incotec

the seed enhancement company

Part of Croda International Plc

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State of the art in seed enhancement treatments

DanSeed Symposium, 06-07 March 2023

Henry Bruggink, senior scientist

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Outline

- Introduction Incotec
- Overview technologies
- New developments
  - New crops
  - Improvements
  - Sustainability
    - organic primings
    - microplastic free coatings
    - application of beneficials

Introduction Henry Bruggink

- 62 years, married with 3 children
- Master Biology at Groningen University
- Government Seed Research Station (3 years) – researcher
  - Vigour tests on corn and vegetable seed
- Bruinsma Seeds (6 years) – seed technologist
  - Protected crops (tomato, pepper, lettuce, melon, endive, …)
- Incotec (26 years) – Senior Scientist
  - Development and introduction of X-ray upgrading systems
  - Priming of Solanaceous, Cucurbits and various other crops

2022: Ch. 10 Advances in seed priming techniques. In Advances in seed science and technology for more sustainable crop production, by Dr. Julia Buitink and Professor Olivier Leprince.

2023: Series of LinkedIn posts on priming

Introduction Incotec

Introduction Incotec

- 2016: Take-over by Croda
- 2006: Acquisition Proteios International
- 2005: Acquisition of Flower Seed Technology
- 2002: Incotec independent (MBO)
- 1996: Merge of Asgrow technology
- 1996: Acquired ISO 9001 status
- 1989: Incotec an independent company
- 1978: Start production facility USA
- 1973: Introduction of priming Endive
- 1969: Start research seed technology
- 1968: Introduction of Split Pill
- 1963: Start research coating technology within Royal Sluis

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Global presence

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Incotec in Croda

35%

Personal Care

25%

Life Sciences

35%

Performance Technologies

5%

Industrial Chemicals

Crop Care

Health Care

Crop Protection

Seed Enhancement

Biostimulants

Vaccine adjuvants

High Purity Excipients

Omega 3 API

Common technologies

- Delivery of actives
- Surface interactions (emulsion, suspension, wetting)

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Technologies

Seven Seed Processing Technologies

Analytical services

Priming

Seed Hygiene

Encrusting & Pelleting

Film coating

Application of actives, biologicals & nutrients

Upgrading

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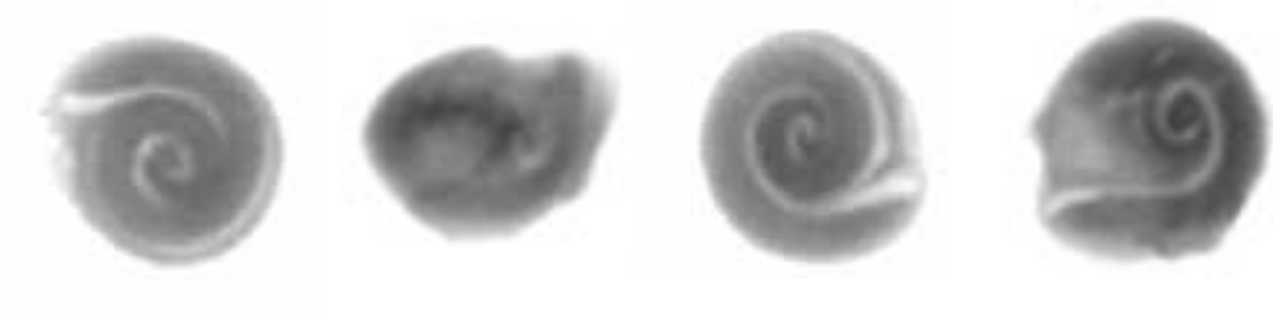
Upgrading

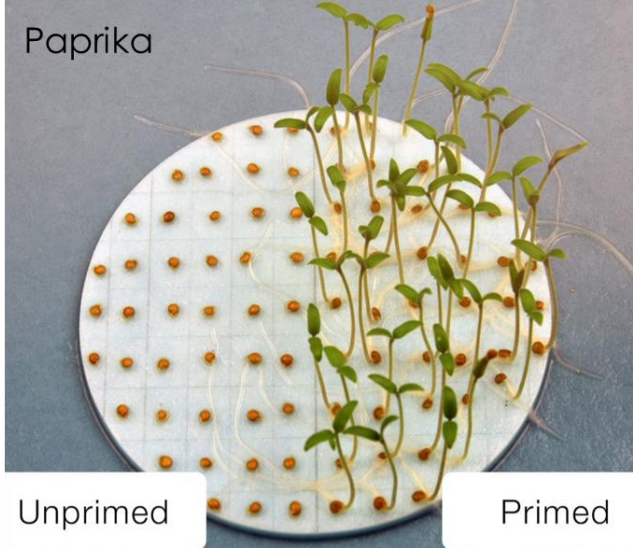
Remove bad seeds from seed lot

Besides the standard techniques, Incotec has

- Fluid density Separation
- X-ray upgrading



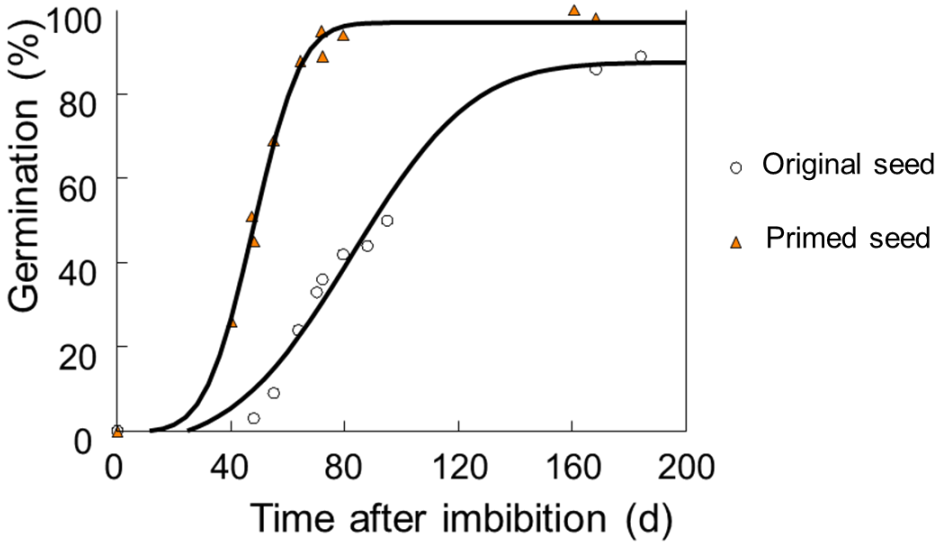
Overview priming



Physiological stimulation of germination

- Faster germination
- More uniform germination
- Improved germination under suboptimal conditions (salt, temperature, oxidative processes, …)
- Relief from (primary) dormancy
- Prevention of (secondary) dormancy
- Seedlings less sensitive for stressful conditions

- Vernalisation
- Combination with seed hygiene treatments
- Addition of compounds or microorganisms
  - Mostly aimed at improved seedling/plant performance



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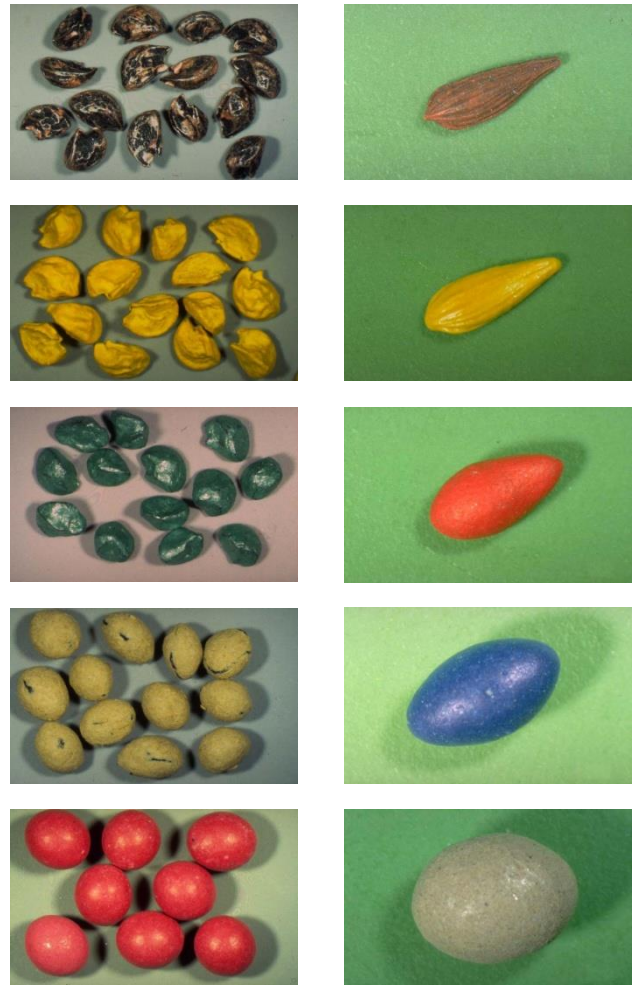
Film coating, encrusting & pelleting

