POSITIVE OUTCOME AREAS

- [x] SOIL
- [x] CARBON
- [x] WATER
- [x] BIODIVERSITY
- [ ] ANIMAL HEALTH & WELFARE
- [ ] SOCIAL

TECHNICAL GUIDE

What is a Biostimulant?

Biostimulants interact with plant signalling pathways, these pathways are like the plant's communication system, helping it respond to its environment. When something happens like a change in temperature, lack of water or an insect attack the plant receives a "signal". The signal then triggers a chain reaction inside the plant. These messages tell different parts of the plant how to respond.

Biostimulants can stimulate beneficial microbial communities. Healthy soil is full of helpful microbes, that support plant health and biostimulants can help to provide a good diet for these microbes, giving them the nutrients they need to grow and thrive.

Biostimulants can be natural or synthetic and can help improve plant growth and soil health. They can work by enhancing nutrient uptake, boosting stress tolerance, and improving overall soil structure and biology.

For organic farmers, check with your certifying body that the biostimulant, or ingredients if you're making your own, are approved or permitted.

What the science says about biostimulants

A meta-analysis (a review of different scientific studies on the same topic) found an average increase of 17.9% across various crops, with the highest benefits in arid climates and vegetable crops (11) and where soil health was compromised. However, it needs to be kept in mind that results do vary and has trials have shown the largest gains are found in vegetable/potato crops and in countries with poorer soils and drier climates, whilst results in the UK on cereals are less consistent.

Scientific research and trials have evidenced biostimulants may have the ability to offer the following benefits.

Improved nutrient use efficiency: By enhancing nutrient uptake and utilisation, reducing the need for synthetic fertilisers and improving nutrient use efficiency (NUE) (2, 4, 6).

Environmental sustainability: By reducing reliance on chemical fertilisers and pesticides, biostimulants could contribute to more sustainable agricultural practices and lower environmental impact (2, 5, 8)

Soil health and microbial activity: By promoting soil health by enhancing microbial activity and improving soil structure, which in turn supports plant growth (7, 8).

Enhanced plant growth and yield: Biostimulants can promote plant growth by stimulating natural processes, leading to increased crop yields and improved quality of produce (1, 2, 4, 9).

Stress tolerance: Biostimulants can help plants withstand abiotic stresses such as drought, salinity, and extreme temperatures by enhancing stress tolerance mechanisms (3, 4, 5, 7).

Whole farm systems

Biostimulants can be part of a whole farm system by reducing chemical dependence on pesticides and artificial fertilisers. Their potential ability to improve soil health alongside increasing stress tolerance and plant health make them a valuable tool on farm.

If you are interested in trialling biostimulants on your farm, the first point to consider is what you would like to achieve from the biostimulant i.e.

Improve soil health
Enhance root growth
Increase drought resistance
Boost nutrient uptake
Reduce crop stress

And understand which type of bio-stimulant will potentially achieve this:

Microbial biostimulants: improve root function and soil microbiome.

Compost teas: encourage beneficial microbes, enhance nutrient availability and reduce stress tolerance

Humic and fulvic acids: enhance nutrient availability and uptake.

Amino acids and peptides: support plant metabolism and stress tolerance.

Seaweed extracts: stimulate growth, boost resistance to pests and diseases.

Another consideration is deciding whether you are going to use an off-the shelf-product or brew your own biostimulant.

Measuring and monitoring

What can be measured to indicate if the applied biostimulant is having an effect?

As with all inputs, having an un-treated control area is essential to ensure that you are seeing a response to the biostimulant applied. In the soil, soil health Indicators can be measured such as:

Examples of biostimulants

A Seaweed Extracts
Compost teas
Humic & Fulvic Acids
Amino Acids & peptides
Microbial Inoculants
Plant Growth Promoters

Microbial activity: use soil respiration tests or microbial biomass assessments to see if beneficial microbes are increasing.

Soil Organic Matter (SOM): higher SOM levels indicate improved soil structure and fertility.

Nutrient availability: soil tests can measure nitrogen (N), phosphorus (P), and potassium (K) levels to check if nutrient uptake potential is improving.

Water holding capacity: soil moisture retention can indicate improved soil structure and drought resilience.

Soil aggregation and structure: better root penetration and reduced compaction suggest positive effects.

Off-the-shelf biostimulants

Pros:

Reliable and consistent: manufactured products have known ingredients and predictable results.

