

Seed Treatment: Innovation Driven, Environmentally Friendly, Committed to Plant Health

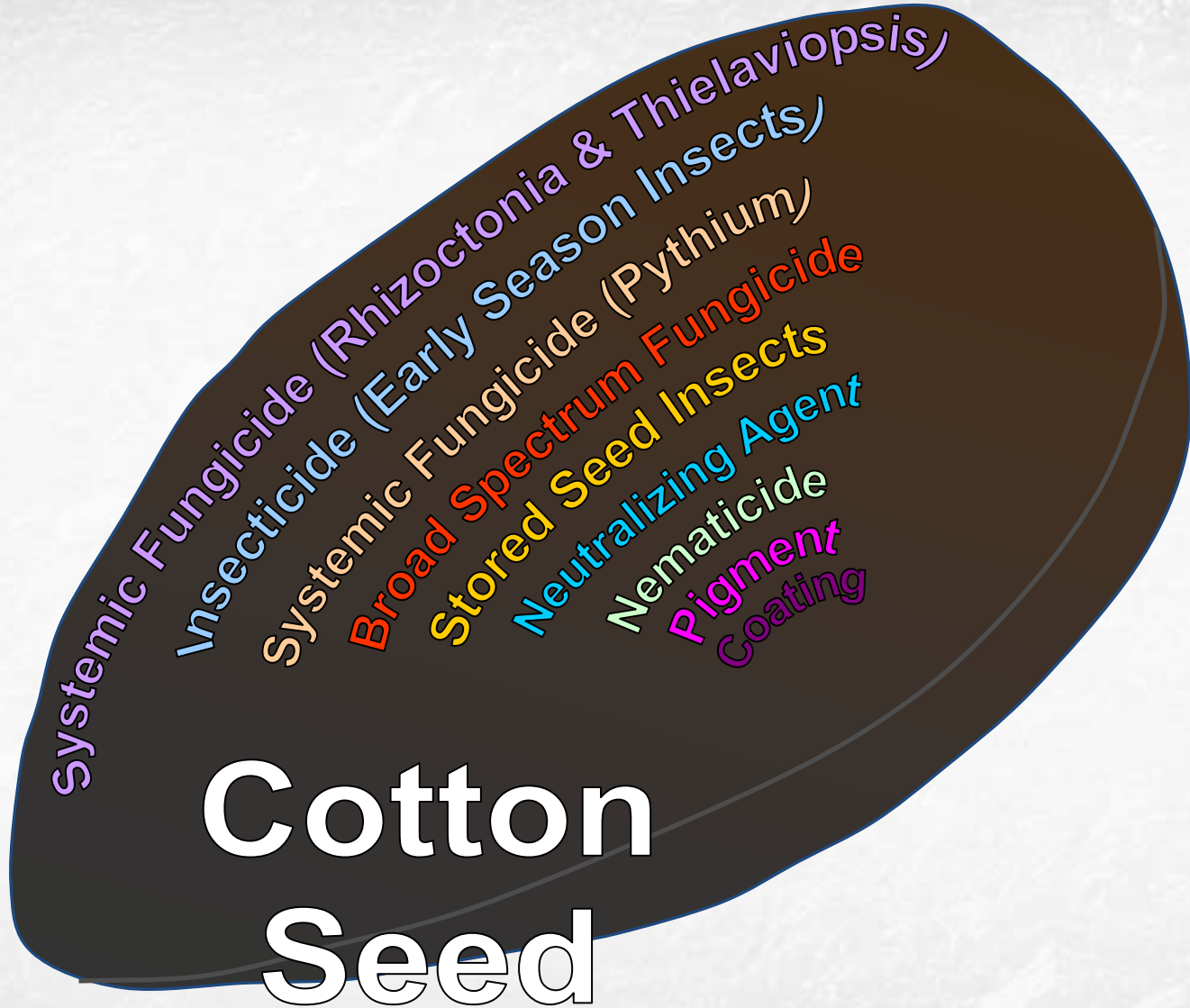
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What is a “Seed Applied Product”?