- Improve sowability
- Reduce dust
- Improve flowability
- Dosing and sticking of all kinds of compounds
- Colour
  - Cosmetic
  - Safety signal
  - Proprietary signal



New developments

New crops

True potato seed (TPS)

True potato seeds, in contrast with potato seeds = potato tubers

- Diploid
- Seed size: 0.7-1.4 mm
- Thousand Seed Weight: 0.3-0.5 g

License agreement with Solynta

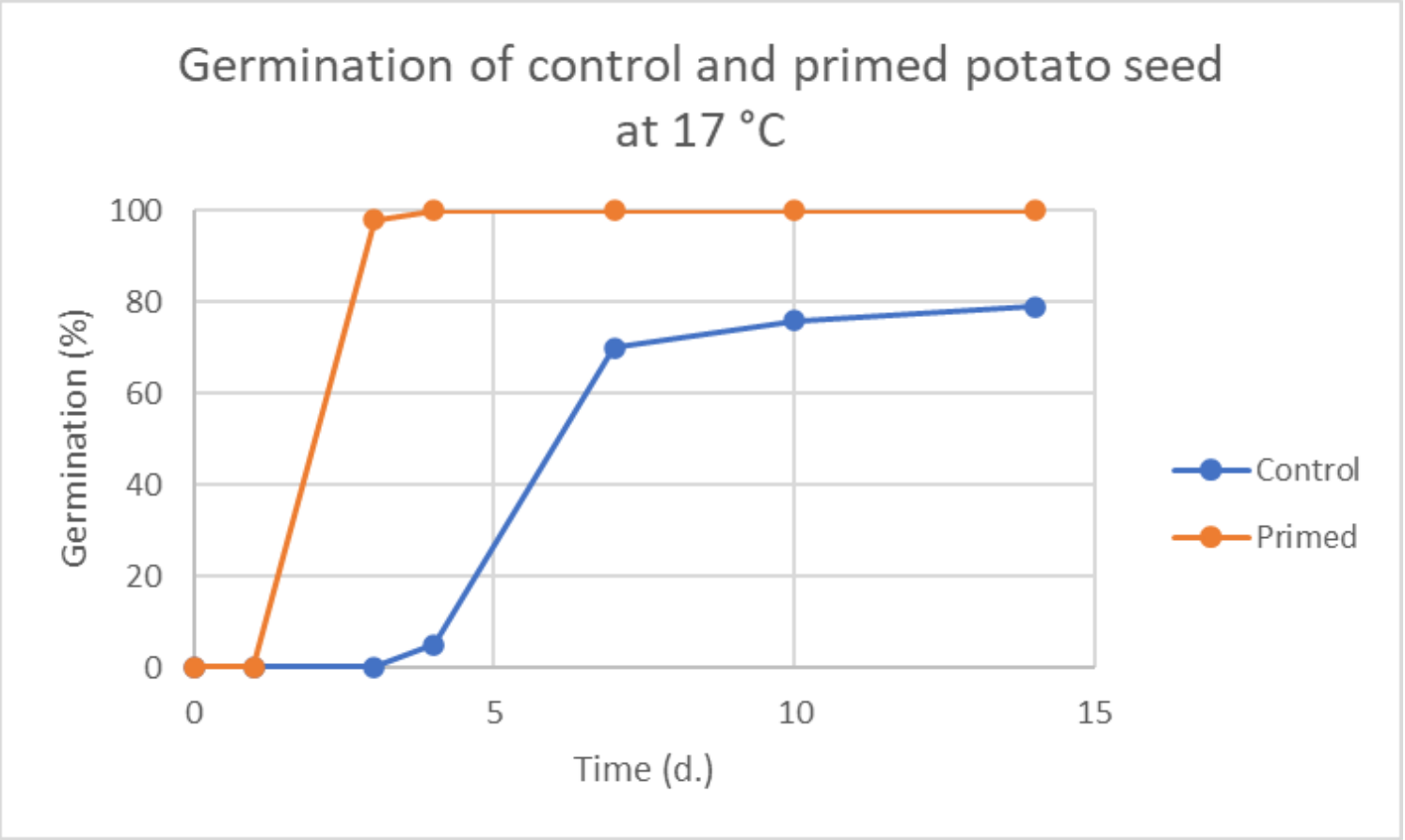
- Primary dormancy in fresh seed
- After-ripened seed still has low speed and uniformity, as well as no germination at higher temperatures (limit ~25 °C , low thermotolerance)

What we need in enhancement:

➢ Remove primary dormancy, increase speed and uniformity, and broaden the temperature range

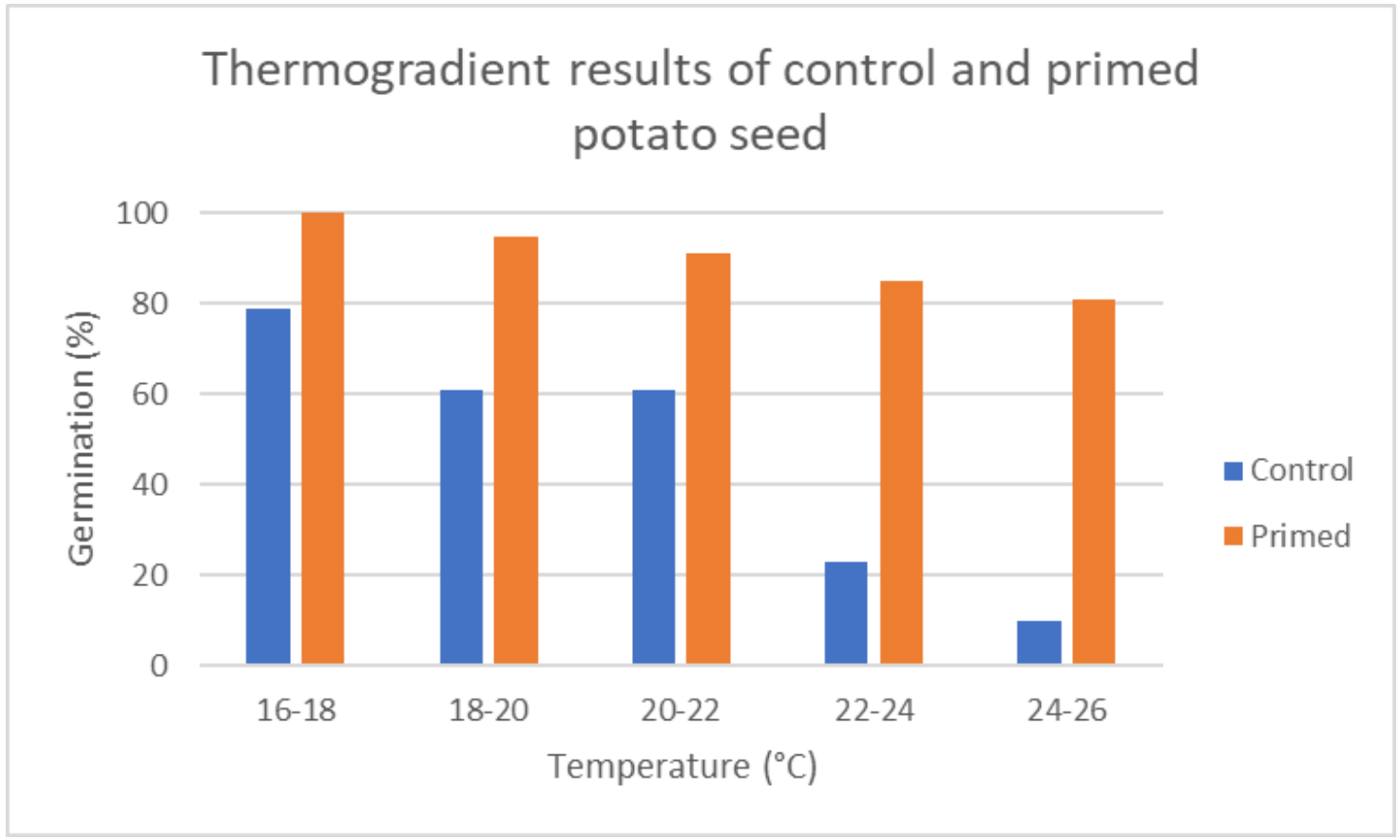
True potato seed - priming

1. To remove primary dormancy and obtain fast, uniform germination



True potato seed - priming

2. To improve germination at higher temperatures



New developments

Improvement X-ray upgrading

X-ray upgrading

Incotec uses X-ray upgrading systems for the improvement of

- tomato,
- rootstock tomato

Why these seeds?

