



Specialist information for soy producers and processors



Control soon after germination. First nodules are visible a few weeks after field emergence.

## Inoculants for soy: Market overview

Soybeans can supply themselves with atmospheric nitrogen in symbiosis with root bacteria (rhizobia). However, the bacterium specialised in soy, *Bradyrhizobium japonicum*, is not yet widespread in our soils. Hence, the use of a high-quality inoculant is a key to the successful soybean cultivation - even if the crop has already been cultivated several times. This is especially true when the protein content is crucial, e.g. for soy intended for human consumption. Experiments have shown time and again that, in addition to the correct application, the choice of the inoculant has a major influence on yield and protein content.

The decision to carry out this market survey was taken after a Taifun contract farmer had produced a lot of soy that could not be used for tofu production but only as animal feed. "A quarter less yield and 20 percent less quality" was his sobering conclusion - a bitter loss on 25 hectares of cultivated land. The reason was the use of a low-quality inoculant. A part of the area had been treated with a proven quality inoculant, and here everything was perfectly fine.



Soy can form huge nodules - if rhizobia have survived to germination.



As the soybean area has grown, the number of available inoculants has also risen rapidly. While some products differ only in name and supplier, others are fundamentally different. To keep you informed, we provide an overview.



There is no shortage of choice - but which inoculants are the best?

## Quality parameters - what is important?



Even small differences in quality are already apparent at flowering on the colour of the plants (middle row)

### Ready or fresh?

In many cases, soy seeds are offered preinoculated ex-factory. From the moment the rhizobia are exposed to the environment by opening the sterile packaging, their number starts to decrease. Therefore, the months between inoculation and sowing are to be compensated by the application of a strongly increased number of rhizobia and a protective polymer. Unfortunately, however, tests and practice have shown that the

ready-to-use pre-inoculation cannot be relied upon. The risk of damaged rhizobia by too warm storage or other influences is too high. Currently, it is generally recommended that pre-inoculated seeds should also be inoculated with fresh rhizobia before sowing.



Ready-to-use inoculation saves work at sowing - but unfortunately too often at the expense of quality

### Peat or liquid?

For years peat was considered the optimal carrier for rhizobia. Peat-based inoculants were particularly safe, long-lasting and effective. In the meantime, however, liquid inoculants have been developed, which in some cases are even superior to the old peat-based inoculants in terms of their effectiveness - and are easier to handle. A disadvantage of the liquid inoculants is the transparency of the agents: it is not easy to see whether all seeds have been inoculated. As soon as the agent has dried, it is practically impossible to tell whether the seeds have already been inoculated. This makes an optimal inoculation technique (spray gun!) and of course the proper labelling of the treated packages all the more important.



Peat colours the seeds black, liquid agents are colourless.



## Adhesives and additives

The use of polymers has already proven successful for peat-based inoculants. The adhesive is mixed in right before inoculation to ensure a good adhesion of the peat to the seed. This is particularly important when pneumatic sowing technology is used, where otherwise the peat can be "sucked" off the seed. Additionally, tests have repeatedly confirmed that the adhesive ensures a certain protection of the rhizobia. By adding an adhesive, inoculation can be carried out 2 days before sowing. For pure peat, a maximum of 24 hours is recommended. Even if the weather is bad after sowing, the glue offers a certain protection until the rhizobia are nourished by the seedling. The modern liquid inoculants come with a mixture of additives. These are also polymers which should protect the bacteria. Often trace elements etc. are added. A new liquid inoculant contains *Trichoderma*, which should have a positive influence on the entire root environment and thus also on the formation of nodules. However, the effect could not yet be confirmed in trials.



Clumping when using peat with a lot of glue: First let it dry, then fill the seed tank!

## Rhizobia strain

There has also been some advancements in the choice of rhizobia strains. While the French G49-strain was common for a long time, different new strains from the Embrapa (Brazil), from the USDA (USA) and also from Canadian and South African institutes are currently being used. In addition, some manufacturers have now combined several strains in one product. The new strains and the combination could explain the success of some of the new products in addition to the new liquid formula. Even in China, where *Bradyrhizobium japonicum* is abundant in the soil and traditionally no inoculation takes place, inoculants are on the rise as modern strains promise higher performance.

## Rhizobia density and quality

The rhizobia density is a central quality feature of inoculants. How many rhizobia per gram are present ex works, how many survive until delivery, and what number are actually found on the seed when it is placed in the soil? Manufacturers' figures are usually between one and three billion rhizobia per gram of inoculant ( $1 \times 10^9$  or  $3 \times 10^9$ ). The number of bacteria is generally decreasing continuously. The higher the initial number, the better the chance that sufficient bacteria will survive until the seed germinates, even under unfavourable conditions. Nevertheless, a product with a lower density can be superior if the quality of rhizobia and the formula is better. There are noticeable differences in the quality of the rhizobia. It is crucial that as many bacteria as possible survive even under unfavourable conditions after sowing until multiplication on the soybean seedling can begin. Accordingly, the manufacturer of Rhizoliq and Turbosoy advertises its products with the processes used for stabilising the rhizobia. Special additives are added to stimulate the formation of thicker cell walls.



Which bacteria have multiplied how much? Laboratory tests are the basis for safe inoculants. Picture source: LegTech

## Value for money

In principle, price is not the most important criterion for inoculants; the decisive factor is quality. The price per hectare, even for the most expensive products, is many times lower than the reduced yield after poor inoculation. But often the most expensive are not the best. Accordingly, it is worthwhile to make a comparison here as well. In Germany the price per 100 kg of seed is usually about 25€.

The defective inoculant mentioned at the beginning was bought much cheaper in Italy. Yet, importing it was not worthwhile. In the large soybean growing regions, however, high-quality inoculants are also traded at considerably lower prices.

