GBR TECHNOLOGY LIMITED

NEWSLETTER

April - July 2020

Welcome *to Edition 6 of our newsletter. Troubling times indeed as I write this, with the spread of Corona Virus around the world. The dangers from the virus and the cost to society of the measures to contain it are dramatically affecting us all. As I write this, the weather is lovely – in the middle of 6 days of expected wall to wall sunshine. Some consolation after the very wet weather of the winter. A lunchtime run for me was glorious for a brief moment I could forget what was going on in the world, as I rounded a hill and a herd of 20 deer bounded across the field in front of me barely 100 feet away.*

So what to say about this edition – Peter McMorran writes about the macronutrient phosphorus, Nathan Scarff shares the results of his look into chitosan and we have articles on the liquid feeds we blend here at GBR and Spray Indicator Dye (which we do sell quite a lot of these days). We also focus on our response to the Corona Virus outbreak on the back page.

Our thoughts go out to all our customers and the industry in general during this time. Of course it will pass – in the meantime we can only all do our best in what we are allowed to do.

Most importantly though, stay safe out there - we all need to stick to the guidance to minimise the deaths and protect our NHS.

Paul Morris
Managing Director

Contents:

What is P Doing for You?

Peter McMorran takes a look at the vital macro nutrient, phosphorus

Phosphorus next to nitrogen has more impact on a plant ecosystem than any of the other essential elements. Phosphorus (P) is linked with DNA, RNA, photosynthesis, Phospholipids, nitrogen fixation, root development and synthesis of many vital compounds necessary for good plant health and function. Added to this it is also an essential part of the ATP molecule – adenosine triphosphate – sometimes referred to as the energy currency. ATP contains a high energy phosphate group that provides the necessary energy for a wide range of biochemical processes within the plant. Phosphorus can be stored in the cell vacuoles and a dry matter content of around 0.2% - 0.4% will deliver good health.

In an undisturbed natural environment phosphorus is recycled as the older parts of plants die back. This organic matter is mineralised over time and phosphorus contained in the active, passive and slow factions of humic material will slowly become available for uptake by plants or become part of fixation processes with other elements to form insoluble inorganic compounds that lock the phosphorus up for longer periods of time. Due to the insolubility and low availability of phosphorus many plants have formed a symbiotic relationship with mycorrhizae that are capable of synthesising phosphatase to mineralise soil organic phosphate. This fungus also lowers the soil pH by carbon dioxide production and the resulting acidification assists the solubilisation of mineral phosphorus.

Phosphorus compounds found in soil are not freely available for uptake due to their degree of insolubility and for this reason phosphorus in solution can be as low as 0.001mg/L up to 1mg/L in infertile and heavily fertilised soils respectively. When soluble sources of phosphorus are applied to soil they are removed from solution relatively quickly due to chemical reactions. Although still slightly soluble at this point and of some use to plants, slower chemical reactions continue that make the phosphorus compounds even more insoluble over time. It is thought, due to these chemical processes, only 10% -15% of applied phosphorus is likely to be available for uptake in the year of application.

Diffusion is the main mechanism for the movement of phosphorus to the root surface for uptake. Diffusion is driven by a concentration gradient between the root surface and the soil when plant uptake of the phosphorus ion is greater than the supply arising from mass flow. At this point replenishment of phosphorus ion has to come from the soil and this will only occur within the water filled pores of an aerated soil and therefore the optimum diffusion of phosphorus will occur at soil moisture contents of field capacity or greater until levels close to saturation limit root respiration and function. Research highlights that increasing water volume content of a soil increases the diffusion of phosphorus and potassium ions and their availability to the plant, and this can only be advantageous for plant health as it goes through its growth and development cycle (see article on "movement of water & nutrients" in Newsletter 4). Aiming to maintain a higher moisture content then conflicts with the need to lower moisture content to produce surface firmness readings that are associated with performance targets for a green regarding pace, trueness and firmness. Also, a moisture content that ensures 50%-60% of the pores are filled with water will not only aid diffusion of phosphorus but will aid the optimum level of microbial activity that is necessary for the breakdown and mineralisation of developing organic matter releasing nutrients for plant uptake including phosphorus. The level of mineralisation is directly linked with soil temperature and the optimum period for mineralisation is from mid-April to about the end of September. Should the aim for a lower water content during this period limit the natural process then there will be a greater need for mechanical removal of developing organic matter and the disturbance this brings. Finding a compromise to these conflicting aims will be key as the industry moves slowly towards a path of sustainability.