- Quality issues
- Expensive
- Flat seeds

Now, we use Artificial Intelligence (AI) to sort the seeds: higher improvement with less seed loss

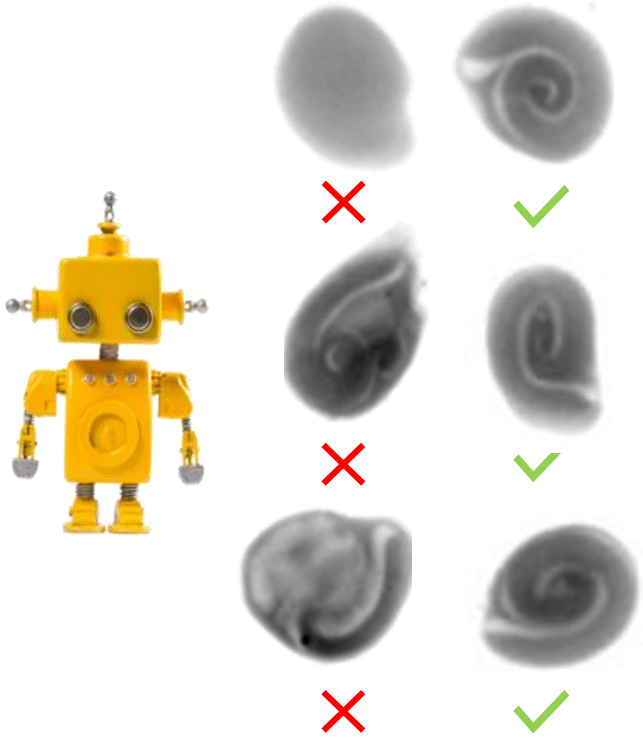
Using AI to detect good seeds

Problem
Unpredictable germination for seed batches

90% 75%

Useable Transplants

AI Solution
A machine is trained to identify good and bad seeds from X-ray images



Result
Guaranteed germination depending on customers specification

~95%

Useable Transplants

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Using AI to detect good seeds

Sustainability

Sustainability

MISSION ZERO

SUSTAINABLE TO THE MAX

Biobased / Biodegradable

Energy transition

1%club

Biologicals

SUSTAINABLE DEVELOPMENT GOALS

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Our sustainability strategy: Mission Zero

- **we do everything within our power** to improve the vitality and performance of seeds
- **contributing to global food safety and security** we are committed to making a positive environmental impact
- **we always look for the most sustainable solutions** to help our customers achieve their goals

MISSION ZERO

SUSTAINABLE TO THE MAX

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Sustainability

Organic products

Organic products

A small market, but steadily increasing.

Incotec has organic upgrading (X-ray), primings and pellets.

So, what is organic?

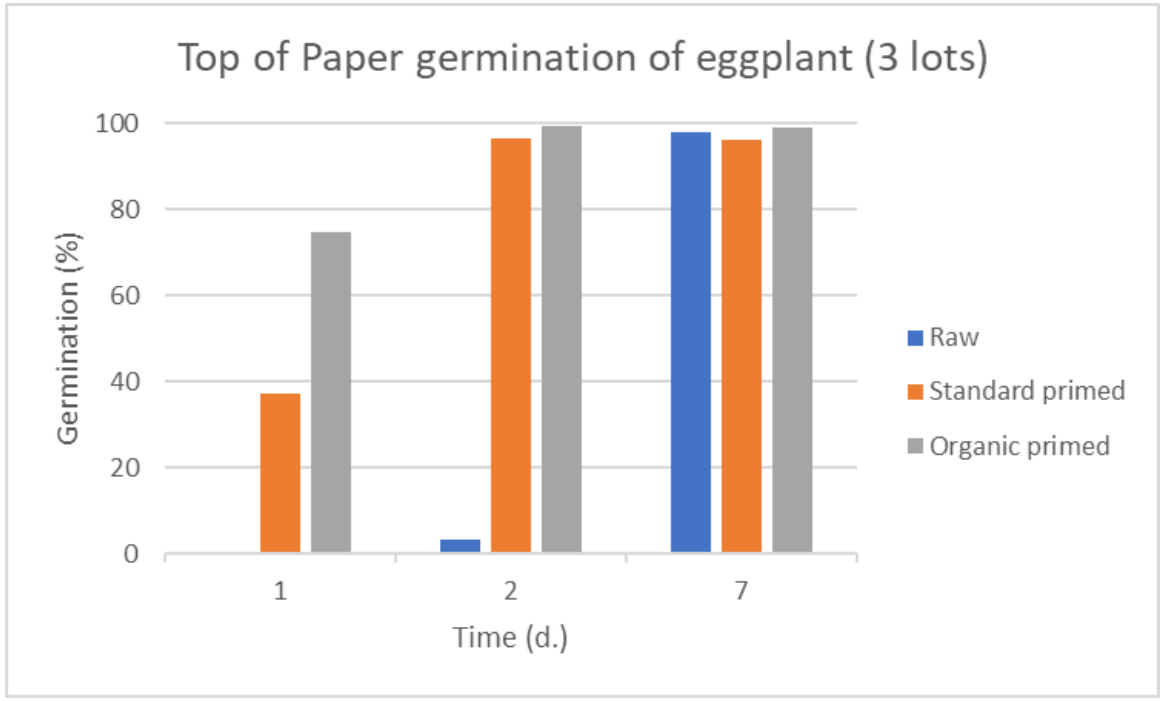
In NL: approved by Skal.

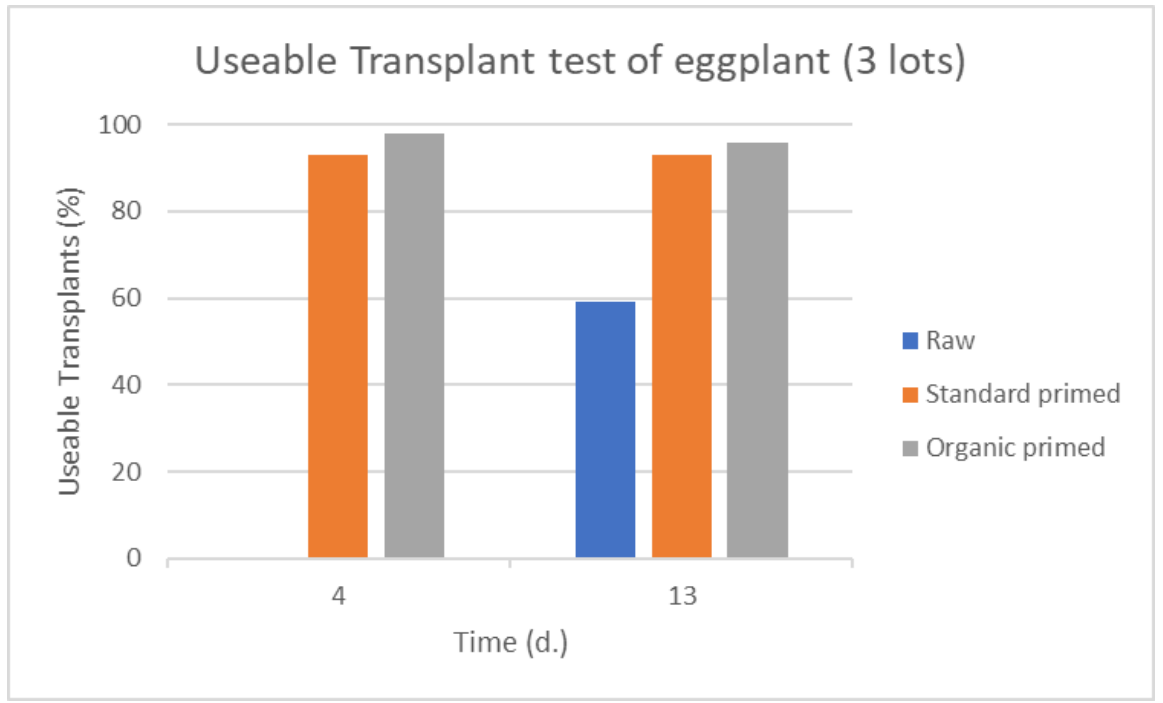
Skal uses FiBL (Research Institute for Organic Agriculture) for check on ingredients.

