Tomato Pest and Disease Solutions
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
- Bb-Protec
- Nomu-Protec
- Baculoviruses
- Key lepidopteran pests
- Tutavir
- Spexit
- Helicovex
- Littovir
- Bio-Fungicides
- T-77
- T-Protec
- AmyProtec 42
- Vitisan

Biostimulants
- T-Gra
- Rhizovital P45

Application Guide
Tomato program
**Bio-Insecticides**

**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 cuticle but is also possible through uptake of fungal spores while feeding on the plant.

<table>
<thead>
<tr>
<th></th>
<th>Untreated Control</th>
<th>Bb-Protec (300 g/ha)</th>
<th>Bb-Protec (600 g/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of living whitefly larvae on 100 tomato leaves, 7 days after fourth application. Source: Field Trial Services, S.L.L., Spain, 2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.98 (a)</td>
<td>10.95 (b)</td>
<td>9.83 (b)</td>
</tr>
<tr>
<td></td>
<td>9.10 (b)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th></th>
<th>Untreated Control</th>
<th>Nomu-Protec (300 g/ha)</th>
<th>Nomu-Protec (600 g/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of living <em>Helicoverpa armigera</em> larvae on all tomato fruits per plot, 7 days after sixth application. Source: Agricultural Science Consultants Research, South Africa, 2018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.50 (a)</td>
<td>3.25 (b)</td>
<td>2.75 (b)</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>58%</td>
<td>69%</td>
</tr>
<tr>
<td></td>
<td>3.25 (b)</td>
<td>2.00 (b)</td>
<td>1.75 (b)</td>
</tr>
<tr>
<td></td>
<td>73%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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** ≥ 2 × 10⁹ spores/g

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

**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** ≥ 1 × 10⁹ spores/g

**Application method** 300–600 g/ha as a full cover spray once a week
**Bio-Insecticides**

**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**

<table>
<thead>
<tr>
<th>Date</th>
<th>Untreated control</th>
<th>Tutavir (100 ml/ha)</th>
<th>Btk (1000 g/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 11</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>July 18</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>July 25</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>August 1</td>
<td>3</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>August 8</td>
<td>4</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Tutavir effectively controls damage of *Tuta absoluta*. Mined leaflets per leaf over time.

**PRODUCT-FACTS**

- **Against**
  - Tomato leafminer (*Tuta absoluta*)
- **Formulation type**
  - Suspension concentrate
- **Distribution of *Tuta absoluta***
  - Concentration $2 \times 10^{13}$ GVI

**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 Europe 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 Speexit efficiently reduces the pest population and crop damage. Speexit is a valuable and efficient tool for integrated pest control programs using beneficial insects.

**Field trial in USA, 2016**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated control</td>
<td>36% (a)</td>
</tr>
<tr>
<td>Btk</td>
<td>55%</td>
</tr>
<tr>
<td>Btk tankmixed with Speexit (75 ml/ha)</td>
<td>69%</td>
</tr>
<tr>
<td>Speexit (180 ml/ha)</td>
<td>72%</td>
</tr>
</tbody>
</table>

Efficacy

55% (a) 11.3% (b)

10% (b) 16.3% (b)

Percentage of damaged fruits 12 days after seventh application.

Source: Two Bees Agricultural Research Consulting, USA, 2016.

**PRODUCT-FACTS**

- **Against**
  - Beet armyworm (*Spodoptera exigua*)
- **Formulation type**
  - Suspension concentrate
- **Distribution of *Spodoptera exigua***
  - Concentration $3.8 \times 10^{12}$ NPV/I

**Source:** EFPO
**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 pests 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**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Efficacy on total larvae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td>0</td>
</tr>
<tr>
<td>1 × Helicovex (100 ml/ha)</td>
<td>92% (b)</td>
</tr>
<tr>
<td>1 × Helicovex (200 ml/ha)</td>
<td>98% (b)</td>
</tr>
<tr>
<td>2 × Helicovex (100 ml/ha)</td>
<td>94% (b)</td>
</tr>
<tr>
<td>2 × B.t kurstaki</td>
<td>87% (b)</td>
</tr>
</tbody>
</table>

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

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**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.

**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 × 10¹² NPV/l

**Distribution of Helicoverpa spp.**

Source: EPPO

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

**Active ingredient**

Spodoptera littoralis nucleopolyhedrovirus (SpliNPV)

**Formulation type**

Suspension concentrate

**Concentration**

5 × 10¹¹ NPV/l

**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 leaves. 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**

<table>
<thead>
<tr>
<th>Against</th>
<th>Formulation type</th>
<th>Application method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray mold (Pathogen: <em>Botrytis cinerea</em>) and White mold (Pathogen: <em>Sclerotinia sclerotiorum</em>)</td>
<td>Wettable powder</td>
<td>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.</td>
</tr>
<tr>
<td>Active ingredient</td>
<td>Concentration</td>
<td></td>
</tr>
<tr>
<td><em>Trichoderma atroviride</em> 778</td>
<td>≥ 2 × 10^9 spores/g</td>
<td></td>
</tr>
</tbody>
</table>

A: Untreated control (a)  
B: Pyraclostrobin + Bexadil (a)  
C: T-77 (300 g/ha) (b)  
D: T-77 (600 g/ha) (b)  
E: Pyraclostrobin + Bexadil (a)  
F: Untreated control (a)
Bio-Fungicides

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.