Easy to use: no need for extra equipment or preparation.

Scientifically tested: backed by research and trials to ensure effectiveness.

Longer shelf life: formulated for storage stability.

Specific formulations available: tailored products for different crops, soil types, and growth stages.

Cons:

Higher cost: more expensive per application compared to DIY methods.

Less control over ingredients: may contain fillers or additives that aren't needed by the crop or soil or may not provide microbes or nutrients that your crop or soil requires.

Environmental impact: some products may have a higher carbon footprint due to manufacturing and transport. necessarily.

Brew-your-own biostimulants

Pros:

Lower cost: can be made from farm waste, compost, or locally sourced materials.

Customisable: farmers can tailor mixtures to their specific soil and crop needs.

Supports soil microbiology: fresh brews often contain more active microbes.

Sustainable and regenerative: reduces reliance on external inputs and supports circular farming.

Cons:

Time consuming: requires preparation, monitoring, and quality control.

Inconsistent results: effectiveness depends on brewing conditions and ingredient quality.

Short shelf life: freshly brewed solutions must be used quickly before they degrade.

Potential for contamination: risk of harmful bacteria or imbalanced microbial populations if not managed properly.

You also need to consider the type of equipment needed for application, where this targets and the amount and timings of applications and if this practically fits into your management system.

Soil-applied: best for improving soil health and root development.

Foliar sprays: useful for quick stress recovery and nutrient uptake.

Seed treatment: enhances early-stage plant growth.

How do I make sure bio-stimulants will work for me?

There is an overwhelming amount of information and products available, start by talking to an established biostimulant suppliers to see what products may meet your above goals, talk to other farmers who have already been using biostimulants and join networks of similar minded individuals to see what did and did not work for them. If you have an existing advisor, ask if they have any experience with biostimulants. Make sure practical considerations like do you have the right size filters on any sprayers? Which biostimulants are most effective on which types of crops?

Tim Parton (right) talks about his journey on using off the shelf and home brewed biostimulants.

Why should I be doing this?

Biostimulants are not an exact science and therefore their effectiveness depends on multiple factors such as crop type, existing soil health, application technique and environmental conditions

Research has shown biostimulants can:

Enhance crop resilience: Helping plants better cope with drought, heat, and disease.

Improve nutrient efficiency: Allowing existing and added nutrients work more effectively

Improve soil health: Encouraging beneficial microbes and improving soil structure.

Increase yields: Some trials report improved crop quality and yield when biostimulants are used (depending on crop type and conditions) but the evidence is not often independently verified.

For plant growth and resilience, the following indicators can be used:

Root biomass and depth: digging up sample plants can show if root systems are developing better.

Leaf chlorophyll levels (SPAD readings): greener, healthier leaves indicate better photosynthesis and nutrient use.

Plant vigour and growth rate: measure plant height, leaf area, and overall growth.

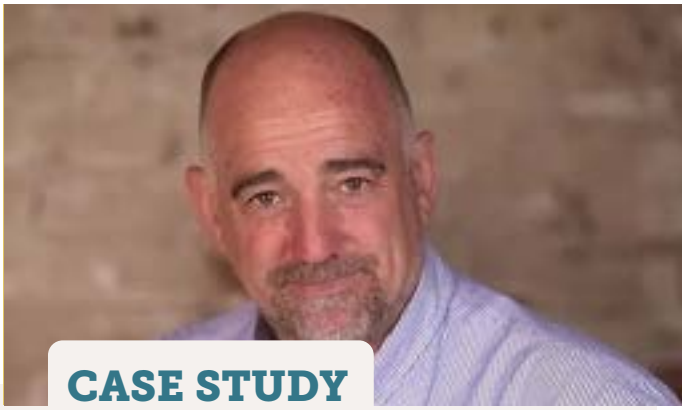
Stress tolerance: check for resilience to drought, frost, or disease compared to untreated crops.

Final yield: compare treated vs. untreated areas for improvements in harvest weight.

Crop quality: look at grain protein content, sugar levels (Brix test), or fruit/vegetable firmness and size.

Pest and disease resistance: record any reductions in fungal infections, insect damage, or nutrient deficiencies.

Reduction in inputs needed: track if less fertiliser, pesticides, or irrigation is required.



