



Even the  
best fertilizer  
can be made  
better with  
**Vibelsol<sup>®</sup>**

Stabilize your  
fertilizer business

 **BASF**

We create chemistry



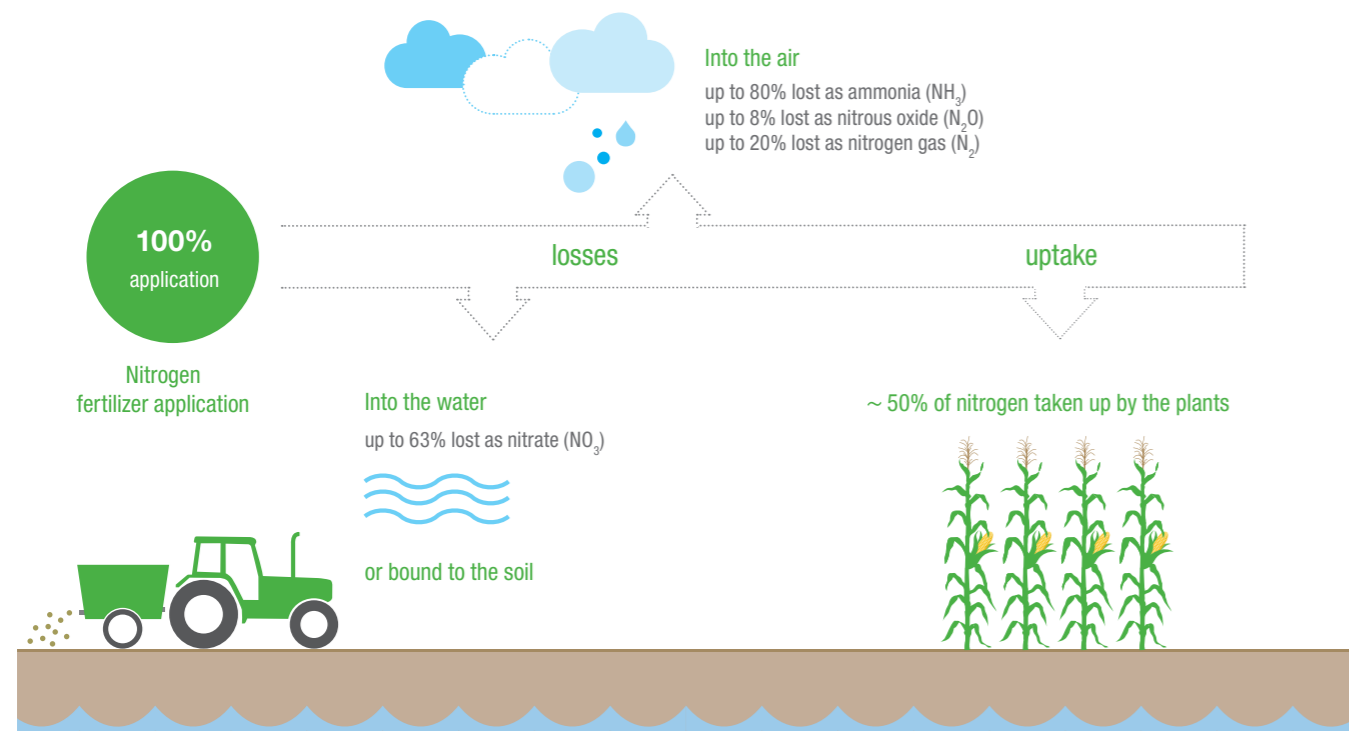
## Minimize the risk of nitrogen loss with Vibelsol®

As a necessary part of proteins, enzymes, vitamins and organic bases, nitrogen is one of the most important plant nutrients, and is considered to be the motor of growth. When the target is maximum crop yield or high crop quality, nitrogen plays a decisive role in farming success. This is why mineral nitrogen fertilizers are among the most important investments farmers can make.

## On average, only 50% of applied nitrogen is absorbed by plants

Despite its positive properties, the use of nitrogen in agriculture can also have a negative impact on the environment.

For instance, nitrogen can contaminate groundwater in the form of dissolved nitrates or be released into the atmosphere as nitrous oxide.



