Tomato Pest and Disease Solutions

Andermatt Biocontrol

Healthy Food and Healthy Environment, for all

International marketing development team visiting a greenhouse tomato production farm in Switzerland.

Tomato is one of the most important vegetables and its production is increasing worldwide. Tomatoes are produced in a wide range of climatic conditions – in open field and greenhouse. To grow healthy tomato a sophisticated disease and pest management program is essential. Here, we present our bio-insecticides, bio-fungicides and biostimulants to flexibly apply alone or in a strategic program. Our products are excellent resistance management tools, residue free and can be integrated into organic programs. Together with you we can contribute to a healthy food and a healthy environment, for all.

Bio-Insecticides

Bio-Fungicides

Biostimulants

Application Guide

Bio-Insecticides

Naturally occurring microorganisms to control various pests.

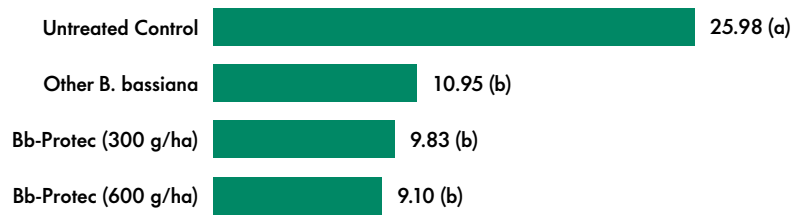
BB-PROTEC

Insect-pathogenic fungus for the effective reduction of insect and mite pests

- ✔ Broad host range
- ✔ Effective against all life stages
- ✔ Unique formulation for improved persistence

Beauveria bassiana is a soil-inhabiting fungus, which infects a broad spectrum of insect and mite pests including vectors of various tomato viruses. This bio-insecticide is effective against all life stages of the target organisms. It's unique formulation prevents fungal spores from drying out and enhances penetration and infection of the pest. The infection mainly occurs through direct penetration of the insect's cuticula but is also possible through uptake of fungal spores while feeding on the plant.

Greenhouse trial in Spain, 2017



Number of living whitefly larvae on 100 tomato leaves, 7 days after fourth application.
Source: Field Trial Services, S.L.L., Spain, 2017

PRODUCT-FACTS

Against
Various insect and mite pests such as whiteflies, spider mites, aphids and tomato leafminer

Active ingredient
Beauveria bassiana R444

Formulation type
Wettable powder

Concentration
$\geq 2 \times 10^9$ spores/g

Application method
300 – 600 g/ha as a full cover spray every 3 – 7 days or as soil drench against soil pests

OMRI LISTED® For Organic Use

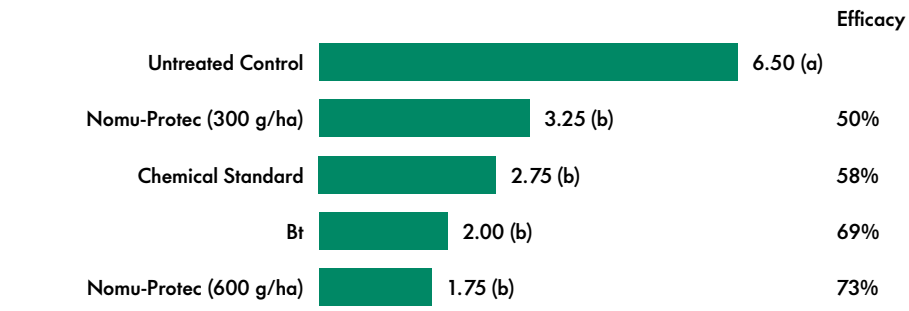
NOMU-PROTEC

Insect-pathogenic fungus for the control of various lepidopteran pests

- ✔ **Effective against all instars**
- ✔ **Broad host range**
- ✔ **Unique formulation for improved persistence**

Nomu-Protec contains spores of the naturally-occurring fungus *Metarhizium rileyi*, which infects a broad spectrum of lepidopteran pests, especially those of the Noctuidae family. The spores are uniquely formulated to prevent drying out and to enhance penetration and infection of the pest. Nomu-Protec is effective against all instars of the target insects. Spores can either penetrate through the cuticle or enter the larvae through ingestion during feeding.