- No use of chemically synthesized compounds
- No use of hormones
- No use of disinfectants
- No use of GMO's
- ….

Organic priming Eggplant

We do have quite a good eggplant priming, but the organic priming is even better
→ it is possible to prime seed with just water.





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Priming Rootstock Tomato

Incotec can prime rootstock tomato for 15 years and the process is still unparalleled. However, certain compounds are not organic.

Original seed lot

Primed seed lot

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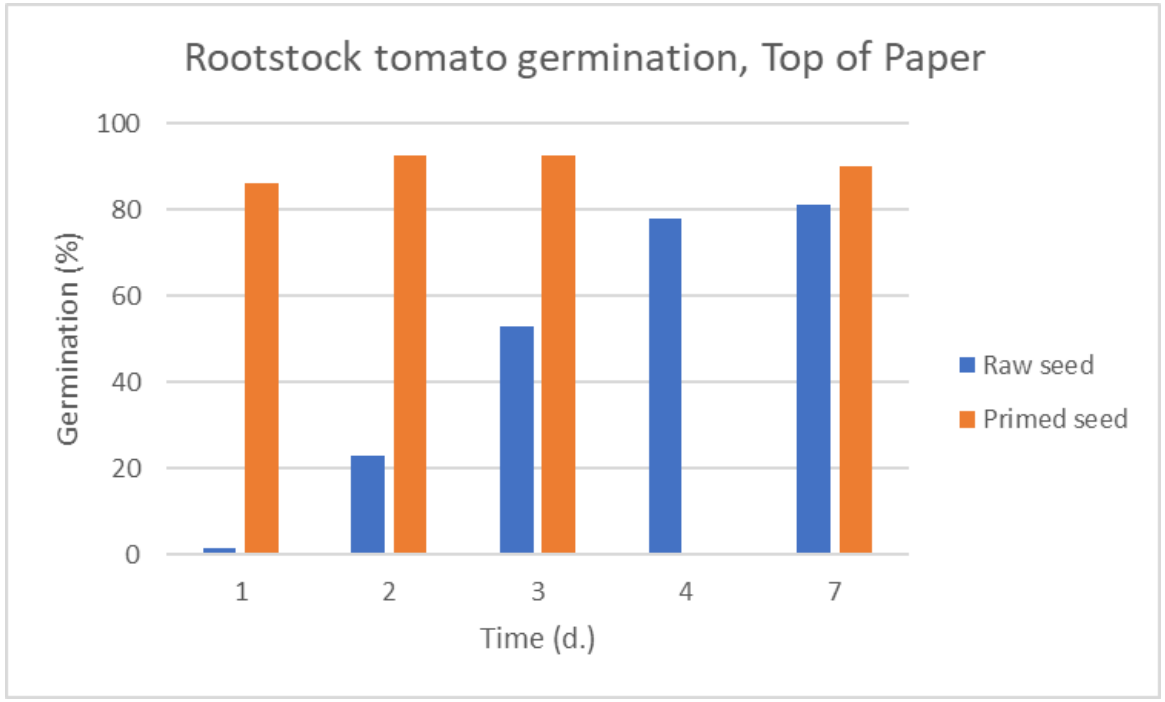
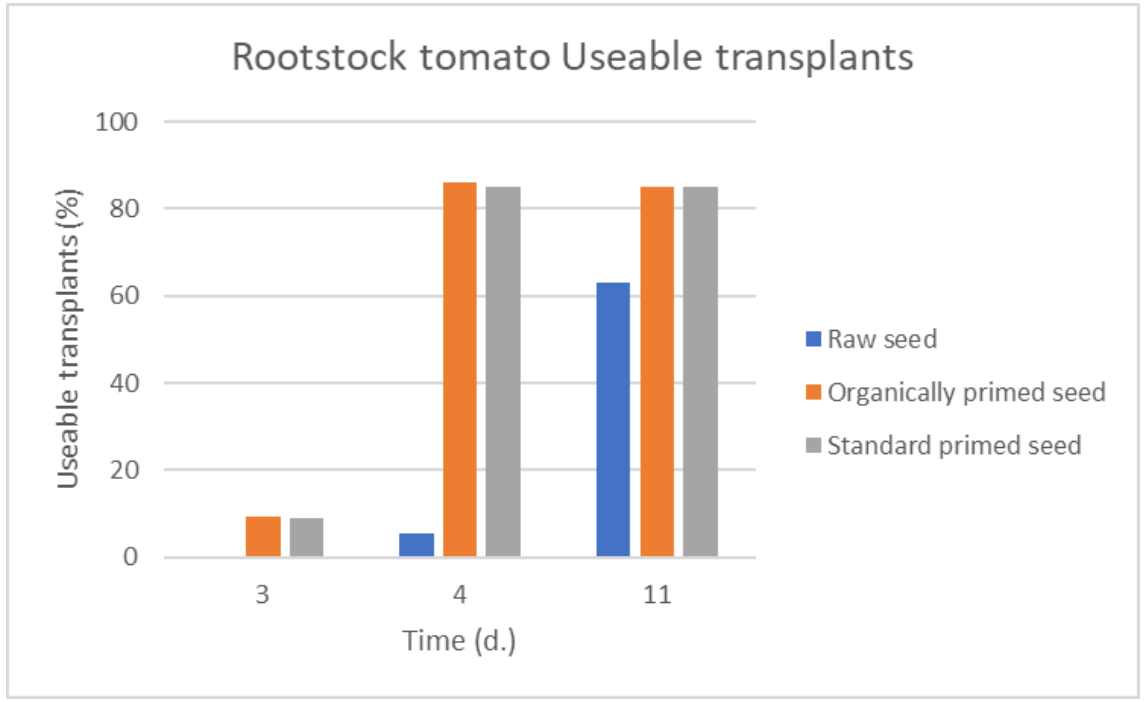
Organic priming Rootstock Tomato

Now we get requests for an organic priming. This priming is still in development, but the first results are promising.





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Sustainability

Microplastic Free Products

Microplastics are a hot topic


Irish Teen Wins 2019 Google Science Fair For Removing Microplastics From Water

Trevor Nace Senior Contributor
Science
Explore More

Fionn Ferreira was the winner of the 2019 Google Science Fair GOOGLE SCIENCE FAIR

An Irish teenager just won $50,000 for his project focusing on extracting micros-plastics from water.


POLLUTION SUSTAINABILITY

Tiny plastic, big problem

Scientists find that tiny pieces of plastic travel great distances, threatening the ocean ecosystem

BY ALISON PEARCE STEVENS APR 10, 2015 — 7:15 AM EST


Consulter le journal

Le Monde

ACTUALITÉS ÉCONOMIE VIDÉOS OPINIONS CULTURE

PLANÈTE

Les océans pollués par des particules invisibles de plastique

THE OCEAN CLEANUP

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Microplastics in seed enhancement

Priming: microplastics are no issue

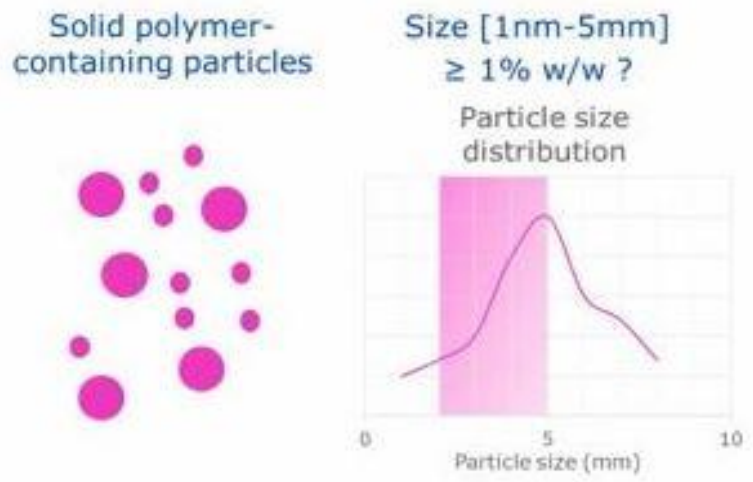
Film coats and pellets: microplastics often are.

