CORTEVA™
agriscience

Seed Treatment Technology Overview

What they are and why they matter

MAY 23, 2022

Agenda

Introductions
- Keri Carstens
- Rick Deadwyler
- Chris Hazel

Background
- What are seed treatments?

Benefits
- Why do farmers use treated seeds?

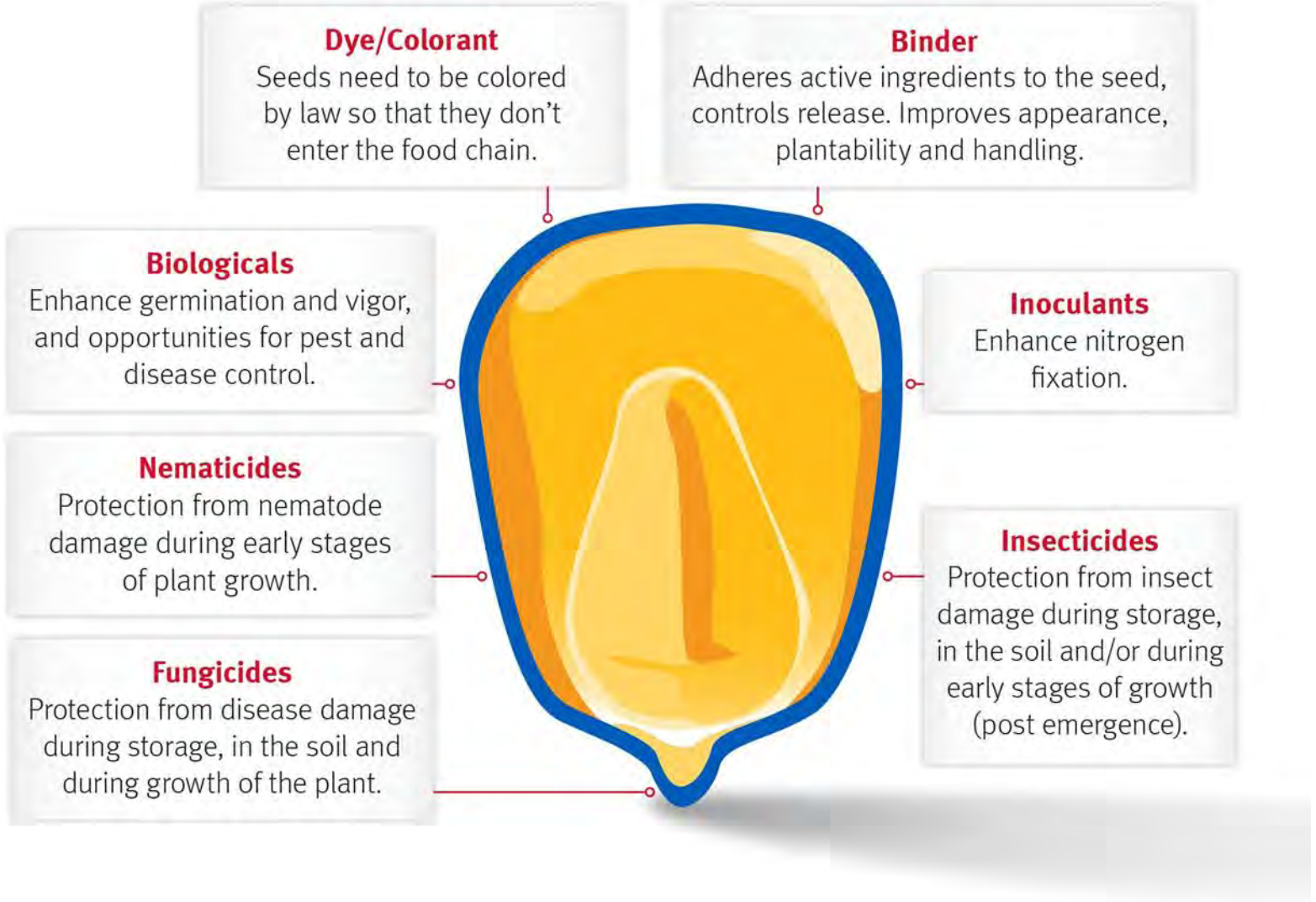
What are seed treatments?