## How Vibelsol® works

Vibelsol® delays the conversion of ammonium via nitrite to nitrate by inhibition of the activity of the enzyme of *Nitrosomonas* bacteria. This inhibition takes place for a certain period of time (4–10 weeks).

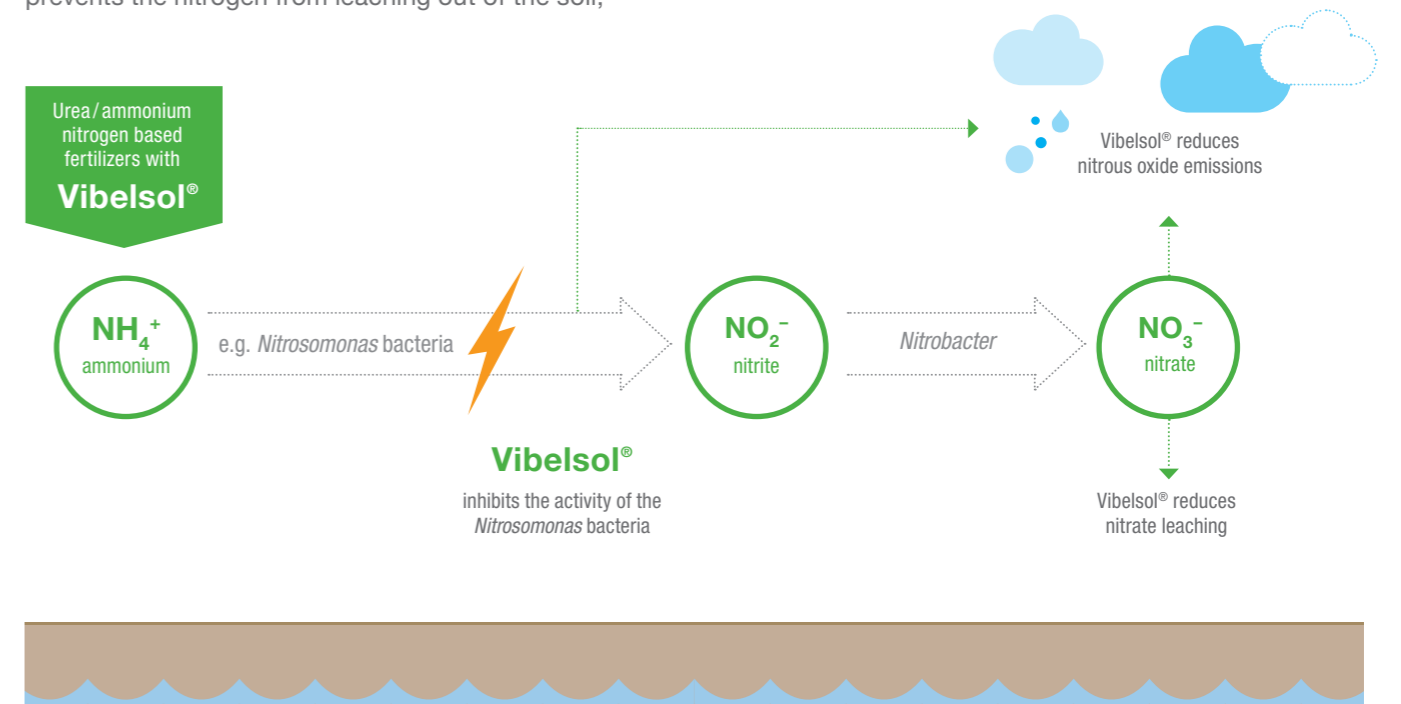
During this period, Vibelsol® protects the nitrogen against losses due to nitrate leaching and nitrous oxide emissions. So more nitrogen is available for the plants. This results in higher yields and better quality of the harvested crops.

Vibelsol® is based on the globally proven and established nitrification inhibitor DMPP (3,4-dimethylpyrazole phosphate). Developed by scientists at BASF, DMPP is one of the most effective nitrification inhibitors of all.

