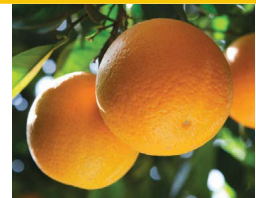
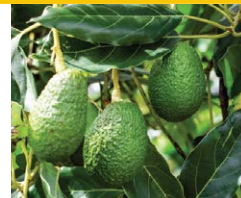




Eco-Bb[®] *FAQ's*

Beauveria bassiana for the control of agricultural mite and insect pests

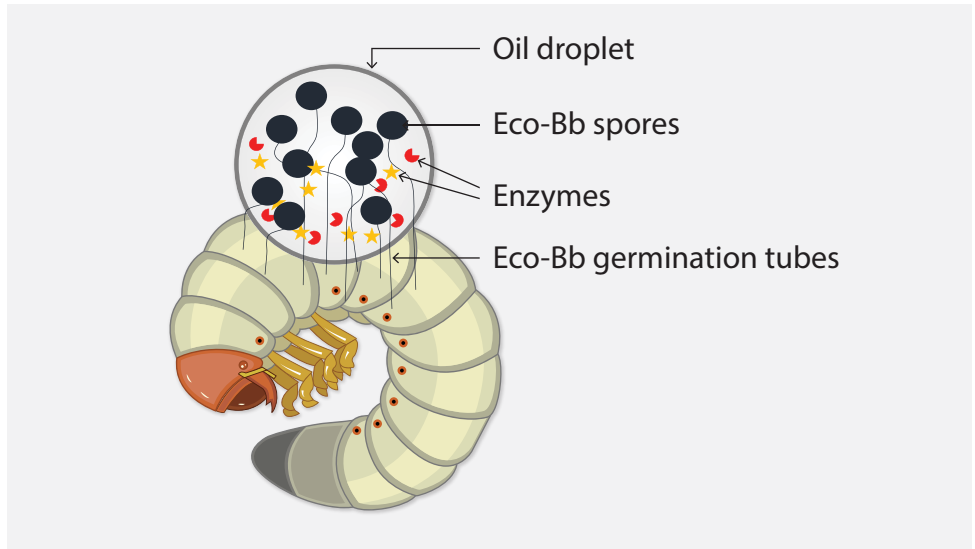


Andermatt
Madumbi

PRODUCT FORMULATION

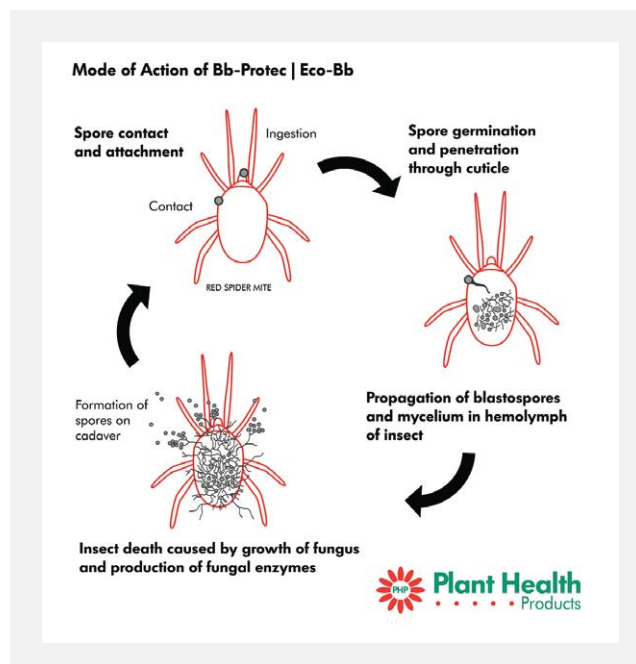
How is *Eco-Bb*[®] formulated?

