



Evonik Developer & Producer of Specialty Chemicals

Sustainable Surfactants for Biological Pesticides

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Sustainable surfactants for biopesticides

Agenda

1. Evonik Industries AG - Who we are
2. Problem statement
3. Portfolio and chemistry
4. Properties
 - 4.1 Deposition, adhesion and retention (delivery)
 - 4.2 Microbial self live, germination and growth
5. Greenhouse experiments
6. Summary



Evonik at a Glance

EVONIK is one of the largest worldwide acting German industrial company with extensive knowledge and experience in developing chemical specialties & offering innovative solutions.



>36,000

Employees in more than 100 countries

15

Billion € sales in 2018

30

Production plants in 30 countries

~240

Patents

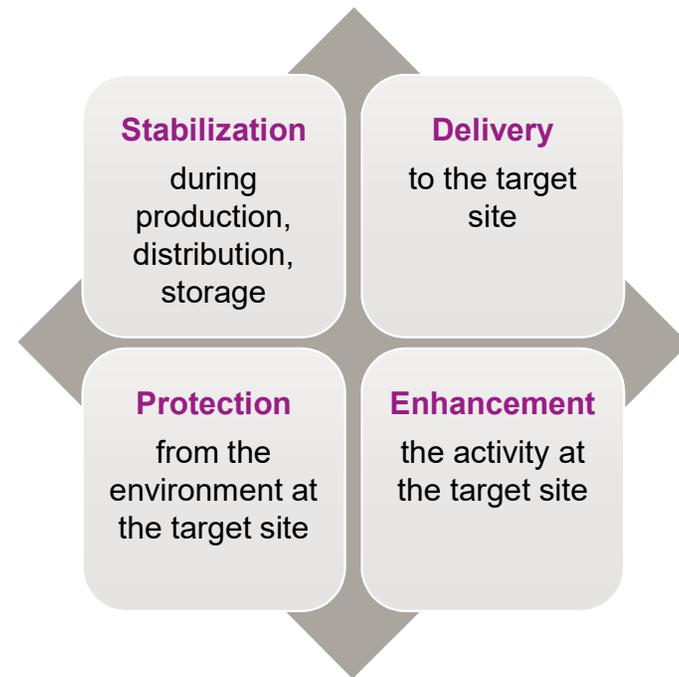
Problem statement - Performance of microbial products is a big challenge in the agricultural market and can be improved by better formulations

Common causes of product failure / low performance:

- Poor stability of the product during storage
- Too little active material actually reaching the field target
- Rapid degradation of the active material on target

Formulation plays a vital role in helping to solve this problems and making a microorganism and other biopesticides effective in practice.

Functions of a formulation



Portfolio - Controlling Processes at Interfaces

1  **BREAK-THRU® S 301**
Super Spreader for liquid formulations

Water and in some oils soluble **Trisiloxane** based product **to be used** as **liquid carrier** for microorganism and as **adjuvant**. Ready biodegradable.



2  **BREAK-THRU® SD 260**
Super Spreader for dry formulations

Water soluble **Trisiloxane** based product **to be used** as **dry carrier** for microorganism and as **adjuvant**. Ready biodegradable.

3  **BREAK-THRU® SP 133**
Super Penetrant for liquid formulations

Bio based and Polyglycerol Ester based product **to be used** as **liquid carrier** for microorganism and as **adjuvant**. Ready biodegradable.



BREAK-THRU® SP 255
Wetting agent for oil based formulations

TEGO® SML 20
Cost-effective wetting ag. for leaf & soil app.

