turf Saver which are mycorrhizal inoculants for turf. In addition, the company offers a bacterial pond/lake-cleansing product called Pond Saver and three mycorrhizal products for trees: Mycor-Tree Root dip for whip planting, Saver Transplant for rootballed trees and Injectable for established trees.

Symbio (tel: 01372 456101)

Symbio products are marketed by Grass Roots Trading (tel: 01763 852228). Offers a thatch reduction programme (Thatch Eater) and mycorrhizal inoculants. Supplies treatments for irrigation, ponds, trees and shrubs

Other contacts: Amenity Land Services (01952 641949), Amenity Technology (tel: 0118 931 1111), Bioseed Probiotics (tel: 01747 852771), Green Releaf (tel: 01782 373878), Maxicrop International (tel: 01536 402182), Organica UK (tel: 0151 639 1916) Samaa International (tel: 01753 775571)

happens. As with the feeding method, some greenkeepers have reported an increase in disease following applications of bacterial products. Gange suggests this may be explained by nitrogen release.

"If you add in lots of microbes, they start causing organic matter to decompose and release a lot of nitrogen. If the plants become lush and full of nitrogen at the wrong time of year – say October – they are more susceptible to disease. That's a likely explanation – we've never tested the theory, as not many greenkeepers are willing to see if disease can be deliberately encouraged in their greens!"

Gange admits to having no clear opinion as to whether feeding or adding is best and personally believes that the ultimate approach may be to do both – add the bugs and then feed them.

If you are considering doing your own trial on either type of product, Gange has this recommendation: "Because of the differing conditions across a course and because microbes are seasonal in their response – they are most active in spring and autumn – it is best to treat nine greens and leave nine untreated and measure the results over the year. You are likely to get an inconsistent response from green to green but the overall average should be positive." □