Eco-Bb has a unique dry powder formulation, which includes oil-coated *Beauveria bassiana* spores. The product is non-toxic, has no with-holding period and is approved for organic use. The oil coating helps protect the spores from UV damage and desiccation. Multiple spores are contained within each oil droplet, which enhances the virulence of *Eco-Bb*[®] against the insect or mite pest.



How does *Eco-Bb*[®] work?

Once the oil droplet lands on the insect pest, the spores germinate and produce enzymes, which penetrate the insect's cuticle. The *Eco-Bb*[®] fungus then grows inside the insect pest, which changes insect behaviour and reduces feeding, before causing death to the insect. Death of the insect will typically occur 3 to 5 days after initial contact with *Eco-Bb*[®].



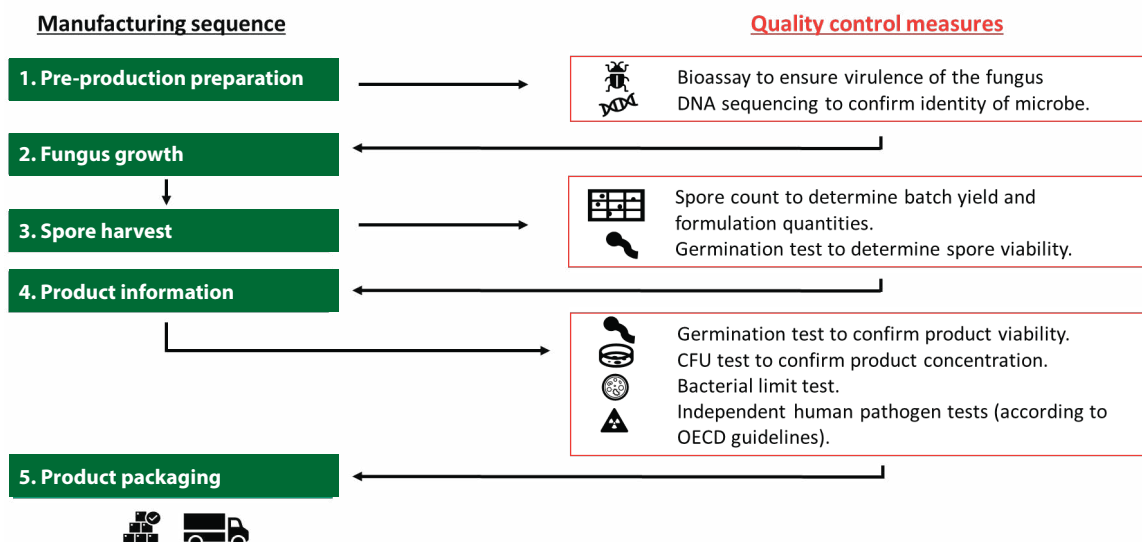
QUALITY CONTROL

How does PHP ensure that every batch of *Eco-Bb*[®] meets a high quality standard?

Multiple quality control steps are undertaken throughout the production process, which ensures that every batch of *Eco-Bb*[®] meets a high quality standard. These steps include:

- **Bioassay** – A bioassay is performed by applying the fungus to an insect within the *Eco-Bb*[®] host range. The insect is monitored to confirm that *Eco-Bb*[®] caused its death.
- **DNA sequencing** – DNA sequencing is conducted by an external laboratory to confirm that the correct microorganism (*Beauveria bassiana*) is included in the production process.
- **Spore count** – A spore count is performed to ensure that every batch of product is formulated with a minimum of 2×10^9 spores per gram.
- **Germination test** – A germination test, which is a measure of the % of spores that germinate, is performed to ensure that the *Eco-Bb*[®] spores are viable. This is undertaken on every batch both before and after product formulation.
- **CFU test** – A CFU test is performed on each batch of the formulated product to confirm the concentration of viable *Eco-Bb*[®] units per gram of product.
- **Bacterial limit and human pathogen testing** – A bacterial limits test and human pathogen test is performed on each batch of the formulated product to ensure that *Eco-Bb*[®] complies with microbial quality and human health standards.