- **Seed application, as defined, relates to the placement on the seed of those products (i.e., fungicides, insecticides, nematicides, herbicides, herbicide safeners, dyes, plant growth regulators, fertilizers, etc...) which are considered beneficial or necessary in maintaining or enhancing genetic yield potential of a crop. Those products being applied are termed *seed applied products*.**

A standard technique

- Today, seed treatment is a standard technique used in many crops. In many parts of the world it is almost inconceivable that certain plants should be grown from non-treated seeds.
- For instance, two of the most damaging pests in corn are wireworms and the corn rootworm
 - Wireworms feed at the seed's germination stage, leading to either the death or considerable damage of the plant.
 - The corn rootworm, due to the damage it causes, has become infamous under the name of “the billion dollar beetle” since the loss in corn due to the larvae of this beetle amounts to \$800 million per year with a further \$200 million per year spent for protective measures in the U.S. alone.
 - Both pests can be controlled by seed treatment.



Systemic Fungicide (Rhizoctonia & Thielaviopsis)
 Insecticide (Early Season Insects)
 Systemic Fungicide (Pythium)
 Broad Spectrum Fungicide
 Stored Seed Insects
 Neutralizing Agent
 Nematicide
 Pigment
 Coating

Cotton Seed

Advantages of Seed Treatment

- Exact placement of the pesticide on the target surface
- Low application rates per acre
- Treated seed is planted, avoiding significant exposure to environment and wildlife

Advantages of Seed Treatment

- Seed treatment is one of the most focused chemical crop protection methods available to date: a relatively small amount of the active substance is needed to provide the seedling with a high level of protection against a wide variety of fungal diseases and insect pests

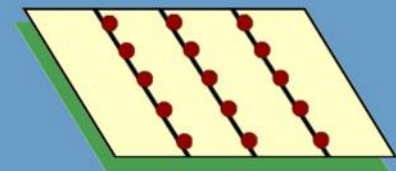
Crop Protection – different application systems



Spray treatment
of the whole area



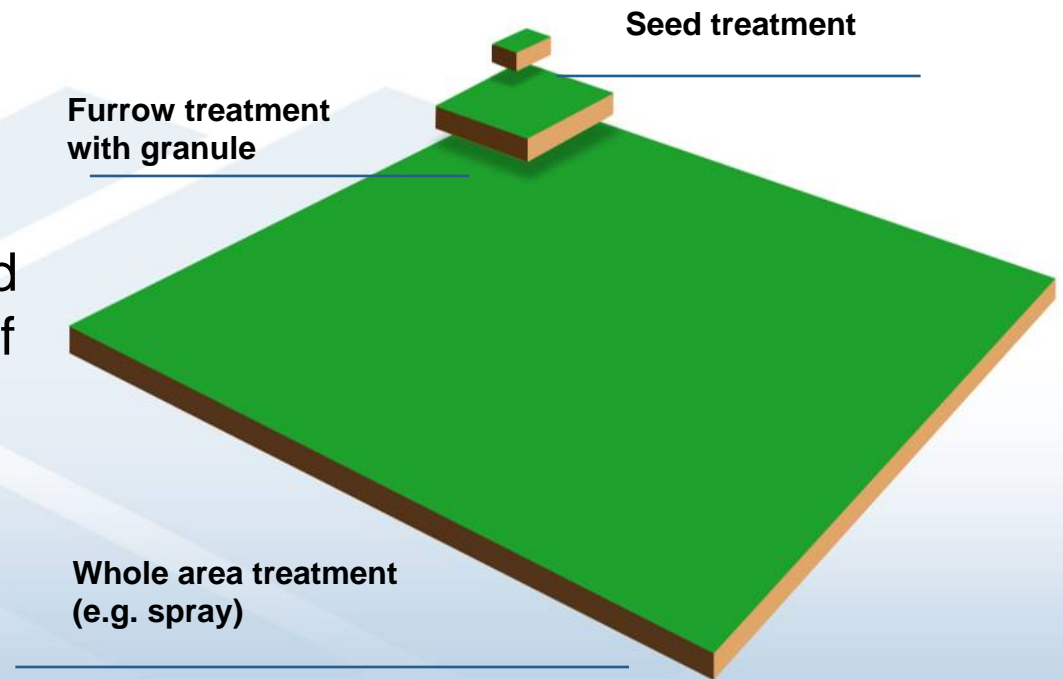
Granule treatment
in furrow



Seed treatment

Advantages of Seed Treatment

- Seed treatment is also advantageous from an environmental point of view: compared with spraying, it effectively reduces the treated area. While spraying 1 acre of land puts 4049 sq.ft of soil in contact with the active ingredient, this shrinks to a mere 24 sq.ft (less than 1 percent), when using seed treatment



