

REDUCING DUST DRIFT TO PROTECT POLLINATORS

For over 3,000 years, seeds have been treated to protect them against pests and diseases and, ultimately, improve yields. More than a century of unmatched experience and expertise in seed treatment technologies distinguishes Bayer's portfolio. However, innovation at Bayer does not stand still and the portfolio is being continuously adapted to address market needs and safety requirements. To this end, Bayer has been working intensively with the seed industry to reduce the risk of dust drift from seed treatment products, which has the potential to negatively affect pollinators during sowing. As a result, significant progress has been made in minimizing the risk of dust emissions from treated seed.

Ash, pulped olives, copper carbonate, liquid manure, copper vitriol, arsenic: all sorts of weird and less than wonderful substances were used to protect seed against pests and diseases in centuries past. A decisive breakthrough in the search for effective and safe seed treatments came in 1914 when Bayer launched Uspulun, a fungicide that finally broke the curse of fungal diseases that had devastated cereal crops since time immemorial. This heralded a century of Bayer driven innovations in seed treatment products that have brought benefits to farmers, consumers and the environment: secure field emergence, uniform and healthier plants, reliable and sustainable yields and, first and foremost, protection against pests and diseases.

Widespread benefits

For farmers, the benefits of seed-applied solutions are mainly economic. Take oilseed rape, for instance. A seed-applied insecticide protects the crop from the significant losses caused by pre- and post-emergence pests (e.g. cabbage stem flea beetles) and ensures higher yields. For consumers it is not only the delightful sight of bright-yellow oilseed rape fields in spring but also the benefits of the harvested product, the processed oil, which is a great source of polyunsaturated fatty acids. Oilseed rape fields are a useful component of agro-ecosystems in temperate zones since the flowers serve as a source of early-season forage, providing nectar and pollen for honey bees.



Without protection against pests such as the flea beetle, farmers can lose a substantial part of their harvest.



In 2015/2016, some 68 billion tons of oilseed rape was harvested worldwide from which we get, among other things, edible oil.
Source: USDA



AT A GLANCE

- // Treating seeds protects them against pest and diseases and, ultimately, improves yield.
- // Bayer's expertise in seed treatment technologies is based on over a century of know-how.
- // Stewardship measures, improved coatings, certification of seed treatment sites and technical innovations (e.g. deflectors, AirWasher, SweepAir or the Bayer Fluency Agent) have significantly reduced environmental exposure to dust drift from seed treatment products, also protecting pollinators.



Unique protection

Systemic seed treatments, which move upwards from the roots into the plant and outwards towards the tips of new leaves as they grow, protect an entire plant during its early growth stages. This dramatically reduces environmental exposure to the necessary plant protection treatment as the insecticide, for example, is applied at the seed level, exactly where it is needed. This reduces the number of foliar applications required in the plant's later life. A greatly reduced proportion of the field area is exposed to the plant protection treatment. An additional benefit is the efficacy of seed-applied solutions against otherwise hard-to-control soil pests and diseases.

Dust drift

If, however, the seeds of certain crops (e.g. corn or sunflowers) are treated in a manner which is not compliant with the recommended quality standards for seed dressing, dust particles from the seed treatment can be abraded during handling, storage or sowing and these can be emitted into the air – especially when vacuum-pneumatic planters, a type of sowing device that accurately places seeds into the soil using a negative pressure system, are used. In 2008, serious incidents occurred in Germany and Slovenia when a combination of factors (poorly treated seed, the type of sowing machine used, landscape structure, and the wind strength) resulted in dust from treated corn seed drifting onto neighboring flowering crops and flowers around the planted fields, causing honey bee mortalities in the vicinity of the field.

Since then, Bayer has been working intensively with the seed industry to reduce the risk of dust drift impacting pollinator health during sowing. The outcome has been a number of effective safety measures. “Stewardship is the responsible and ethical management of a product throughout its life cycle, the maximization of the benefits derived from the use of our products, and the minimization of potential risks to human health and the environment,” says Dr Peter Ohs, Senior Global Stewardship Manager at Bayer's Crop Science Division. “Bayer is working with agricultural communities worldwide to ensure that its products are used in an environmentally responsible manner.”

Enhanced stickability

The starting point for reducing dust drift is to increase the ‘stickability’ of the seed treatment product in order to prevent abrasion of dust particles. Here, coatings play a decisive role. At the Bayer SeedGrowth Center of Excellence in Méréville, France, a team of specialists develops, produces and markets a wide range of film coatings to improve seed treatment quality and support the performance of seed-applied solutions. Marc Andrieux, Global Head of SeedGrowth Technology, Services and Coatings at Bayer's Crop Science Division,

Seed treatments are nothing new

Seeds have been treated to protect them against pests and diseases for over 3,000 years. Seed treatment has come a long way since the 1930s when mercury was used to stave off seed-borne diseases. Mercury treatments were stopped in the 1970s due to health issues.