Eco-Bb[®] production process and associated quality control measures



***Eco-Bb*[®] SHELF LIFE AND CORRECT STORAGE**

How should *Eco-Bb*[®] be stored?

The optimum storage condition for *Eco-Bb*[®] is 4°C - 10°C. At this temperature, the product is expected to have maximum shelf life; the current registered shelf life is 12 months. Refer to the label for the batch expiry date at the expected storage conditions. In warehouses and consignment depots, stock is stored at 4°C; however, when in transit *Eco-Bb*[®] is not in a refrigerated environment because this transit period is usually less than 7 days.

Once opened how long can I keep *Eco-Bb*[®] ?

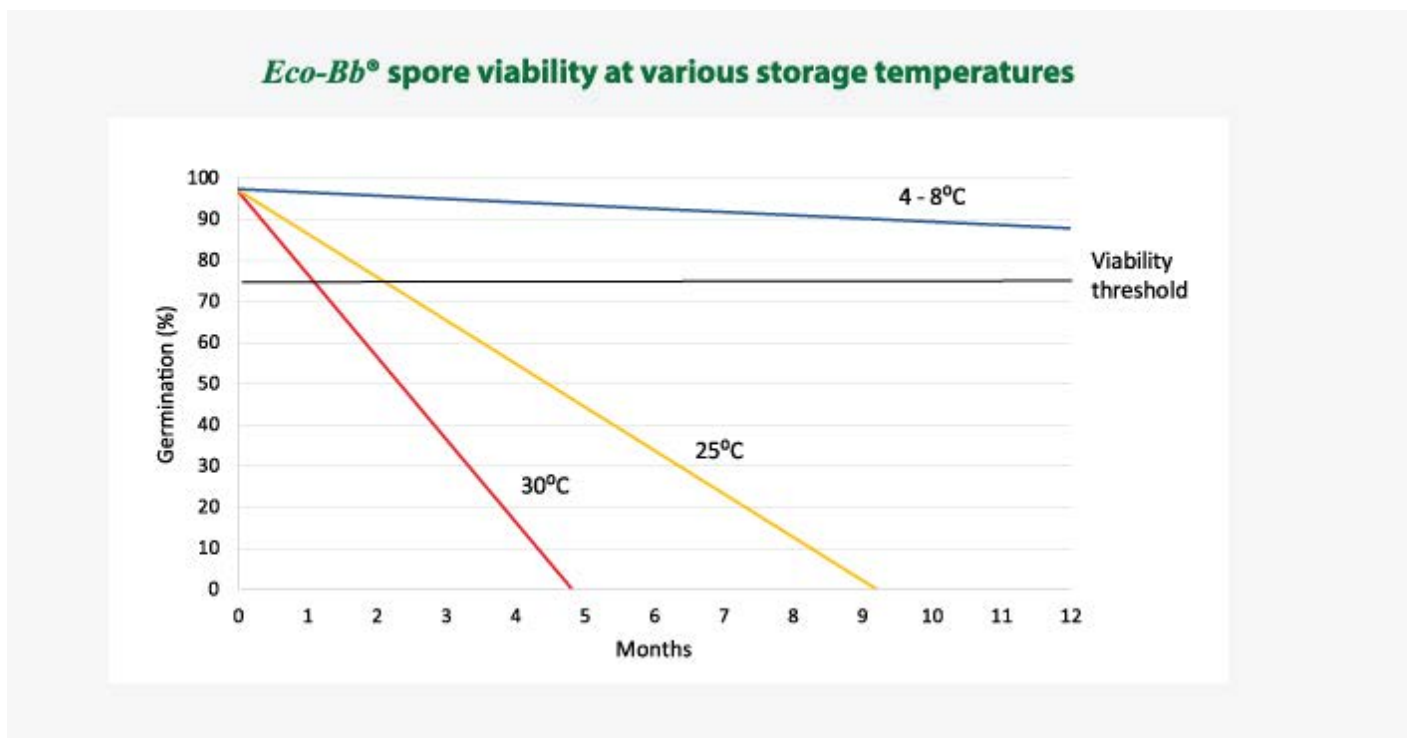
Once the product packaging has been opened, the spores are exposed to moisture fluctuations. This will affect the viability of the product slowly over time. The product will still be fully viable for 1 month after opening.

