

BREAK-THRU® Products

Seed Treatment Applications





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Seed treatment describes the application of biological or chemical compounds to seeds to provide protection during germination, field emergence and early growth. In addition, seed treatment can improve the resistance of seeds against pests and unfavorable growing conditions. In contrast to crop protection methods applied to the field, seed treatment precisely provides each individual seed with the necessary protection for a successful start into the crop cycle. Precise application of chemical and biological actives by seed treatment reduces the overall amount of crop protection products needed, yielding economic and ecological benefits to the farmer as well as addressing regulatory needs to reduce the use of pesticides

Common seed-applied chemical and biological agents are fungicides, insecticides, plant

growth regulators, biostimulants and fertilizers, which offer protection against soil-borne pathogens, seed-borne insects, diseases, pests and abiotic stress. Flowable concentrates (FS) are the most popular type of seed treatment formulations. A FS-formulation is a modified suspension concentrate (SC) formulation for seed treatment which contains additional pigment and a binder. These formulations are applied via film coating, but also via encrusting and pelletizing processes. Additional special formulation types for seed treatment include capsule suspensions (CF) and powder-based formulations.

Treated seeds have to pass various quality criteria. Visual examination of the treated seeds focuses on appearance, uniformity and coverage of the seeds; a high seed coverage is a prerequisite for high biological efficacy. Low dust-off values are critical to achieve compliance with regulatory and environmental limits. High flowability and plantability are meaningful indicators for efficient precision planting on the field. The key to achieving high seed treatment quality, safe and easy-to-handle sowing, successful germination, and field emergence, is a well-developed formulation containing the right performance additives for the required task.

BREAK-THRU® S 301 and SP 133 improve seed coating performance

Evonik's BREAK-THRU® additives are well known innovative solutions

in the crop protection industry, but they can also play a critical role in the improvement of seed treatment formulations. By using BREAK-THRU® additives S 301 or SP 133 in commercial seed treatment formulations, the performance of the coating process and, thereby, the quality of the seed coating, can be significantly enhanced. Both additives are compatible with commercial FS-formulations containing chemical as well as biological actives.

The OMRI-listed, biodegradable superspreader BREAK-THRU® S 301 offers an important reduction of surface tension of formulations after dilution in water which leads to a highly homogenous seed coating. Independent of the seed variety, a significant decrease of the dust-off value and an improvement in flowability can be achieved by applying BREAK-THRU® S 301 (Figures 1,2). Formulation stability and seed germination remain unaffected by the additive making it a highly convenient solution to improve the coating process with chemical and biological actives.

OMRI- and FIBL-listed BREAK-THRU® SP 133 represents a fully bio-based alternative to BREAK-THRU® S 301 and offers similar performance benefits and excellent handling properties. The use of these additives within the application of a commercial FS-formulations leads to significantly lower dust-off values, improved flowability and plantability of the treated seeds while maintaining seed germination and formulation stability (Figures 1,2).

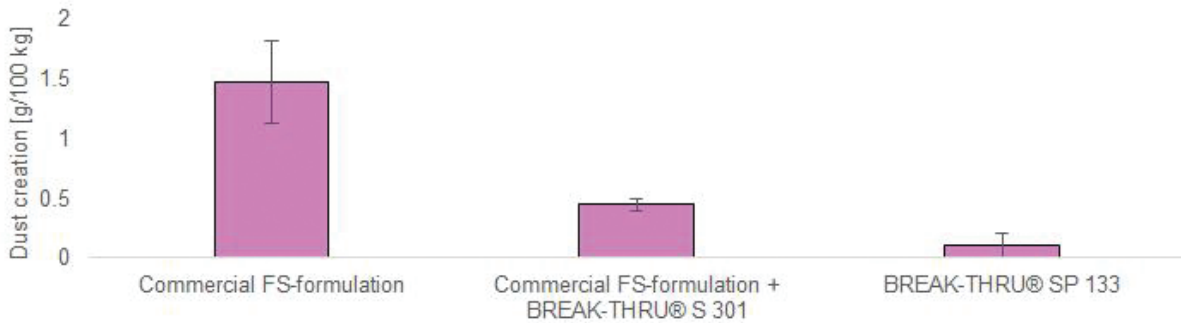


Figure 1: BREAK-THRU® S 301 and SP 133 as additives for FS-formulations. Dust-off values for wheat after coating. Treat rate 200 mL / 100 kg seeds for commercial FS-formulation, 20 mL / 100 kg seeds for BREAK-THRU® S 301 and SP 133.