The main phosphate ions taken up by the plant are HPO_4^{2-} (hydrogen phosphate) and $H_2PO_4^-$ (dihydrogen phosphate), there are also some soluble organic phosphorus compounds taken up. The pH of the soil influences the phosphate ion that will be available and an acidic soil will deliver hydrogen phosphate whilst and alkaline soil will deliver dihydrogen phosphate. Uptake of these ions by the plant can be restricted due to:

1 - The tendency for phosphorus to react with other elements and form insoluble compounds
2 – Low level of phosphate ions in solution
3 – The association with diffusion that requires water filled pores for this process to occur and this will be limited in a free draining sandy profile.

To overcome this low availability and slow movement of phosphorus to the root surface plants, as mentioned above, have formed a symbiotic relationship with mycorrhizae fungi that are capable of extracting phosphorus from the organic and inorganic sources of the soil profile and transporting it via hyphae back to the root of the plant thereby protecting the phosphorus from further soil chemical reactions that would lock it up. The organic sources of phosphorus are subject to the routine process of mineralisation from the active, slow and passive factions of humic material and once mineralised phosphorus is free for uptake by roots and the cycle begins once again.

The 3 main forms of phosphorus found in the soil are organic P, calcium bound inorganic P (associated with alkaline soils and these become more soluble as pH decreases) and iron or aluminium inorganic P (associated with acidic soils and these become more soluble as pH increase). Phosphorus will be available from these three sources but the process will be slow due to the varying degrees of solubility and the level of microbial activity that will be influenced by temperature and available water within the profile. Also, the longer the phosphorus remains in the soil its insolubility increases reducing its availability for plant uptake.

There are 3 main groups of organic P:

1 – Inositol phosphates – these are associated with humic compounds of a higher molecular weight and will make up 10%-50% of the total organic P

2 – Nucleic acids and Phospholipids - together these 2 groups make up about 2% of organic P and the nucleic acids are adsorbed by both silicate clays and humic material.

The remaining organic P appears to be linked with the fulvic acid fraction of the soil. Although the plant can take up some organic compounds directly this is considered to be low in comparison to inorganic phosphate that will be released through mineralisation.

Phosphorus that forms part of iron compounds is very insoluble when the profile is well aerated and free draining and these are the very conditions aimed for to develop a golf green for year round play, so once again a potential conflict arises. Although not desired for a golf green, research has highlighted that prolonged anaerobic conditions can bring about reduction of the iron in the iron phosphate compounds i.e. Fe^{3+} to Fe^{2+} making these compounds more soluble and the phosphorus moves into solution becoming available for plant uptake , however, this approach is best left for improving phosphorus availability in paddy fields!

Cultural practices can either assist or hinder the availability and uptake of phosphorus. Aeration and free drainage will reduce water content in the soil and encourage lock up of phosphorus with iron/aluminium compounds associated with acid soils and limit the potential for diffusion essential for the release of phosphorus. Regular aeration brings disturbance to the soil profile and this will have a negative effect to some degree on mycorrhizae activity in comparison to an undisturbed ecosystem but not to the same degree as found in agriculture with intensive tillage. Maintaining soil moisture deficits to develop acceptable firmness readings will only reduce the potential of the profile to release phosphorus to the plant and this will be exacerbated by the build-up of sand only dressings to improve drainage, dilute thatch and provide firmness. It should be noted that as the sand particle size increases the surface area per gram decreases along with the percentage of available water at field capacity. Also, with the tendency to target OM readings of circa 3% in the top 20mm and less below this top layer, the water holding capacity will remain low apart from the top 20mm. An observation was made on some greens where cultural practices and use of pure sand have achieved the target of 3% OM in the top 20mm, however, as the layer below the top 20mm had even less OM the water being held in the top 20mm was being retained and not released. This in turn had restricted air movement to and from the soil and anaerobic conditions had developed with subsequent black layer below. With no aerobic mineralisation to develop humic material linked with phosphorus availability and improved crumb structure it can be argued, that unless close monitoring of materials and practices associated with modern aims is implemented, then further problems can arise. It should also be noted that on the problem greens observed further mechanical practices were being considered to release water from the top layer and improve air movement to and from the soil. As the need for mechanical practices increases there must be a corresponding effect on mycorrhizae fungi that are known to work effectively with plants in the undisturbed ecosystem, so finding the balance between the performance aims for a green and what the natural cycle does best would seem the logical path to follow towards the goal of sustainability.

