Bacstim®100

High Performance Biology

FREQUENTLY ASKED QUESTIONS

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What is BACSTIM® 100?

- BACSTIM® 100 is a microbial based product containing five different spore forming *Bacillus* spp. strains. The strains have been selected based on proven superiority in cropping systems.
- When root colonisation is established by these *Bacillus* spp, they can perform a wide variety of actions such as the breakdown of organic matter to supply nutrients to the crop, production of phytohormones and improved resistance of plants against pathogenic microorganisms and adverse conditions.

What is a *Bacillus* strain?

- *Bacillus* is a wider classification of bacteria and within the *Bacillus* group exists different species of *Bacillus*. Strains are a subgroup within bacterial species with minor differences in their DNA.
- Bacterial strains are the equivalent of breeds within a species like dogs. Just like dog breeds can vary widely and are useful for a range of purposes, so different *Bacillus* strains have different activity in the way they interact with plants.

How does BACSTIM® 100 work?

The *Bacillus* found in BACSTIM® 100 are categorised as plant growth promoting rhizobacteria (PGPR). They are bacteria that inhabit soils and can populate plant roots, the rhizosphere or both.
When these are applied to seeds or crops, they enhance or maximise the yield and growth of plants. PGPR's have characteristic mechanisms which they use to enhance plant growth in various crops, including:

Phytohormone (Plant Hormone) Production

Bacillus produce plant hormones or stimulate plants to produce plant hormones from within. They can promote plant growth by inducing plant cell growth and division. These hormones include indole acetic acid (IAA), abscisic acid (ABA), gibberellic acid, cytokinins, and jasmonic acid.

Extracellular Polymeric Substances (EPS) Production

Bacillus can form biofilms by secreting EPS which increase water potential around plant roots. EPS can also improve permeability thereby increasing nutrient uptake by both plants and microbes contributing toward increasing plant growth and drought tolerance.

Enzymatic activity

Bacillus are known to perform a wide range of enzymatic reactions which make a range of nutrients and metabolites easily available to plants by directly breaking down organic matter. These enzymes include cellulases, amylases, lipases, chitinases, proteases, glucanases, ureases, tannases, and xylanases. Enzymes such as chitinases have been shown to directly breakdown the cell walls of plant pathogenic organisms thereby exhibiting biocontrol activity.

Siderophore Production

Bacillus access iron by secreting iron chelators called siderophores which increase the amount of soluble iron available to the plants and themselves.

Biocontrol Activity

Bacillus can reduce the growth or effects of plant pathogenic microorganisms on plants. Some enzymes produced by *Bacillus*, such as chitinases, have been shown to directly breakdown the cell walls of plant pathogenic fungi and insects thereby exhibiting biocontrol activity.
Siderophores also have antifungal and anti-microbial activity because they chelate the iron required by the pathogens.

Bacstim®100

Why are spore forming *Bacillus* species more ideal as microbial inoculants compared to non-endospore formers?

- The *Bacillus* in BACSTIM® 100 are in the form of endospores. Endospores are resistant dormant cell structures which remain dormant but viable under unfavourable growth conditions such as nutrient deprivation, heat, cold, desiccation or drastic pH changes.
- Endospores are highly stable and can remain dormant for long periods of time until conditions-for growth become favourable.
- If field conditions become unfavourable, the *Bacillus* in BACSTIM® 100 can potentially produce their endospore form again, ready to germinate again once conditions improve.
- Non-endospore forming microorganisms on the other hand are susceptible to harsh environments as they do not possess the thick casing of endospores. As such, they can die out quickly without the ability to repopulate.
- The dormant state of the *Bacillus* endospores ensures consistent product quality from production to application.
- The shelf-life of endospore based microbial products can be well over a year, unlike the non-endospore forming based products which have a lower shelf life.

Why should I buy BACSTIM® 100 instead of other biological inputs?

- BACSTIM® 100 consists of non-GMO soil borne naturally dominant *Bacillus* strains.
- The product contains a highly concentrated amount of *Bacillus* endospores ensuring successful root colonization.
- BACSTIM® 100 has proven plant growth promoting properties.
- BACSTIM® 100 has been statistically evaluated under greenhouse and field conditions on a range of BACSTIM® 100
- BACSTIM® 100 is scientifically formulated and produced using a commercial scale GMP fermentation facility.
- BACSTIM® 100 has shown the ability to prime the plant against adverse conditions.

How do endospores become active in the soil?

Upon application to the soil, the *Bacillus* endospores can quickly come out of dormancy when sensing there is favourable conditions,i.e. food source available. Ongoing growth relies on exudates from plant roots. BACSTIM® 100 can quickly multiply exponentially in symbiosis with plant roots.

How frequently should BACSTIM® 100 be applied to soils?

BACSTIM® 100 must be applied once at planting for broadacre crops, and 2-3 times during the active growing season for permanent crops.

What are the benefits of using BACSTIM® 100?

- Produce phytohormones encouraging root growth
- Increased above ground and root biomass
- Improve nutrient mineralization and uptake
- Improve stress resistance
- Increased chlorophyll content
- Increased root and shoot length
- Increased rate of emergence
- Potential yield increases

Which crops can I apply BACSTIM® 100?

BACSTIM® 100 can be used on all crops. The product has been successfully tested on a wide variety of crops, which include numerous broadacre, annual and permanent horticultural crops.

How should I apply BACSTIM® 100 to my crops?