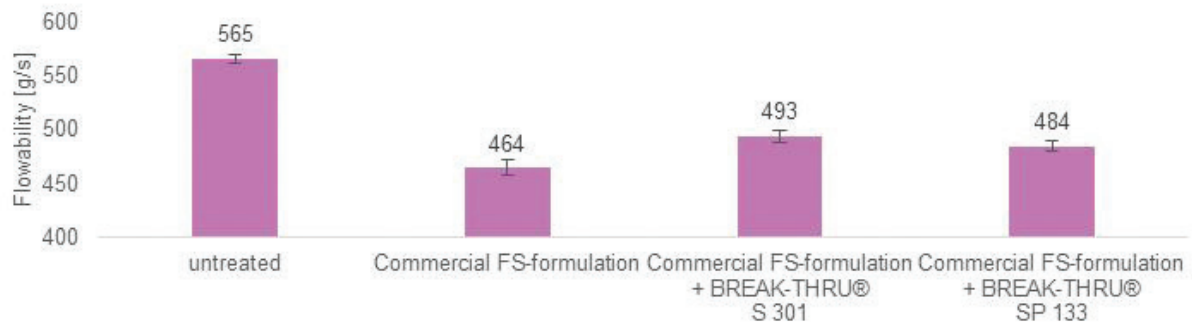


Figure 2: BREAK-THRU® S 301 and SP 133 as additives for FS-formulations. Flowability values for wheat after coating. Treat rate 200 mL / 100 kg seeds for commercial FS-formulation, 20 mL / 100 kg seeds for BREAK-THRU® S 301 and SP 133.

BREAK-THRU® BP 787 enhances shelf life of microorganisms

Based on the growing public and regulatory demand to minimize the use of chemical pesticides as well as the increased resistance of pests against broadly applied chemical pesticides, the use of microorganisms as biological alternatives becomes more and more important. In addition to its effectiveness against various pests, microorganisms can act as biostimulants by facilitating the access and uptake of soil-bound fertilizers, increasing the resistance against environmental stress, and supporting the plant in various growing stages. However, the

sensitivity of microorganisms against performance additives and water represents a major hurdle for industry-wide application.

In order to overcome this hurdle, Evonik developed BREAK-THRU® BP 787 as an innovative carrier fluid specifically designed for the application of microorganisms in seed treatment and foliar applications. BREAK-THRU® BP 787 is a highly sustainable solution thanks to its biodegradability, absence of microplastics, and lack of toxicity. Additionally, BREAK-THRU® BP 787 offers convenient handling, and full miscibility with Evonik's BREAK-THRU® additive portfolio, rheology modifiers (e.g.

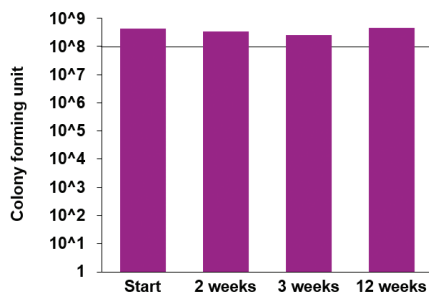
Aerosil®, Sipernat®) and other commercial water-based products.

Using BREAK-THRU® BP 787 as a carrier fluid in seed treatment formulations has multiple benefits. Developing FS-formulations for microorganisms (e.g. *Trichoderma harzianum*, *Clonostachys rosea*, *Beauveria bassiana*) using BREAK-THRU® BP 787 as a carrier fluid in combination with the dispersing agent BREAK-THRU® DA 646 and the superspreader BREAK-THRU® S 301 significantly enhances the microbial shelf life in the formulation as well as after application to the seed (Table 1, **Figure 3**).

Table 1
BREAK-THRU® BP787-based guideline formulation for *Trichoderma harzianum*.