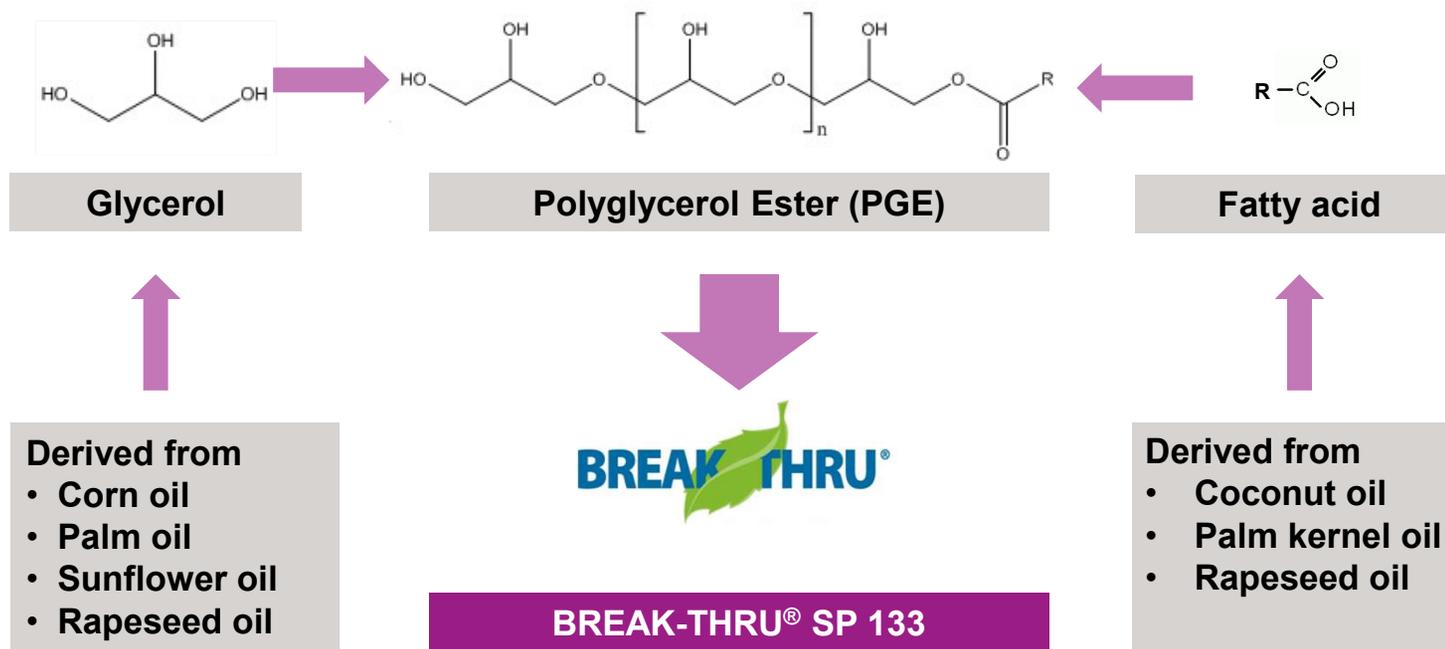
BREAK-THRU® EM V20
Emulsifier for veg. oil and nat. pesticidal oils

TEGO® STO 85 V
Emulsifier for paraffinic oils

BREAK-THRU® DA 646
Disp. agent for OD + Emulsifier for veg. oils

Chemistry - BREAK-THRU® SP 133

This product is made out of components from renewable sources



FiBL

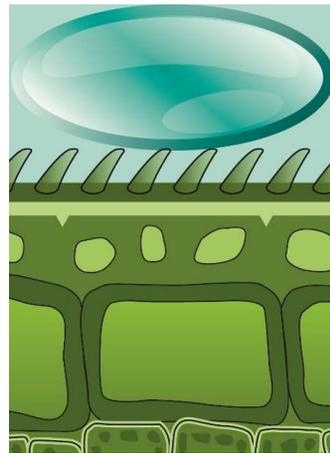
Properties - Deposition, adhesion & retention + shelf life