Field trial in South Africa, 2018



Number of living Helicoverpa armigera larvae on all tomato fruits per plot, 7 days after sixth application.
Source: Agricultural Science Consultants Research, South Africa, 2018

PRODUCT-FACTS

Against
Lepidopteran pests, especially of the Noctuidae family e.g. *Spodoptora* spp., *Helicoverpa* spp.

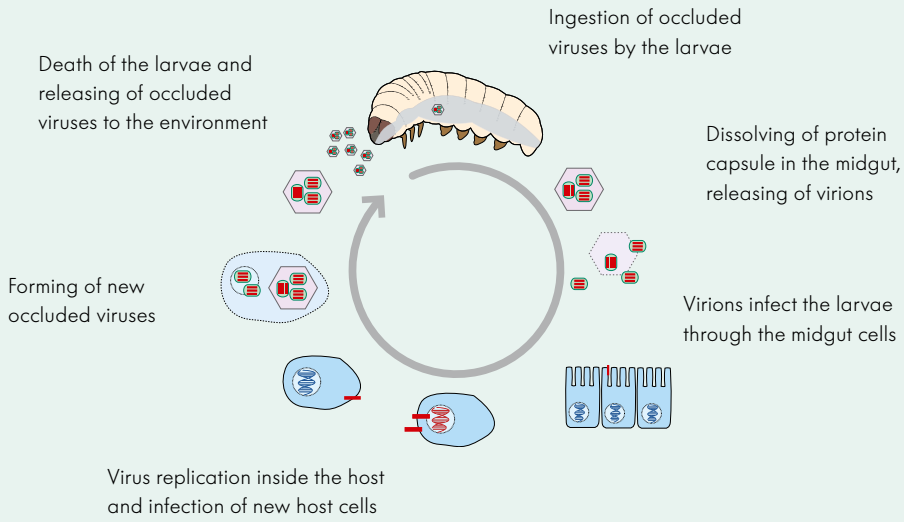
Active ingredient
Metarhizium rileyi PHP1705

Formulation type
Wettable powder

Concentration
$\geq 1 \times 10^9$ spores/g

Application method
300 – 600 g/ha as a full cover spray once a week

BACULOVIRUSES



What are baculoviruses?

Baculoviruses are naturally occurring pathogens of insect populations, mainly lepidopteran species. They need to be ingested by the larvae to start the infection cycle.

Application

- Targets eggs and early instar larvae
- Apply at hatching of first larvae and cover the whole larval hatching period until harvest
- Interval: every 7 – 14 days, depending on weather conditions and strategy
- Application rate: 50 – 200 ml/ha, depending on product, pest pressure and strategy

Our baculovirus products

- Manufactured in our production facilities in Switzerland or Canada.
- Each batch has undergone stringent quality control to ensure the consistent and high quality the Andermatt Biocontrol brand stands for.
- High virulence of each batch is verified in extensive lab testing.
- Approved and listed for the use in organic farming in many countries (FiBL, OMRI, SGS, BFA, BioGro New Zealand, and others).

