FACTSHEET

Crop biostimulants

Figure 1. Wheat crop at growth stage 59

This factsheet summarises the mode of action, efficacy and value of commercially available biostimulant products on main crops grown in the UK.

Latest information

- **Some biostimulants can affect plant growth and development positively, according to an AHDB-funded review**
- **Biostimulant product types available in the UK and the level of evidence for effects on cereals and oilseed rape (OSR) crops are outlined in this publication**

Points to consider

- **Understand the environment into which biostimulants are being introduced, especially for products containing microorganisms**
- **Follow product labels and, if necessary, consult a professional agronomist**
- **Some biostimulant products are derived from mammalian tissue by-products, including pork and beef material. It is essential to check the acceptability of their use with your trade customers or buyers**

What are biostimulants?

The definition of 'biostimulants' is under debate. According to a widely used definition from the European Biostimulants Industry Council, a biostimulant is a material that contains substances and/or micro-organisms whose function, when applied to plants or the rhizosphere, is to stimulate natural processes to enhance/benefit nutrient uptake, nutrient efficiency, tolerance to environmental stress and crop quality.

It should also be noted that a biostimulant's main role should not be to provide fertilisation or pesticidal activity. Any product marketed as a pesticide must have a Ministerially Approved Pesticide Product (MAPP) number.

Due to a lack of consensus on the term, there are no specific frameworks for regulating biostimulants in the EU, United States and other countries.

The European Commission, however, intends to revise Regulation (EC) No.2003/2003 (the Fertiliser Regulation) and extend its scope to include plant biostimulants (among other materials).

Biostimulant product types

In the UK, a diverse range of biostimulants is available. Grouped as either 'non-microbial' or 'microbial', they can be further classified by product type. The most common product types used in the UK are summarised in Table 1.

Table 1. A summary of the most common biostimulant product types used in the UK

Group	Product type	Description of the product types
Non-microbial	Seaweed extracts	Extracted from seaweed
	Humic substances	Extracted from decayed plant or animal material (eg humic or fulvic acids)
	Phosphite and other inorganic salts	Salts that do not contain carbon. Phosphite (PO_3) is a commonly used inorganic salt
	Chitin and chitosan derivatives	Chitin is an abundant natural polysaccharide obtained from crustaceans. Chitosan is derived from chitin
	Anti-transpirants	Products which reduce transpiration by plants (eg abscisic acid and waxes)
	Protein hydrolysates and free amino acids	Protein hydrolysates are produced from animal and plant residues. Free amino acids are obtained through enzymatic breakdown of agro-industrial by-products Note: Biostimulants derived from mammalian tissue by-products, such as pork and beef materials, might not be acceptable to customers/buyers
	Complex organic materials	Broad range of products that contain material derived from the remains of organisms (eg plants)
Microbial	Plant growth promoting bacteria	Bacteria that potentially benefit plant growth (eg *Bacillus*/*Rhizobia spp.*)
	Non-pathogenic fungi	A wide range of fungal species that have no direct pathogenic effect on plants (eg *Trichoderma spp.*)
	Arbuscular mycorrhizal fungi	Common type of endomycorrhizal fungus that forms a symbiotic association with plant roots (eg *Rhizophagus irregularis*)
	Protozoa and nematodes	Protozoa are single-celled rhizosphere organisms. Nematodes are non-segmented worms

What can biostimulants do?

Some biostimulants are associated with increased crop nutrient uptake and tolerance to environmental and pest stresses. Their use may increase plant growth and yield.

There is, however, limited research evidence to provide clear guidelines on when and how to use biostimulants to achieve consistent benefits in the UK.

The evidence for biostimulant products to provide benefits has been reviewed and summarised (see Table 2).