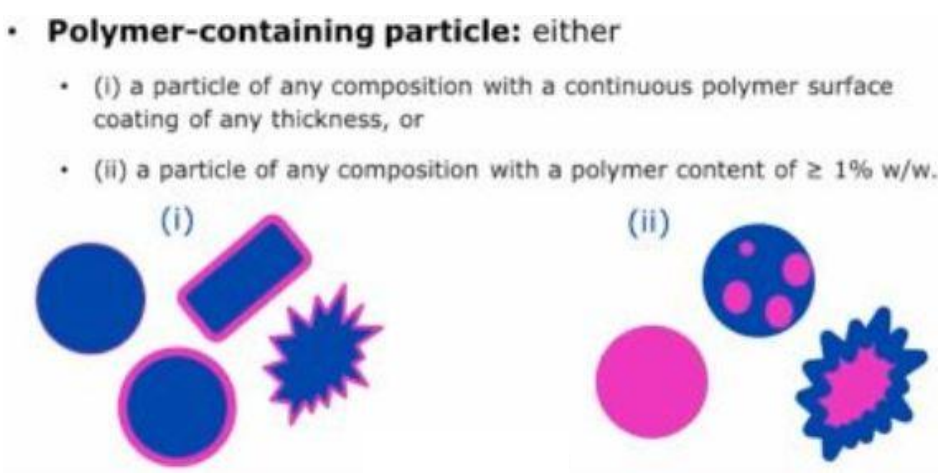
But what are microplastics and where do they come from?

What are microplastics?

Based on the draft definitions provided by the ECHA*:

- A material consisting of **solid polymer-containing particles**
- To which additives or other substances may have been added
- ≥ 1% w/w of particles have:
  - all dimensions 1 nm ≤ x ≤ 5 mm, or
  - fibres, a length of 3 nm ≤ x ≤ 15 mm; length to diameter ratio of > 3





ANNEX XV RESTRICTION REPORT PROPOSAL FOR A RESTRICTION on intentionally added microplastics by the European Chemical Agency (ECHA) 11th January 2019.

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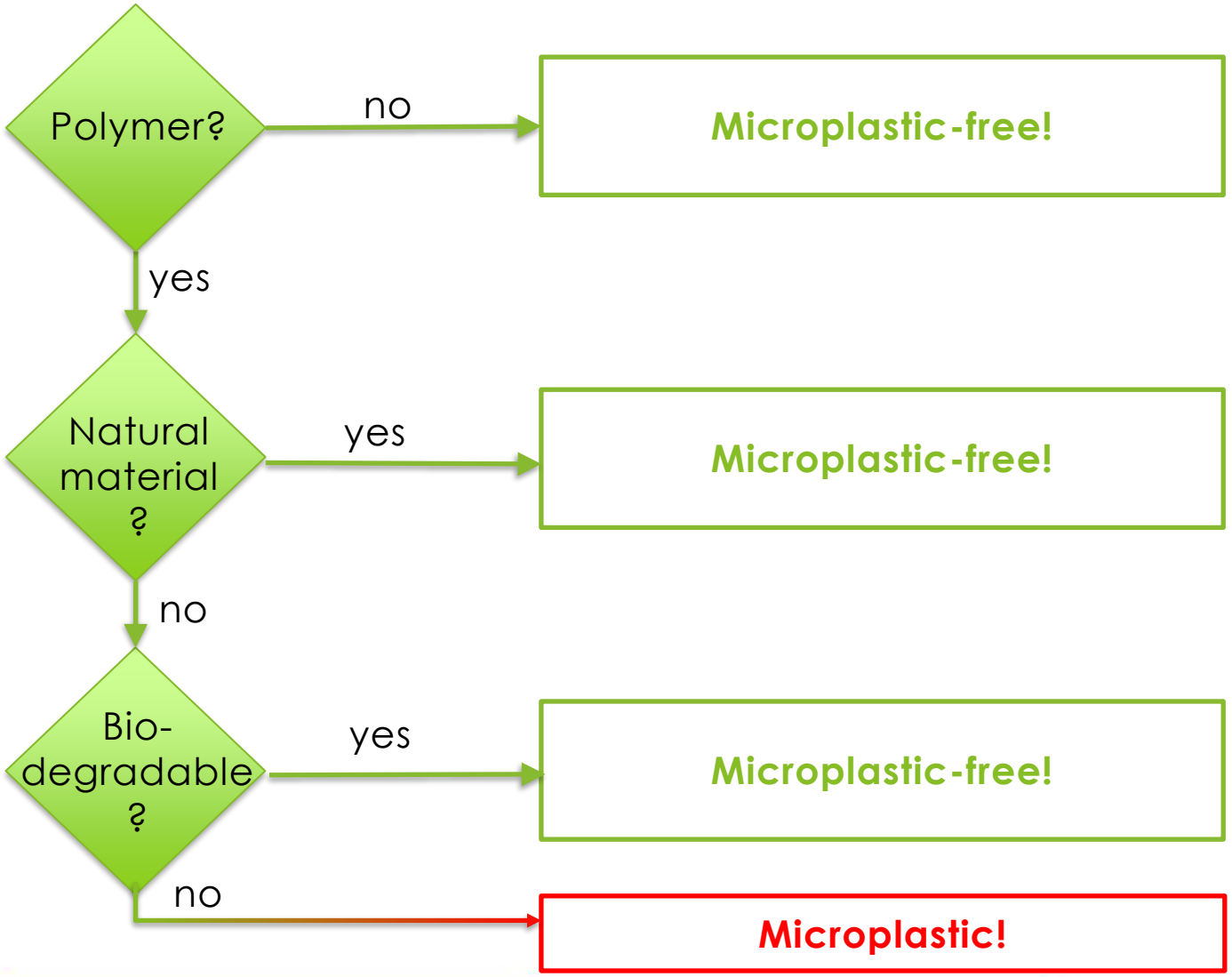
Sources of microplastics

Microplastic or microplastic free?



Sustainability

Microplastic Free Film Coats

Microplastic free (MPF) in film coats?

Water 40-70%

Binder 5-15%
(film-forming polymer)

Wax 0-15%
(flow agent, often polymeric)

Other carbon-based <15%
(pigments, emulsifiers, etc.)

Non-carbon-based <30%
(filler materials)

WITHIN SCOPE OF MICROPLASTIC DEFINITION

NOT DEFINED YET IF WITHIN SCOPE

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Microplastic free (MPF) film coats

Same requirements as for microplastic containing film coats:

- Germination
- Cosmetics
- Dust-off (Heubach)
- Abrasion resistance
- Flowability
- Plantability (skips, multiples)
- Compatibility with Plant Protection Products

MPF film coats: agronomics and vegetables

After thorough screening of binders, waxes, defoamers, and wetting agents, we now have film coats for corn and sunflower,

and for various vegetable seeds

Sustainability

Microplastic Free Pellets

Microplastic free (MPF) pellets

- Mostly in the binder
- But also in one or more of the pelleting materials
- Example: Fennel Split Pill Light

Powder formulation
contains microplastics

Binder solution
contains microplastics

- 2021-2022: Development of a pellet as good as or better than the present product.