Advantages

- ✔ Efficient population and damage control
- ✔ Excellent resistance management tool
- ✔ High compatibility with other products
- ✔ Non-toxic for beneficials, no MRL, min. WHP and REI
- ✔ Good rainfastness

KEY LEPIDOPTERAN PESTS

Helicoverpa armigera
African cotton bollworm
➜ **Helicovex**

Helicoverpa virescens
Tobacco budworm
➜ **Helicovex**

Helicoverpa zea
Corn earworm
➜ **Helicovex**

Spodoptera exigua
Beet armyworm
➜ **Spexit**

Spodoptera frugiperda
Fall armyworm
➜ **Littovir**

Spodoptera littoralis
African cotton leafworm
➜ **Littovir**

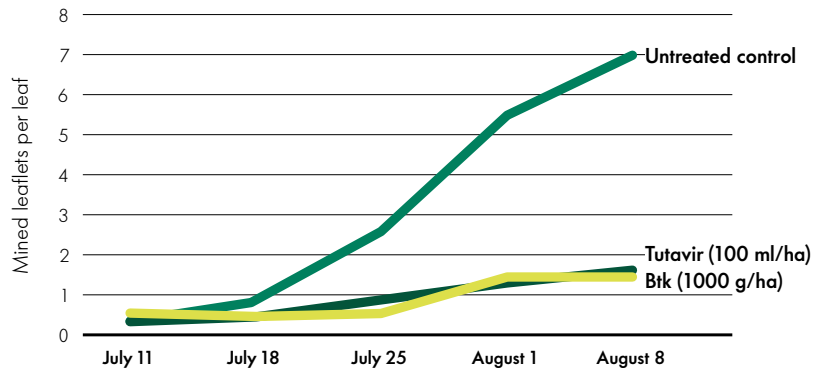
Tuta absoluta
Tomato leafminer
➜ **Tutavir**

TUTAVIR

Granulovirus product for the integrated control of *Tuta absoluta*

Tutavir contains highly infectious virus particles that infect *Tuta absoluta*. Because Tutavir is specific and has no effect on other organisms than *Tuta absoluta*, it is the perfect candidate to be used in an integrated program in the greenhouse. It can be sprayed when no other product can be used. Furthermore, with a pest like *Tuta absoluta* that becomes resistant to insecticides very quickly, Tutavir is a direly needed tool for resistance management. Use Tutavir early in the season to bring down the Tuta population and help the virus to establish itself in the greenhouse to cut costs for insecticides.

Greenhouse trial in Italy, 2018



Tutavir effectively controls damage of *Tuta absoluta*. Mined leaflets per leaf over time.
Source: SESAT Srls, Parete, Caserta Province, Italy, 2018

PRODUCT-FACTS

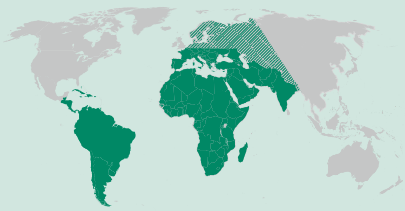
Against
Tomato leafminer *(Tuta absoluta)*

Active ingredient
Phthorimaea operculella granulovirus (PhopGV)

Formulation type
Suspension concentrate

Concentration
2×10^{13} GV/l

Distribution of *Tuta absoluta*



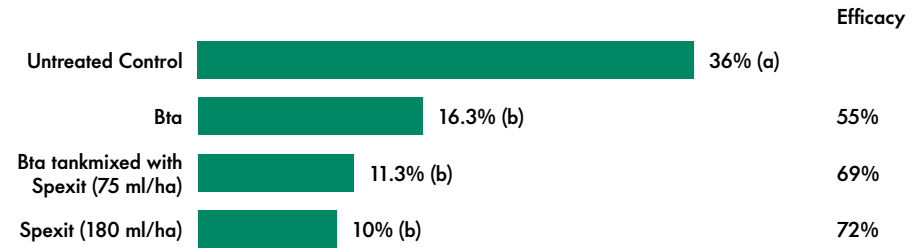
Source: EPPO

SPEXIT

Efficient and specific control of beet armyworm *(Spodoptera exigua)*

The beet armyworm *(Spodoptera exigua)* is an important pest on tomatoes in North America, Southern Europa and other countries. Whereas young larvae feed on the lower surface of leaves, fully-grown larvae devour foliage completely, leaving only major veins. The application of Spexit efficiently reduces the pest population and crop damage. Spexit is a valuable and efficient tool for integrated pest control programs using beneficial insects.

