Basel | October 22, 2013

Science For A Better Life

Effective and selective control of plant parasitic nematodes with *Paecilomyces lilacinus* 251

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Sustainable food production

- **Consumers** expect **safe** and **sustainably-produced food**
- **Global retailers** and the **food chain** have more stringent **quality targets**
- **Farmers** need **Integrated Crop Management (ICM)** programs

This has led to an increasing demand for biologicals within integrated crop solutions

BioAct – one example of several well developed biologicals

The Bayer CropScience portfolio of biologicals

REQUIEM®

SERENADE® OPTIMUM

VOTiVO

BioAct®

Contans®

SONATA®

Threat of plant parasitic nematodes

- Nematodes or eelworms are **major soil pests** affecting horticultural and agricultural crops. They cause **severe damage** and crop losses, if they are not controlled.
- Harmful soil nematodes infect the roots of plants. They **impede the take-up** of water and nutrients and **weaken the standability** of affected plants.
- The nematode species involved are **world-wide** in their **distribution** and collectively cause **billions of dollars** of crop damage every year.

Paecilomyces lilacinus

- *Paecilomyces lilacinus* 251 very efficient egg parasitizer
- It attacks all stages of nematodes (juveniles and adults)
- No genotoxicity (absence or insufficient conc. of genotoxic mycotoxins)
- Intensely developed by R. Holland, A. Khan, G. T. Garcia, S. Kiewnick and uncountable others, incl. own team

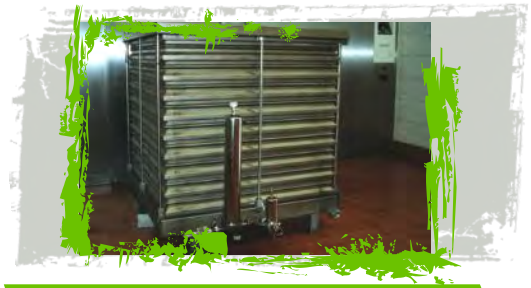
Mode of action is parasitism in which no toxins are involved

© Dr. Rita Holland, Macquarie University, Sydney, Australia

Intense Research & Development

The Active

- Mode of action
- Tox/Eco-tox/EnSa
- Relation with known other strains (features)
- Efficacy
- Reproduction



Formulation

- Shelf life
- Consistent quality
- Manageability
- Way of application
- Confirmatory efficacy trials

Competitiveness

- Target market
- Regulatory data package
- Ability to produce
- Price/volume
- Farmers support

The Active

Item	Method	Result
Mode of action on eggs of different stages	Scanning electron microscopy	Clear insight on the parasiting and proliferation process
Screening of 89 strains	Allozyme electrophoresis	Parasiting features; different P.I. can coexist in same soil
Genetic relation between strains of 47 strains	Long Primer - Random Amplified Polymorphic (LP-RAPD) analysis	Identification of strain; no correlation related to origin
Growth at 37 °	Plating at different temperatures	Limited growth at > 32°C

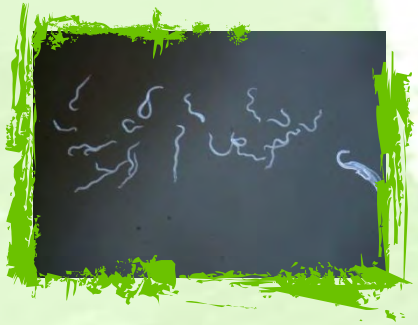
The Active: well explored already before studies for registration were conducted

The Active

Item	Method	Result
Persistence in soil	Re-isolation from different soils	Rapid decline, after appl. back to back-ground level after crop
Non establishment of PL in roots?	Plating of stained root tips	Non establishment of PL in and on roots!
Paecilotoxin present?	HPLC comparison (high performance liquid chromatography)	Paecilotoxin not present!

Range

- Awl nematode (*Dolichodorus heterocephalusspecies*)
- Burrowing nematode (*Radopholus similis*)
- Citrus nematode (*Tylenchulus semipenetrans*)
- Cyst nematodes (*Heterodera* and *Globodera* species)
- False root knot nematodes (*Naccobus* species)
- Lance nematode (*Hoplolaimus columbusspecies*)
- Lesion nematodes (*Pratylenchus* species)
- Reniform nematode (*Rotylenchulus reniformis*)
- Ring nematodes (*Criconemoides, Criconemella* and *Mesocriconema* spp.)
- Root knot nematodes (*Meloidogyne* species)
- Spiral nematodes (*Helicotylenchus* and *Rotylenchus* species)
- Stem nematodes (*Ditylenchus dipsaci*)
- Sting nematode (*Belonolaimus longicaudatus*)
- Stunt nematodes (*Tylenchorhynchus* species)