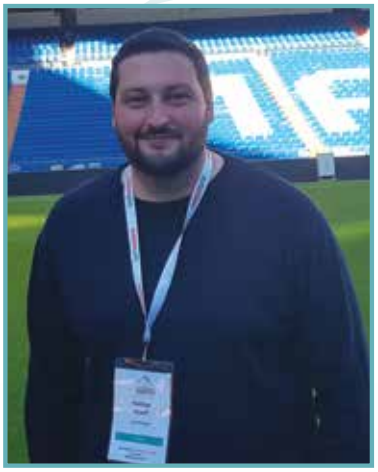
It is possible that some compromise may need to be considered when reflecting on turf performance aims and availability of phosphorus and that may include managing a minimum soil moisture content for phosphorus uptake, a return to an 80/20 type topdressing with humic material to develop greater uniformity through the profile for moisture retention and microbial activity, application on a drip feed basis of phosphorus with fulvic acid and ongoing monitoring of leaf tissue analysis to ensure there is balanced uptake of all the essential elements including phosphorus. These points may be considered contentious but if the aim is for sustainability over the longer term then we need to focus in on the relevant facts, understand what issues are arising and why, then keep things as simple as possible and develop reliable practice for the future.

In conclusion, phosphorus is a key component of the ATP molecule essential for providing energy to drive a wide variety of biochemical functions deemed necessary for the plant's existence and ongoing health. It is also considered to be second to nitrogen regarding its impact on plant ecosystems so there can be no question over the value that can be gained by the grass plant if it has access to the necessary amount of phosphorus to deliver the quality swards being aimed for. As phosphorus will be removed when clippings are boxed off consideration has to be given to replacement by fertilisation. The thought of applying phosphorus will go against old school greenkeeping but as layers in greens are built up using sand only dressings an aerobic profile is being developed with low CEC, low moisture retention and low content of humic material all of which will inhibit solubility and availability of phosphorus. Availability of phosphorus can be tested using leaf tissue analysis and taking several samples whilst recording soil moisture content as the soil dries from field capacity down to the desired SMD for green performance will indicate how moisture content is affecting phosphorus uptake along with the uptake of the other essential elements. Ensuring balanced nutrition throughout the year will be an important aim as the industry moves towards a path of reduced fungicide application by developing the plant's resistance, tolerance and recovery from disease. Phosphorus, as an important part of the ATP molecule necessary for energy transfer, will have its part to play in this process along with the other essential nutrients to deliver swards more capable of coping and recovering from the various biotic and abiotic stresses associated with the golf course environment.

Chitosan

A Highly Bioactive Material with a Lot of Uses!

Just Google it!



Nathan Scarff is **GBR's Mid UK Area Technical Sales Representative** and an ex-Head Groundsman (Championship Groundsman of the Year 2015/16) with 13 years' experience of managing sports turf. In this article, Nathan explores the rather interesting and quite bioactive substance, chitosan - over to you Nathan…….

When I first started at GBR in September 2019, I had never heard of chitosan. I obviously saw it in the catalogue and thought I need to have a look at it, but the realisation of needing to learn a whole catalogue and price list which contains yet more products meant it went on the "to-do" list.

About a month into the role, I went to meet with a Head Greenkeeper, as they flicked through the catalogue talking about how interested he had been in what GBR do from my predecessors sole visit - he stopped and turned back a page, "chitosan??...You sell chitosan?!". His reaction told me I needed to know more about this, he ordered it without hesitation or even knowing the price, I didn't know the price myself at the time. We spoke about why he wanted it and what they felt it did for them and I walked away thinking someone had marketed chitosan so well to them that he convinced himself it did all these wonderful things.

A couple of weeks later, another Head Greenkeeper had a similar reaction and similar experiences on the benefits of chitosan. These two meetings made me realise I needed to accelerate my research into chitosan… So here we go on what I have learnt so far!

