Overview of Seed Treatment Technology and Stewardship

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Outline

- What are seed treatments and why do farmers use them?
- How do you know if seed treatments work? What data are available?
- How are seed treatments regulated? What do the EPA pollinator risk assessments tell us about seed treatments?
What are seed treatments? What goes in a recipe?

**Dye/Colorant**
Seeds need to be colored by law so that they don’t enter the food chain.

**Polymer/Binder**
Adheres active ingredients to the seed, controls release. Improves appearance, plantability and handling.

**Biologicals**
Enhance germination and vigor, and opportunities for pest and disease control.

**Nematicides**
Protection from nematode damage during early stages of plant growth.

**Inoculants**
Enhance nitrogen fixation.

**Fungicides**
Protection from disease damage during storage, in the soil and during growth of the plant.

**Insecticides**
Protection from insect damage during storage, in the soil and/or during early stages of growth (post emergence).
Why do farmers use seed treatments?

- Planting early
- Ease of handling and use, safety
- Integrated Pest Management
  - “Rescue” treatments are not an option for some pests
- Seedling/stand establishment and vigor
- Prevent disease transmission (seed, soil or vector-borne)
- Prevent predation/feeding on seed and seedling
- Yield benefits

Examples of early season pests and diseases:
- Corn: Black cutworm, wireworm, “white grubs,” seed corn maggot, “seedling blights” (*Pythium, Fusarium, Rhizoctonia*)
- Soybean: bean leaf beetle, seed corn maggot, “seedling blights” (*Phytophthora, Pythium, Fusarium, Rhizoctonia*)

Source: A. Goggi, Iowa State University. 2011. Evolution, purpose and advantages of seed treatments. Seed Congress of Americas
Factors that influence early season pest and disease pressure

- Soil type
- Soil moisture, drainage and irrigation
- Planting date
- Planting density/seeding rate
- Manure application on-field or nearby
- Cover crop history
- Tillage type
- Prior cropping history
- Weed pressure
- Neighboring crops/plants
- Genetics of hybrid/variety
- Pest/disease history
• 1% of a field is treated compared to broadcast spray
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How do we decide what to offer?

Seed treatments undergo thorough evaluation before being commercialized

**P**  Plantability: Does it plant as well as or better than our current product(s)?

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

**S**  Stewardship: Is it a sustainable solution for our customers?

**S**  Seed Safety: Does it affect germination?

**E**  Efficacy: Does it perform?

**R**  Regulatory: Is it in compliance?
What yield improvement is important to a farmer?

- 2 bu/acre for corn
- 0.5 bu/acre for soybeans
EXAMPLE: Detecting a yield difference of \( >0.8 \text{ bu/acre} \) for an experimental soybean seed treatment
Research studies from 2001 to 2013
- 50 locations and >10 years
- Average insect pressure including: wireworm, white grub, seedcorn maggot & corn rootworm
- Base rate IST is the recommended for early season pests

Yield protection:
- 12 bu/acre grain
- 11% silage

Product performance is variable and subject to any number of environmental, disease and pest pressures. Individual results may vary.
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1.6 bu/acre yield protection from IST over FST
Percent Wins for IST = 79.7%

- Data from 2004 - 2014
- Pioneer Soybean Research
- 59 replicated research locations
- Average insect pressure

10 Years of trials show IST consistently improves:
Yield
Stand count
Vigor

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Agronomic benefits analyses – Why do some claim ‘no benefit’?

- Study design for yield trials
  - Replication
  - Seeding rates and economics for farmers
  - Planting dates
- Benefits beyond yield
- Entomology
  - Ease of monitoring early season vs later season pests
  - Grad student availability, funding and experience
  - “Secondary” pests
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Seed Treatment Regulation

1. Seed treatment product regulation – e.g., FIFRA
2. Pesticide application
3. Federal Seed Act
Pesticide Registration Overview

- Scientifically demonstrate that it:
  - Does not cause unreasonable effects to human health and the environment
  - Is effective against target pests (weeds, insects, disease)

- Pesticide registration is needed for:
  - Active Ingredients (e.g., clothianidin)
  - Finished products (formulations)
  - Every country of sales, manufacturing and seed treating
  - Each specific use (crop protected, pest controlled, use rate)

- Detailed data requirements and application processes are different in different countries
Questions a pesticide registrant has to answer:

- 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
  - Human safety
  - Repeat same question for fish, birds, bees, butterflies, worms, mammals, plants, beneficial insects…

Can this product be used safely?
Printed OECD dossier to be submitted for one application
EPA Pollinator Risk Assessment Framework
Neonic pollinator risk assessments – EPA and PMRA Conducted under Obama administration

- EPA used data submitted by registrants, as well as public sources
- Use patterns showing most potential risk to pollinators include citrus and cotton, for example
- Seed treatment uses are generally considered a low risk for route of exposure for pollinators.
  - “EPA concludes that any issues related to dust-off at planting can be addressed using Best Management Practices and working with the ag industry.”
- PMRA also released its benefits assessment, and concludes that use of neonicotinoid treated corn and soybean seed has value in Canada, with the levels of value varying by province and crop.
Clean seed is better for consumers, farmers, our employees, and the environment
Deploy state-of-the-art seed conditioning and seed treatment systems
Air Stream Cleaner – Separates seed from foreign material

Seed Sizing – Group seed by size/shape and removes small seed, debris and dust

Gravity Table – Seed floats on stream of air, seed pieces and dust are removed

Seed Treating – Aspiration of seed prior to treating removing dust
Guide to Seed Treatment Stewardship

- Covers Best Management Practices for applicators and users of treated seed
- Input from farmer groups, stewardship experts, and experts in seed treatment application
- Topics covered include: Safe Use and Handling, Selection of Treatment Product, Locating Hives and Communication with Beekeepers, Planting of Treated Seed, Application, Storage and Disposal
Scientists are focused on the interaction of multiple factors:

- Parasites (*Varroa* mites)
- Diseases (*Nosema*, bacteria and viruses)
- Weather patterns and changing climate
- Beekeeping practices
  - Transportation stress
  - Lack of genetic diversity
  - Artificial food sources
  - Pest management within colonies
- Pesticides (used in hives and in agriculture)
- Lack of suitable habitat
- Lack of varied diet
- Queen failure


The Coalition is focusing on accelerating collective impact to improve honey bee health in four key areas.

**Nutrition & Forage**
We are looking at ways to improve honey bee nutrition to provide diversity in honey bee forage

**Hive Management**
We are making investments to understand and suppress varroa mite and virus susceptibility and developing best management practices (BMPs) for beekeepers

**Crop Pest Management**
We are developing crop- and product-specific best management practices and messaging

**Cross Industry Collaboration**
We are working across the public and private sector to coordinate on solutions that work
Summary

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Thank you