- BACSTIM® 100 is supplied as a highly concentrated liquid suspension.
- The product should be applied at 1 L/ha per application.
- Mix well before use.
- It is recommended that you dilute the product with water. Municipal water sources that include chlorine can be used.
- BACSTIM® 100 should be applied close to the root area, seed or applied directly on seed in the planting furrow.
- BACSTIM® 100 is compatible with a range of delivery systems including drip irrigation.
- BACSTIM® 100 can be mixed with other compatible agricultural chemicals, such as herbicides, pesticides and fungicides (except copper containing fungicides).
- Once mixed, it should be used within 4-6 hours.
- BACSTIM® 100 should be stored under cool and dry conditions, below 30°C.

Where should BACSTIM® 100 be placed in the soil profile?

BACSTIM® 100 should be applied in the top soil close to the existing plant root area, seed or applied directly on seed in the planting furrow.

Do I need to apply any other products at the same time as BACSTIM® 100?

- BACSTIM® 100 can be used in conjunction with humate derivative products for increased biostimulatory results.
- Improved performance has been observed when combined with the Rhizovator™ range of products. Speak to your local Omnia agronomist for advice on the most suitable Rhizovator™ version for your situation.

Can I apply it with fertilizer?

- BACSTIM® 100 can be mixed with commonly used agricultural fertilizers.
- For untested mixtures it is advisable to test mixture using small quantities in a small field area before mixing large batches.

Do I need to modify my irrigation after application?

- BACSTIM® 100 is compatible with irrigation equipment as it is a flowable liquid suspension.
- Following application, care should be taken to avoid washing out the bacterial endospores from the root zone before colonization occurs. Where irrigation is necessary before colonization, only the required immediate water needs should be met to minimize water movement away from the root zone.

How long does BACSTIM® 100 stay active on the roots?

The number of bacterial colony forming units will remain high for the duration of the plant cycle. They will decrease when the plant roots go into dormancy or the roots are harvested but will remain in the soil in low numbers.

How frequently should BACSTIM® 100 be applied to soils?

BACSTIM® 100 must be applied once at planting for broadacre crops, and 2-3 times during the active growing season for permanent crops.

How can I tell if BACSTIM® 100 has successfully colonized the roots?

- BACSTIM® 100 starts colonizing plant roots a few hours after the bacteria make contact, and complete colonisation is established after 2-3 days after application. This process will depend on root activity levels and the amount of sugars exuded.
- Successful colonization of BACSTIM® 100 on plant roots can be observed as a slimy matrix on plants roots or visually by the greater than normal growth in plant biomass.

What not to do with BACSTIM® 100?

- BACSTIM® 100 should not be mixed with copper containing fungicides.
- The diluted or mixed product with compatible agricultural chemicals should not be stored for-more than 24 hours.
- The product should not be stored under extremely high temperatures above 30°C
- Do not ingest the product.
- Avoid contact with the eyes and skin.
- How do you guarantee the analysis of the product?
- The product is analysed by trained and highly qualified microbiologists using direct count of colony forming units (CFU). CFU is a unit of measure of the number of bacterial cells with the ability to multiply and reproduce.

Can you give me a certificate of analysis from an independent lab?

The quality of the product has been tested by an independent lab, and the results are available.

Does it have an expiry date? What is the shelf life?

- The shelf life of endospore based microbial products is a minimum of one year, where the optimal function of product is guaranteed.
- Storage conditions influence the shelf life of BACSTIM® 100, and it should be stored as recommended.

Glossary

Bacteria:	Microscopic single-celled organisms that live in huge numbers in almost every environment on Earth and are vital to the planet's ecosystems.
Bacillus:	A group of rod-shaped bacteria that stain gram positive and are widely found in soil and water.]
Abscisic acid (ABA):	A plant hormone that functions in numerous biological processes in plants, especially in the control of transpiration, seed maturation and dormancy.
Colony forming unit (CFU):	A unit of measure used to count the number of bacteria or fungal cells with the ability to multiply and reproduce.
Cytokinin:	A plant hormone involved in several plant processes that promote cell division and differentiation in plant roots and shoots.
Cytoplasm:	A jelly-like fluid that fills all living cells and is mainly composed of water, salts, and proteins.
Deoxyribonucleic acid (DNA):	A double helix molecule responsible for carrying all the genetic instructions necessary for the growth, development, functioning and reproduction of all known living organisms.
Dipicolinic acid (DPA):	A chemical compound implicated in the protection of bacterial spore proteins and DNA from heat inactivation.
Endospores:	Extremely resilient dormant cell structures produced on the inside of some bacteria cells under unfavourable growth conditions.
Enzymes:	Protein molecules inside living cells which speed up chemical reactions.
Extracellular polymeric substances (EPS):	Polysaccharide and protein substances, which are actively secreted by the microbial cells and function in their clumping, biofilm formation, and protection from harsh environments.
Gibberellic acid:	A plant hormone involved in stimulating plant growth and development. Indole acetic acid (IAA): An abundantly available plant hormone which is commonly produced in young leaves of plants and is known to induce cell division and cell elongation.
Jasmonic acid:	A hormone produced by many plants and found to play important roles in plant defence systems especially against herbivores (plant eating organisms).
Plant growth Promoting Rhizobacteria (PGPR):	Bacteria that live in soils and can populate plant roots or the rhizosphere and promote plant growth.
Rhizosphere:	The narrow zone of soil surrounding a plant root.
Siderophore:	Small compounds that are produced by bacteria, with the sole function of binding iron and facilitating its uptake by these cell structures.
Strain:	A strain is an offspring of a single bacterial species. Microorganisms of the same strain differ from microorganisms of other strains at a genetic (DNA) level. An analogy is the different breeds of dog that exist within the dog species and have a wide range of purposes and abilities.

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