Chitosan is made through the deacetylation of crustaceans and fungi which contain large amount of chitin. Chitin is one of the most abundant biopolymers in the world. It has been estimated that every year 10,000,000,000 tonnes of chitin is biosynthesized in nature. Crustacean chitosan is a made as a by-product of fishing industries too, essentially it is utilising something that would otherwise have been wasted. It was registered as a biopesticide with the Environmental Protection Agency in 1986, 6 years before Bacillus Subtillis GB03 (registered in 1992) and 14 years before Harpin Protein (registered in 2000) both of which are widely used on turf. It was registered with the EU in 2014, although neither Harpin Protein nor Bacillus Subtillis GB03 appear on the EU register of Active Substances. What this means is chitosan has been extensively studied for its safety to the environment and humans while also proving it has beneficial properties to be utilised in agriculture. Even more fascinatingly, chitosan has no 'Maximum Residue Level' under the regulations. These regulations are effectively what will bring a product to be reviewed for withdrawal faster if detected in water courses or food sources at too high a level. Given that chitosan is made from something so abundant in nature, it is highly unlikely it will disappear from our actives list. Even urea must go through this, in fact urea is to be reviewed later this year, however urea also shares the same no MRL regulations. If we look at phosphites, which have been widely proven for their fungicidal benefits on turf in recent years, it is due for review in 2023 and it has MRL regulations in place for all sorts of crops. If the bigger chemical industries get their way, this one will be taken away from us or will end up going up in price quite dramatically due to the cost of fungicide registration for the amenity market. Because chitosan is found in nature, it would be virtually impossible to regulate Maximum Residue Levels or would it be feasible to argue for its removal from use.

Chitin is essentially a natural building block, which makes things more rigid. It's the principle structural polysaccharide of the arthropods! For example, crab shells contain vast amounts of chitin and It is also what gives mushrooms their "crunch".

What is GBR Technology's Chitosan made from?

Our '6% chitosan' is a fungal derived chitosan, made in the EU. It contains no animal waste or by product so can even be used on turf being maintained to vegan standards. We also offer a crustacean derived chitosan.

So how does it work?

Well, this one could take a while for all its different properties! Effectively the application of chitosan onto a plant elicits chitinase production in what is called an 'Innate Immune Response'. Chitinase is an enzyme naturally created by plants that breaks down chitin. What is so beneficial about the 'Innate Immune Response' is that this has been nature's way of getting plants to defend themselves since time immemorial and the attacking fungi or bacteria are unlikely to develop any sudden resistance as they may do to newly, synthesised chemicals.

The reason that's beneficial?

Parasitic and pathogenic fungi and bacteria contain chitin in the bits they need to cause problems to turf managers. For example, nematodes contain chitin in the biting parts (for example the stylet on a needle nematode) and the skin of a leather jacket to name a couple. Chitinase breaks down the chitin containing parts of these fungi and bacteria, so a needle nematode with a stylet being broken down by chitinase has a limp stylet unable to pierce into the plant's root system and feed.
A leather jacket's skin gets biodegraded by the chitinase and causes the leather jacket to try and escape the soil which irritates its unprotected skin. Fusarium fungi also contain chitin, so plants that have ramped up the production of chitinase are more likely to resist attack from fusarium too. To explain it simply, there have been millions (probably billions or trillions actually) of crabs die, but all the shells have decomposed, the enzyme responsible for this is chitinase.

What's the catch?

The main one is lower tank mix compatibility when compared to some products. It isn't the easiest thing to incorporate into what is already being applied. But beyond that, there doesn't appear to be a catch. However, it is tank mixable with a range of wetting agents, Kelpak™ and GBR's Liquid Turf Hardener for example.

Fascinatingly, it doesn't even appear to harm beneficial fungi and bacteria as they don't contain significant amounts of chitin on the outside. Effectively the chitin is hidden within the beneficial bacteria and fungi so chitinase does not have ready access to the chitin parts, which prevents it from being broken down.

Sounds good, right?

I've not even scratched the surface of chitosan!

In a range of plants, it is shown to increase photosynthesis, it does this by being an excellent natural chelator of nutrients - by increasing the rate at which nutrients such as magnesium and iron are moving through the plant it increases chlorophyll production. This chelation of metal ions also inhibits toxin production.

On a huge range on plants in agriculture chitosan has reduced water consumption, in pepper plants it reduced water consumption by up to 43%, imagine that benefit in the summer of 2018! It does this by using the chitosan to control the stomata, by being able to close the stomata during heat stress it reduces transpiration and therefore moisture loss. Interestingly by this mechanism of increasing the plants control of the stomata, it can also open the stomata further during periods of excessive moisture, increasing transpiration rates and effectively using more water during these wet spells.

It is widely used as an agricultural seed treatment to enhance germination and root development while also protecting young plants from pathogenic and fungal attack.