Trichoderma harzianum spores (25% on silica)	20%
BREAK-THRU® DA 646	5%
BREAK-THRU® S 301	3%
Pigment	2%
BREAK-THRU® BP 787	70%

Survival of *Trichoderma harzianum* in the guideline formulation @RT



Survival of *Trichoderma harzianum* on the coated wheat seeds

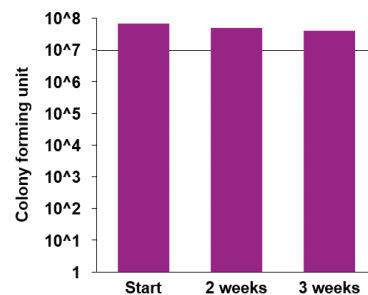


Figure 3: Survival of *Trichoderma harzianum* in a BREAK-THRU® BP 787-based guideline formulation. A) Formulation. B) After seed coating on wheat, treat rate 100 mL / 100 kg seeds.

The developed guideline formulation based on BREAK-THRU® BP 787 as a carrier fluid allowed for superior seed treatment performance in wheat and corn compared to the commercial benchmark. In corn, seed flowability was increased by 8% while dust-off values were reduced by 95% simultaneously (**Figure 4**). Furthermore, earlier germination, higher uniformity as well as a reduced disease severity of *Pythium* compared to the commercial benchmark was observed in corn demonstrating the capabilities of BREAK-THRU® BP 787 as a carrier fluid for microorganisms in seed treatment (**Figure 5**). A detailed account about the use of BREAK-THRU® BP 787 as multifunctional carrier enabling liquid formulation of microbes has been published in the Formulation & Adjuvant Technology special issue in AgroPages (<https://news.agropages.com/News/NewsDetail---42381.htm>).

Seed Treatment Applications

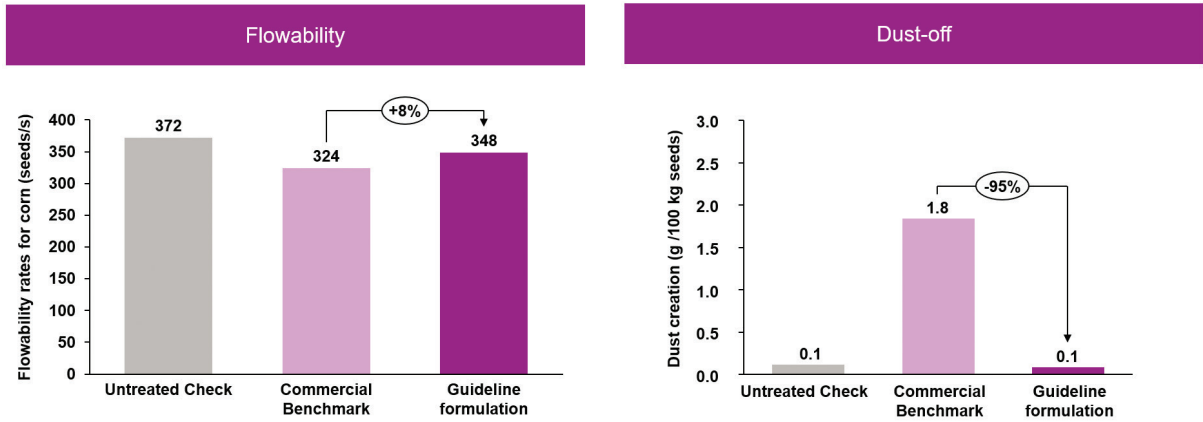


Figure 4: Improved flowability in corn for BREAK-THRU® BP 787-based Trichoderma harzianum guideline formulation. Treat rate 100 mL / 100 kg seeds.