Can *Eco-Bb*[®] be frozen?

Eco-Bb[®] can be frozen once, but must be used soon after thawing and not frozen again once it has thawed.

What happens if the *Eco-Bb*[®] is exposed to elevated temperatures?

In an experiment, *Eco-Bb*[®] was stored at various temperatures for an extended period in a controlled environment. During this time, the product was tested regularly for viability in the form of a germination test. This was to establish the reduction of spore viability when exposed to different temperatures and therefore the quality of the product.



The 25°C and 30°C results illustrate the potential effect of extended temperature exposure on the shelf life of the product. Daily temperatures would naturally fluctuate, so these results represent a worse case scenario of exposure. Responsible transport and short-term exposure to adverse conditions (not exceeding 35°C) will not affect the long-term storability and efficacy of the product.

PRODUCT APPLICATION

How should *Eco-Bb*® be applied?

For the best results when using *Eco-Bb*®, please consider the following:

- *Eco-Bb*® is a contact insecticide and therefore the best efficacy is achieved when *Eco-Bb*® makes direct contact with the target insect.
- Good spray coverage is essential. The best results are achieved using a mist blower.
- Ensure that areas where pests are found habitually are covered. i.e. on the underside of the leaf and leaf folds.
- Where possible, apply the product in the late afternoon when humidity is high and UV is low, unless the target insect/life cycle stage is only active during the early morning.
- Avoid the use of broad-spectrum fungicides for at least 3 days before and 3 days after *Eco-Bb*® applications. Consult your sales representative for a list of compatible and incompatible products.
- Tank pH must be maintained between 4 and 12.
- *Eco-Bb*® is compatible with non-ionic silicone based surfactants. Surfactants and other adjuvants should be used only when recommended.
- The product must be used within 1 month of opening. The 12 month shelf life is only guaranteed in sealed packaging under the recommended storage temperature.