## Stabilization of ammonium nitrogen with the help of Vibelsol®

The addition of Vibelsol® to ammonium nitrogen based fertilizers slows down the conversion rate of ammonium to nitrate considerably. The active ingredient, DMPP, keeps the level of ammonium stable for a longer time by inhibiting the action of the specific bacteria. This prevents the nitrogen from leaching out of the soil,

meaning it is protected and available to plants just when they need it. In addition, heavy rain results in a much higher risk of nitrate leaching, a scenario in which the performance and benefits of Vibelsol® are particularly important.





## Effects of nitrification inhibition with Vibelsol®

Vibelsol® protects the nitrogen against losses due to nitrate leaching and nitrous oxide emissions. More nitrogen is then available to plants. This results in higher yields and better quality of the harvested crops.

## Vibelsol® also means benefits for the environment

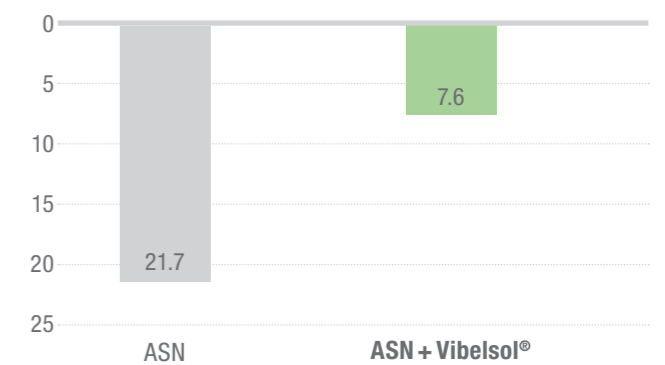
Alongside economic benefits in the form of higher yields, better quality and labor-related advantages, Vibelsol® also delivers numerous benefits to the environment – such as, reduced nitrate leaching and lower greenhouse gas emissions.

### Reduced nitrate leaching

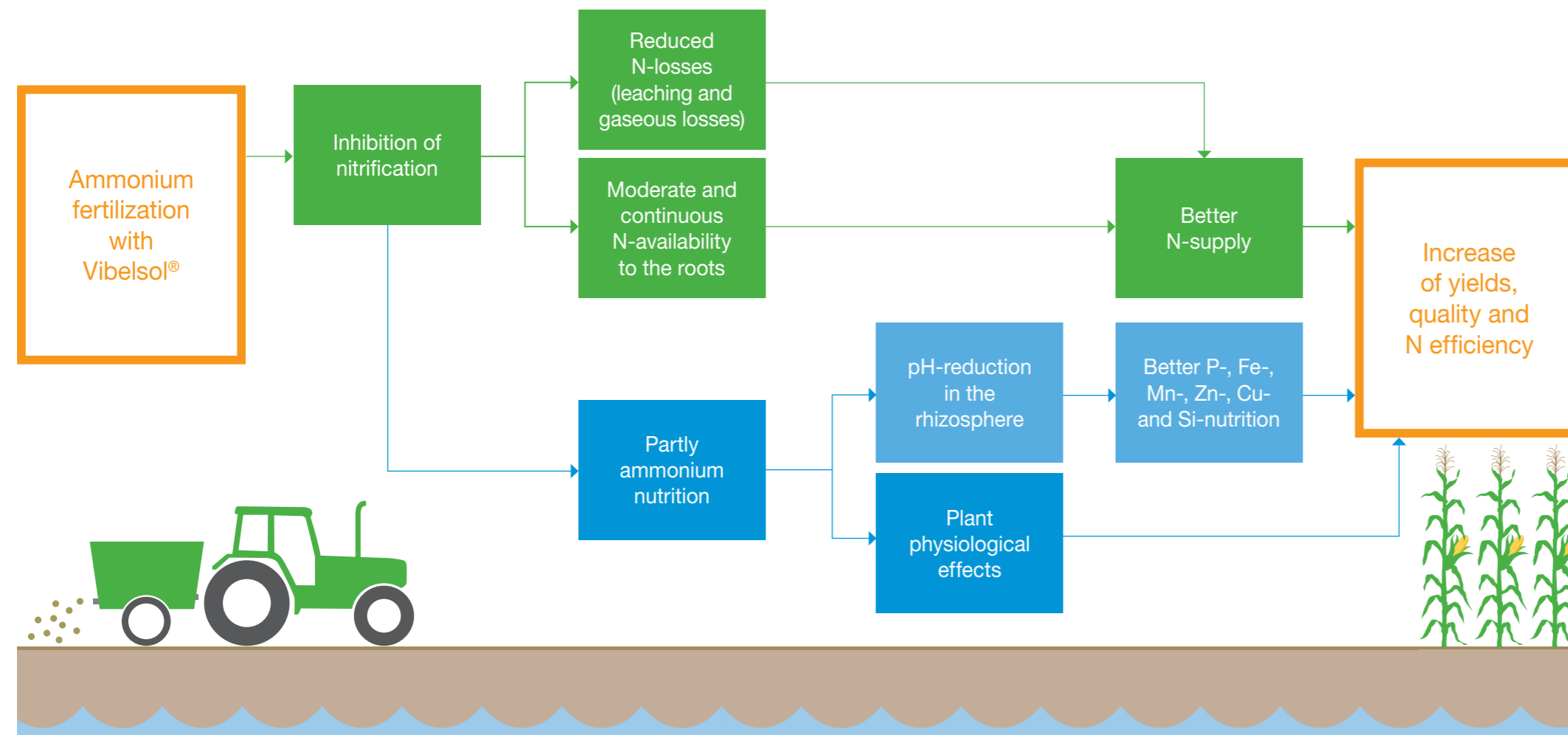
Experiments show that DMPP, the active agent in Vibelsol®, delays the conversion of ammonium into nitrate. This significantly reduces the risk of nitrate leaching.