QUALITY STANDARDS

for a high level of application quality at seed-treatment plants:

RECOMMENDATIONS on recipes, best management practices and tested modifications for sowing machines (e.g. deflectors), as required by some authorities (for implementation by seed-treaters and farmers).

Close follow-up and on-going MONITORING of treatment quality and implementation of best management practices in the field.

INFORMATION AND TRAINING of customers in best management practices, incl. CERTIFICATION SUPPORT (for seed-treaters) and good sowing practices (for farmers).

explains what matters most: “It's a constant challenge to develop coatings to protect the seed, ensure the additives stick to it, and make sure seed germination, sowability, flowability, i.e. smooth mobility of the seeds in the machinery, and dust control are all tackled. Balancing stickiness and flowability is one of the main aspects in the development of film coatings.” The results of Méréville's work are impressive: Bayer's Peridiam coatings have been shown to reduce dust emissions by up to 95 percent and improve the flowability of treated seed in the sowing machine by up to 15 percent.



Developing coatings to protect the seed, ensure the layers stick to it, make sure seeds don't stick together, can be sown easily, don't create lots of dust and will still germinate, is a constant challenge.

Certified seed treaters

A crucial step in reducing the risk of dust emissions is to ensure seed is treated at certified sites. Compliance with an industry-driven certification scheme, such as the European Seed Treatment Assurance (ESTA), proves that a specific seed treatment process and the treated seed meet the operator- and environment-related quality and safety standards of regulators and the industry. One ESTA quality criterion, for example, is compliance with pre-defined Heubach dust values (grams of dust per unit of treated seed, following a pre-defined handling procedure). The Heubach test is generally recognized as the standard method to determine the loss of dust from treated seed. Certification proves seeds have been treated professionally and sustainably and thus contributes significantly to higher-quality seed treatment products. The higher the quality of the seed treatment, the less dust is generated.

Improved in-field safety

Once the treated seed has been loaded into the sowing machine, several technological advances in which Bayer has been a key player have made a critical contribution to minimizing the risk and levels of dust emissions. Field tests have shown that **deflectors** fitted to a pneumatic vacuum sowing machine reduce dust emissions by as much as 90 percent through directing abraded seed treatment particles onto the soil. Having deflector technology available is one thing; investing in the actual equipment is another.



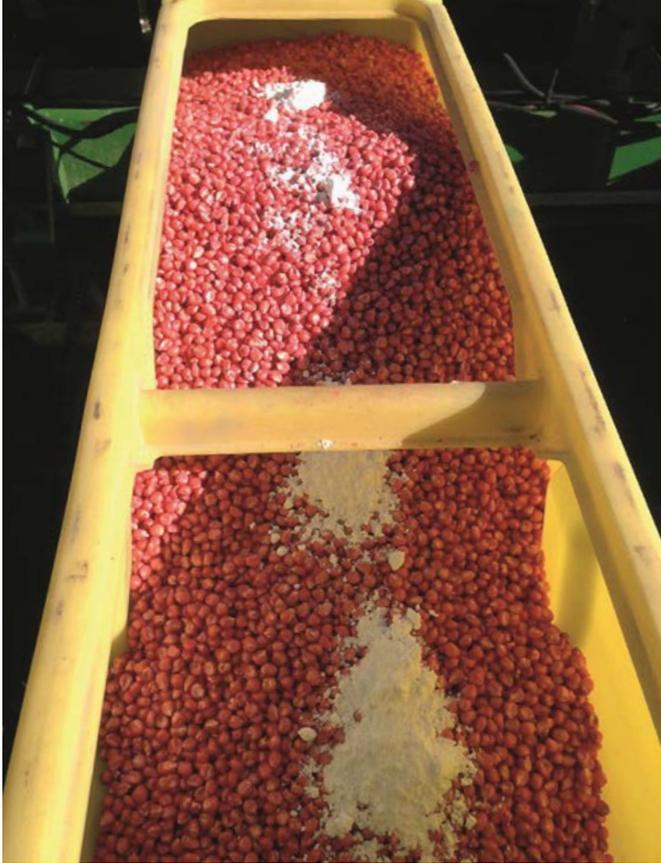
Bayer is working worldwide with agricultural communities to ensure that its products are used in a responsible manner.

FACTS & FIGURES

3.9 billion US dollars

The global chemical seed treatment market was worth around \$3.9 billion in 2015 and is expected to cross \$6 billion by 2020.

Source: www.researchandmarkets.com



Tests with **Fluency Agent**, a polyethylene wax lubricant, show up to 90 percent total dust reduction from vacuum sowing machines.

Fortunately, the deflectors have already been widely implemented in several European countries since 2008, as for instance Germany or Slovenia. In Hungary, Bayer has been proactively involved in a campaign to raise awareness of the need for deflectors. A standardized deflector kit was developed to fit the planting equipment commonly used in Hungary and discounts of 50–70 percent are encouraging farmers to purchase the kit. In Romania, deflectors will become mandatory by early 2017 and, in Spain, Bayer has been working with machinery suppliers to make the necessary technology available. In Italy, deflector technology is being implemented in collaboration with seed companies. Additionally, in North America, specifically-certified deflectors came onto the market in January 2016.

