OUR INVISIBLE FRIENDS

ONE GREENKEEPER INVESTIGATES HOW NATURE CAN LEND A HELPING HAND

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As I approached the end of my second year studying towards my degree in Sports Turf Science, I came to the decision that many degree students fear the most: what topic would I spend the next year of my life reading, referencing and writing about for my dissertation?

After a number of aborted ideas I opted for a topic I had always found fascinating, soil biology. Over the following months, the research I conducted provided a fascinating insight into the influence of soil fungi and biostimulants on seedling shoot growth, and the impact this has on turf management.

While walking through local parks and woodland areas around the city of Edinburgh, I have often found myself contemplating the marvellous job that nature does in looking after its grasslands. Often on show will be a healthy dense sward with scarcely a sign of disease and, if we choose to delve beneath the surface, most likely a thriving, adventurous rooting system.

All of this with not a single piece of aeration or spraying equipment in sight.

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And if we can, what role could this play in shaping a more sustainable approach to turf management?'

Something must be happening down below our feet.

It has long been recognised that the relationship between the grass plant and a healthy soil ecosystem is a pivotal one. The microscopic world below our feet has a fundamental bearing on what is visible above the surface.

The biological activity that is essential for processes such as nutrient recycling and the conversion of dead organic material into soil nutrients requires a range of micro-organisms, with the major groups of bacteria and fungi recognised as being responsible for over 90% of all decomposed organic matter.

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As roughly 70% of vascular plant species, including many grasses, are thought to form mutualistic associations with fungi that are members of the mycorrhizae family, I decided upon Arbuscular Mycorrhizae as my fungi of choice.

Previous research has shown biostimulants such as seaweed extract to have a positive influence on soil microbial activity, partly due to providing a source of carbon that can be utilised by the soil microbes. So I incorporated a liquid seaweed product in to my experimental design, which allowed me to evaluate any interaction between the fungi and biostimulant.

One of the fundamental building blocks of a healthy soil ecosystem is the nitrogen cycle. This process converts dead organic matter in to plant-abstractable nitrogen nitrate form and involves numerous microorganisms and a number of stages of decomposition and oxidation. Initial decomposition of organic compounds by aerobic bacteria and lignin-eating fungi, among others, produces ammonia, which is then followed by a nitrification process. Oxidation by nitrosomonas bacteria then converts the ammonia to nitrite ions with further oxidation by nitrobacter resulting in the production of nitrate ions. These are accessible for plant uptake and 'hey presto' we have food for our grass. The relevance of this vital process in relation to my research will become clear.

To assess whether the mycorrhizae fungi and seaweed extract had any influence on the grass plants' efficiency to uptake available nutrients, I evaluated their influence on the establishment of bent grass seedlings.

Continued over

Growth tubes

Clippings were weighed to discover shoot growth

To enable this, data was collected over an 18-week period using a partially randomised experimental design model, involving four differing treatments and incorporating 32 growth tubes. This allowed for eight replicates for each treatment type.

The four treatments were: A, seaweed extract; B, mycorrhizae and seaweed extract; C, control; D, mycorrhizae.

I built growth tubes and placed them outside, in an open space.

These were designed to replicate the specification and performance of a USGA putting green with a creeping bent and browntop bent seed mix sown at a rate of 20g/m².

Kerr Hunter of Symbio kindly provided me with a mycorrhizae seedcoat product, which was applied directly to the seed prior to sowing and also incorporated in to the top 30mm of the rootzone for the relevant mycorrhizae-treated growth tubes.

A liquid seaweed product, derived from Ascophyllum Nodosum alga, was applied fortnightly at a rate of 20L/500L to treatment groups A and B, while two applications of a standard liquid feed (8:1.5:5) were made during the trial to address seedling chlorosis issues.

One specific area I evaluated was shoot growth, with seven harvests being taken in total. Clippings were taken at a height of 10mm and were then left to dry at room temperature for 72 hours prior to being weighed. By the end of the trial period, 224 samples had been recorded and these provided a good sample size to allow statistical analysis to be carried out on the data.