A mix of multiple products applied to a seed, safeguarding the seeds and seedlings against insects, fungal diseases and soil-borne pathogens

Right: Corteva seeds are colored to keep the seeds from entering food or feed channels.

Seed treatments

On a single treated seed, the treatment's formulation may combine multiple products to protect both the seed and young seedlings



Did You Know?

It's estimated that – without the availability of pesticide treated seeds -- for every pound of an insecticide used through seed treatment, up to five pounds would be required via traditional application techniques. This translates to a 375% increase in insecticide application rates per acre (AgInfomatics.com).

Benefits

Why do farmers use treated seeds?

The long list of reasons boil down to this: treated seeds help **improve seed and plant health** and **reduce the potential for exposure** to people, beneficial insects and the environment

Source: A. Goggi, Iowa State University. 2011. Evolution, purpose and advantages of seed treatments. Seed Congress of Americas

Treated Seed Benefits
Helping Improve Seed and Plant Health

- **Protects against soil borne pests and diseases that can destroy the seed or plant before it emerges from the soil**, which promotes stand establishment (plant growth) and vigor
- Serves as vital component of **Integrated Pest Management** (IPM)
- **Increased and uniform germination**, which results in increased, healthier, and stronger crop stands
- Increases likelihood of **improved yields**

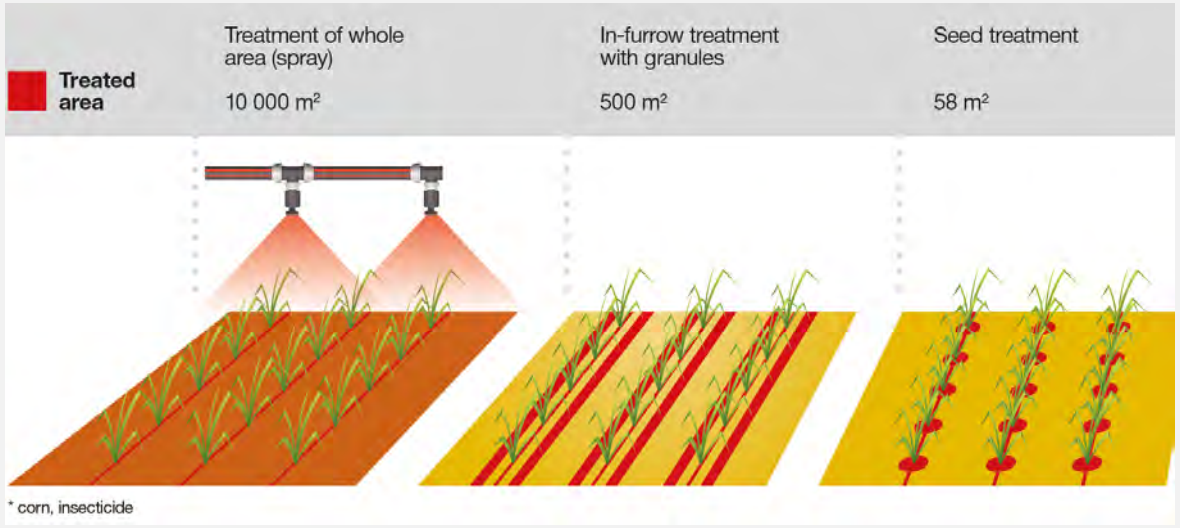
Did You Know?

Seed treatments help protect against pests such as cutworms, wireworms, maggots, thrips, beetles, and fungal plant pathogens like pythium, fusarium, rhizoctonia, and penicillium.

Treated Seed Benefits

Helping Reduce Potential for Exposure To People, Beneficial Insects and the Environment

Foliar or in-furrow application can use up to **10X higher** amounts of active ingredient than seed treatment.