| | | | |
|---|---|--|---|
| 1 |  | BREAK-THRU® S 301 Super Spreader for liquid formulations | <ul style="list-style-type: none">- Enhances adhesion and retention of biopesticides by lowering surface tension- Improves shelf life of microorganisms |
| 2 |  | BREAK-THRU® SD 260 Super Spreader for dry formulations | <ul style="list-style-type: none">- Enhances adhesion and retention of biopesticides by lowering surface tension- Improves shelf life of microorganisms |
| 3 |  | BREAK-THRU® SP 133 Super Penetrant for liquid formulations | <ul style="list-style-type: none">- Enhances adhesion and retention of biopesticides by lowering surface tension- Improves shelf life of microorganisms- Increases penetration- Enhance deposition through drift reduction |

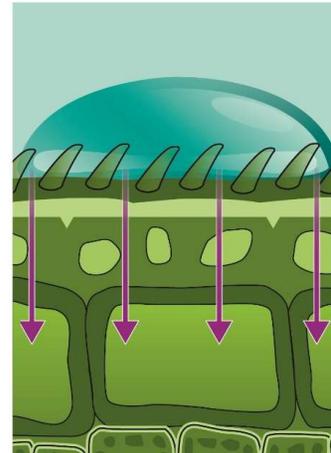


Surfactant basics – Surface tension is responsible for the shape of droplets

- The high surface Tension gives droplets their near-spherical shape.
- Surfactants lowers the surface tension, and thus the surface energy required to expand the surface.



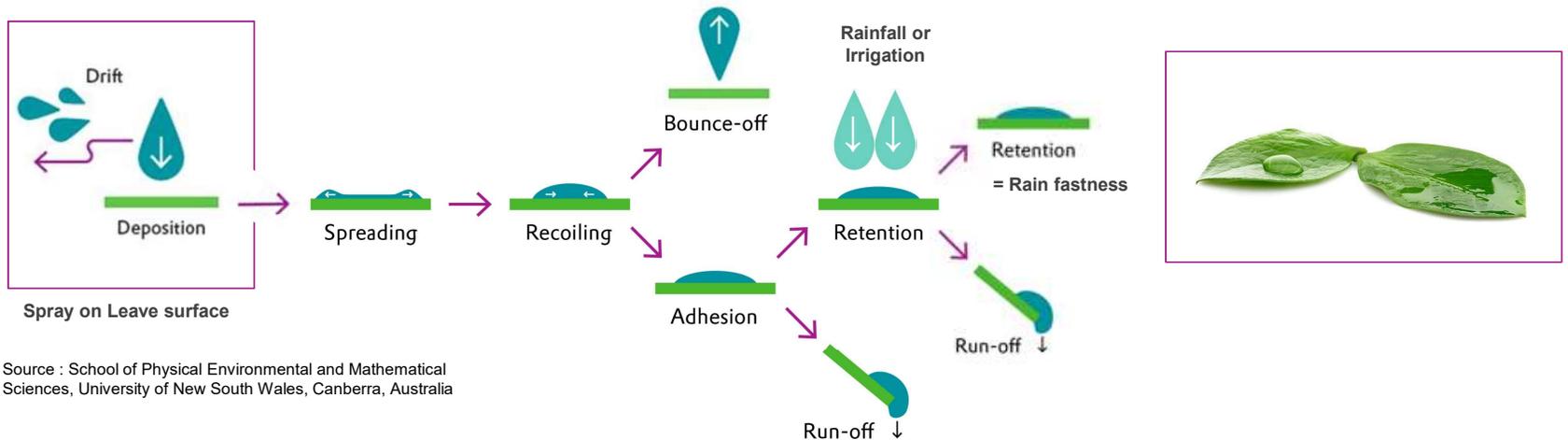
High Surface Tension
e.g. pure water (72 mN/m)



Low Surface Tension
better adhesion and contact

Properties - Deposition, Adhesion, Retention and Rain fastness

| | |
|-------------------|---|
| Deposition | Application volume retained on target |
| Adhesion | Retention of droplets on initial impact |
| Retention | Volume remaining on the leaf after spraying and after the rain |