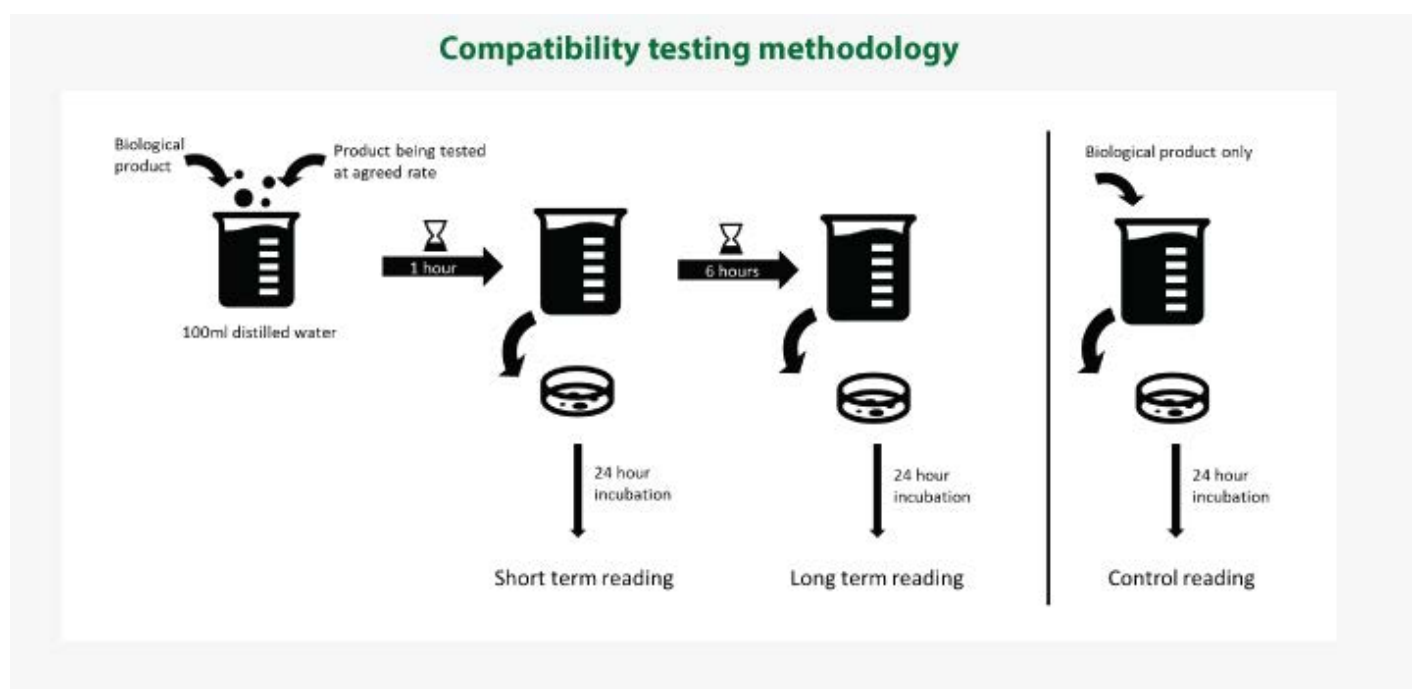
DISCLAIMER: Although this inoculant has been tested under a variety of conditions, the supplier does not warrant that it will be efficacious under all conditions. Because the active agent is a living organism, its action may be affected by storage, handling, climatic or soil conditions. This naturally occurring organism should not cause damage to crops, vegetation, or the environment, nor harm to man and animals. However, in the unlikely event of this happening, the supplier does not accept responsibility for any damage that may occur.

COMPATIBILITY TESTING

Eco-Bb[®] is compatible with baculovirus products, IPM and organic programmes. Before mixing *Eco-Bb*[®] with other pesticides and fungicides, consult the compatibilities list or contact your sales representative. *Eco-Bb*[®] contains a live fungus and therefore it is at risk to being damaged by broad-spectrum fungicides.

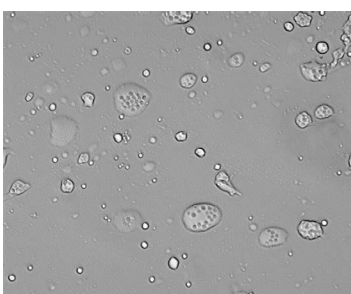
How do you know if *Eco-Bb*[®] can be tank mixed with another product?

PHP conducts compatibility tests to determine whether *Eco-Bb*[®] can be used together with another product. A tank mix with *Eco-Bb*[®] and the test product is simulated in the laboratory at the predetermined rates. The solution is then extracted and placed on growth media after 1 hour and again after 6 hours. Each sample is incubated for a period of 24 hours, after which the samples are examined.



How are the compatibility test results interpreted?

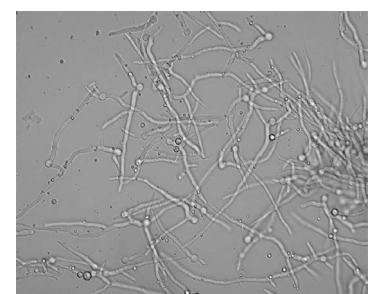
Each sample is examined and compared to the control to determine the effect of the test product on *Eco-Bb*[®] spore germination and growth. Incompatible products either kill the *Eco-Bb*[®] spores, so that they do not germinate, or they damage the *Eco-Bb*[®] spores, so that the fungus does not grow as expected under favourable conditions. Completed results are uploaded onto the compatibility sheet and updated regularly. Contact Madumbi Sustainable Agriculture for the latest compatibility results.