Field trial in USA, 2016



Percentage of damaged fruits 12 days after seventh application.
Source: Two Bees Agricultural Research Consulting, USA, 2016.

PRODUCT-FACTS

Against
Beet armyworm
(Spodoptera exigua)

Active ingredient
Spodoptera exigua
nucleopolyhedrovirus (SeNPV)

Formulation type
Suspension concentrate

Concentration
3.8×10^{12} NPV/l

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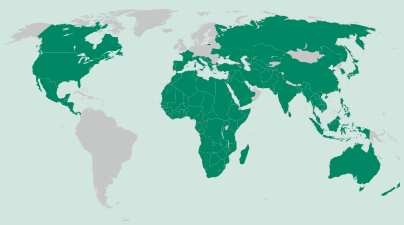
Distribution of *Spodoptera exigua*



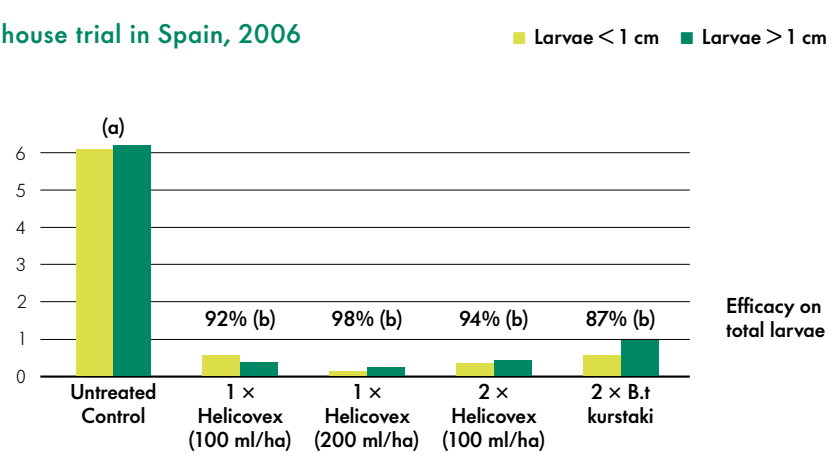
Source: EPPO

HELICOVEX

Effective control of African cotton bollworm *(Helicoverpa armigera)*, Corn earworm *(Helicoverpa zea)* and Tobacco budworm *(Helicoverpa virescens)*

Helicovex is an efficient tool to combat one of the most destructive agricultural pest of economic importance around the globe. Due to its wide distribution and the use of insecticides with the same mode of action, *Helicoverpa* spp. have built up wide resistance against many synthetic pesticides. Helicovex is a valuable and efficient tool to prevent resistance and damage to the crop.

Greenhouse trial in Spain, 2006



Number of larvae per plant 14 days after first treatment.
Source: Agrichem Bio, Spain, 2006.

PRODUCT-FACTS

Against
African cotton bollworm *(Helicoverpa armigera)*, Corn earworm *(Helicoverpa zea)* and Tobacco budworm *(Helicoverpa virescens)*

Active ingredient
Helicoverpa armigera nucleopolyhedrovirus (HearNPV)

Formulation type
Suspension concentrate

Concentration
7.5×10^{12} NPV/l

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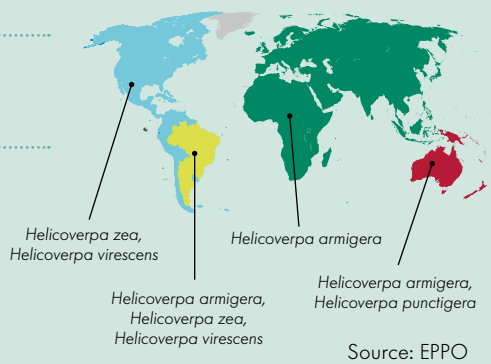
Distribution of *Helicoverpa* spp.



