

DATA SHEET

***Bacillus subtilis* FZB24® WG**

a plant growth-promoting rhizobacteria and biocontrol agent

1. Introduction

FZB24® WG is a natural product containing *Bacillus subtilis*-spores, a non-pathogen microorganism occurring naturally everywhere in the soil.

Several strains of *Bacillus subtilis* are clearly defined as natural and not genetically modified strains of *Bacillus subtilis*, which are selected out of different strains because of its broad spectrum of activity and used as plant growth-promoting rhizobacteria and biological control agent for the control of various soilborne diseases.

The formulation **FZB24® WG** is a water dispersible granular (WG) containing living spores with $\geq 5 \times 10^{10}$ cfu/g (culture forming units per gram). The carrier of the formulation is corn starch with about 80 % of weight.

Following effects could be observed:

1. improved germination
2. improved rooting of plants
3. improved yields, height or blowing
4. earlier yield or blowing
5. higher vitality of plants
6. reduced disease intensity and frequency
7. delay on-set of disease

2. Physical Properties

The formulation is stable for more than two years at 20°C or one year at 0° - 50°C respectively. Please keep dry on storage.

In combination with chemical substances the stability is not proved and no guarantee is given.

Various combinations with fertiliser and fungicides showed additional effects indeed.

3. Toxicology

Different biological studies on various *Bacillus subtilis*-strains used as biocontrol agent including acute studies and aqua toxicology studies showed no harmful effects (studies on FZB24 and other strains are available).

Neither phytotoxic nor phytopathogenic effects were observed in greenhouse and field trials in Germany.

4. Biological Activity

Bacillus subtilis is a biological control agent active against a wide range of soil pathogens (fungal and bacterial), tested *in vitro*:

- *Alternaria sp.*
- *Botrytis cinerea*
- *Curvularia radicola*
- *C. inequalis*
- *Fusarium avenaceum*
- *F. culmorum*
- *F. oxysporum f.sp.callistepi*
- *F. oxysporum f.sp.cucumerinum*
- *F. oxysporum f.sp.dianthi*
- *F. oxysporum f.sp.gerberae*
- *F. oxysporum f.sp.gladioli*
- *F. oxysporum f.sp.lycopersici*
- *F. oxysporum f.sp.narcissi*
- *F. oxysporum f.sp.tulipae*
- *Gaeumannomyces graminis*
- *Gerlachia niveale*
- *Phoma chrysanthemi*
- *Phomopsis sclerotioides*
- *Phytophthora cryptogea*
- *Pyrenochaeta lycopersici*
- *Pythium ultimum*
- *Rhizoctonia solani*
- *Sclerotinia sclerotiorum*
- *Stromatinia freesia*
- *Verticillium albo-atrum*
- *Corynebacterium michiganense*
- *Erwinia carotovora*

but not against: *Pseudomonas fluorescens*, *P. putida*

In soils with high moisture or a high humus content or high microbial activity the efficacy of *Bacillus subtilis* can be reduced.

5. Application

The formulation of *Bacillus subtilis* is based on corn starch.

The carrier is fully dispersible, but as a first step for preparation of solution for use (drench, spray or for hydroponics) it is recommended to put the rates of granule to a small amount of water. It has to be good stirred.

Then put it into the rest of water to the recommended concentration of the solution.

If the solution is ready for use it should be applied immediately within 2 hours or it must be stirred.

6. Safety Precautions

Wash hands and exposed skin before eating, drinking or smoking and after work.
Wear respiratory protection when handling powders or very volatile materials or spray overhead.

Keep it far from food and children.

For details on handling the product please follow the attached Safety Information Sheet.

7. Disclaimer

The uses as described have not necessarily been approved by any regulatory authority.

This Technical Data Sheet in no way constitutes a recommendation to apply *Bacillus subtilis* for unregistered uses.

Direction for Use

Bacillus subtilis FZB24[®] WG

active ingredient: *Bacillus subtilis* strain FZB24
content: $\geq 5 \times 10^{10}$ cfu/g (colony forming units per gram)
carrier: corn starch, fully dispersible

1. Introduction

FZB24[®] WG containing *Bacillus subtilis* FZB24-spores, a non-pathogen micro-organism occurring naturally everywhere in the soil.

The strain *Bacillus subtilis* FZB24 is clearly defined natural and not genetically modified strain of *Bacillus subtilis*, which is selected out of different strains because of its broad spectrum of activity and used as plant growth-promoting rhizobacteria and biological control agent for control of various soilborne diseases.

The formulation as granular containing living spores with $\geq 5 \times 10^{10}$ cfu/g (culture forming units per gram). The carrier for formulation is corn starch with about 90 % of weight.

2. Mode of action

Granules contain living spores of *Bacillus subtilis* FZB24, which germinate in contact with growing plant roots which will be colonised if soil moisture is enough and temperature about 15 °C and more.

The specific mode of action is not yet clear.

Substances produced by *Bacillus subtilis* FZB24 stimulate the growth of plants, increase yield and induce plant resistance against stress and pathogens. In soil no direct activity of these substances against pathogens (fungal and bacterial) could be indicated.

FZB24[®] WG (*Bacillus subtilis* FZB24) has a **preventive**, but not a curative activity.

The use of **FZB24[®] WG** is more effective after soil disinfection or when the infection risk is low.

3. Application:

ORNAMENTALS, VEGETABLES, OTHER CROPS - drench application

IN SEEDBEDS OR CUTTINGS

0,01 % (1 g / 10 litre water)

drench or spray suspension with maximal 1 l/m² before or just after sowing, planting or other plant setting forms on moist soil.

IN ESTABLISHED CULTURES

0,02 % (2 g / 10 litre water) drench or spray suspension with maximal 2 l/m² before or just after sowing, planting or other plant setting forms on moist soil.

It is recommended to have a first application on seedling production with a small amount of solution.

Depending on crop repeated applications (after 2-4 weeks) can be useful (max. 2x)

SEED TREATMENT

1 - 2 g per kg seed

- dip seed into a small amount of solution for 15 - 30 min
- spray solution on seed and then retry it

TREATMENT IN HYDROPONICS

0,01 % (0,1 g / litre water)

drench young plants (rockwool cubes) with 0,1 - 0,5 l suspension.

It is recommended to have a first application on seedling production with a small amount of solution.

or 0,01 % (100 g / 1000 litre nutrient solution)
add the pre suspended granular to the fertilizer suspension about 7 days before planting and 1 to 14 days after planting.

Depending on crop repeated applications (after 4 - 6 weeks) can be useful (max. 2x)

POTATOES

Against *Rhizoctonia solani* and *Streptomyces scabies*

- Dip-treatment before planting:** **0,1 % (1 g/l water)**
approximately 14 days before planting seed potatoes (stimulated for germination) will **dip** into a solution for about 20 - 30 minutes, dry the tubers on air before planting
- or**
- Spray-treatment before planting** **100g per 3-5 l water per ton tubers**
spray the tubers with a solution while out-of store on conveyor belt.
- or**
- Spray-treatment during planting** **250 g per 80 l water per ha (10.000 m²)**
tubers (stimulated for germination) should be sprayed during planting as a row-spray or in furrow-spray.
It is important, that the surface of the seed tubers is wetted 100 percent with solution.

4. Instruction for the preparation of the ready for use solution

The carrier is fully dispersible, but as a first step for preparation of solution for use (drench, spray or for hydroponics) it is necessary to put the recommended rates of granule to a small amount of water and it must be well stirred.
Then put it into the rest of water to the recommended concentration of the solution.

If the solution is ready for use it should be applied immediately within 2 hours or it must be stirred.