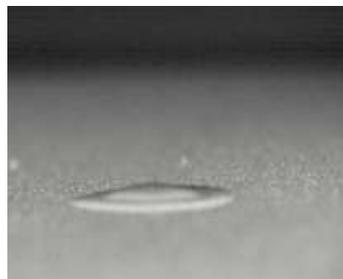
Source : School of Physical Environmental and Mathematical Sciences, University of New South Wales, Canberra, Australia

Efficient spray application is a complex process depending on droplet size, velocity, wettability of surface, surface roughness and surface tension of the droplet

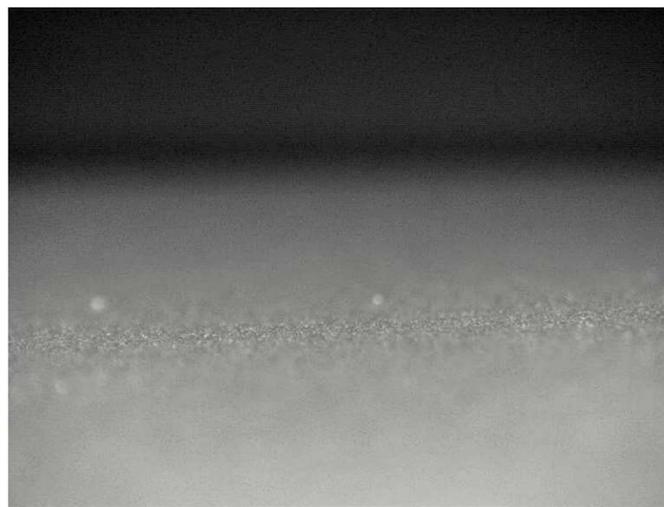
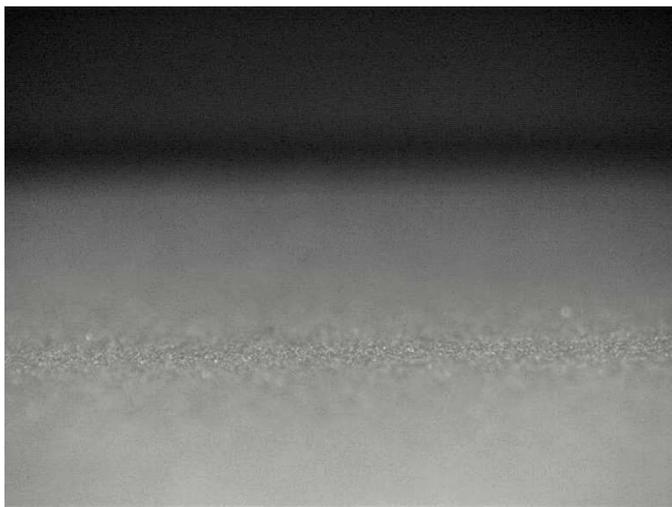
Adhesion of a droplet on Polypropylene film - BREAK-THRU® S 301



Water droplet
on hydrophobic surfaces
=> **Bounce-off effect**



Water droplet + 0.05% BREAK THRU®
on hydrophobic surfaces
=> **Adhesion and retention effects**



Adhesion and retention are improved due to the lowering of surface tension of water