Protective zone in the soil

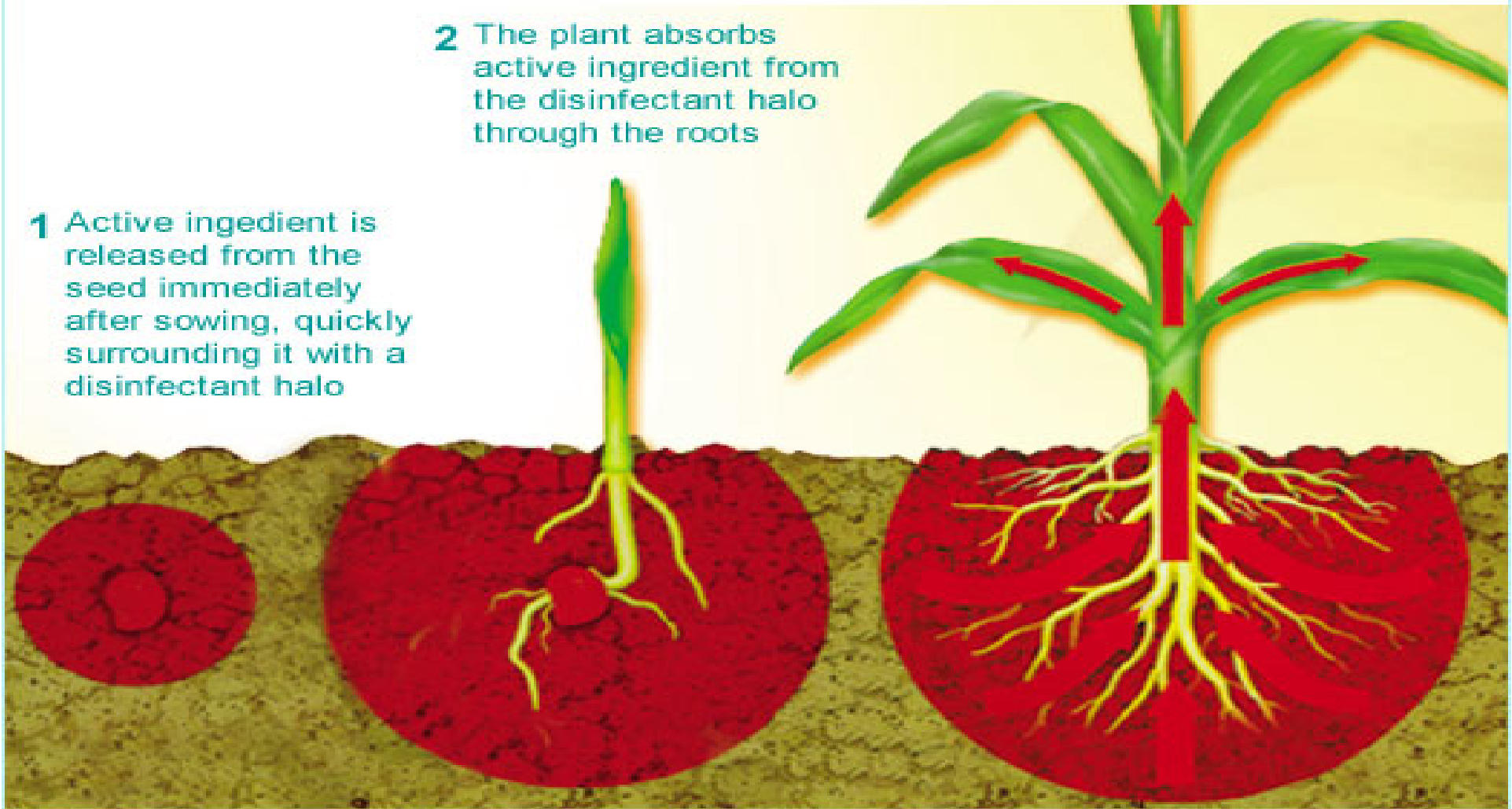
1. Applying the active substance directly to the seed disinfects its surface.
2. Soon after planting, the product forms a protective zone directly around the seed.
3. As soon as the tender roots emerge, they absorb the systemic agent. The plant's vascular system carries it from the roots to its upper leaves.
4. In this way the seedling can be protected against seed-, soil- and wind-borne diseases.

A combination of fungicidal and insecticidal active substances in one product creates welcome synergies.