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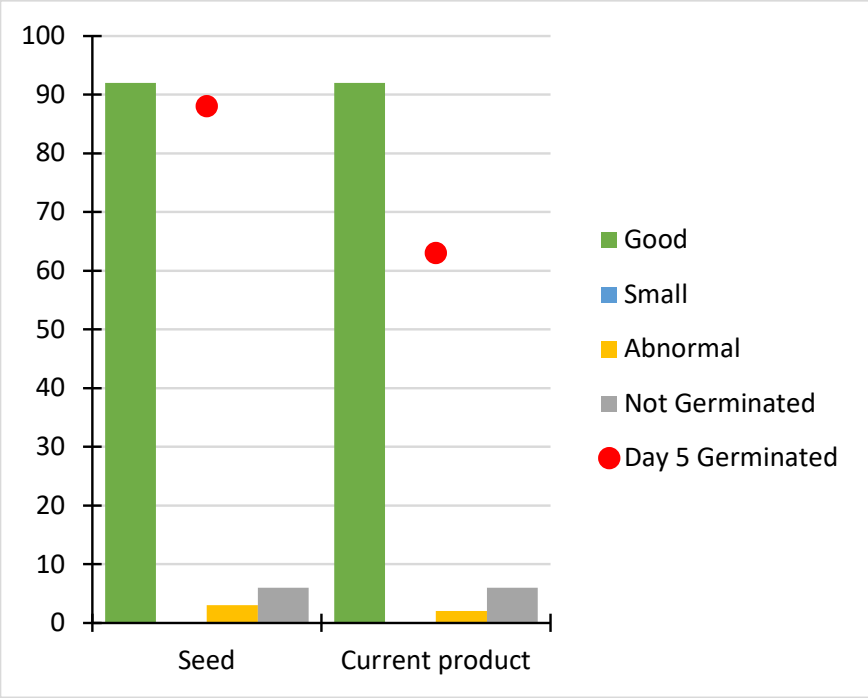
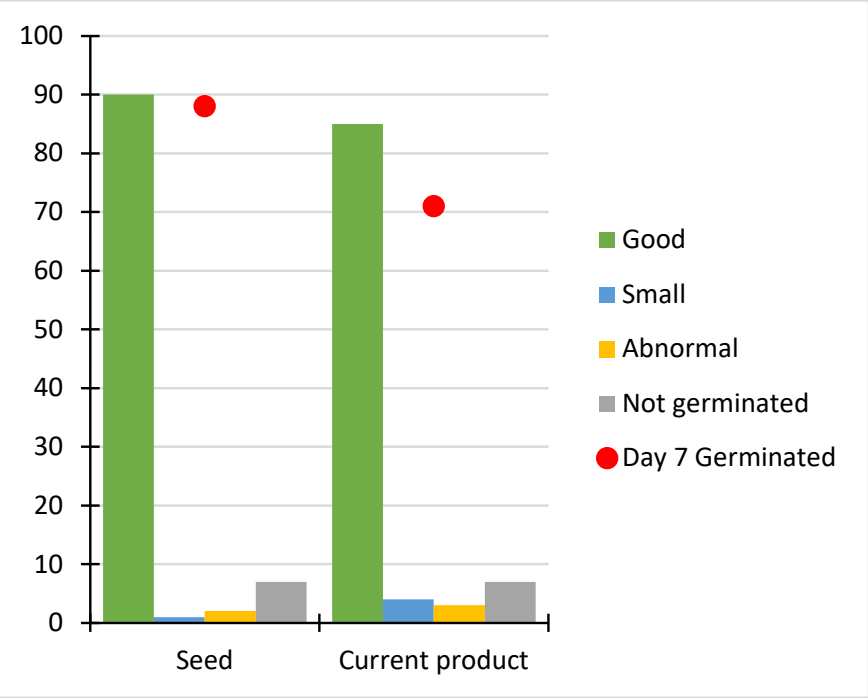
Present situation – Germination of Fennel Split Pill Light

Filter paper test

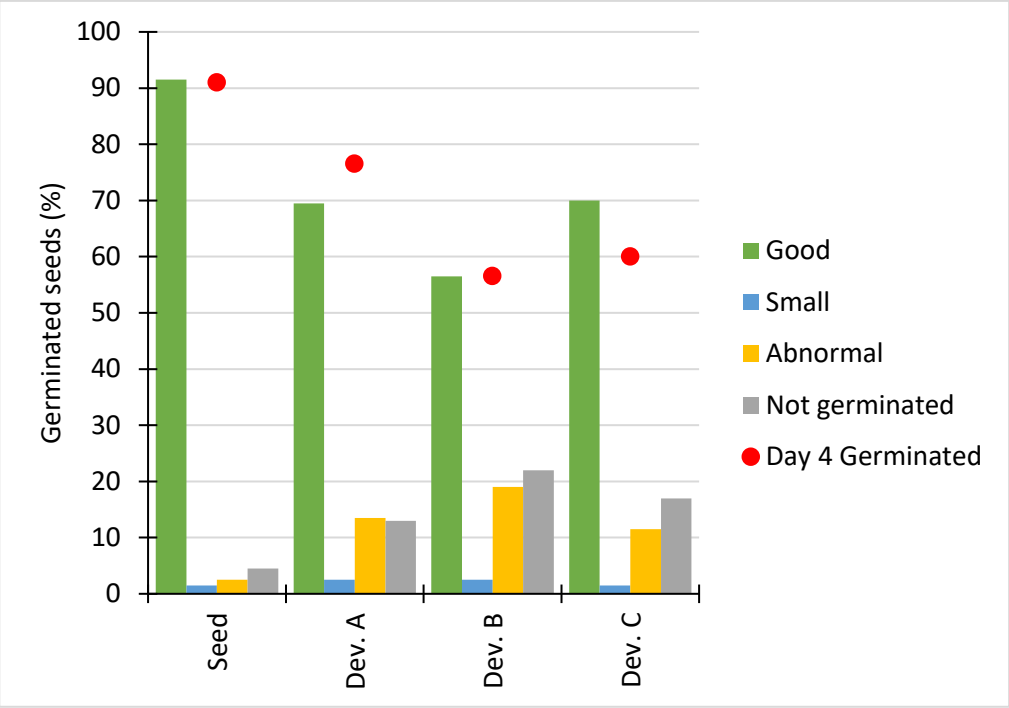


Greenhouse test

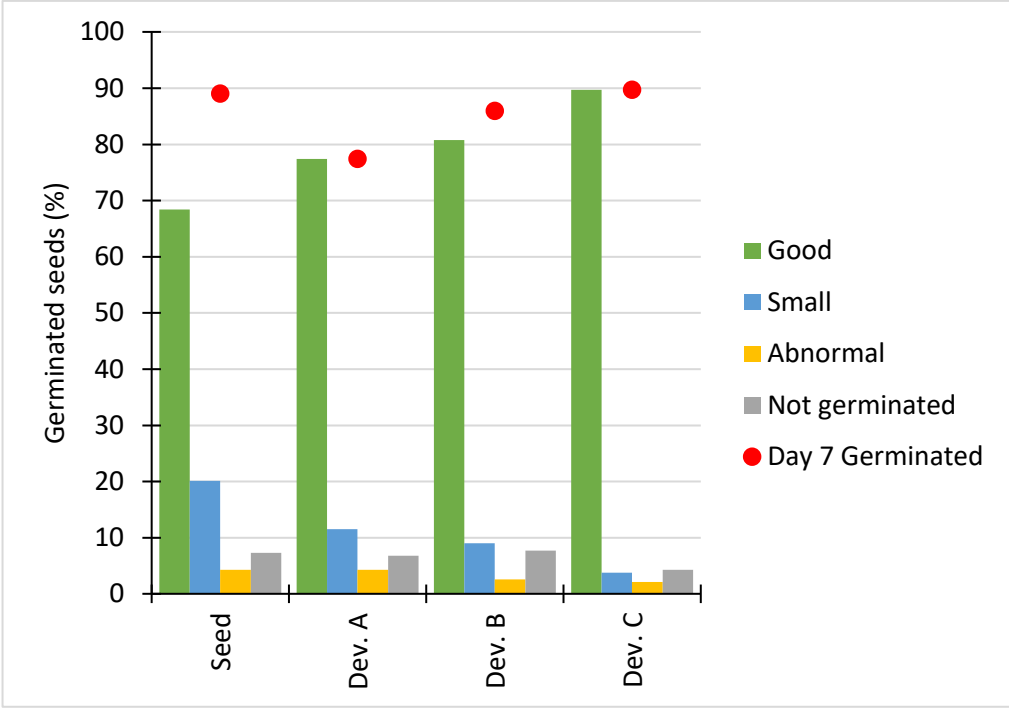


Developments – Germination of MPF Fennel pellets

Filter paper test



Greenhouse test



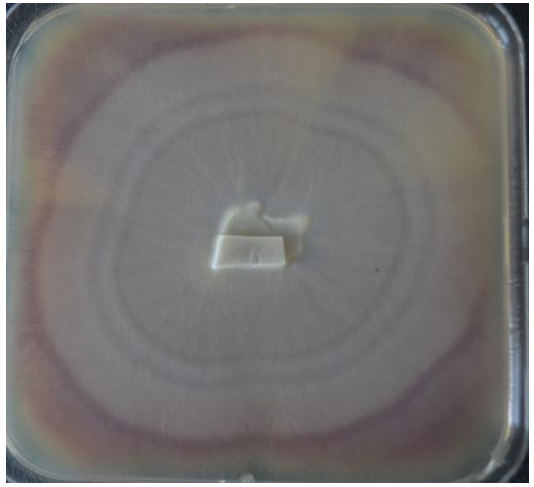
Actions for 2023

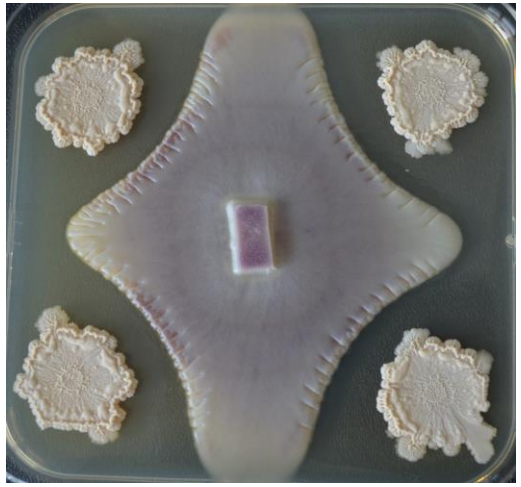
- Internal validation of the results found.
- Finetuning of the recipe
- Issues to handle:
  - Dust-off
  - Meeting all quality standards
- Customer feedback
- Making production ready