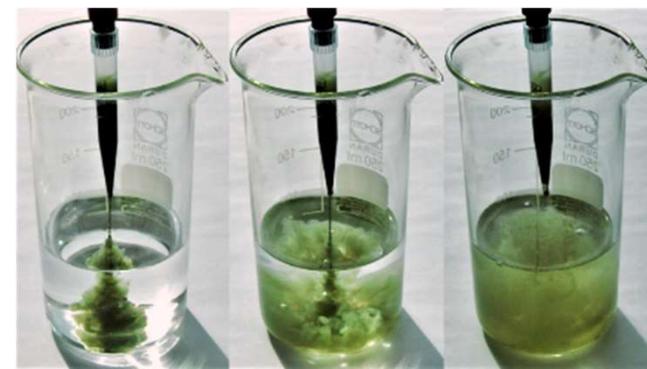
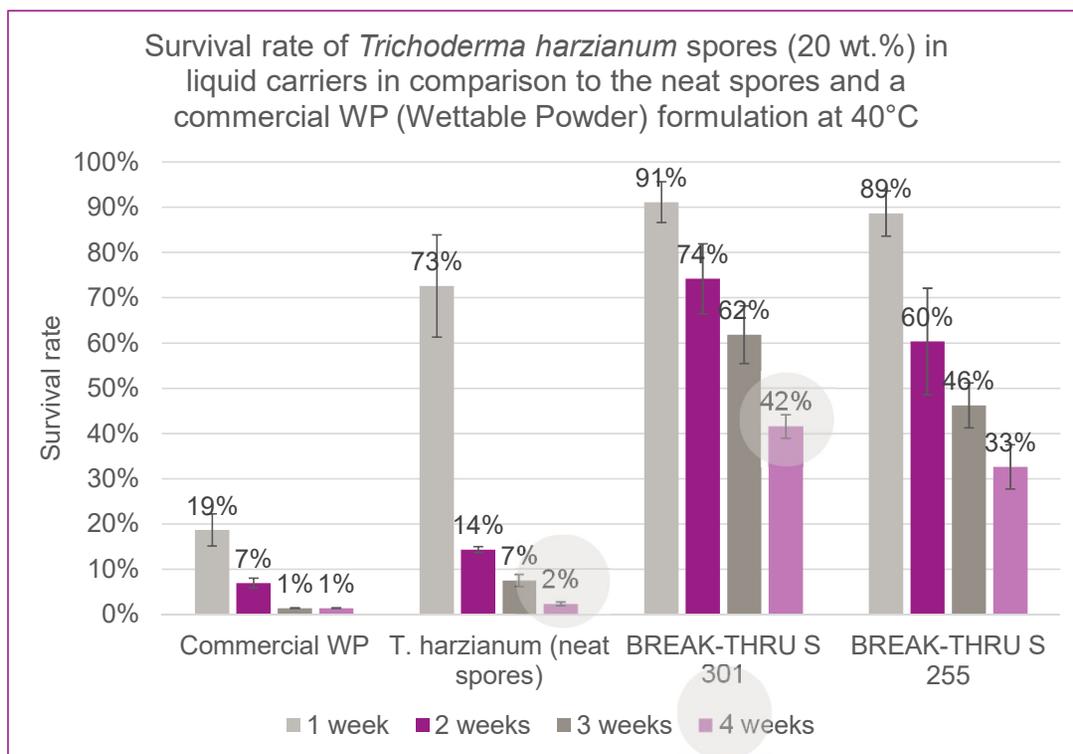
Adhesion + Spreading on Cabbage Turnip Leaf - BREAK-THRU® S 301