Graphic source: https://register.extension.msstate.edu/sites/register.extension.msstate.edu/files/2018%20MSU%20Seed%20Tech%20Short%20Course%20Proceedings.pdf

- **Reduces the total amount of pesticide** used throughout the life of a crop[1]
- Enables selectively targeting pests that feed on the seed or emerging plant, while helping **minimize potential exposure to beneficial insects**, like pollinators
- Reduces need to handle chemistries directly, which **lowers operator exposure** to the measuring or mixing required through traditional pesticide applications
- Seed treatment active ingredients **effective at reduced rates**
- **Potential for less foliar sprays reduces carbon footprint** from fewer tractor passes and additional post emergent pesticide or fertilizer applications
  - More tractor passes may mean increased carbon releases, soil degradation and compaction from the tractor tires, and increased potential of inadvertent offsite movement.
- **Increases adoption of cover crops** since seeds are protected against soil pests that may be enhanced with cover cropping practices
- **Less packaging material** use

[1]Bayer study in 2014: Seed treatment involves exposure of a.i. to 58 m² of soil surface compared to 500 m² for an in furrow application and 10,000 m² for an over spray

The Guide to Seed Treatment Stewardship

seed-treatment-guide.com

- The guide is the product of industry-wide collaboration between seed companies, seed treatment providers and universities; it draws from data collected worldwide
- Jointly produced by the American Seed Trade Association and CropLife America
- Provides farmers and seed companies with critical information and up-to-date guidelines for managing treated seeds effectively to minimize the risk of exposure to non-target organisms
- Covers Best Management Practices for applicators & users of treated seed. Topics include:
  - Safe use and handling, selection of treatment product, locating hives and communication with beekeepers, planting of treated seed, application, storage and disposal

Thank you

Rick Deadwyler – Government Affairs
rick.m.deadwyler@corteva.com

Christine Hazel – Global Regulatory Lead – Seed Applied Technologies
christine.b.hazel@corteva.com

Corteva Difference

Our evidence-based process combines science and ingenuity to discover, develop and collaborate to deliver advanced seed treatment

Evidence-based Science

Product development evaluates performance in efficacy, application and planting

Above: Agriculture reporters learn about Corteva seed treatment field trials at the US Center of Seed Applied Technologies (CSAT) location.

Our team evaluates hundreds of products each year, seeking out the right components and formulations to meet farmer needs. Once products are developed, our regulatory, technical services and commercial teams work to ensure successful market adoption.

Formulation science

Identifying the right balance of actives

Assurance evaluation

Determining and characterizing agronomic benefits

Testing

Understanding how products perform in labs, greenhouses and fields

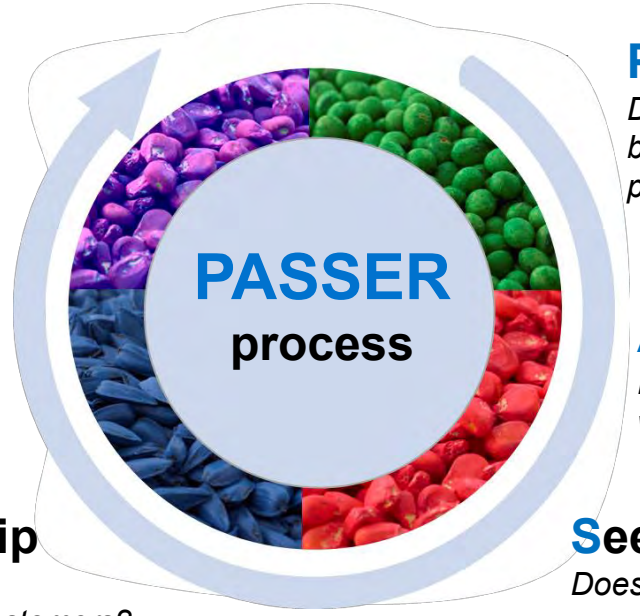
Rigorous on-farm testing under real conditions, combined with IMPACT™ testing of more than 30,000 plot evaluations, help ensure our seed treatments meet farmer needs.

Designed, Verified, and Proven to Work

Delivering products and services to support our seed treatments

Seed treatments undergo our thorough evaluation, called PASSER, before being commercialized

P	A	S	S	E	R
Plantability	Application	Seed Safety	Stewardship	Efficacy	Regulatory



Plantability
Does it plant as well as or better than our current products?

Application
Does it adhere to the seed well (e.g. polymer usage)?

Seed Safety
Does it affect germination?

Stewardship
Is it a sustainable solution for our customers?