1 Active ingredient is released from the seed immediately after sowing, quickly surrounding it with a disinfectant halo

2 The plant absorbs active ingredient from the disinfectant halo through the roots

3 Active ingredient is transported to the aerial parts of the plant and uniformly distributed in its tissues



A.I. Consumption by Crop Based on 25 ppm Application Rate

Crop	Acres (millions)	Application Rate (oz.ai/cwt)	oz.a.i./Acre	gm.a.i./Acre	Total Lbs. A.I. Used *
Canola	1.50	0.04	0.0018	0.051	151.88
Corn	89.80	0.04	0.0076	0.215	42655.00
Sorghum	8.90	0.04	0.0024	0.068	1201.50

(*Total Lbs. AI Used adjusted based on planting rate & potential crop treated.)

Industry core message

- In order to maintain a longer term viability of this technology a strict implementation of specific stewardship measures by all involved stakeholders is essential.
 - Cooperation & commitment requested from Crop protection industry, Seed Companies, Conditioning plants, and Growers

Stewardship in Seed Treatment

Factors influencing seed treatment

Initial Seed Quality and Conditioning

- Purity
- Screening, sorting and sizing
- Seed-related dust properties
- Dust aspiration prior to treatment
- Mechanical, drying or frost damage

Seed Treatment Equipment

- Calibration
- Type (batch/continuous flow)
- Monitoring of treatment process
- Dosing system (vol./weight)
- Operator safety

Product (formulation)

- Concentrated
- Easy to apply
- Stable
- Good adhesive properties
- Safe to seed

Slurry recipe

- Liquid volume
- Film coatings
- Colorants
- Micronutrients
- Miscibility

Quality of
Seed
Treatment

Quality control

- Dust abrasion
- Loading analysis
- Seed-to-seed distribution
- Plantability

Seed Treatment

Seed Quality – Seed Cleaning



Air classifier

Seed Treatment: Seed Quality

Only well-cleaned seed should be used for treatment as:

- Contaminants such as dust and straw are resulting in
 - Highly-contaminated bags
 - Difficulties when disposing of these bags

Cleaned seed



Seed with dust



The uniqueness of seed treatment formulations

Seed is the target; seed are living organisms so there is no tolerance for a delivery system that negatively affects the health and/or contributes to an untimely death of seeds and/or seedlings.

Seed is the carrier of the pesticide(s).

Treated seeds must be robust enough to withstand **handling multiple times** after application... from the time the application is made, to packaging in bags and/or bins and finally in transport to the final destination...**the grower!**

Since seeds are a **3-dimensional substrate**, they must be treated uniformly so that the active ingredients are evenly distributed to provide optimum protection in a harsh growing environment.

Seed treatment products can be quite sophisticated in that they may be formulated with one or more fungicides in combination with one or more insecticides, i.e., they can be **multi-functional products** delivered in a single container.

Because seed is sold as a commodity, certain varieties or **genetic traits** are often distinguished in the marketplace by the addition of a **unique color** and/or **cosmetic enhancement**.

Because seed is the target, the **impact on the environment is minimal** (treatment on the seed, seed in the ground). The danger of excess runoff does not exist.

Seed Treatment: Treatment Quality

The quality of seed treatment has an influence on:

- Loading; amount of product per seed (mg a.i. / kernel) > biological activity
- Homogeneous seed-to-seed distribution > biological activity
- Adhesion properties / low dust formation provide > environmental protection
and > user protection
- Flowability/plantability of treated seed



Seed Treatment Film Coating

- To improve the adhesion of the coating on the treated seed, resulting in a reduction of dust, thus increasing user safety during the seed treatment process (e.g. bagging) and planting
- Improved flow-ability of treated seed
- Improved color (optional)



Seed Treatment

Film Coating / Quality of Film Coatings

Different film coatings on corn seeds lead to different losses of active substances after abrasion



Seed Treatment Commercial Application Equipment

Application equipment must:

- Allow accurate treatment
- Allow easy calibration and adjustment
- Address potential sources of chemical exposure (handling of product and treated seed, dust as much as possible)
- Be easy and safe to clean with minimal waste

Application equipment must be:

- Calibrated regularly to avoid any shift in quality

Continuous quality control of commercial samples for ensuring high quality standards



Stewardship in Seed Treatment Label

The seed bag tag (on bag with treated seed) should include the precautionary phrases, such as:

- Store under appropriate conditions
- Avoid direct contact with treated seed
- During handling, wear protective clothing and gloves
- In the event of intoxication, consult a doctor, showing him this label, or call emergency number
- Never use treated seed for human/animal food**
- Never re-use empty bags