Cabbage Turnip Leaf with 0,05% BREAK-THRU® S 301 in water

Water



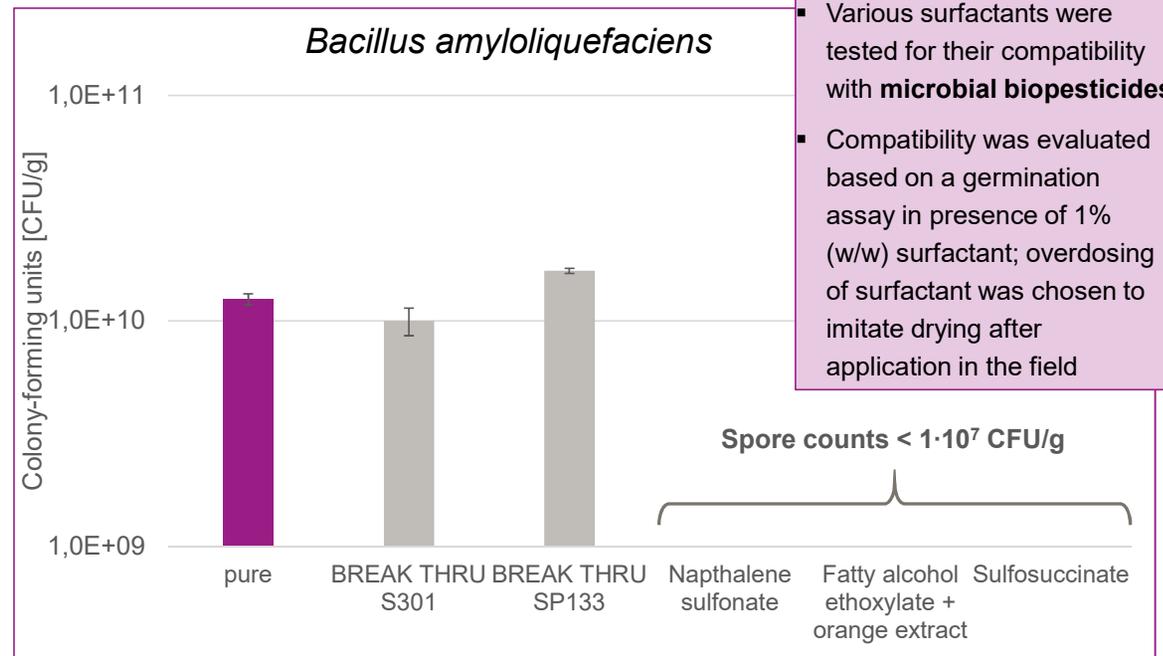
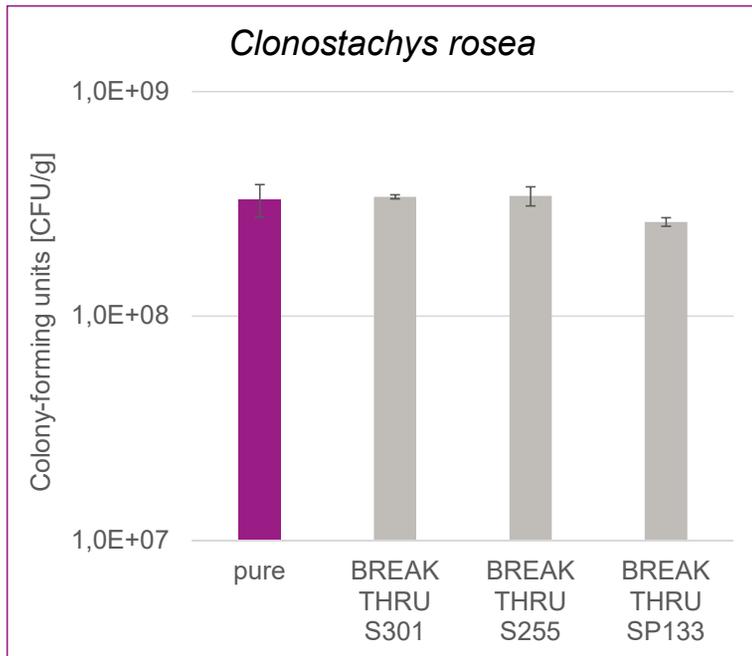
Self Live enhancement of *Trichoderma harzianum* spores using a Dispersion concentrates based on BREAK-THRU® S 301 carrier liquids



Dispersion concentrate of 10 % *Trichoderma harzianum* spores in BREAK-THRU® S 301 (1 ml in 100 ml water)

Germination - BREAK-THRU® additives can be used as tank mix adjuvants without interference of germination or viability of the microorganisms