CASE STUDY

Tim Parton, Brewood Park Farm

Microbial Inoculants in intelligent, biological farming

Tim Parton is passionate about addressing the root causes of poor soil health rather than relying on short-term solutions. At Brewood Park Farm in Staffordshire, he has been trialling both off-the-shelf and home-brewed microbial products to improve soil function and reduce reliance on artificial inputs.

Getting started: trial and observation

Tim advises that success with microbial inoculants comes through trial and error. He recommends starting with a commercially available fermented fertiliser or compost extract, then closely monitoring improvements in both root development and above-ground biomass.

Transitioning to home-brewed solutions

Once initial improvements are observed, Tim suggests gradually moving towards brewing your own microbial inoculants. However, he cautions that at this stage, farmers should still buy in beneficial microbes to avoid unintentionally introducing harmful organisms. Key microbial groups to focus on include:

Nitrogen fixers – to enhance soil fertility naturally

Phosphate solubilisers – to unlock bound nutrients in the soil

As experience and understanding grow, farmers can begin brewing their own fungal mixes using microbes sourced from healthy soil on their farm. Tim highlights the importance of microbial diversity, stating, "You need a variety of microbes as they complement each other."

Long-term investment, long-term gains

This is not a quick fix – Tim emphasizes that meaningful, sustainable results take anywhere from four to seven years. He stresses that microbial inoculation should be part of a whole-farm system, integrating regenerative practices that improve soil health while reducing reliance on synthetic inputs.

Costs, savings, improvements

For growers, the economic viability of applying any product to a crop is essential. The potential financial benefits of biostimulant use stem from increased yields and improved nutrient use efficiency leading to reduced artificial fertiliser requirements. Alongside enhanced stress tolerance may lower the need for pesticide applications. Cost saving will depend on context of crop type, soil type, environmental conditions and existing soil health.

For example, 36 separate field trials carried out by Biostim on potatoes demonstrated a total % increase margin of 9.30% which after deducting the cost of the biostimulant equalled £885 per hectare. Trials across onion, potato and turf demonstrated on average a 25% reduction in artificial fertiliser usage.

Biostimulants could be a useful tool as part of a wider whole farm system. However studies have emphasised the importance of environmental factors and cropping systems in determining the success of biostimulant applications.

Contacts

Soil Association advice and support

Contact our Farming and Land Use Team
Speak to a farming advisor: 0117 314 5100
Find out more soilassociation.org/farmers-growers
Email: producer.support@soilassociation.org
General enquiries: 0300 330 0100

Timescales

The frequency of application depends on the product, some need applying once whilst others multiple times. Therefore, factors such as how often is it difficult to travel on your land after wet weather events and time management need to be taken into consideration.

Improvements in soil health including microbiome and structure is not a quick fix. It will depend on several factors including the type of biostimulant, soil health and management practices.

For example, microbial biostimulants can start colonising roots within weeks and improve nutrient uptake within months. Combined with other practices improved soil structure, more efficient nutrient use and reduced disease suppression can be seen. Longer term use can lead to healthier, more resilient soils with increased water holding capacity and organic matter content and reduced reliance on synthetic fertilisers and pesticides as the soil ecology improves.

However, this cannot be done as a standalone practice as it needs to be part of a whole farm approach including practices such as cover crops, mindful cultivation and diverse rotations.

Impact

Improve soil health: Biostimulants can help enhance the biological, chemical, and physical properties of the soil. They can increase microbial activity, improve soil structure, and enhance nutrient cycling. Which leads to better soil fertility and long-term sustainability.

Enhance root growth: certain biostimulants, such as seaweed extracts and humic acids, promote root development. Stronger, deeper roots allow plants to access more nutrients and water, improving overall plant health and stability.

Increase drought resistance: by improving root systems and water retention in the soil, biostimulants can help plants withstand periods of low rainfall or high temperatures. Some biostimulants also help plants produce stress-related compounds that reduce water loss.

Boost nutrient uptake: biostimulants can make nutrients more available in the soil or help plants absorb them more efficiently. This can reduce reliance on synthetic fertilizers while still ensuring crops get the necessary nutrients to grow.

Reduce crop stress: plants face stress from extreme weather, pests, diseases, and soil imbalances. Biostimulants can help plants produce natural protective compounds, strengthen cell walls, and regulate hormones, making them more resilient against environmental stressors.

Research references, plus a webpage and pdf version of this guide, can be found at www.soilassociation.org/biostimulants