Efficacy
Does it perform?

Regulatory
Is it in compliance?

At right: Seed treatments are developed at our dedicated Center of Seed Applied Technologies (CSAT), a comprehensive facility that combines the capabilities of a laboratory, testing center and seed treating plant.

Summary: Benefits of Treated Seeds

Treated seeds help improve seed and plant health and reduce the potential for exposure to people, beneficial insects and the environment

For Seed and **Plant** Health

- Increased and uniform germination which results in increased, healthier, and stronger crop stands
- Protection against soil borne pests and disease that can destroy the seed or plant before it emerges, which promotes stand establishment (plant growth) and vigor/yield
  - The list of pests that treated seeds help protect against includes – but is not limited to – cutworms, wireworms, maggots, thrips, beetles, and fungal plant pathogens like pythium, fusarium, rhizoctonia, and penicillium
- Serves as vital component of Integrated Pest Management (IPM)
- Increases likelihood of improved yields

For **People** and **Beneficial Insects**

- Enables selectively targeting pests that feed on the seed or emerging plant, while helping minimize potential exposure to beneficial insects, like pollinators
- Reduces need to handle chemistries directly, which lowers operator exposure to the measuring or mixing required through traditional pesticide applications
- Seed treatment active ingredients effective at reduced rates

For the **Environment**

- Reduces the total amount of pesticide used throughout the life of a crop[1]
- Potential for less foliar sprays reduces carbon footprint from fewer tractor passes and additional post emergent pesticide or fertilizer applications
  - More tractor passes may mean increased carbon releases, soil degradation and compaction from the tractor tires, and increased potential of inadvertent offsite movement.
- Increases adoption of cover crops since seeds are protected against soil pests that may be enhanced with cover cropping practices
- Less packaging material use

[1]Bayer study in 2014: Seed treatment involves exposure of a.i. to 58 m^2 of soil surface compared to 500 m^2 for an in furrow application and 10,000 m^2 for an over spray

Summary: Key Messages

What are seed treatments?	Seed treatments are generally a mix of multiple products applied to a seed, safeguarding the seed and seedlings against insects, fungal diseases and soil-borne pathogens.
What are some of the benefits of treated seeds?	A few of the many benefits include: • **Protection against soil borne pests and disease that can destroy the seed or plant before it emerges from the soil,** which promotes stand establishment (plant growth) and vigor • **Reduces the total amount of pesticide** used throughout the life of a crop, while also reducing the carbon footprints that would accompany those later sprayer trips across the field. • Enables selectively targeting pests that feed on the seed or plant, while helping **minimize potential exposure to beneficial insects**, like pollinators • Reduces need to handle chemistries directly and the need for later sprayer applications, which **lowers the potential for operator or neighbor exposure**
How does Corteva develop seed treatments?	Corteva's seed applied technologies team evaluates hundreds of products each year, seeking out the right components and formulations to meet farmer needs. Once products are developed, our regulatory, technical services and commercial teams work to ensure successful market adoption.
Are seed treatments regulated? How?	Seed treatment pesticide products are highly regulated, just like foliar and soil-applied pesticides, under FIFRA. All pesticides must go through a rigorous data review and registration process via the U.S. Environmental Protection Agency (EPA), including extensive human health and environmental risk assessments. Seeds treated with pesticides are considered "treated articles" if and only if the article (i.e., the seed) is treated with a pesticide registered for this use (meaning EPA has already assessed whether use as a seed treatment, meets FIFRA's registration standard); the seed treatment is intended to protect the seed itself.

Seed Treatment Regulation

Seed treatment pesticide products are **highly regulated** – just as foliar and soil-applied pesticides – under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

All pesticides must go through a **rigorous data review and registration process** via the U.S. Environmental Protection Agency (EPA), including extensive human health and environmental risk assessments.