Source: EPPO

LITTOVIR

Excellent and sustainable control of African cotton leafworm *(Spodoptera littoralis)* and Fall armyworm *(Spodoptera frugiperda)*

The cotton leafworm as well as the Fall armyworm are important pests on many different plant species. If conditions are conducive, both can rapidly multiply threatening the whole tomato plant. It is therefore important to intervene early with a product that sustainably brings down the population and keeps it low. Furthermore, *Spodoptera* species quickly develop resistances to insecticides, so it is important to use several mode of actions to prevent this, and Littovir will deliver exactly that.

Spodoptera littoralis larva feeding on tomato

PRODUCT-FACTS

Against
African cotton leafworm *(Spodoptera littoralis)* and Fall armyworm *(Spodoptera frugiperda)*

Active ingredient
Spodoptera littoralis nucleopolyhedrovirus (SpliNPV)

Formulation type
Suspension concentrate

Concentration
5×10^{11} NPV/l

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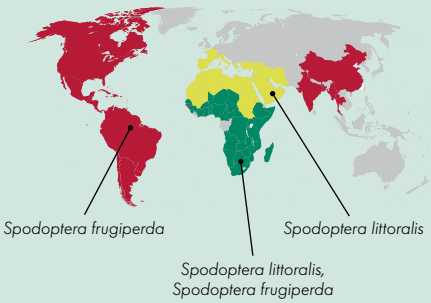
Distribution of *Spodoptera* spp.



Source: EPPO

Bio-Fungicides

Naturally occurring microorganisms protecting plant tissue from pathogen attacks.

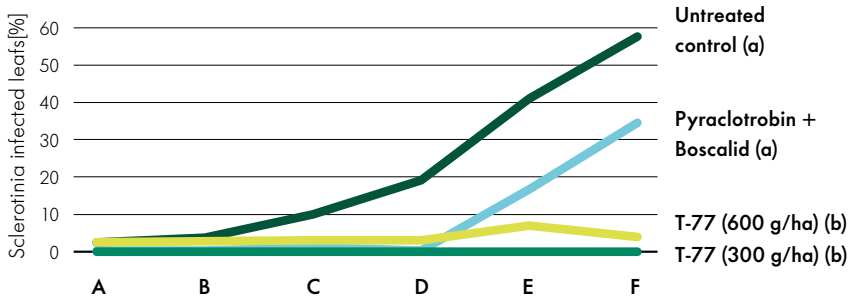
T-77

Bio-fungicide that protects senescing plant parts and pruning wounds against pathogens such as *Botrytis* spp. and *Sclerotinia sclerotiorum*

- ✔ Dual mode of action
- ✔ Isolated for foliar application
- ✔ Powerful against pathogens

T-77 contains the beneficial fungus *Trichoderma atroviride*, which colonizes plant wounds or senescing plant tissue. As a consequence, this bio-fungicide prevents pathogens from penetrating the tomato plant. In addition, *T. atroviride* can parasitize and destroy fungal pathogens. This leads to an efficient protection of stem, leaves, flowers and fruits from gray and white mold in greenhouses and open fields.

Greenhouse trial against Sclerotinia in Canada, 2017



Percentage of Sclerotinia infected leafs. A – F indicate the last 6 damage assessments.
Last assessment (F) was conducted 30 days after the last application of T-77.
Source: FarmForest Research, Canada, 2017

PRODUCT-FACTS

Against
Gray mold (Pathogen: *Botrytis cinerea*) and White mold (Pathogen: *Sclerotinia sclerotiorum*)

Active ingredient
Trichoderma atroviride 77B

Formulation type
Wettable powder

Concentration
≥ 2×10^9 spores/g

Application method
250 – 750 g/ha as a full cover spray or directed on pruned surfaces. 1st Application: start of flowering or after first pruning Interval: 7 – 14 days or after every pruning.