No *Eco-Bb*[®] spore germination observed, therefore product incompatible at tested rate.



Limited *Eco-Bb*[®] spore germination, therefore product incompatible at the tested rate.



Eco-Bb[®] germination and fungus growth similar to the control, therefore product is compatible at the tested rate.

BENEFICIAL INSECTS

Does *Eco-Bb*[®] negatively effect beneficial insects and bees?

Eco-Bb[®] has been tested by various local and international laboratories to determine its effect against beneficial insects

Green lacewing, Predatory wasps, Ladybirds

GLP accredited laboratories in the USA conducted studies which concluded that *Eco-Bb*[®] does not harm:

- Green lacewing (*Chrysoperla rufilabris*)
 - Predatory wasps (*Pediobius foveolatus*)
 - Ladybirds (*Lindorus loypanthae*)
- at the recommended field application and concluded

Predatory wasps and predatory beetles

Biobee Laboratory in South Africa tested *Eco-Bb*[®] at the recommended field application and concluded that it is harmless to both a predatory wasp (*Anagyrus* sp. Nr. *Pseudococci*) and predatory beetle (*Cryptolaemus montrouzieri*) specie.

Honeybees

Applied Insect Science, a British GLP-accredited laboratory, tested *Eco-Bb*[®] on honeybees. Both a contact (product applied to the body of the bees) and an oral (product fed to the bees) study were undertaken and determined the following:

Honeybee contact study:

This study was conducted by exposing honeybees to 100 x the maximum field dose rate of *Eco-Bb*[®]. The researchers did not find a significant difference in mortality between the treated group and the untreated control group. Therefore, *Eco-Bb*[®] is not harmful to honeybees on contact.

Honeybee oral exposure study:

The oral exposure study was conducted by feeding the bees *Eco-Bb*[®] at 100 x the maximum field dose rate. This treatment was found to reduce honeybee survival, however, it is unlikely that bees would ever encounter this dose rate in the field. In addition, less than 50% of the treated bees had died by the end of the 30 day study period and therefore the median lethal time (the amount of time it takes for 50% of the population to die) could not be calculated.



PRODUCT PERFORMANCE AND BENEFITS

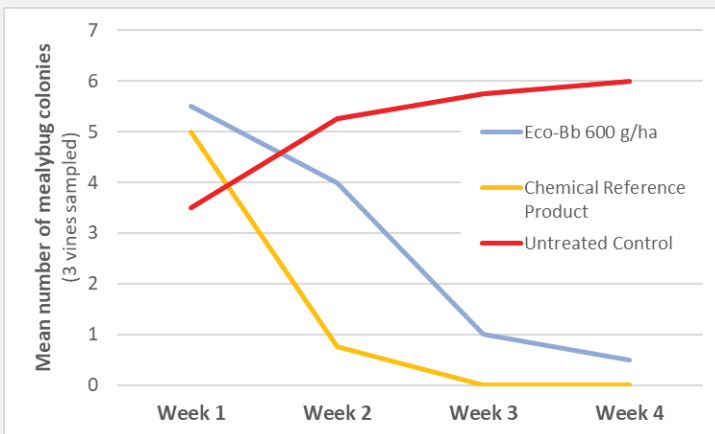
How does *Eco-Bb*® perform?

Eco-Bb® provides effective control against various insect pests, including red spider mite, whitefly, woolly whitefly, mealybug and false codling moth. It has successfully been used on a range of crop types, in different conditions around the world. It targets all insect life stages and therefore it is able to reduce the target pest population at various levels.