## What products are available on the market?



Care pays off: In the choice of the inoculants as well as in the application of the product.

### **Biodoz** (no longer available)

Biodoz is a classic among peat inoculants. It comes in a 400 g bag for 100 kg of seed. The rhizobia are from the G49 strain. In trials Biodoz always ranks in the upper range. The product is produced by Novozymes/Monsanto, the European distribution has been done by De Sangosse.

### **HiStick**

HiStick corresponds to a large extent to Biodoz in its formula and also in its quality according to exact trials. Since a few years, a Canadian rhizobia strain is used instead of G49. The original manufacturer Becker Underwood has been bought by BASF.

### **LegumeFix and LiquiFix**

After researching for the first edition of this market survey, the author looked for an inexpensive, reliable alternative to the expensive established products. The products of the English specialist Legume Tech have so far been used on large areas of land, especially in Kanada and the Ukraine. The rhizobia strains are the same as those used for Rhizoliq. In addition to their good efficacy, the products convince thanks to the large packaging units and the short supply chain at a considerably lower price. LegumeFix is a classic peat agent like HiStick or Biodoz, LiquiFix is a liquid inoculant.

After some tests, the inoculants can be ordered online from the company Gartensoja since 2017.

### **Force 48**

Force 48 is a combination of HiStick and an adhesive. Each package of 400 g of peat comes with 800 ml of polymer. According to the manufacturer, the protective effect of the glue allows inoculation as early as 48 hours before sowing, as opposed to the recommended 24 hours for pure peat. Force 48 has been used successfully for years.



Glue and peat can be mixed easily with the kitchen mixer.

### **Rhizoliq Top S**

Rhizoliq Top S is a breakthrough in liquid inoculants for soybeans. Thanks to intensive research, the Argentinean manufacturer Rhizobacter has succeeded in producing a safe and very efficient agent. In addition to the optimised formula, two current Embrapa strains, SEMIA 5079 and SEMIA 5080, are used. Rhizoliq has repeatedly produced the highest quality and yields in German trials - even when inoculated 10 days before sowing. The product comes as two liquid components, which are poured together before inoculation. After De Sangosse has stopped distribution in Europe, it has been distributed by Arysta LifeScience Germany (meanwhile upl-ltd.) from autumn 2018. The inoculant is therefore still available from the well-known distributors who have distributed the inoculant so far.

### **Turbosoy**

Turbosoy is also produced by the Argentinean company Rhizobacter but is distributed by Saatbau Linz. Obviously Rhizobacter supplies two distributors in Europe at the same time. According to the manufacturer, the two products are very similar. In general they should have the same effect. There is a small difference in the way the bacteria are prepared. Also, Saatbau Linz sells the product in a double pack for a total of 200 kg seed.

### Rootwin Plus-S

Another new product, this time from South Africa. Under the name Eco-Rhiz or Rhizeup-Soy the product showed good to very good test results. For the market launch the name was changed to Rootwin Plus S. The product is supplied as a granulate in small units for 50 kg seed. The promised additional effect of the Trichoderma by the Swiss distributor "Andermatt Biocontrol" could not be confirmed so far.

### Radycin

After this product repeatedly failed to meet expectations in tests and in practice, the German manufacturer Jost temporarily stopped production. Still not working.

### Rhizofix

A new development of Freudenberger Saaten on the basis of milk powder. On several farms and also in exact trials, test results at the market launch were unsatisfactory. The manufacturer attributes this to technical start-up difficulties; it remains to be seen whether the product will be improved.

### Soilbac (no longer available)

Brand new on the market, this product is distributed by Agrel GmbH. The liquid inoculant is mixed with 100 litres of water and sprayed onto the soil immediately before sowing and worked in horizontally. Spraying requires an extra step and is likely to be a time-consuming and costly process. Rhizobia are sensitive to UV light. Especially in sunshine there is a risk that they will be damaged. Since official tests showed unsatisfactory results distribution has meanwhile been stopped.

### MASTERfix L Premier

The liquid inoculum from the Brazilian manufacturer Stoller comes in a 1.5 l package for about 2.5 ha. The inoculation can be carried out up to seven days before sowing.

## Conclusion

There are several carefully tested and proven inoculants for soybeans available on the market. Recently there has been further progress in product quality, which can have a significant impact on protein content and yield. A number of new products are currently entering the market, but many of them are not yet tested. For a long time soy inoculants were considerably more expensive in Germany than overseas. In the meantime, however, good, inexpensive agents are also available.

The basis for biological N-fixation is a healthy soil. Rhizobia need air and a healthy environment. Agricultural mistakes cannot be corrected even by the best microbes.

## Links

The choice of the inoculant is central to the success of soybean cultivation - but even the best inoculant is of no use if mistakes are made in its use. We have therefore summarised all important details in pictures and text for the professional application of inoculants:

[https://www.sojafoerderring.de/wp-content/uploads/2020/11/Sojainfo-46-seed-inoculation\\_EN.pdf](https://www.sojafoerderring.de/wp-content/uploads/2020/11/Sojainfo-46-seed-inoculation_EN.pdf)

<https://www.sojafoerderring.de/anbauratgeber/ausaat/vide-impfung-von-sojasaatgut/>

For comprehensive information on all aspects of soy cultivation visit:

[www.sojafoerderring.de](http://www.sojafoerderring.de)

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Author: Fabian von Beesten  
Editorial assistance: Martin Miersch  
Translation: Stefan Paul  
Publisher: Taifun-Tofu GmbH  
Bebelstraße 8 | 79108 Freiburg |  
Tel. 0761 152 10 13  
[soja@taifun-tofu.de](mailto:soja@taifun-tofu.de)



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