It also provides a source of carbon and nitrogen.

So, if the plant can produce chitinase on its own, why do we need to elicit its production using chitosan?

Attacking fungi contain something called Proteases. Proteases effectively hide chitin from detection by the plant, so the fungi have the chance to get into the plant before the plant begins its production of chitinase, at which point, you already have a diseased or stressed plant. By applying chitosan which does not contain Proteases, the plant is prewarned of an impending attack and begins producing chitinase, but the chitosan isn't actually attacking the plant, so we end up with an abundance of chitinase being excreted ready to defend the plant from pests and fungal infections.

What other uses (yes there is more!) are there?

Chitosan is used to make biodegradable plastics, in weight loss tablets, medical dressings and wine making to name a few!

Why is this not widely promoted by big chemical companies?

Due to its abundance in nature, it is not feasible to put chitosan through patents, or intellectual property rights. Chitosan is what is known as a basic substance, readily available to anyone, provided you have the capacity to either purchase it or manufacture it. Because of this it is hard to drive up the price and therefore profit. Secondly, because you are working with a natural product, the results are harder to predict and replicate time and time again than with a synthesised chemical. That being said, to get onto the EU Pesticide register it does mean there has to be significant data to confirm the efficacy of the product in numerous field trials.

Application rates and timing?

This is where target, frequency of spraying, pest and disease incidence all come in to play. Applications as low as 2L/Ha can be applied as a foliar treatment to help the plant fend off fusarium attack for example. However, trying to achieve a seed drench requires higher rates, up to 10L/Ha. It is always best to have a chat with your technical rep to discuss what you are trying to achieve. Consider too, using a wetting agent such as Influxer Excel to enhance foliar coverage or products like Intensive Wetter, Formulation 42 and Hydrozone for better spread of the actives throughout the rootzone.

For timing, an ounce of prevention is worth a tonne of cure!
As mentioned earlier, your plant increases the production of chitinase because it is under attack, by using chitosan before an attack happens you put the plant into a stronger position to resist attack.

Anything else?

Google it, YouTube it, Wikipedia it! You will go on quite the journey!

Precise Control and Easy Mixing
With Our Liquid Feeds!

GBR Technology now manufacture three liquid feeds which are gaining a loyal and happy customer base. These have been carefully formulated to deliver a range of NPKs, trace elements plus fulvic acid. One unique feature is the amount of fulvic acid we add to each formulation (we add 5% of a 40% fulvic acid liquid). We are a firm believer here at GBR on the benefits of fulvic acid!

The three products are detailed in the table below (% is in w/v):

Product Name	Additional Information	Nitrogen Type	Treat Rate (L / Ha)	Season
V-Pro 21-0-0	+ Fulvic Acid & TEs	21% ureic	25-50	Spring / Summer
V-Pro 12-0-8	+ Fulvic Acid & TEs	10.9% ureic, 1.1% nitrate	25-50	Spring / Summer
V-Pro 4-2-12	+ Fulvic Acid & TEs	2.5% ureic, 1.1% nitrate, 0.4% ammonium	25-50	Autumn / Winter

The trace element package delivers the following amount of trace elements in the V-Pro liquid fertiliser as supplied:

Element		%	Form
Magnesium oxide	(MgO)	0.24	-
Boron	(B)	0.0012	As polyborate
Copper	(Cu)	0.0013	EDTA chelate
Iron	(Fe)	0.0101	DTPA chelate
Manganese	(Mn)	0.0076	EDTA chelate
Molybdenum	(Mo)	0.00025	As molybdate
Zinc	(Zn)	0.0030	EDTA chelate

We supply these products in 20L packs, 200L drums and 1000L IBCs. Manufacture is carried out by two members of staff. The blend sheet comes down from the office, raw materials assembled and the process starts with a charge of warm water. Warm water is used since the addition of many of the components at high concentrations is quite strongly endothermic (that means it brings energy in from the surroundings and thus causes a lowering in the temperature of the solution).

When we made the first batches we started with water at around 15 degrees and soon found the temperature probe measuring minus 5 degrees and ice forming on the outside of the blending vessel – we then couldn't proceed with further additions until the batch was warmed! Fortunately the contents of the vessel weren't freezing since the dissolved nutrients have a freezing point supressing effect in water. Now we start with water at around 45 degrees and by the time the blend is finished a few hours later the endothermic nature of the additions have lowered the temperature to around 15 degrees.