As the bar chart on page 27 shows, the yield values for each treatment type intimated that both the mycorrhizae and seaweed extract products, when used independently, had an influence on the shoot biomass of the seedlings. Respectively, their yields were 18% and 5.9% greater than the control seedlings.

However, by far the greatest increase was shown when both products were used in conjunction with each other, with a 45.3% increase being recorded compared to the control seedlings.

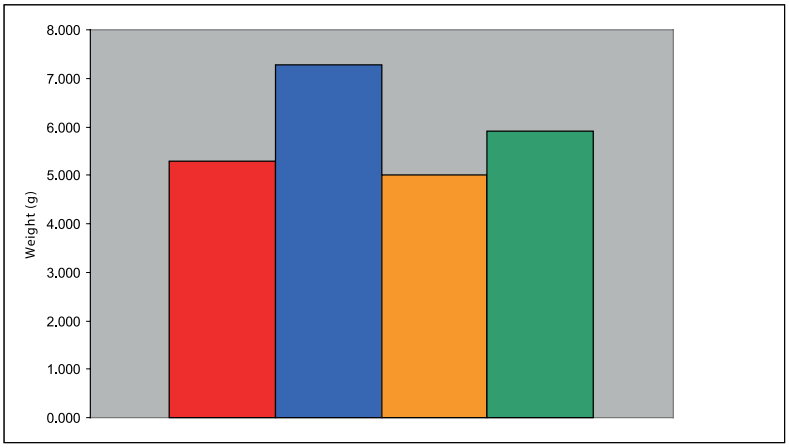
These figures indicate a mutual interaction between both parties, an observation supported by the results of statistical tests carried out on the data.

This showed that yield values for the seedlings treated with both mycorrhizae and seaweed extract were significantly different to the control seedlings on four of the seven harvests.

It was evident the analysis of the data was leaning heavily one way, but what was this telling us about the relationships being formed and how could we potentially utilise these when managing our turf?

The increased yield for the seedlings inoculated with mycorrhizae supports previous research in this area, which recognised the role these fungi play in enhancing the grass plants' ability to sequester nutrients from the soil, with the fungi's network of hyphae known to increase the absorption area available to roots.

Growth tubes were designed to replicate USGA stanfards



Key

Seaweed extract | Mycorrhizae and seaweed extract | Control | Mycorrhizae

The fact yield levels increased significantly when the seaweed was incorporated in with the mycorrhizae may well point to the positive role biostimulants play in enhancing nutrient availability.

Biostimulants such as seaweed extract are known to increase soil microbial activity, which in turn have a crucial role to play in the conversion of dead organic matter. This brings us back to the nitrogen cycle. Put simply, the faster the microbes work, the faster this cycle can function. This all leads to increased levels of accessible nitrogen being present in the soil solution, which the hyphae-extended rooting network of the mycorrhizae-inoculated seedlings can access.

If we could help maximise the amount of available nitrogen in the soil solution while providing the grass plant with additional mechanisms to uptake it, might this enable us to reduce frequency and levels of fertiliser application? It would cost less, but could having the potential to unlock the nutrient potential of our rootzones, while reducing synthetic fertiliser inputs, help us to avoid inconsistent and undesirable 'flush' growth patterns?

As we know, these fluctuations can be conducive to many problems, including excessive thatch accumulation, increased susceptibility to disease and poor sward density. This type of growth pattern is therefore detrimental in achieving the consistent smooth and firm playing surfaces that are now in such high demand from our customers.

So to summarise, the hidden world beneath our feet is vast and its influence on all aspects of the flora and vegetation that is visible to us is endless. Nutrient recycling is only one area which enables our soils to function as growing mediums, but is of particular relevance to turf managers.

By recognising this ecosystem to be potentially our biggest asset and by prioritising and managing it in a responsible and sympathetic manner, the possibility exists for us to embrace a more economically and environmentally sustainable future in relation to our turf management practices.

If we can ensure there is life below the surface, you will often find that Mother Nature will give us a helping hand in creating life above.