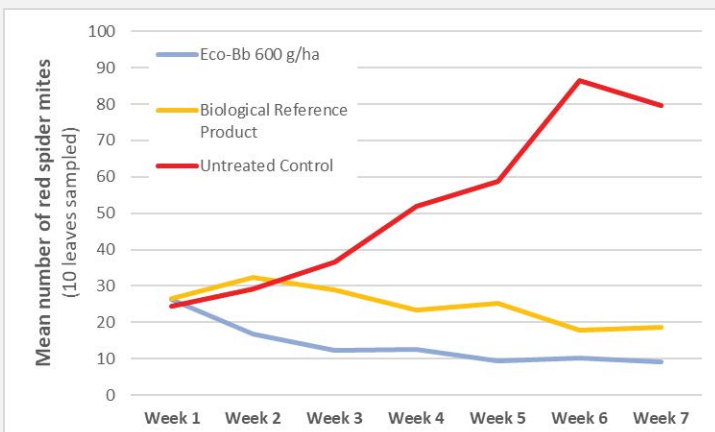
It is important to note that a biological control product, such as *Eco-Bb*®, does not have an overnight knock-down effect on insects as with a chemical insecticide, but is effective over time in weakening and eroding insect populations. Therefore preventative control to manage pest populations is recommended.

Eco-Bb® is compatible with virus based products, which strengthens overall biological control and IPM programmes by combining different modes of action.

Eco-Bb® has been tested in various conditions in South Africa, Europe, America, Canada and Asia and performs well against other internationally produced *Beauveria bassiana* based products.



Results of *Eco-Bb*® against mealybug compared to chemical standard. While it took *Eco-Bb*® longer, the end results matched the performance of the chemical.



Results of *Eco-Bb*® against red spider mite compared to a European *Beauveria bassiana* based reference product. *Eco-Bb*® provided significantly better control at various stages of the trial.

Eco-Bb® FATE IN THE ENVIRONMENT

At what ambient temperature will the product work?

The percentage germination of *Eco-Bb*® spores at different temperatures, as well as the rate of growth at each temperature, was tested in the laboratory.

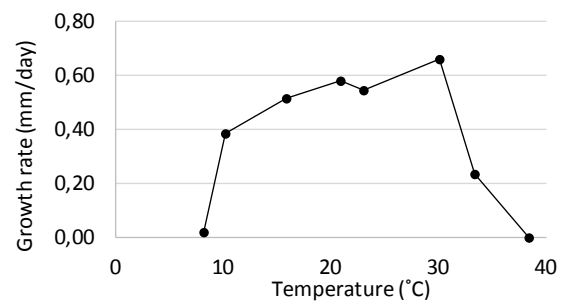
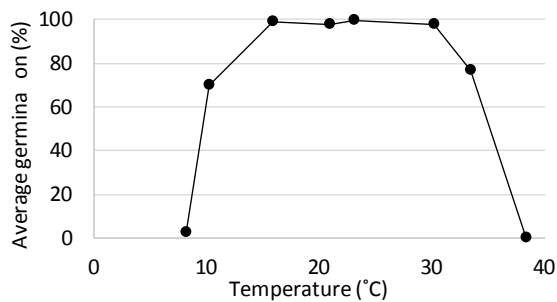
The growth range of *Eco-Bb*® is 10 – 33 degrees Celsius.

At low temperatures:

The spores are dormant and will grow when the temperature warms up.