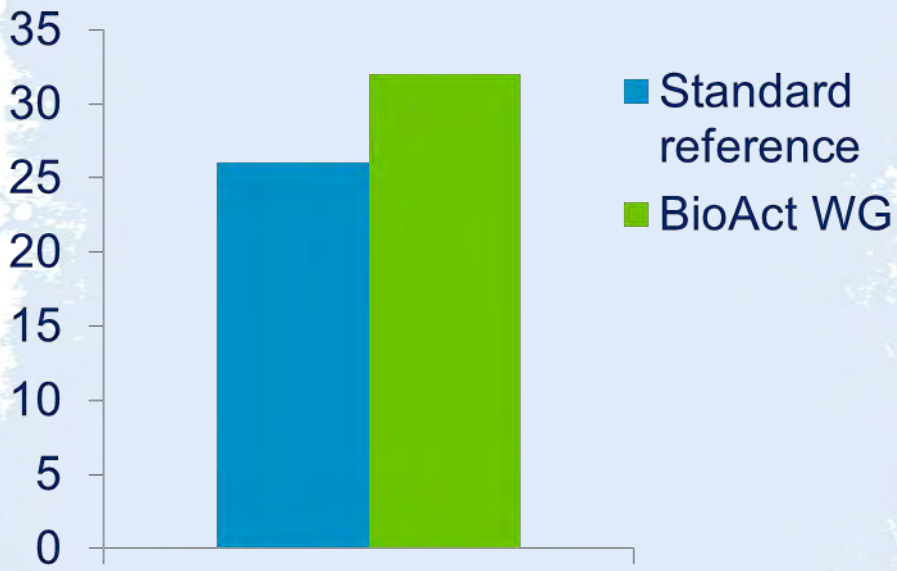


No side effects on beneficial insect parasitic nematodes

Paecilomyces lilacinus 251 – Consistent efficacy in all kind of crops

Average yield increase (in %)

Average result of a series of 14 comparable GEP efficacy trials
(8 tomato and 6 cucumber) conducted in Spain, Italy and Greece



Application 14 days prior to planting, at planting and every 6 weeks after planting
Trial was conducted by GAB Technology GmbH

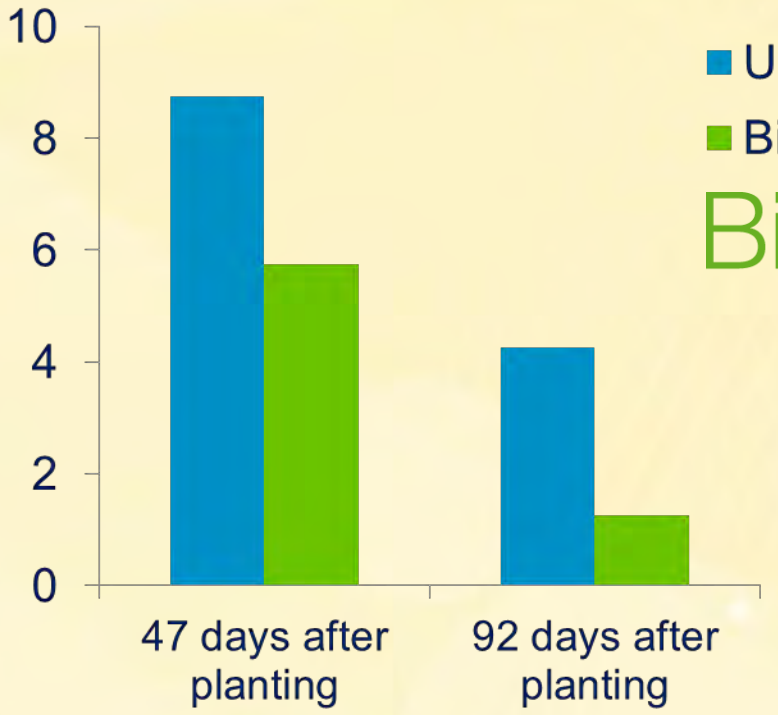
Numerous trials conducted

- Tomatoes
- Cucumbers
- Bananas
- Potatoes
- Grape vine
- Tobacco
- …

BioAct®

Experiences with BioAct – Proved efficacy

Gall index (0-10)