#### Effect of Vibelsol® on nitrate leaching

NO<sub>3</sub> leaching in % total fertilizer N, 22 days after treatment, 40 mm precipitation



Zerulla *et al.* 2001

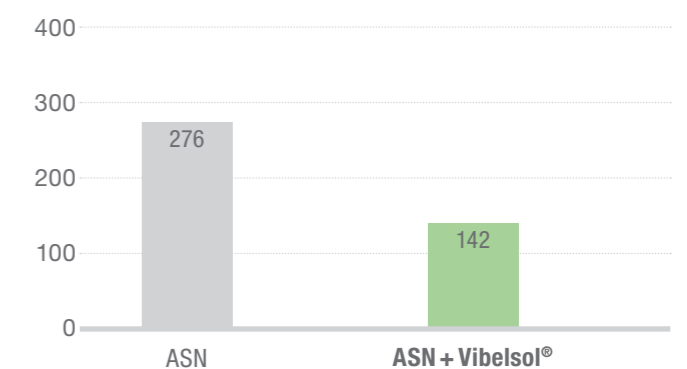


### Reduced nitrous oxide emissions

The addition of Vibelsol® to mineral fertilizers is a very effective way of reducing nitrous oxide emissions. Because of its active agent DMPP, Vibelsol® is one of the world's most effective nitrification inhibitors. On average, it reduces nitrous oxide emissions by 50%.

#### Effect of Vibelsol® on N<sub>2</sub>O emissions

g/ha N<sub>2</sub>O-N



Average of 3 field trials, Weiske *et al.* 2000



## The industry reaps the rewards of Vibelsol®

Due to its ready-to-use formulation, the mineral fertilizer industry can conveniently combine Vibelsol® with a multitude of mineral fertilizers (such as urea and ammonium-based fertilizers like ASN or NPK fertilizers). Vibelsol® offers fertilizer blenders further benefits for manufacturers of mineral fertilizers, suppliers, or fertilizer blenders, as it enables them to differentiate their product portfolio and prepare for future changes in regulatory requirements.