We start with addition of a largely chelated micronutrient package and then add the macronutrients and finally the fulvic acid. A very small amount of preservative is added to give the product its 'in can' stability. Once finished the blend is sampled and quality control tested in the laboratory - once this is signed off the blend can be pumped out and is ready to be filled into the necessary containers and some held as a stock solution to be filled off according to orders received.

Liquid fertilisers are relatively cost effective, they allow precise control of applied nutrients and they save time compared with dissolving your own straights.

We believe we have three excellent products in this range and will add to them as customer demand dictates.

Ensuring your Chemical Sprays Do their Job to Best Effect

A look at Spray Pattern Indicator Dye!

Spray indicator dye is widely used during spraying and serves a number of functions:

- A clear indication of area receiving the treatment
- Reduction in overlap
- Avoidance of missed areas
- A stronger indication of drift
- A clear indication of blocked nozzles

Of course on the downside – it is a bit messy to handle! So what is this material – we almost exclusively use (we know of only one main exception)? It's a compound called Acid Blue 9.

Acid Blue 9 is classified as a triarylmethane dye - it is synthetically produced and is very widely used as a blue colourant in the food and beverage industry due to it low toxicity. A word of warning here – material supplied for use as a spray indicator dye is not to be used as a food colourant since it is not necessarily produced to the same purity and the handling and containerisation are not necessarily done to food grade standards.

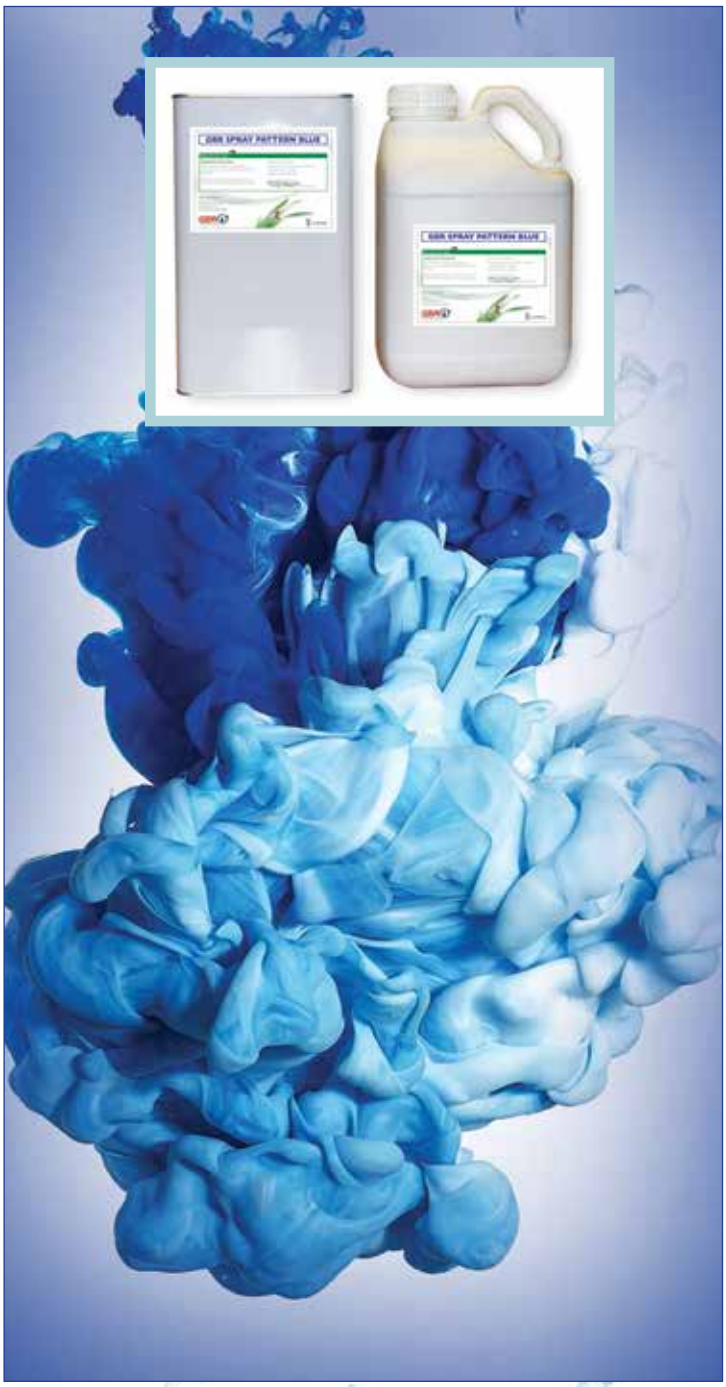
Acid Blue 9 is very soluble in water and has a high colour strength – in fact when GBR looked at a range of dyes to see if we could better this in terms of colour strength when applied to grass vs cost – we couldn't. Our conclusion was Acid Blue 9 – due to its safety profile, colour strength and cost – would remain the ideal dye for this application. The other advantage is that it has poor lightfastness and fades in UV light – rendering it perfect for a temporary spray pattern indicator.