Treated Seed: Disposal

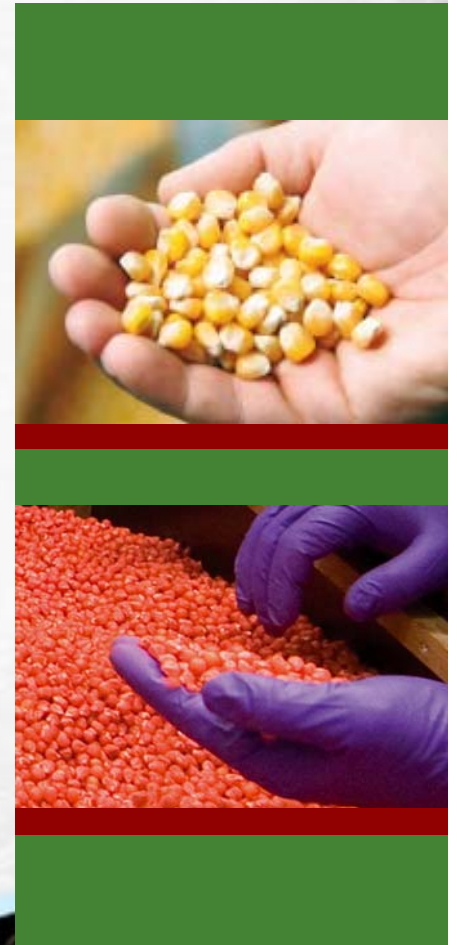
- Discard of treated seed is most often by incineration, alcohol production, composting, or donated/sold to plant food plots.
 - Incineration (EPA permit required) is usually for electrical generation or cement kilns where temperatures are sufficient high to destroy the chemicals
 - These plants get green credits when they displace coal with treated seed.
- Seed can be planted at higher rates and the crop plowed under as a green manure crop but equates to small volumes
- Wildlife groups plant considerable volumes of seed for pheasants, turkey, quail, geese, ducks, deer, etc.

Seed Treatment Quality Standards Initiatives (summary)

Industry commitment on quality assurance scheme

Key elements

- Application by trained professionals
- If necessary, effective use of film coatings
- Compliance with established quality standards
- Quality monitoring of commercially treated seed
- Guidelines for handling and planting of treated seed
- Promotion of a safe handling and use of treated seed



Guide to responsible Industrial Seed Treatment



BEFORE APPLICATION



1 Only high quality products and recipes specially designed and approved for high quality seed treatment must be used



2 Products must be kept in a locked room that has been approved for crop protection products



3 Label recommendations and directions for handling must be followed, including the treatment procedure (use of a sticker) as well as the safety requirements



4 Personal Protection must be effective – gloves, glasses, mask, overalls and boots must be used as appropriate and according to each product label



5 Seed treatment equipment must be checked and calibrated regularly to ensure accurate and safe application



6 Only well cleaned seed must be used to avoid creation of polluted dust that will contaminate the treating facility and its workers as well as the farmers and the environment during sowing

DURING THE APPLICATION



7 Spillage must be avoided; it must be thoroughly cleaned up to avoid contaminating the environment and waterways



8 Non-returnable empty containers must be rinsed three times before they can be disposed. For others the recommendation of the producer must be followed

AFTER THE APPLICATION



9 It must be ensured that access to treated seeds is not possible



10 Seed treatment equipment must be cleaned regularly. Use of a vacuum cleaner suitable for chemicals is always the preferred option



11 Contamination of hands when handling treated seeds must be avoided



12 The protection equipment must be cleaned regularly; Workers must take a shower after each shift

Current Challenges – European Issues

Application Quality – Planters

- Abrasion from coated seeds due to **poor application quality (stickers)**
- Dust emission and drift due to airflow from **pneumatic planting machines**

Led to:

- “Bee incidents” in a specific local area in Germany (2008)
- Suspension of neonicotinoides for maize treatment in Germany (Italy)
- Review of seed treatment applications in all crops (e.g. OSR, cereals)





BEES, THE INDUSTRIOUS HELPERS of farmers, are purely vegetarian. Their main source of food is nectar from plants. They obtain their protein from the pollen.

TEAM OF EXPERTS TO ANALYZE AND DEVELOP MEASURES

Safety for bees

The health of bees is a priority issue for Bayer CropScience: a global **“Bee Health Assurance Team”** specially set up for this purpose has been coordinating measures to, for example, improve the safety of seed treatment products for pollinating bees.

THANK YOU

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BAYER CROPSCIENCE COMMITMENT

Today and tomorrow, Bayer CropScience focuses on grower needs and innovation to deliver the most complete and effective crop protection portfolio.

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