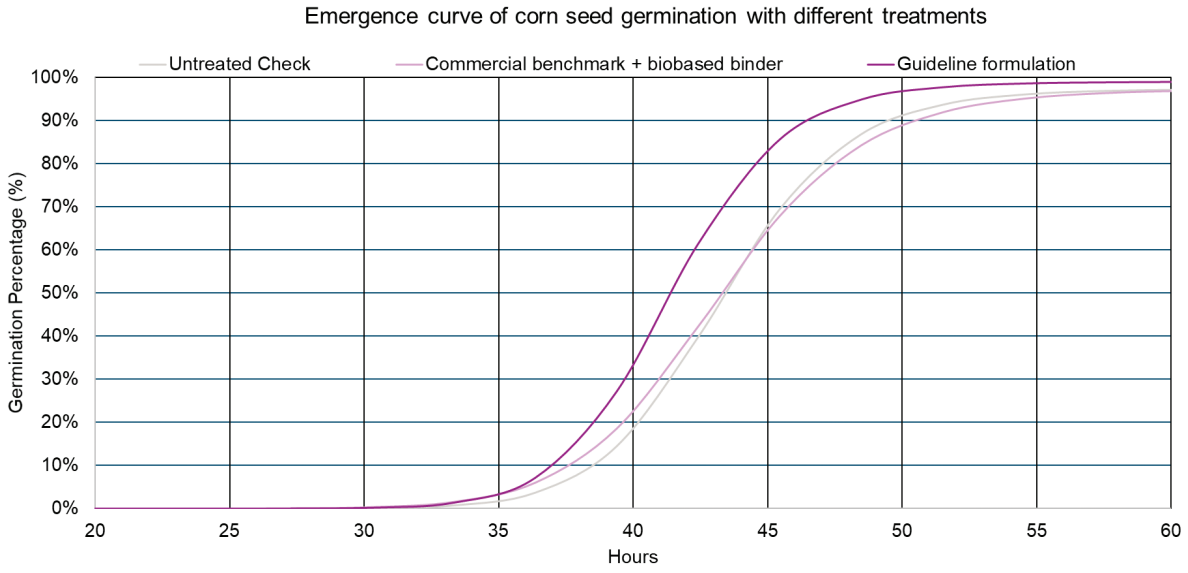


Figure 5: Improved germination in corn for BREAK-THRU® BP 787-based Trichoderma harzianum guideline formulation. Treat rate 100 mL / 100 kg seeds.

BREAK-THRU® BP 787 as a readily biodegradable, microplastic-free binder for conventional formulations

In addition to the growing public and regulatory demand to minimize the use of chemical pesticides, the elimination of microplastics in crop protection products is a major point of attention within the agriculture industry. BREAK-THRU® BP 787 is

a readily biodegradable, microplastic-free alternative to classical binder solutions for seed treatment application. Due to its miscibility with water, BREAK-THRU® BP 787 acts, in combination with silica (e.g. Aerosil® 200), as a binding component. A guideline formulation containing the fungicides fludioxonil, difenoconazole and tebuconazole in combination with BREAK-THRU® BP 787 and Aerosil® 200 allowed

for excellent seed treatment of wheat (**Figure 5**). A detailed account about the use of BREAK-THRU® BP 787 as multifunctional carrier enabling liquid formulation of microbes has been published in the Formulation & Adjuvant Technology special issue in AgroPages (<https://news.agropages.com/News/NewsDetail---42381.htm>).

Table 2

BREAK-THRU® BP 787 as a binder component in microplastic-free guideline formulation containing fludioxonil, difenoconazole and tebuconazole.

Fludioxonil	2.4%
Difenoconazole	1.9%
Tebuconazole	0.5%
BREAK-THRU® DA 646	3%
BREAK-THRU® S 301	7%
Propylene glycol	2.5%
Xanthan gum	0.3%
Pigment	4%
BREAK-THRU® BP 787	10%
Aerosil® 200	2.5%
Water to	61.9%

Flowability was increased by 9%, dry friability reduced by 33%, and no measurable dust-off detected demonstrating a clear advantage compared to the commercial benchmark (**Figure 6**). Furthermore, a faster germination and improved disease control versus Fusarium as well as Ustilago was observed for the guideline formulation containing BREAK-THRU® BP 787 and Aerosil® 200 which is in line with the results obtained for BREAK-THRU® BP 787 as carrier fluid for microorganisms (**Figure 7**).