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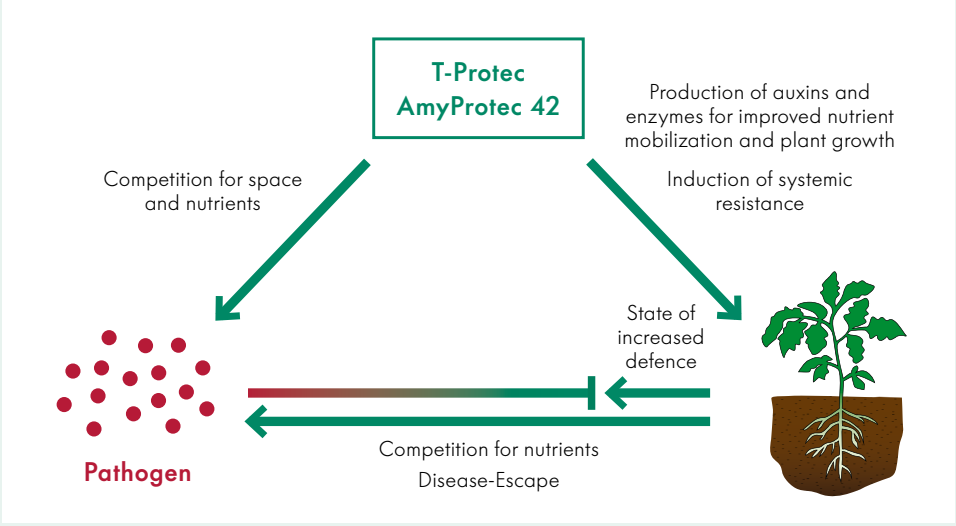
T-PROTEC

Effective Trichoderma species for the control of damping-off and root rot diseases and for enhanced plant resistance and growth

- ✔ **Improved seedling emergence**
- ✔ **Root zone protection**
- ✔ **Higher stress tolerance**

The fungus *Trichoderma asperellum* protects the plant against soil-borne pathogens by colonization of the plant root zone. Additionally, *T. asperellum* can parasitize the attacking pathogens. This leads to improved seedling emergence and survival. Tomato plants treated with T-Protec have a larger and healthier root system resulting in enhanced uptake and efficient use of nutrients. Additionally, a better tolerance towards environmental stress is observed.



More information about AmyProtec 42 can be found on the opposite page.

PRODUCT-FACTS

Against
Damping-off and root rot diseases (Pathogens: *Sclerotinia sclerotiorum, Fusarium* spp., *Rhizoctonia solani, Verticillium* spp., *Pythium* spp.), nematodes

Active ingredient
Trichoderma asperellum

Formulation type
Wettable powder

Concentration
≥ 2×10^9 spores/g

Application method
1. Seed treatment for field grown tomatoes: 40 g/kg seeds
2. Drench seedlings before transplanting: 0.5 g/l water
3. Field application/ chemigation: 250 – 750 g/ha (repeat application (bi)monthly)
4. Hydroponics: 1 g/8 l weekly

AMYPROTEC 42

Growth-promoting bacteria for the control of root diseases and for healthy plant growth

- ✔ **Well studied bio-fungicide and bactericide**
- ✔ **Excellent storability at room temperature**
- ✔ **Easy to include in IPM program**

AmyProtec 42 is a preventively applied soil bio-fungicide and bactericide. It's active ingredient *Bacillus velezensis* (synonym *B. amyloliquefaciens* spp. *plantarum)* colonizes the plant root zone leading to disease suppression. In addition, application of AmyProtec 42 improves nutrient mobilization and stress tolerance and the systemic resistance of the tomato plant is induced. Mixing with a wide range of fertilizers and plant protection products is possible.