Sustainability

Application of beneficial micro-organisms

Application of micro-organisms





Micro-organisms can be beneficial:

- Protect against microbial attacks
  (*Trichoderma* spp., *Bacillus* spp.)
  → replacement of PPP's.

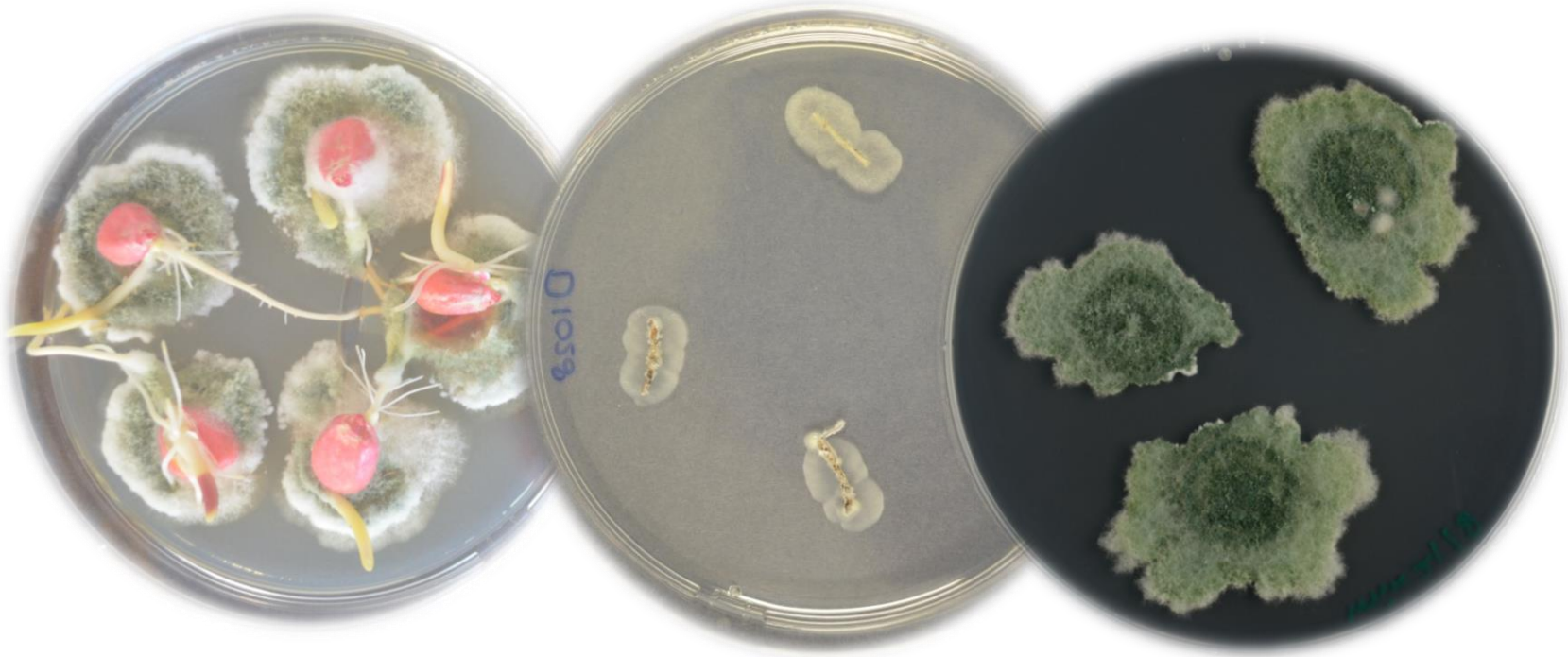
- Protection against insects

- Supply plant with nitrogen (*Rhizobacter* spp., *Gluconacetobacter diazotrophicus*)
  → reduction of fertilizer use

- Growth promotion

Benefits of seed application

- Rapid root colonization
- Provide nutrients/protection at very early stage of plant development
- Less needed than with soil application



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Challenges

Compatibility with plant protection products

Type of formulation

Compatibility with application method

Shelf life of the product

Seed application rate

Microorganisms are alive

Registration as seed treatment

Temperature

Colonisation from seed

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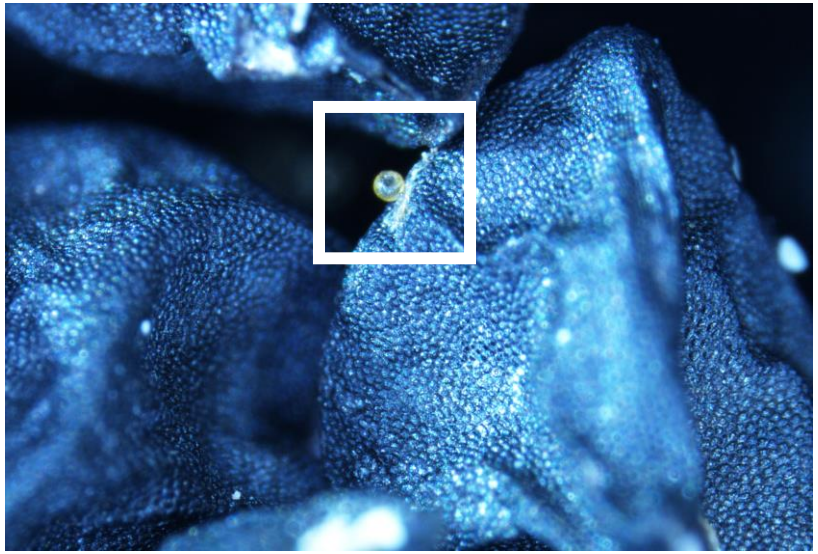
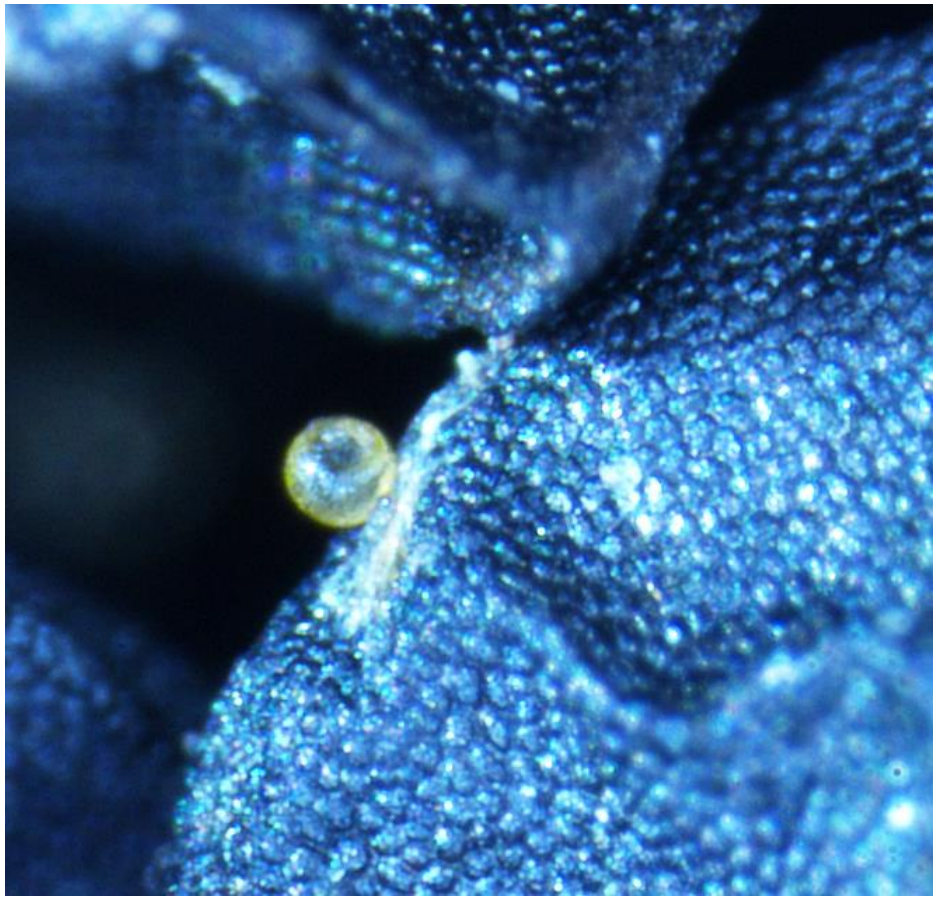
Spores – size does matter