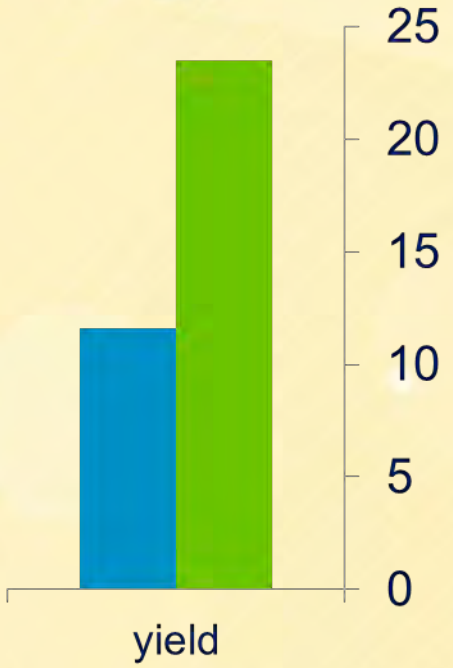


Untreated control

BioAct

BioAct®

Yield in kg / plot

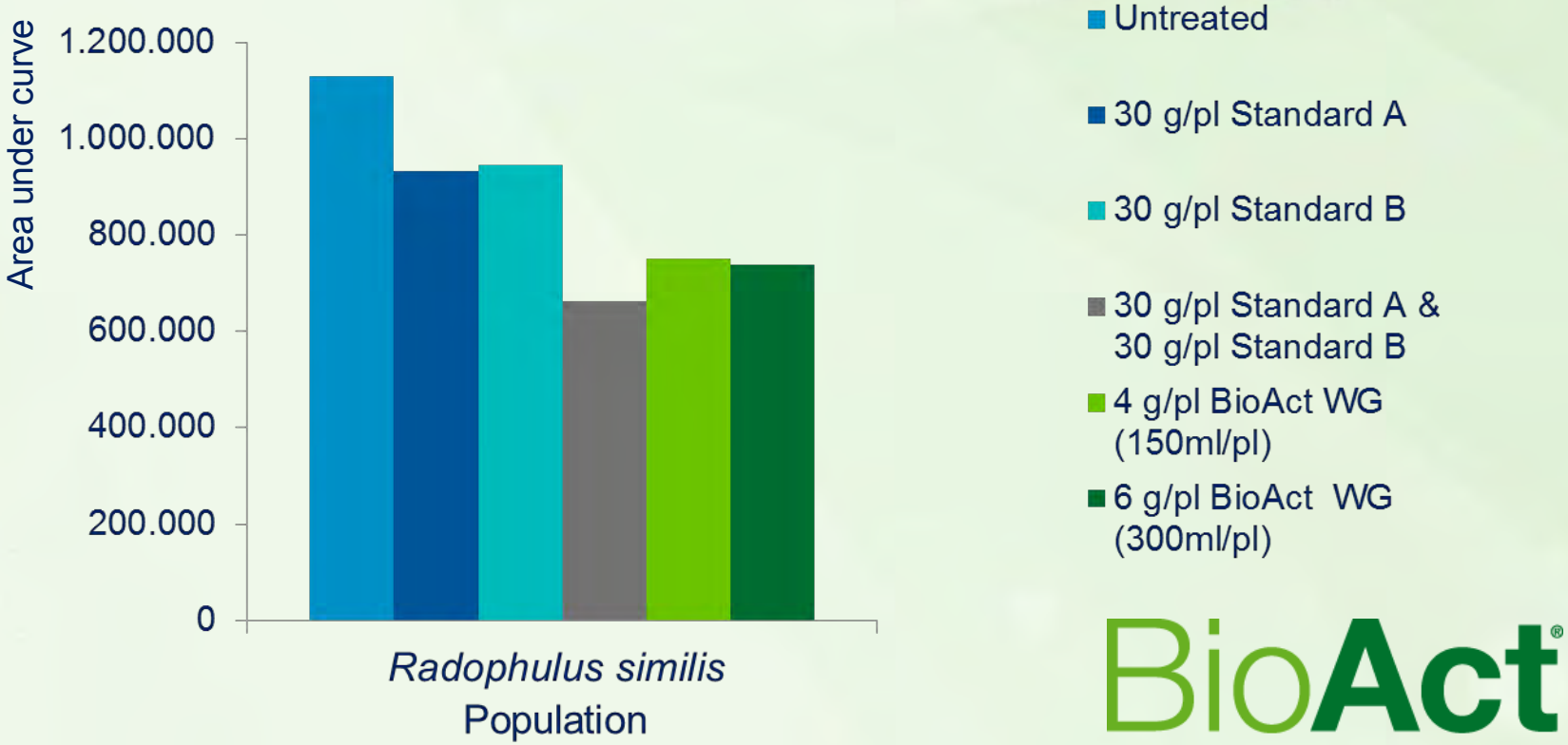


Effect of BioAct WG controlling *Melodoidogyne incognita* on cucumber in Greece 2004 (GEP– trial); application 14 days prior to transplanting, at transplanting and 6 weeks after planting; last harvest was made 92 days after planting; Trial was conducted by GAB Technology GmbH