PRODUCT-FACTS

Against
Damping-off and root rot diseases (Pathogen: *Rhizoctonia solani, Fusarium* spp., *Verticillum* spp., *Phytophthora* spp.)

Active ingredient
Bacillus velezensis (synonym *B. amyloliquefaciens* spp. *plantarum*) FZB42

Formulation type
Suspension concentrate

Concentration
$> 2.5 \times 10^{10}$ CFU/ml

Application method
1. Seed treatment: 2 – 5 ml/kg seeds
2. Application on seedlings (drenching or dipping): 0.5 – 2 l/ha
3. Application at or right after planting: 0.5 – 2 l/ha
   Application over irrigation system/ watering devices/ hydroponics: 0.5 – 2 l/ha (every 3 – 6 weeks)

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VITISAN

Bio-fungicide with preventive and curative effects against a wide range of fungal diseases

- ✔ Broad fungal disease spectrum
- ✔ No risk of resistance
- ✔ Beneficial friendly

Vitisan is a contact fungicide that can be used for preventative and curative application. Vitisan acts through a multiplex mode of action (pH-value, osmotic pressure and specific bicarbonate ion effects). As a consequence, the fungal hyphae burst and desiccate. There is no risk of resistance – even when applied frequently. Application of Vitisan is residue free and beneficial friendly.

PRODUCT-FACTS

Against
Powdery mildew and Grey mold *(Botrytis cinerea)*

Active ingredient
Potassium bicarbonate

Formulation type
Soluble Powder

Concentration
994.9 g/kg

Application method
Dosage: 2.5 – 5 kg/ha in max. 1200 l/ha
First application: At infection risk
Interval: 5 – 7 days

OMRI LISTED® For Organic Use

Biostimulants

Bacterial and fungal soil microorganisms for improved nutrient mobilization and fixation.

T-GRO

For nutrient mobilization and enhanced stress tolerance

- ✔ Enhanced nutrient uptake
- ✔ Higher stress tolerance
- ✔ Improved soil quality

Application of T-Gro leads to enhanced nutrient uptake and use, and increased stress tolerance. T-Gro also improves soil health by enhancing beneficial soil microorganisms. All in all, crop quality is higher and yield can be increased. T-Gro can be applied through versatile methods like seed treatment, drenching or fertigation.

Greenhouse trial in Switzerland, 2017

Seedling height over time compared to the untreated control.
Source: Andermatt Biocontrol AG, Switzerland, 2017

PRODUCT-FACTS

Active ingredient
Trichoderma asperellum

Formulation type
Wettable Powder (also available as a talc-graphite lubricant for mechanical planters

Concentration
≥ 2 × 10^9 spores/g

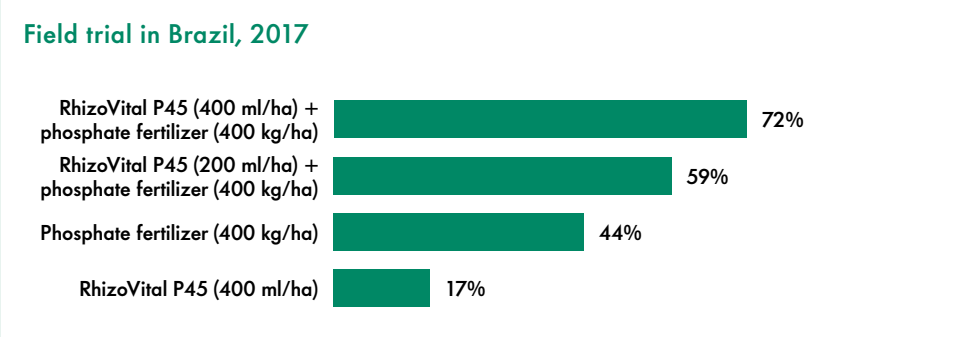
Application method
1. Seed treatment for field grown tomatoes: 20 g/kg seeds
2. Drench seedlings before transplanting: 1 g/4 l water
3. Field application/ fertigation: 250 – 750 g/ha (repeat application (bi)monthly)
4. Hydroponics: 1 g/ 8 l weekly