A seed-box lubricant, the **Bayer Fluency Agent**, also greatly reduces dust emissions from vacuum sowing machines, e.g. in corn by up to 88 percent compared to talc, which is widely used as a seed flow lubricant in planting equipment. Lubricants like talc or graphite are used in planters to decrease wear in mechanical seeding mechanisms by reducing friction or as drying agents to prevent seeds sticking to machine parts or clumping together. The Bayer Fluency Agent is a polyethylene wax lubricant which is thus the ideal replacement for conventional lubricants. It can be used with all makes and types of sowing machines, and has no impact on planting accuracy. It has been readily taken up in Canada and the northern states of the USA.



SweepAir, is a prototype technology based on a cyclone system that separates the dust from the outlet air of vacuum-pneumatic planters.

Sometimes, the inspiration for an innovation comes from an unusual source. After noticing how construction sites heavily douse dust with water to prevent drifting, Bayer specialists in Austria co-developed a technology they christened **AirWasher** with Lechler, a German machinery manufacturer. The exhaust air from a seed planter is sprayed in a tube with a fine mist of water and the water droplets mix with the dust particles before draining into the field. Tests at the renowned Julius Kühn Institute (JKI) in Germany revealed that an AirWasher kit fitted to a deflector reduced dust emissions by up to 97 percent, i.e. significantly more than the already impressive results achieved by deflector technology alone.

Another Bayer development, **SweepAir**, is a prototype technology based on a cyclone system that separates the dust from the air. Here, JKI tests have shown that SweepAir can reduce in-field dust emissions from pneumatic corn-sowing equipment by up to 99 percent.

The advances in seed treatment and sowing technologies in recent years have been made possible by close collaboration between stakeholders along the entire value chain. The beneficiaries have been pollinators, people and our environment.

CONCLUSION

There have been significant advances in seed treatment and sowing technologies in recent years. Bayer has made a major contribution to these beneficial developments through close cooperation with the seed industry and sowing equipment manufacturers, as well as through its own technical innovations. Where these advanced technologies have been implemented, the potential risk to pollinators and the environmental exposure to dust drift from seed treatment products has been greatly reduced.



We talked to Dr. Björn Schwenninger, who heads Bayer's "Zero Dust" project, about the latest developments in dust reduction technologies.



"Hearing aid": A computer program recognizes, via a microphone attached to the seed treatment tank, the exact time when the seed treatment process must stop.

Project "Zero Dust"

How do you define "zero dust"?

I would compare our project with "zero emissions" projects in the automotive industry, for example. Since it's scientifically impossible to achieve absolute zero in dust or exhaust emissions, I'd say we're striving to minimize dust emissions to the lowest technically feasible levels.

What are the most recent developments in your "Zero Dust" project?

Our project has many different facets – SweepAir and AirWasher are just two of the better-known technological outcomes. In our formulation technology lab in the USA, for example, we are currently optimizing several seed treatment products for cereals, so products marketed from 2018 onwards will be characterized by even lower dust emissions. Another exciting development is the end-point determination technology we call "hearing aid".

What's a "hearing aid" got to do with seed treatment?

Rather a lot actually. This new technology determines the precise point in time when the seed treatment process is to be stopped. Right now, an experienced operator at a seed treatment site listens and decides by ear when the process is finished. Now we can offer treaters an ultra-precise technical solution. A specially developed software tool translates the noises recorded by a microphone attached to the seed treatment tank into signals that automatically stop the seed treatment mixing process – independent of the experience level of an operator. If the mixing goes on too long, the treated seed will end up with less favorable dust values and particles of the treatment will be abraded during mixing. The seed-treater will have higher costs due to wastage of seed treatment product which has been abraded and sub-standard seed which has not been correctly coated with the right amount of seed treatment to meet customer requirements. Our "hearing aid" has been successfully tested in our labs and at various treatment sites for corn, cereals, soybean and oilseed rape seeds in Germany and Canada. The treaters were so pleased with its performance they would have gladly carried on using our prototype.

What progress has been made in putting these technological advances into practice?

In 2015 we had two most encouraging roundtable discussions in Germany involving representatives of the equipment manufacturers, regulatory bodies and crop protection industry in which it was agreed that it was key to bring further dust reduction technologies to the market. What we agreed on is a kind of 'letter of intent' to introduce a dust reduction classification scheme in Europe, an idea similar to the CO₂ emission classes for cars. The dust reduction level currently achieved by deflector technology, 90 percent, would be a kind of "Class I", and two new classes could relate to 95 percent and 99 percent dust reduction. We are currently working on translating this letter of intent into concrete common activities which will also extend to all types of planters and all relevant crops. Our ultimate goal is that authorities consider the dust reduction classes for registrations of seed treatment products. Today, we see that many planters in the market already fulfill "Class II" or "Class III" levels so, hopefully, these advanced technologies could soon actually be used in practice.