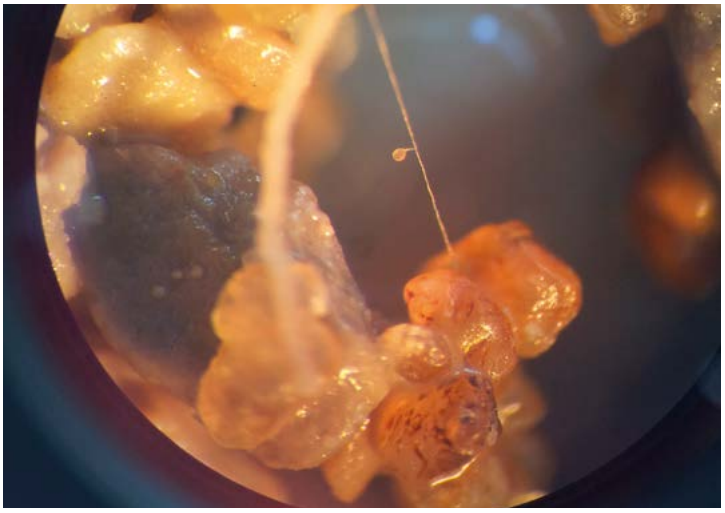

Figure 2. A microscopic photograph of *in vitro* arbuscular mycorrhizae culture

Table 2. A summary of the evidence for positive biostimulant effects on plant nutrition, growth and stress tolerance for any plant species, based on information summarised in AHDB Review No. RR89

		Promote plant nutrition?			Improve plant growth and yield?			Promote biotic stress tolerance?	
Group	**Product type**	**Nitrogen**	**Phosphorus**	**Other nutrients**	**Hormonal**	**Growth**	**Yield**	**Pathogen**	**Pest**
Non-microbial	Seaweed extracts								
	Humic substances								
	Phosphite and other inorganic salts								
	Chitin and chitosan derivatives								
	Anti-transpirants								
	Protein hydrolysates and free amino acids								
Microbial	Plant growth promoting bacteria								
	Non-pathogenic fungi								
	Arbuscular mycorrhizal fungi								

Good evidence base (including multiple field-based experiments on cereals or oilseed rape)

Moderate evidence base (good number of experiments, including some field-based experiments on cereals or oilseed rape)

Low evidence base (principally laboratory-based experiments with little or no data on cereals or oilseed rape)

No evidence base (not enough evidence available)

How should microbial biostimulants be used?

There are some common factors known to affect the success of microbial biostimulants. These are outlined in Table 3, with more detail in AHDB Review RR89.

It should be noted that when microbial biostimulants are applied to plants, they can have a dual function of a biocontrol agent and of a biostimulant.

Table 3. Getting the best results from microbial biostimulants

Risk factor	How to manage the risk
Method of inoculum production, storage and application	Refer to manufacturer's guidelines. Consider application method (eg seed coatings may provide better access to plant roots at early growth stages)
Soil physical properties	Adverse conditions may reduce effectiveness. Consider soil (eg water potential, temperature and clay contents) physical properties at the time of application
Soil chemical factors (pH, available nutrients, pesticides)	If unknown, get the soil analysed. Under incorrect chemical environments, the inoculant might not be useful
Competition from indigenous soil microbes	Follow manufacturer's guidelines to minimise this risk of competition from the local microbial community
Impact of crop species and management inputs	Understand the needs of the organism you are applying (eg oilseed rape cannot form an association with mycorrhizal fungi. A fungal inoculant may also be adversely affected by some fungicides)

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Glossary

Abiotic stress - An environmental stress to the plants (for example, due to water deficit or water logging, too low or too high temperature and salinity) that results in poor growth and development

Biotic stress - A stress that occurs as a result of damage done to plants by living organisms, such as bacteria, viruses or fungi

Endomycorrhizal fungus - A type of mycorrhiza in which the fungus penetrates the roots of a plant

Inoculum - Cells or biological material used to start a culture in a lab

Pathogens - Organisms, such as bacteria, viruses and fungi, that are capable of causing disease in other living organisms

Polysaccharides - Large carbohydrate molecules, such as starch

Rhizosphere - Volume of soil influenced by plant roots

Symbiosis - Interaction between two different organisms living in close physical association, typically to the advantage of both, eg arbuscular mycorrhizae with plant roots

Further information

Information on AHDB review on biostimulants can be found at:
cereals.ahdb.org.uk/biostimulants

Information on crop nutrition can be found at:
ahdb.org.uk/RB209

Information on soil management can be found at:
ahdb.org.uk/greatsoils

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