### Vibelsol® in mineral fertilizer

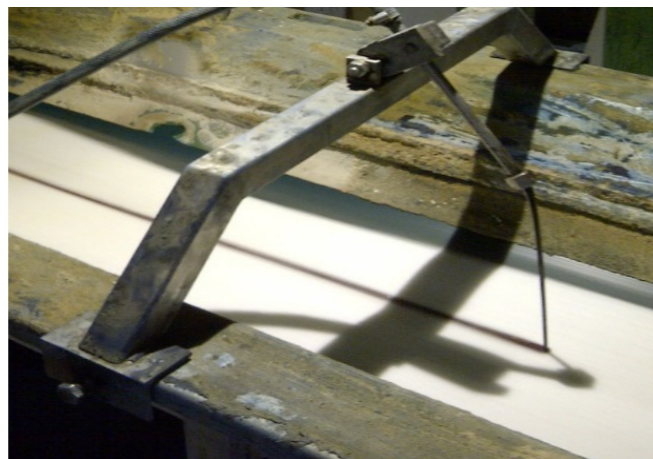
Vibelsol® is the ideal product for all fertilizer mixing plants. The nitrification inhibitor can be added to fertilizers in a number of different ways – either by direct addition in the batch blender or on the conveyor before the fertilizer reaches the batch blender.

Mixing in a batch blender



Picture source: RS-Trading

Addition in a continuous fertilizer blender

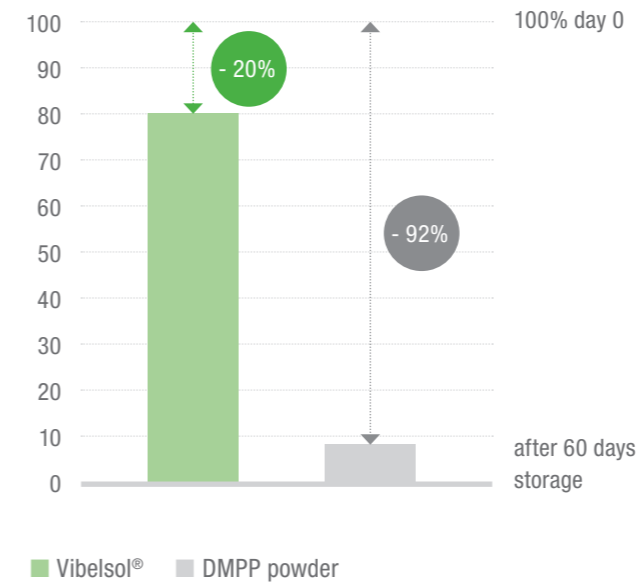


Picture source: Jochen Hübler

### High storage stability of fertilizers treated with Vibelsol®

Thanks to its special ready-to-use formulation, Vibelsol® shows outstanding storage properties in comparison with products in powder form.

Relative DMPP content after 60 days storage at 30 °C



### Future-proof in every respect

International framework agreements such as the Paris Agreement, which regulates greenhouse gases like nitrous oxide and numerous national fertilizer regulations for the protection of groundwater from nitrates are forcing the industry, suppliers, and agriculture to concern themselves to a greater degree with environmentally friendly technologies.

In addition, increasing pressures from politics and society demand a reduction of environmental impact resulting from fertilizer application. In many cases, the consistent use of nitrification inhibitors like Vibelsol® can provide answers to regulatory, political and societal demands.





## Unique expertise in products for nitrogen use efficiency

In agriculture, demands for high profitability are equally as important as current challenges in the environmental sector. As a close partner of the fertilizer industry, suppliers, and the agriculture sector, BASF addresses change and the needs of the industry and sets standards time and time again. Comprehensive, in-depth expertise in application technology guarantees that the special needs of all customers are fulfilled to a high degree.

In many cases, reliance on BASF is reliance on solutions for the future. Examples of this are innovations that ensure maximum nitrogen efficiency like Vizura®, the nitrogen stabilizer for slurry and biogas digestate, and the urease inhibitor Limus®.

With Vibelsol®, the nitrification inhibitor for mineral fertilizers, BASF introduces yet another groundbreaking product to the market that offers real added value for the mineral fertilizer industry, suppliers, and farmers while simultaneously reduces environmental impact.



## BASF services for the mineral fertilizer industry

In contrast to the powdered products offered by competitors, Vibelsol® can be used immediately due to its ready-to-use liquid formulation.