At right: Current treatment requirements call for the use of multiple pumps to apply multiple coverings such as fungicides, insecticides, biologicals and polymers

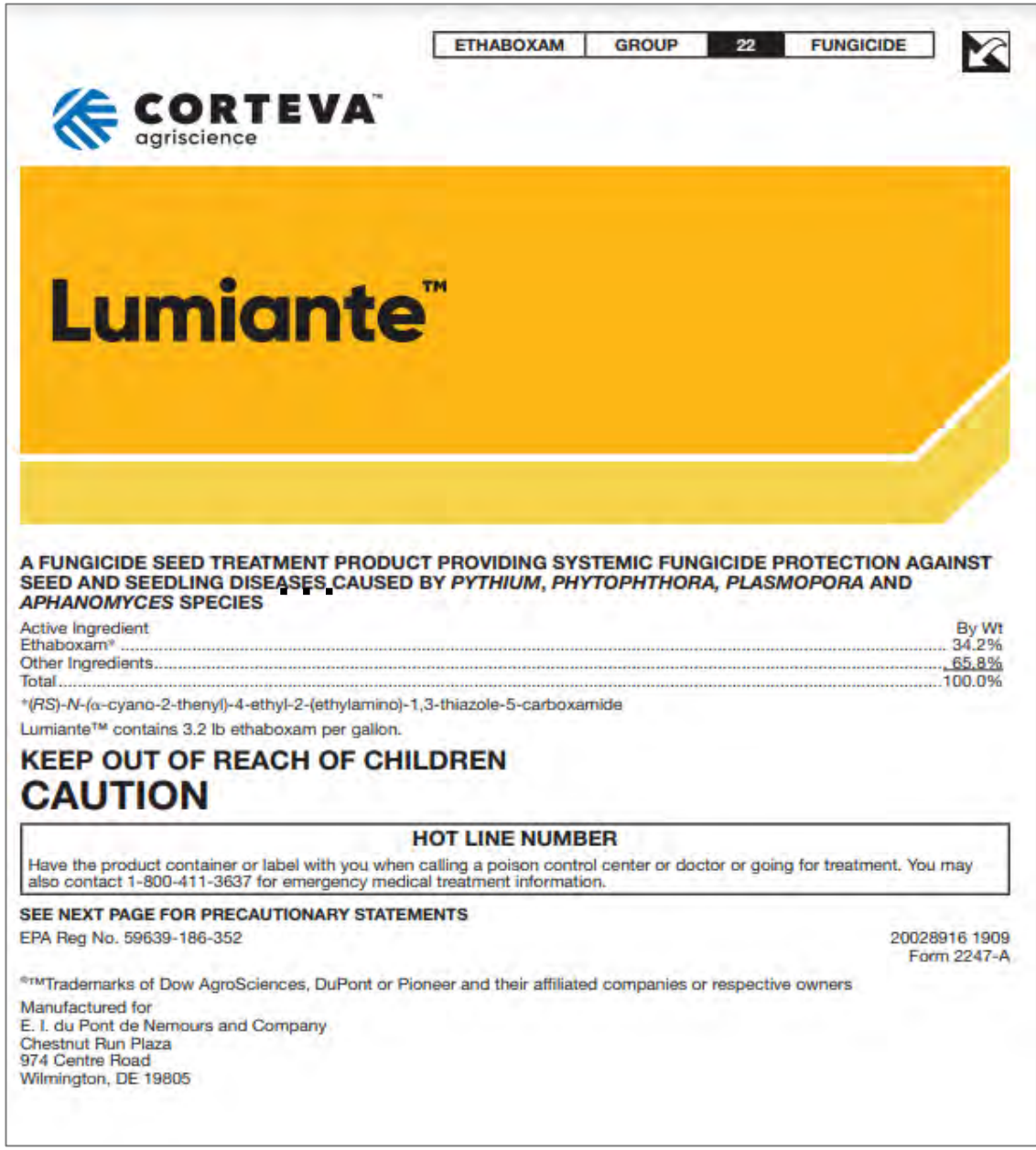
Every registered seed treatment **must** scientifically demonstrate that:

- It does not cause unreasonable effects to human health and the environment
- It is effective against target pests, such as insects, disease or weeds

Pesticide registrations are **required** for:

- Individual active ingredients, such as ethaboxam
- Formulated products that use the active ingredients, such as this Lumiante™ fungicide seed treatment label, *shown at right*
- Each specific use, including crops protected, pests controlled, use rate
- Every country of sales, manufacturing and seed treating

  Note: Detailed data requirements and application processes are unique for each country