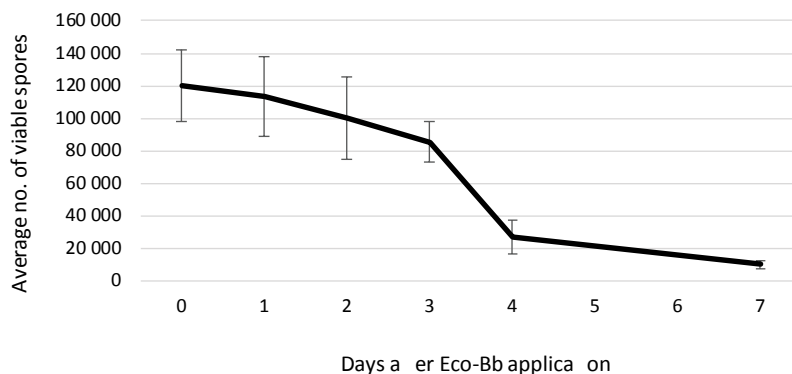
At high temperatures:

The surface of a leaf has a micro climate that can protect the spores from high temperatures.



How well does the product survive after application?

Eco-Bb® was applied at the highest dose rate to a number of fruiting tomato plants in a polytunnel. The fruit was then sampled on the day of application and each day following to determine the amount of product that remains on the fruit over time.



Temperature in polytunnel:

Mean 20.3°C

Minimum 8.9°C

Maximum 43.9°C

Results: From the time of application to 3 days after application, the number of viable spores remained stable. A significant decrease in the number of viable spores was observed between days 3 and 7. However, viable spores were still detected in low numbers up to 7 days after application.

Registered uses:

Pest	Crop type	Dose rate	Remarks
Whitefly	Beans, tomatoes, cucumbers, brinjals	300 – 600 g/ha is recommended depending on spray volume, crop, growth stage and pest severity.	Apply as a full cover spray every 7-14 days depending on the severity of the pest. Apply at early stage of infestation for best results.
<i>Tuta absoluta</i>	Tomatoes		
Leafminer (<i>Liriomyza spp.</i>)	Potatoes		
Red Spider Mites	Beans, tomatoes, cucumbers, brinjals	600 – 1000 g/ha depending on size of tree and degree of infestation.	Apply as a full cover spray, contact with pest is desired for maximum effect. Apply at an early stage of infestation to optimize efficacy. Repeat application every 7-14 days or use in an IPM programme. A minimum of three applications is recommended. The higher rate is preferred on large trees, high spray volume application or when pest severity is high.
Red Spider Mites	Stone fruit (peaches, plums, nectarines, cherries)		
Woolly Whitefly	Citrus		Apply as a full cover spray, contact with pest is desired for maximum effect. The higher rate is preferred on large trees, high spray volume application or when pest severity is high. Apply at an early stage of infestation to optimize efficacy. Ensure coverage of lower leaf surface. Repeat application every 7-14 days if necessary.
False codling moth	Avocados; litchis; citrus; stone fruit (apricots, cherries (sweet and sour), nectarines, peaches, plums and prunes); tree nuts (almonds, cashews, hazelnuts, macadamia nuts, pecans, pistachio nuts, walnuts, coconut, Brazil nuts and pine nuts), table grapes, pomegranates		Apply as a full cover spray, contact with pest is desired for maximum effect. Apply when moth activity peaks or eggs or larvae are first noted. Repeat application every 10-14 days or use in an IPM programme. The higher rate is preferred on large trees, high spray volume application or when pest severity is high.
Mealybug	Pome fruit (apples, pears); citrus; grapes		Apply as a full cover spray, from when the pest is first noticed. Ensure coverage of lower leaf surface – contact with pest is desired for maximum effect. Repeat application every 7-14 days. A minimum of three applications is recommended. In severe cases repeat application until the pest is no longer present, or use in an IPM programme. The higher rate is preferred on large trees, for high spray volume application or when pest severity is high.

Available in: 40 g, 300 g, 1 kg

Eco-Bb® contains *Beauveria bassiana*. Reg. No. L8469, Act No. 36 of 1947. Plant Health Products (Pty) Ltd, PO Box 207, Nottingham Road, 3280. Reg. No. 2003/007987/07.

Certified by:



Inspected by ECOCERT SA F-32600
Product suitable for use in organic
agriculture complying to the annexes
of the (EC) regulation n° 834/2007 and 889/2008

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