- *Bacillus* 1-2 µm
- *Trichoderma* 2-5 µm
- Mycorrhiza 50-500 µm





Mycorrhiza applied on onion by film coating

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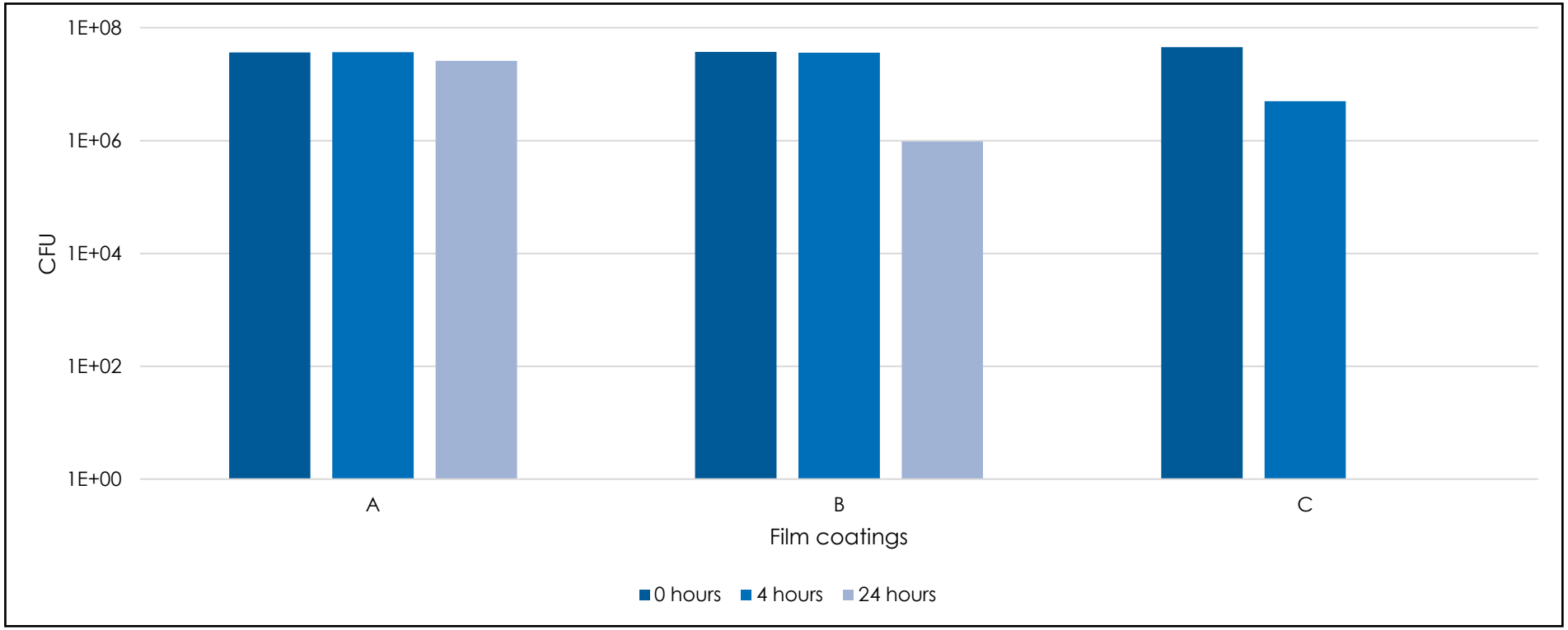
Solution – size matters

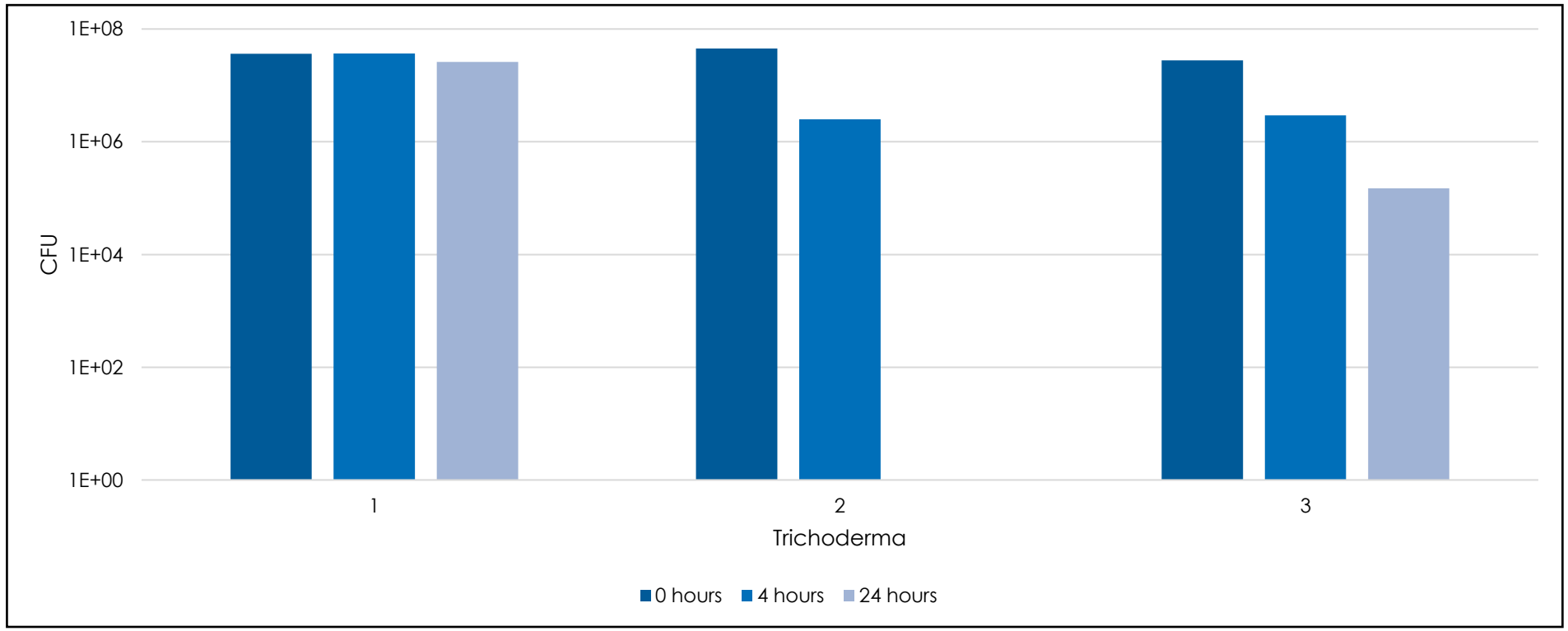
Challenge – they are all different

Survival of 1 Trichoderma in three different film coats



Challenge – they are all different

Survival of 3 Trichoderma's in one film coat



Solution – they are all different

Tailor made solutions

Seed Application

Opportunities

- Microbials can be applied on seed
- Requires specific seed enhancement knowledge and expertise
- Providing nutrients/protection at a very early stage of plant development

Challenges

- Integrated crop protection
- Tailor made solutions dependent on microbial-crop combination
- Registration for seed treatment

Finally

Incotec is dedicated to SUSTAINABILITY, with using resources that if possible are

- biobased,
- biodegradable,
- microplastic free and
- organic

Resulting in

- organic upgrading and primings,
- and MPF coatings

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