ETHABOXAM | GROUP 22 | FUNGICIDE

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Lumiante™

A FUNGICIDE SEED TREATMENT PRODUCT PROVIDING SYSTEMIC FUNGICIDE PROTECTION AGAINST SEED AND SEEDLING DISEASES CAUSED BY *PYTHIUM, PHYTOPHTHORA, PLASMOPORA* AND *APHANOMYCES* SPECIES

Active Ingredient	By Wt
Ethaboxam*	34.2%
Other Ingredients	65.8%
Total	100.0%

*(*RS*)-*N*-(α-cyano-2-thenyl)-4-ethyl-2-(ethylamino)-1,3-thiazole-5-carboxamide

Lumiante™ contains 3.2 lb ethaboxam per gallon.

KEEP OUT OF REACH OF CHILDREN

CAUTION

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact 1-800-411-3637 for emergency medical treatment information.

SEE NEXT PAGE FOR PRECAUTIONARY STATEMENTS

EPA Reg No. 59639-186-352

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Form 2247-A

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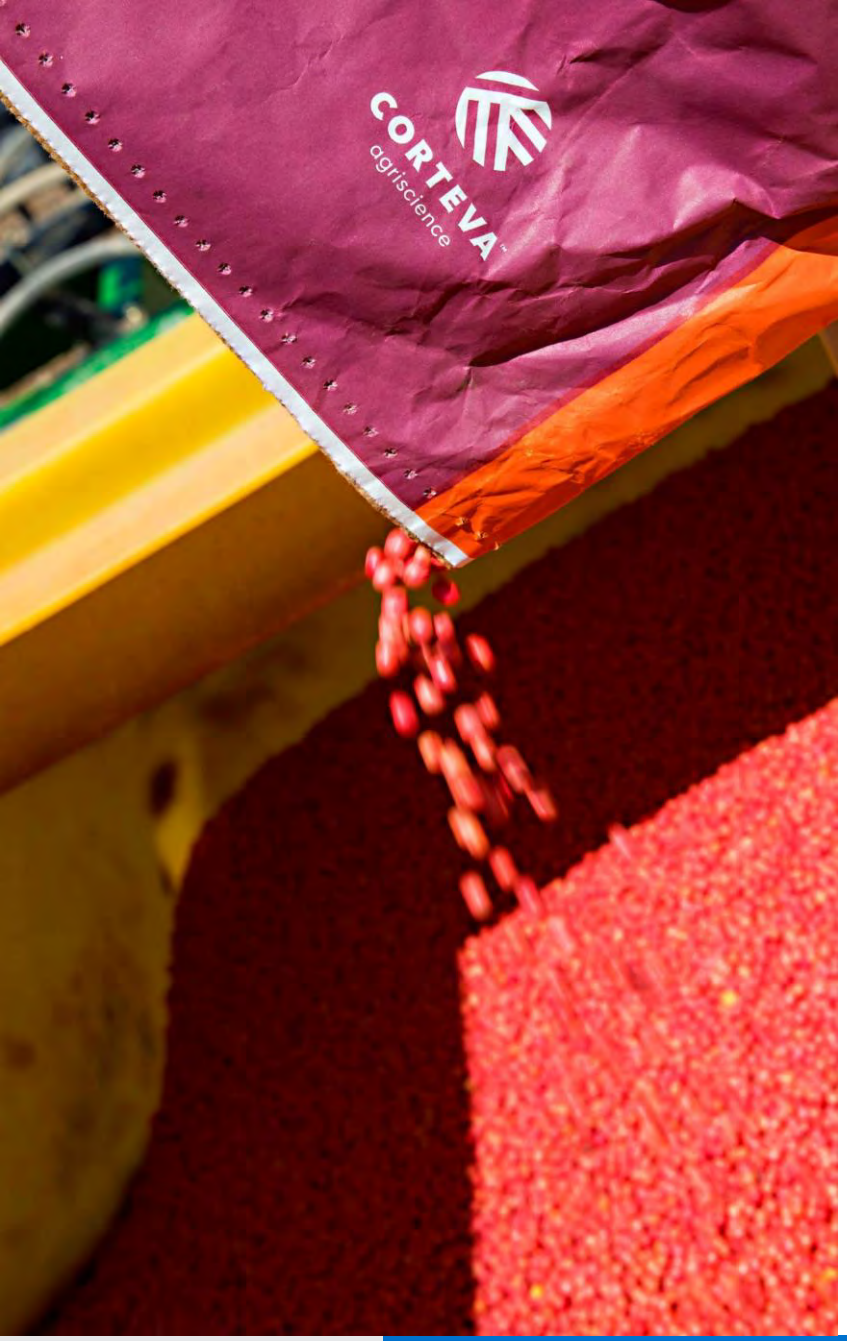