BASF offers even more for the mineral fertilizer industry. For instance, in combination with specific expertise, product support services ensure that fertilizers with Vibelsol® are fully optimized marketable products.

### Application lab for Vibelsol®

The dedicated application lab at the BASF agricultural center develops precisely tailored customer solutions. Compatibility and storage stability tests with customer specific fertilizer samples can be performed to determine the optimum application rate and storage conditions. This means maximum efficiency from the beginning.



### On-site application advice

A team of qualified specialists from BASF advises manufacturers and blenders of mineral fertilizers on how to best integrate the application of Vibelsol in their fertilizer production process. Based on the customer specific process conditions and requirements, the best suitable equipment and point of application can be recommended. The Vibelsol® application lab team can also provide on-site support during a production trial.

### Exploit Vibelsol® as a unique selling proposition

Within the framework of a brand alliance, BASF cooperation partners can have their product packaging labeled with the note “Stabilized with Vibelsol® from BASF” to make the high quality of the fertilizer and its additional benefit visible at a glance.



## Vibelsol® offers added value for farmers

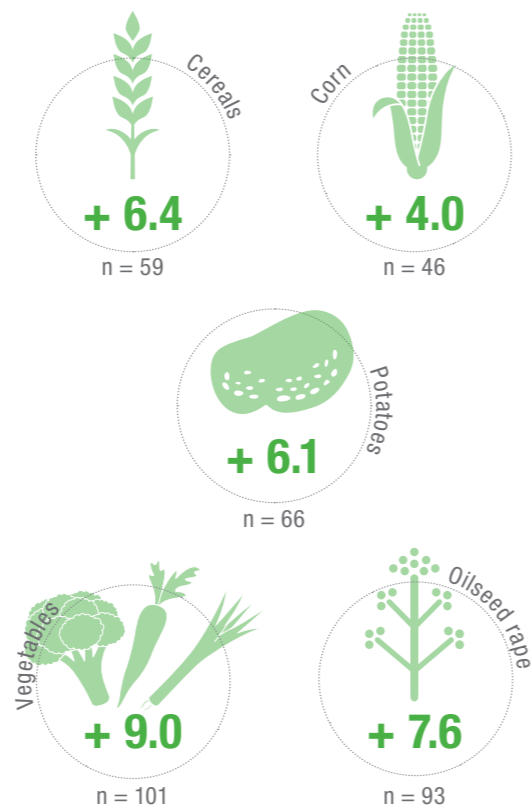
Vibelsol® can be applied with mineral fertilizers to numerous crops, such as: corn, cereals, rapeseed, pastures, sugar beets, potatoes and vegetables. Vibelsol® brings decisive benefits to farmers. The application of nitrogen-based mineral fertilizers with Vibelsol® reduces nitrogen losses, which can lead to higher crop yields and/or higher produce quality as well as cost savings for nitrogen fertilizer while reducing the environment impact. With Vibelsol®, farmers can look forward to higher returns on investment and more enhanced operational management.



### Higher crop yields

With Vibelsol®, nitrogen remains in the root zone and is available to plants for a longer period of time. The result is a higher crop yield while reducing the environment impact. Numerous field trials around the world have confirmed the positive effects of Vibelsol® on crop yield.

#### Yield increase (%) compared to fertilizer without Vibelsol®

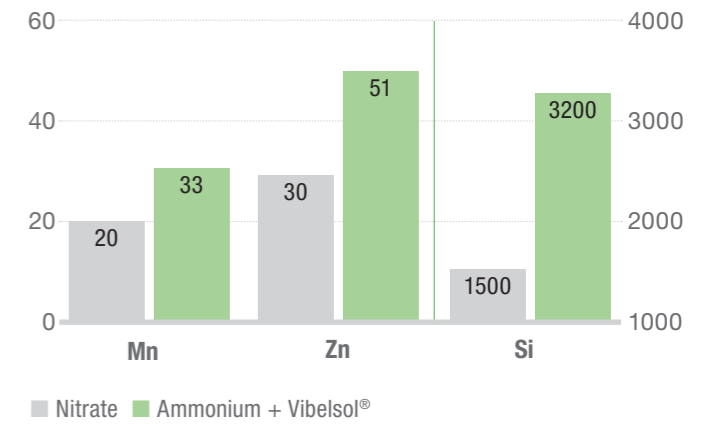


### Better crop quality

Reduced nitrate losses and partial ammonium nutrition lead to a better provision of nutrients, e.g. Manganese, Zinc and Silicon. This is reflected in higher quality of the harvested crops.

