



Biostimulants - a look at the major groups

More commonly we are focused on the chemical and physical environment directly surrounding our turf as we measure, monitor and manage, but maybe we should be sharing our focus a little as we come to understand more and more about the potential biostimulants may hold for our turf. Not so easy to measure, this whole other world that is dynamic and very much influential - even sometimes living, can definitely be challenging to understand. Possibly this is because it's not uncommon for the benefit of a biostimulant to be indirect in nature so the cause and effect relationship is not immediately obvious. It sounds complex and some of it genuinely is but to help examine this potential we attempt here to put some of our biostimulants in some boxes and look at a few things as separate and discrete subjects.

A definition and relevant categories

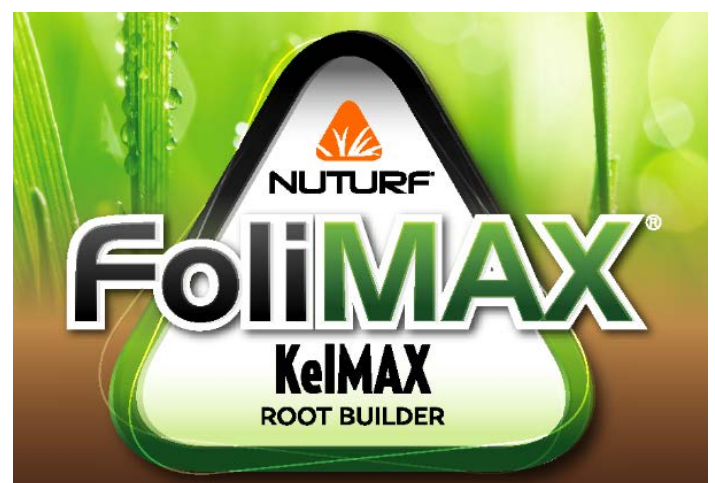
First of all let's be clear that applying a biostimulant, regardless of its nature or source, seeks to confer a favourable plant response – either in growth, some sort of stress tolerance or quality attribute. For this communication we'll be a bit more specific here and focus on a sub section of possible biostimulants such as plant hormones, humic substances, kelp and seaweed extracts, protein hydrolysates and bacteria and fungi. Believe it or not of all the research done in the area of biostimulants, getting an agreed definition for what they are has proven as complex as any individual investigation undertaken. Should we focus on what's in them – or what they actually do? We won't tackle that question here rather try to give some general information so when we cross them again in products or literature we can separate the options (or combo's) and have a sense of what response or benefit they may confer.

Plant hormones, kelps and seaweeds

Research performed over a long period of time has clearly characterised 5 major classes of plant hormones: auxin, cytokinin, gibberellin, ethylene and abscisic acid. They all have the common characteristic of being very effective in small doses. Whilst concentration may be low plant hormones have been shown to pack a mighty punch. Auxins are hormones that are naturally produced by plants and have absolutely vital roles in cell growth, division and expansion. In turf they get attention for the role they play in promoting root growth but auxins are known to have wide ranging roles, vary considerably in concentration between space and time, and are quite amazing in the diverse effects they can confer. Cytokinins play important roles in cell division and the differentiation of cells into new plant parts and organs. Interestingly, like many principles of nature cytokinin and auxin often work in concert with each other and it can be the relative balance between the two that deliver different developmental

outcomes. Gibberellins are hormones that behave a little like auxin but the role its best known for is cellular elongation as part of plant growth.

Exogenously applying biostimulants to supplement the hormones produced naturally within the turf is an area of great interest given the well established and just discussed power of those very molecules. This is where kelps and seaweed extracts have developed a real niche. Some of those hormones just named plus a range of other compounds have been shown to potentially be in seaweed extracts – differences coming from things such as source, processing method and plant available concentrations. Interestingly there still seems some unresolved science as to whether the additionally applied hormones are causing the favourable response, or if it's causing an upregulation (or down regulation whichever the favourable case is) of genes involved in natural internal hormone biosynthesis. Again we are discussing it here not answering it so we will leave that unanswered for the moment. Regardless, particular types of brown seaweed e.g. *Ascophyllum nodosum* sourced from specific high northern latitudes in the world are highly favoured since depending on processing method they have been found to contain extracts that when applied can confer a growth benefit. Other species such as the *Ecklonia* from the southern tip of South Africa is also highly favoured. This however isn't a more is always better issue. As mentioned they are active in small quantities and too much can be a bad thing as can small doses of a wrong ratio of hormones.