Questions registrants answer through the registration process

Product identification

- What are the properties of this new product?
- Do you have the tools to measure it?

Product efficacy

- How does it work? On which targets?
- What is the use rate?

Exposure

- How does it breakdown in the environment? plant tissue?
- Where does it go in the soil, air, water, food chain?

Safety

- Is it safe for humans?
- Is it safe for fish, birds, bees, butterflies, worms, mammals, plants, beneficial insects…

Finally - Can this product be used safely?

Federal Seed Act

The Federal Seed Act requires **accurate labeling** and **purity standards** for seeds in commerce and prohibits the importation and movement of adulterated or misbranded seeds.

The law works in conjunction with the Plant Protection Act of 2000 to regulate the importation of field crop, pasture and forage, or vegetable seed that may contain noxious weed seeds.

USDA's Agricultural Marketing Service is responsible for enforcing the labeling and purity standard provisions.

USDA Agricultural Marketing Service
U.S. DEPARTMENT OF AGRICULTURE

Credit, seed label: https://www.ilsoyadvisor.com/on-farm/ilsoyadvisor/understanding-soybean-seed-tag

Summary: Seed Treatment and Treated Seed Regulations

Highly regulated, like all pesticides

Seed treatment pesticide products are highly regulated, just as foliar and soil-applied pesticides, under FIFRA. All pesticides must go through a rigorous data review and registration process via the U.S. Environmental Protection Agency (EPA), including extensive human health and environmental risk assessments.

Extensive risk assessments

US EPA undertakes an extensive risk assessment of all seed treatment pesticide products, including an evaluation of applying the product and planting the seed (i.e., environmental fate, ecotoxicology, and operator exposures) and the consumption of the harvested commodity by the consumer. The associated science-based evaluation also considers the application rates, analysis of the quantity "planted per day," and typical seeding/planting rates per acre, among other factors.

Just like traditionally applied pesticides, the pesticide used as a seed coating must be evaluated according to application rates and delivery system.

Periodic Review

All pesticides are subject to periodic review to ensure that, as the science advances and/or policies and pesticide use practices change over time, all registered products continue to meet the statutory standard of "no unreasonable adverse effects" on humans or the environment.

Strict labeling requirements

The Federal Seed Act (FSA) regulates the sale and movement of seed in the U.S; seed companies must abide by those regulations. Within the FSA, there are requirements about the labeling of treated seed. The US-EPA-approved labels for commercial seed treatment products also include language that must be placed on the seed tags accompanying treated seed regarding permitted and prohibited practices. Tags on a seed package must include identification of what the seed has been treated with; hazard related warnings; and other applicable labeling requirements.

Any worker safety requirements are ~~must be~~ printed on the seed tag so workers can read them when planting. Anyone who treats, handles, transports, plants, recycles, re-uses, or disposes of treated seeds must manage them properly and in accordance with label instructions.

Stewardship

Industry-wide collaboration between seed companies, seed treatment providers and universities provides farmers and seed companies with Best Management Practices for the proper use and disposal of treated seed

Seeds treated with pesticides are considered "treated articles" if and only if the article (i.e., the seed) is treated with a pesticide registered for this use (meaning EPA has already assessed whether use as a seed treatment, meets FIFRA's registration standard); the seed treatment is intended to protect the seed itself.

Without a 'Treated Article Exemption,' EPA would be required to duplicate the effort and resources it used in registering the seed treatment to also register the treated seed itself as a pesticide product. Given EPA's comprehensive assessment of the seed treatment product, the duplicative review would have no additional benefit to health, safety, or the environment.