Control of Nematodes in bananas (BioAct WG – 4 x 10^9 spores/gram)

Efficacy of BioAct WG in the control of nematodes in Bananas (ECA, 2002)

Average: 102 days after 1st application



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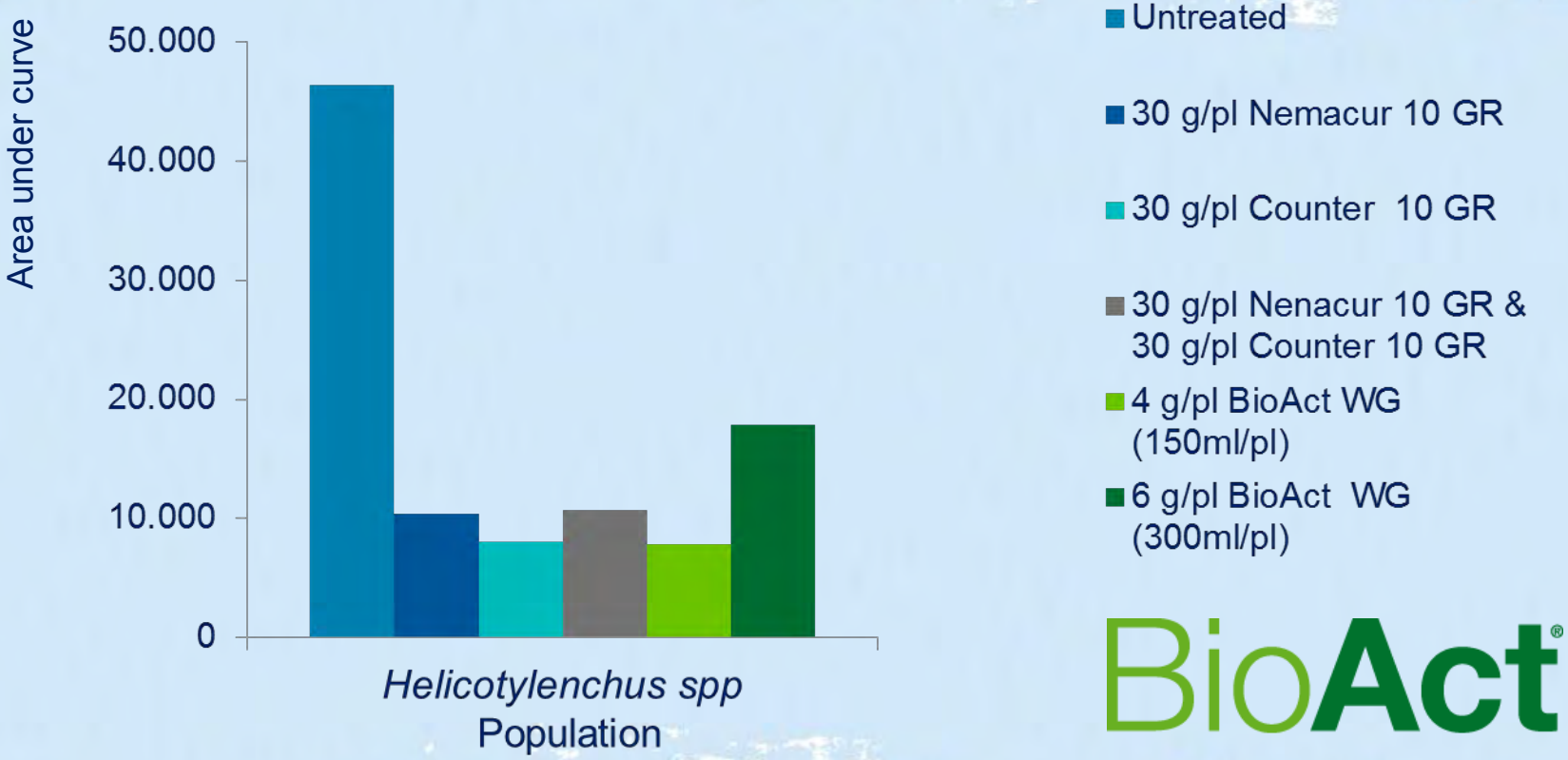

BioAct – an example of ideal successful product development

Intensive research efforts for a safe and reliable product

- Strain 251 isolated amongst other strains in the Philippines
- No correlation of genetic specifics to the region
- Not harmful for beneficial (entomopathogenic) nematodes
- No toxin involved in the parasitizing process
- No growth at >37 °C
- No contamination, no metabolites due to state of the art production
- Formulation of consistent quality; transparent quality control
- Screened for efficacy for commercial use
- Consistent efficacy proven for diverse crops
- Well suited for integrated pest management programs