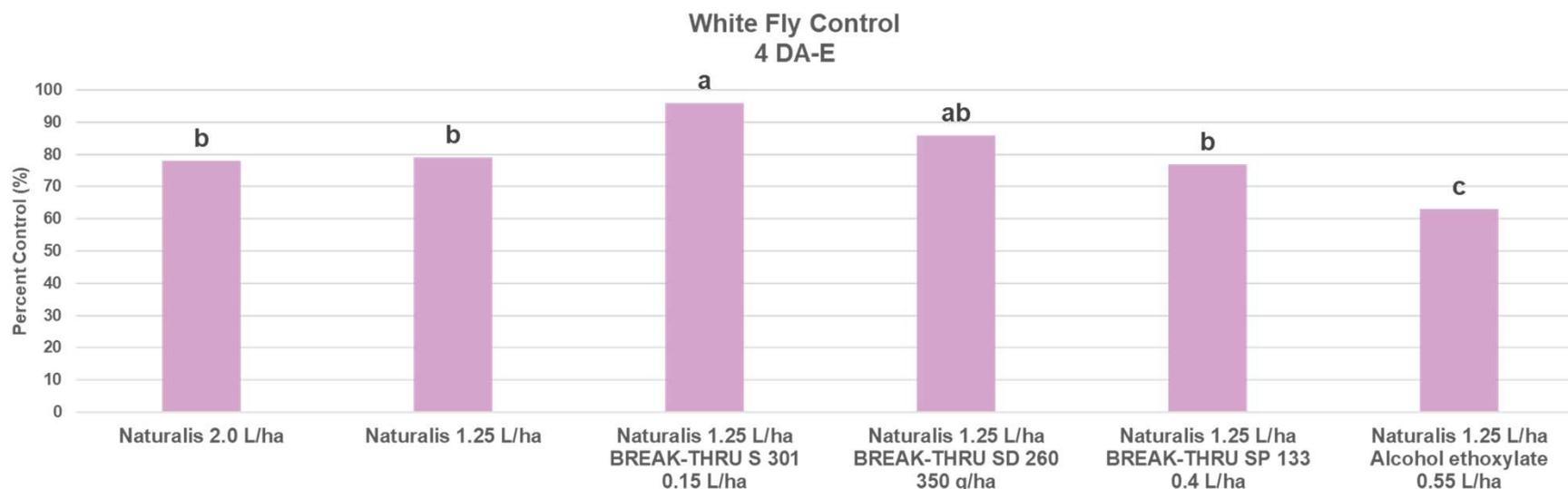
Spore counts for microbial products with 1.0 wt% surfactant added



Test set-up:

- Various surfactants were tested for their compatibility with **microbial biopesticides**
- Compatibility was evaluated based on a germination assay in presence of 1% (w/w) surfactant; overdosing of surfactant was chosen to imitate drying after application in the field

Greenhouse experiments - Biological Insecticide Control of White Fly (*Bemisia tabaci*) on Tomato (*Solanum lycopersicum*)