RHIZOVITAL P45

The next generation plant inoculant for improved nutrient mobilization and stress tolerance

- ✔ Enhanced nutrient uptake
- ✔ Higher stress tolerance
- ✔ Increased phosphate mobilization

Bacillus velezensis (synonym *B. amyloliquefaciens* spp. *plantarum)* FZB45 colonizes the root zone, which leads to enhanced nutrient uptake and increased tolerance to abiotic stress. Increased phytase production favors phosphate mobilization. RhizoVital P45 may lead to increased crop yields through greater nutrient availability. RhizoVital P45 is compatible with most fertilizer and plant protection products.



Yield increase after directed band treatment at sowing with RhizoVital P45 compared to untreated control.
Source: UEPG, Brazil, 2017

PRODUCT-FACTS

Active ingredient
Bacillus velezensis (synonym *B. amyloliquefaciens* spp. *plantarum*) FZB45

Formulation type
Suspension concentrate

Concentration
> 2.5 × 10^{10} CFU/ml

Application method
1. Seed treatment: 2 – 5 ml/kg seeds
2. Application on seedlings (drenching or dipping): 0.5 – 2 l/ha
3. Application at or right after planting: 0.5 – 2 l/ha
4. Application over irrigation system/watering devices/ hydroponics: 0.5 – 2 l/ha (every 3 – 6 weeks)

Application Guide

Healthy tomatoes – produced naturally

TOMATO PROGRAM

For a healthy and sustainable tomato production

BBCH	0	10	14	51	61	71	85
	Dry seed	Cotyledones completely unfolded	4th leaf on main shoot unfolded	First inflorescence visible (first bud erect)	First inflorescence open: first flower open	First fruit has reached typical size (unripe)	50% of fruits show typical fully ripe colour
Biostimulants	**RhizoVital P45** Seed treatment: 2 – 5 ml/kg seeds		**RhizoVital P45** Dipping before or drenching right after transplanting. 4 ml/10 l water			**RhizoVital P45** 0.5 – 2 l/ha every 3 – 6 weeks over irrigation system or watering devices	
	T-Gro Seed treatment: 20 g/kg seeds		**T-Gro** Dipping before or drenching right after transplanting. 1 g/4 l water			**T-Gro** 250 – 750 g/ha every month over irrigation system or watering devices	
Bio-Insecticides		**Bb-Protec** for the reduction of insect and mite pests. 300 – 600 g/ha every 3 – 7 days					
					Nomu-Protec for the reduction of Lepidopteran pests 300 – 600 g/ha every 7 days		
					Helicovex to control *Helicoverpa* spp. 100 – 200 ml /ha at hatching of first larvae, every 7 – 14 days		
					Spexit to control *Spodoptera exigua* 100 – 200 ml /ha at hatching of first larvae, every 7 – 14 days		
			Tutavir to control *Tuta absoluta* 50 – 200 ml /ha at hatching of first larvae, every 7 – 14 days				
					Littovir to control *Spodoptera littoralis* and *Spodoptera frugiperda* 100 – 200 ml/ha at hatching of first larvae, every 7 – 14 days		
Bio-Fungicides				**T-77** to control *Botrytis cinerea* and *Sclerotinia sclerotiorum* 250 – 750 g / ha every 7 – 14 days or after pruning			
	AmyProtec 42 to control damping-off diseases and other soil-borne diseases. 0.5 – 2 l/ha every 3 – 6 weeks, possible to rotate with T-Protec						
	T-Protec to control damping-off and other soil-borne diseases. 250 – 750 g/ha every 1 – 2 month, possible to rotate with AmyProtec 42						
	Vitisan to control powdery mildew and grey mold. 2.5 – 5 kg/ha every 5 – 7 days.						

10/19

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