PRODUCT-FACTS

Against
Damping-off and root rot diseases (Pathogens: Sclerotina sclerotiorum, Fusarium spp., Pythium spp., nematodes)

Active ingredient
Trichoderma asperellum

Formulation type
Wettable powder

Concentration
≥ 2 x 10^9 spores/g

Application method
1. Seed treatment for field grown tomatoes: 40 g/kg seeds
2. 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 amyloliquefaciens 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 (Pathogens: Rhizoctonia solani, Fusarium spp., Verticillium spp., Phytophthora spp.)

Active ingredient
Bacillus amyloliquefaciens FZB42

Formulation type
Suspension concentrate

Concentration
> 2.5 x 10^11 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)
**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

<table>
<thead>
<tr>
<th><strong>Against</strong></th>
<th><strong>Formulation type</strong></th>
<th><strong>Application method</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Powdery mildew and Grey mold</td>
<td>Soluble Powder</td>
<td>Dosage: 2.5 – 5 kg/ha in max. 1200 l/ha</td>
</tr>
<tr>
<td>(Botrytis cinerea)</td>
<td></td>
<td>First application: At infection risk</td>
</tr>
<tr>
<td><strong>Active ingredient</strong></td>
<td><strong>Concentration</strong></td>
<td><strong>Interval</strong>: 5 – 7 days</td>
</tr>
<tr>
<td>Potassium bicarbonate</td>
<td>994.9 g/kg</td>
<td></td>
</tr>
</tbody>
</table>

**Biostimulants**

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

**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.

![Seedling height over time compared to the untreated control.](image)

**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:** $\geq 2 \times 10^9$ 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 amyloliquefaciens 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.](image)

**Source:** UEPG, Brazil, 2017

**PRODUCT-FACTS**

- **Active ingredient:** Bacillus amyloliquefaciens FZB45
- **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 before transplanting: 0.5 – 2 l/ha (drenching or dipping)
  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)
# TOMATO PROGRAM

For a healthy and sustainable tomato production

## BBCH

<table>
<thead>
<tr>
<th>BBCH</th>
<th>0</th>
<th>10</th>
<th>14</th>
<th>51</th>
<th>61</th>
<th>71</th>
<th>85</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Dry seed</td>
<td>Cotyledon completely unfolded</td>
<td>4th leaf on main shoot unfolded</td>
<td>First inflorescence visible (first bud erect)</td>
<td>First inflorescence open</td>
<td>First fruit has reached typical size (ripe)</td>
<td>50% of fruits show typical fully ripe colour</td>
</tr>
</tbody>
</table>

## Biostimulants

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>T-Gro Seed treatment:</td>
<td>20 g/kg seeds</td>
<td>Dipping before or drenching right after transplanting.</td>
<td>0.5 – 2 l/ha every 3 – 6 weeks over irrigation system or watering devices</td>
<td>Dipping before or drenching right after transplanting.</td>
<td>0.5 – 2 l/ha every 3 – 6 weeks over irrigation system or watering devices</td>
</tr>
<tr>
<td>RhizoVital P45 Seed treatment:</td>
<td>2 – 5 ml/kg seeds</td>
<td>Dipping before or drenching right after transplanting.</td>
<td>0.5 – 2 l/ha</td>
<td>0.5 – 2 l/ha every 3 – 6 weeks over irrigation system or watering devices</td>
<td></td>
</tr>
<tr>
<td>RhizoVital P45</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

## Bio-Insecticides

<table>
<thead>
<tr>
<th>Bio-Insecticides</th>
<th>Be-Protec</th>
<th>Bb-Protec</th>
<th>Nomu-Protec</th>
<th>Helicovex</th>
<th>Spexit</th>
<th>Tutavir</th>
<th>Littovir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be-Protec</td>
<td>for the reduction of insect and mite pests. 300 – 600 g/ha every 3 – 7 days</td>
<td>for the reduction of insect and mite pests.</td>
<td>300 – 600 g/ha every 7 days</td>
<td>to control Helicoverpa spp</td>
<td>100 – 200 ml /ha at hatching of first larvae, every 7 – 14 days</td>
<td>50 – 200 ml /ha at hatching of first larvae, every 7 – 14 days</td>
<td>to control Spodoptera litoralis and Spodoptera frugiperda</td>
</tr>
<tr>
<td>Bb-Protec</td>
<td></td>
<td>300 – 600 g/ha every 3 – 7 days</td>
<td>300 – 600 g/ha every 7 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bb-Protec</td>
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</tbody>
</table>

## Bio-Fungicides

<table>
<thead>
<tr>
<th>Bio-Fungicides</th>
<th>T-77</th>
<th>AmyProtec 42</th>
<th>AmyProtec 42</th>
<th>AmyProtec 42</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-77</td>
<td>to control Botrytis cinerea and Sclerotinia sclerotiorum</td>
<td>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</td>
<td>250 – 750 g / ha every 7 – 14 days or after pruning</td>
<td>to control damping-off and other soil-borne diseases. 250 – 750 g/ha every 1 – 2 month, possible to rotate with AmyProtec 43</td>
</tr>
<tr>
<td>AmyProtec 42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Healthy tomatoes – produced naturally