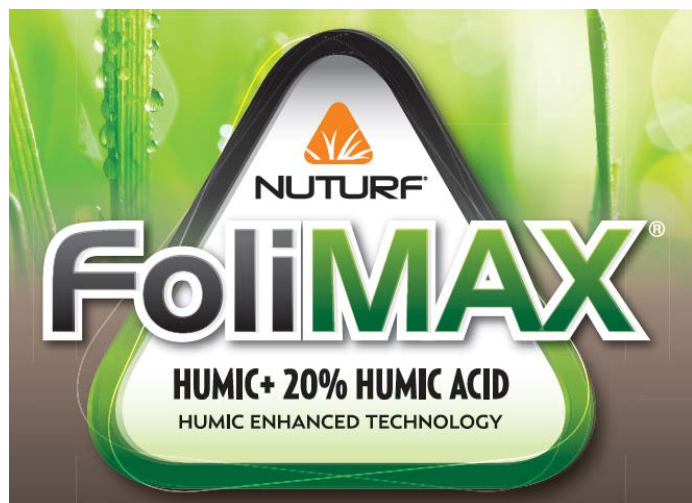
Humic substances

Humic substances are naturally occurring components of organic matter. Think of them as the degradation end points of various marine and soil processes. We can divide humic substances into three basic categories, humin, humic acids and fulvic acids. This group of substances offer physical benefits to the soil by improving structure, improving CEC and aiding oxygen

potentials, while chemical benefits are achieved via the negative charge they hold which helps attract and retain the major cations (Ca, Mg, K) we wish to hold.

Searching available literature there are many studies that examine discrete steps or parts in what they do requiring the reader to sometimes piece bits together – but a common thread is the observation of improved nutrient availability especially of the big three (N:P:K) so from a practical point of view for turf agronomy humic substances look a real positive for turf nutrition and soil health.

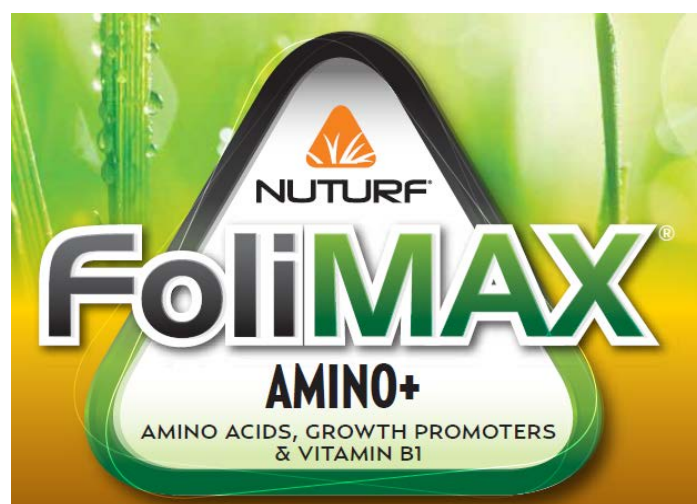
Of the three sub categories of humic substances noted above the humic and fulvic acid fractions are broken out based on high or low molecular weight. The smaller size of the fulvics tends to make them more mobile and active – able to be applied to plants to penetrate leaves, roots and stems allowing them even broader location and scope for benefits they can provide. Hence products confirmed to be proportionally higher in them seem to carry the interest. Whilst the humic substance story is a good one they should be considered part of a broader plant health program, not the plant health program, and should be thought of as building blocks we use as foundations of turf health.