#### Effect of Vibelsol® on dry matter and Mn, Zn, and Si concentrations in shoots of cucumber

Mineral concentration [mg/kg dry wt] Growth (g dry wt/pot): 0.46

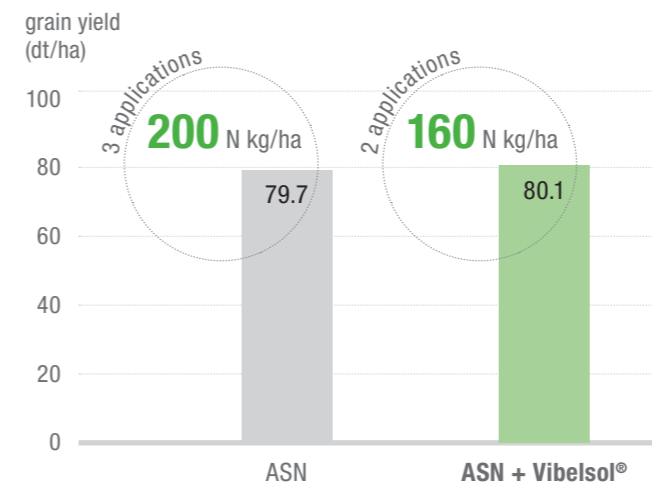


Zhang *et al.* 2005

### Nitrogen fertilizer savings

Fertilizer trials on winter wheat have provided clear proof that the addition of DMPP, the active agent in Vibelsol®, can reduce the amount of nitrogen fertilizer otherwise required for crops.

#### Effect of the fertilizer application strategy on the grain yield of winter wheat (n = 6)

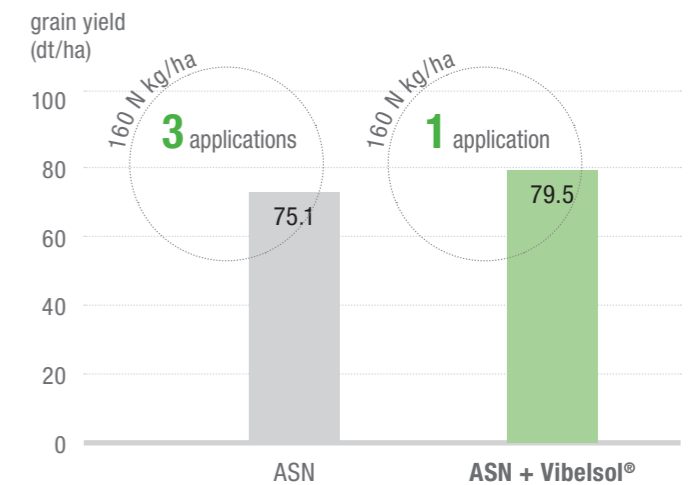


Institute of Plant Nutrition, Technical University Munich

### Fewer applications

Another positive aspect is that the delayed release of nitrate can often reduce the number of applications, as nitrogen dosages can be combined.

#### Effect of the fertilizer application strategy on the grain yield of winter wheat (n = 6)



Institute of Plant Nutrition, Technical University Munich

Vibelsol® means multiple benefits – for the industry, for farmers and for the environment



### Benefits for the fertilizer industry

- Ready-to-use formulation
- Comprehensive support from BASF (e.g. application service)
- Compatibility with a wide range of fertilizer types
- Differentiation within the market
- Fulfillment of regulatory requirements



### Benefits for farmers

- Higher crop yields
- Higher quality of harvested crops
- Fertilizer nitrogen savings
- Less fertilizer applications
- Fulfillment of regulatory requirements



### Benefits for the environment

- Significantly reduced nitrate leaching
- Significantly reduced nitrous oxide emissions

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