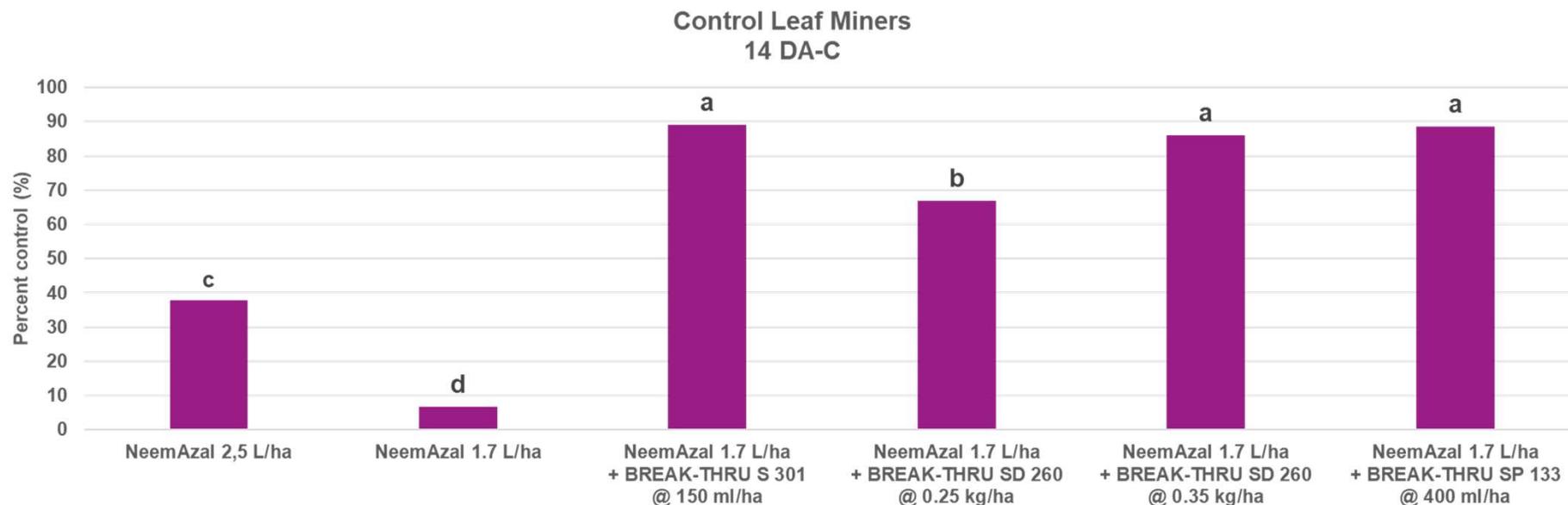
Trial location: Greenhouse, Germany
Pesticide: Naturalis, *Beauveria bassiana*
Replications: 4
Water volume: 1500 L/ha
Application: hand gun (Backsprayer)



No phytotox on tomato

Efficacy of reduced rate of Naturalis insecticide was improved by addition of **BREAK THRU®** adjuvants to level of full rate Naturalis with the exception of SP 133

Greenhouse experiments - Biological Insecticide Control of Leaf Miners (*Tuta absoluta*) on Tomato (*Solanum lycopersicum*)



Trial location: Greenhouse, Germany
Pesticide: Neem Azal (1% Azadirachtin A)
Replications: 4
Water volume: 1000 L/ha
Application: hand gun (Backsprayer).



No phytotox on tomato

Efficacy of reduced rate of Neem Azal insecticide was improved by addition of **BREAK THRU®** adjuvants.

Summary

Our portfolio of **biocompatible BREAK THRU®** additives helps our customers to **formulate biopesticides with better and consistent performance by enhancing in liquid or solid formulations**

Shelf-life of microbials

Stabilization:

- Physically stable **solid and liquid formulations**

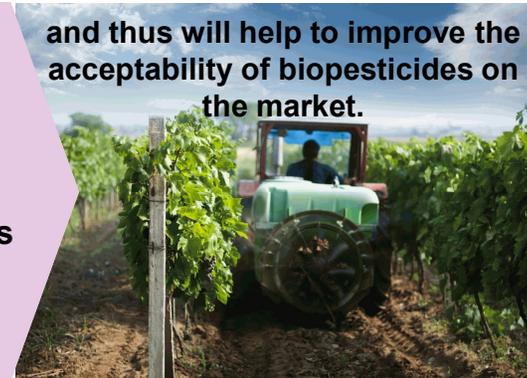
Targeted Delivery:

- **Reduced amount of droplets prone to drift** of foliar applied products
- **Improved adhesion, retention and deposition of spray solutions**
- **Homogenous spreading of actives in the soil. No leaching into deeper soil zones.**

Protection:

- **Humectant properties**
- **Improved rain fastness**

and thus will help to improve the acceptability of biopesticides on the market.



Thank you very much For Your Attention!

Sustainable surfactants for biological pesticides

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