Protein hydrolysates

The peptides and amino acids found in hydrolysates (whether sourced from plant or animal origins) are another area of ongoing learning. Whilst some evidence suggests they may act directly on the turf by affecting hormones or metabolism and therefore can affect abiotic stress tolerance (which is absolutely a good thing) there's seems to be a bit more information on how they can support valuable microbiology in the soil environment and/or as chelating or complexing agents for soil nutrition. We often

grow turf on soils of poor water and nutrient holding capacity courtesy of their sand dominance and low organic matter composition, or we do things to sustain and maintain turf health that inadvertently may reduce microbiology, or we have situations of bound or unavailable nutrition. The evidence seems to suggest they are conferring positive impacts in these areas so they support a diverse and healthy soil micro-biome that can directly and indirectly support soil nutrient availability and turf health. Based on information available thus far they appear a worthwhile area for continued development.



Bacteria and fungi

A healthy soil will contain generous amounts of both bacteria and fungi, and being a living part of the ecosystem the abundance, relative composition and population dynamic can and will fluctuate depending on how the site is managed and the prevailing environmental conditions. Names that commonly come up for the bacteria team are Bacillus spp, while the more common candidates for the fungal team are Trichoderma spp and Vesicular Arbuscular Mycorrhizae (VAM).

Bacillus are a diverse group of bacteria commonly found in soils. They are environmental processors working through all kinds of dead and decaying materials, consuming carbon and generally aiding the cycling that drives decomposition. They are an important and very valuable team member in the broader scheme of things with some Bacillus spp being specialists in certain areas. For this reason sometimes you will see products that contain multiple Bacillus species trying to capture the broad skill set the collection contains.

The fungi tend to be a little different – but still very valuable. Certain fungi will colonise the root/soil interface (the rhizosphere) of a turfgrass. Some have a specific affinity with plant roots and will colonise that rhizosphere to form a mutually beneficial relationship with the turf root system. Some species of fungi are species specific in the plants whose roots they colonise while others are less selective and will form a relationship with a range of plant species if the conditions are right. In recent years it has

become more common for turfgrass managers to introduce mycorrhizal fungi into their turfgrass profiles in the hopes of establishing a colony to assist in plant and soil health. One of the most popular choices of fungi for this has been the *Trichoderma* spp. of fungi

There are numerous reasons why *Trichoderma*, and more specifically *Trichoderma viride* application to turf has been adopted. Improved nutrient access is one as the hyphal network that the fungi develop around the turfgrass root system greatly increases the surface area of the roots, improving nutrient access. These fungi also exude compounds that can assist in solubilizing certain nutrients to make them available for plant uptake. Drought resistance is another reason as the fine filament network (hyphae) that the fungi create enables the turfgrass plant to access water in pore spaces that its own larger roots cannot access. Improved fungal pathogen resistance is a further reason for adoption as sometimes they build natural disease defences for the root system by releasing chemicals that inhibit infection. Finally total microbiology is increased with the inclusion of *Trichoderma* as the addition enhances the diversity of the soil ecosystem, improving the overall health of the soil environment. Diversity is good.



A quick look at published literature on the subject of soil-borne microbiology in turf shows numerous studies that examined population differences across sub sections of sites (e.g. different areas of golf courses such as fairways versus greens) and some general correlations can be seen between intensity of management and the resilience of bacterial and fungal populations with bacteria seemingly more consistent across areas.

The message coming from the evolution of biostimulants

The message that seems to come through when looking at the subject of biostimulants in turf is there appears value in

trying to extend our understanding a little to see the fascinating interactions occurring in the 'turf system' but equally to be open to many developing areas of investigation as there still seems so much knowledge being generated that is relevant and may help us to manage our turf even better. If you picture a graph of 'potential' and every time we apply a 'stress' we see potential go down, biostimulants are tools that may be able to help us claw back some of that lost potential and the interesting bit for the future will be just how much can we get and how they ultimately cooperatively work with traditional chemical tools.

How Nuturf can help you

Nuturf have developed a comprehensive liquid range that contains a number of biostimulant types and have various other granular fertiliser options that provide the opportunity to introduce biostimulants into your turf management regime. The FoliMAX liquid range either contains or has under development, a suite of options catering for the major biostimulant sub types named in this communication. Nuturf also offers products like Nutrismart either as straight granule for incorporation of humics or nutrismart as a component of other products to offer humics + NPK and TE nutrition options. This is an area Nuturf has embraced and is committed to further developing for our customers in future.



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