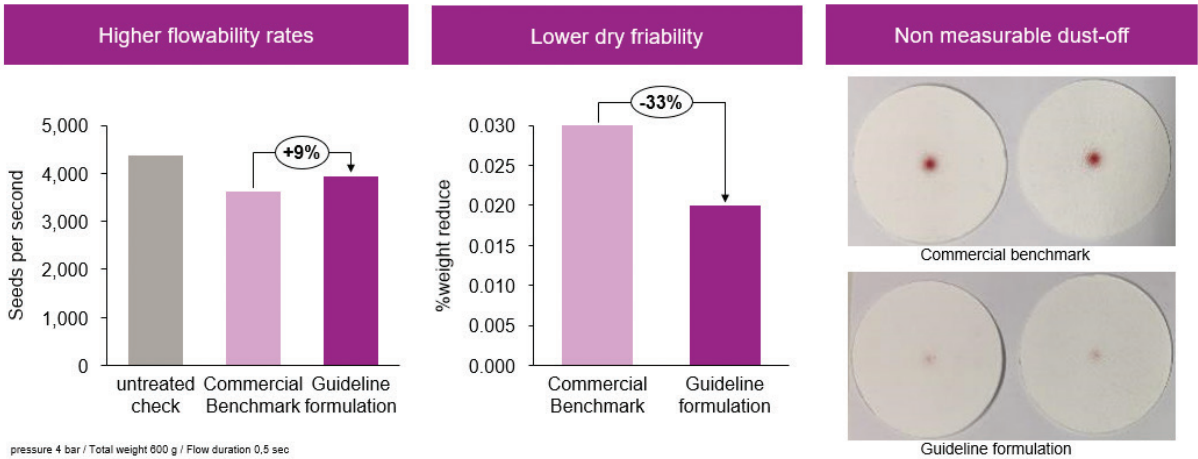


Figure 6: BREAK-THRU® BP 787 as a microplastic-free binding component. Improved seed treatment parameters for wheat. Treat rate 200 mL / 100 kg seeds.

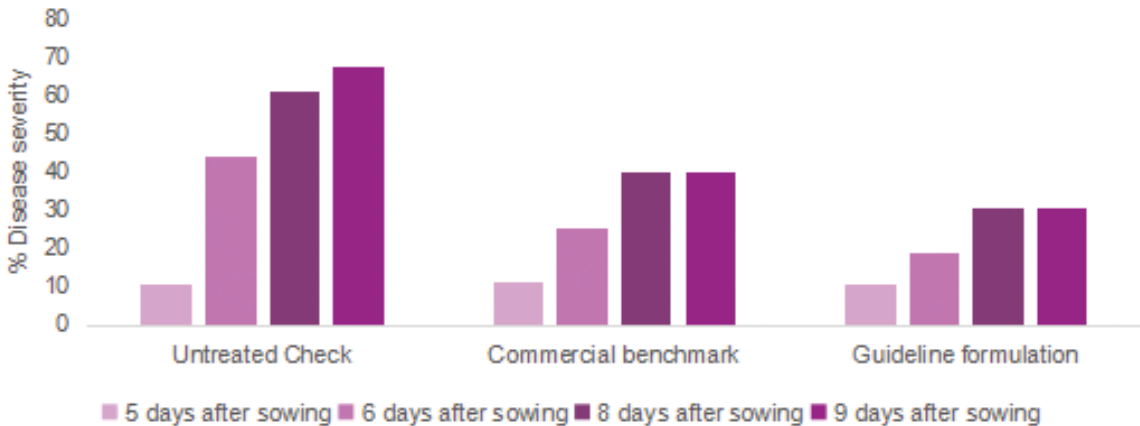


Figure 7: BREAK-THRU® BP 787 as a microplastic-free binding component. Improved disease control against Fusarium in wheat. Treat rate 200 mL / 100 kg seeds.

Evonik’s BREAK-THRU® products can provide sustainable solutions to challenges in seed treatment. The biocompatible BREAK-THRU® S 301 and BREAK-THRU® SP 133 improve the performance of existing chemical and also microbial based seed treatment products. The innovative multifunctional carrier fluid BREAK-THRU® BP 787 provides enhanced shelf life of microbial products in seed treatment formulations and once applied on the seed. In addition together with silica it provides binder properties with excellent dust-off values. Taken together BREAK-THRU® products will expand the use of biological actives in seed treatment and offer sustainable binder solutions.

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