The liquid can be supplied at a variety of strengths and indeed on the market we see a variation between the strongest and weakest solutions of roughly 3.5 times. That means for one product if 500ml is required for a 600 litre spray tank – the weakest will require 1750ml. More typical appears to be a strength that is roughly half that of the strongest.

Another word of caution – avoid comparing products purely on what the supplier says is the treat rate – there is no standard – and we see that suppliers judge what is enough very differently.

GBR Spray Pattern Blue offers the highest strength available as a liquid and there are others at this strength too.

Another option is solid material – granules or crystals. These do work out more expensive though since they are prepared by a spray drying operation from the liquid so extra processing is involved. On the one hand they could be considered less messy however if you do have a spillage the granules can travel quite some distance and if you don't manage to gather them all up – they'll be reminding you of their presence for a long time to come as soon as they encounter moisture! With a liquid any spillage onto a hard surface is much more likely to be fully cleared up at the time.



Blobber fluid is also used by many – we formulate and produce one ourselves. Far less messy of course compared with using dye, however, on the downside it doesn't give quite the same picture of where the spray has landed, it won't indicate blocked nozzles or uneven spraying and it does leave a foam blob for a while on your greens.

The choice is yours – oh and if you need a sample of ours – we are always happy to send out a 250ml bottle to potential customers!

COVID 19

A Summary of the Position at **GBR Technology**

This is being written on 15th April. GBR Technology are still operating. Sales staff are working from home and only essential staff are on site – processing orders, making blends, picking and packing etc.

There has been some misinterpretation of government advice over the last week. Some believing that only essential businesses are to remain open – this is not the case. Certain places have been closed down, mostly non-essential places that the public would go to. The advice remains clear though that if your work can be done from home then it should be and that workplaces should be able to maintain the necessary safety standards.

Some companies have chosen to close supply operations for a period for very good reasons and many such companies will furlough workers during this time and retain a few vital functions. Much of the manufacturing sector is doing its best to keep operations going however – often with reduced workforces due to the self-isolation rules around the worker or household member displaying certain symptoms (fever or persistent cough).

At GBR Technology – our total business is roughly a two thirds to one third split between lubricants and amenity. Our lubricant operations go into a diverse range of industries and with some very specialised lubricants too being supplied for critical applications. We've been reminded by a number of our customers that we are a key supplier and many are seeking to secure their supply chains as they are going into essential items. To give you a flavour of some of the areas we are involved in on the lubricants side:

- Food grade lubricants used in food processing and food manufacturing plants
- Vacuum fluids - used widely in the food and pharma packaging industry
- We supply over 80% of UK cardboard manufacturers (that's more than 50 sites) with a critical high temperature fluorinated lubricant essential for continuing operations
- We supply the UK Ministry of Defence with a significant number of lubricants under contract
- We supply a critical oxygen safe lubricant used in medical oxygen breathing equipment
- We supply a manufacturer with a key input for the production of medical face masks going to the NHS and health systems worldwide

We also supply important inputs into the energy sector and have been reminded that this is a vital sector that needs to keep its supply chain operating to continue to bring energy to the country.

It's been quite an interesting discovery as we've seen applications for our products come to light where we didn't realise exactly what was being done (customers don't always like to give this information).

For amenity markets, as we write this, we are aware that although golf courses are shut, the course will need maintenance in order to avoid a rapid deterioration and fortunately, this has still been allowed to continue. At GBR we are continuing to process amenity orders and we are holding good stocks of many items. There are some supply chain issues but generally everything is currently running pretty well.

Our sales staff, although now based at home are all available for contact – by phone and email and they are also now used to using Zoom video conferencing. Face to face videoconferencing can flow better and seeing someone's face at this present time can help ease the feelings of social isolation that most of us are experiencing right now.

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