

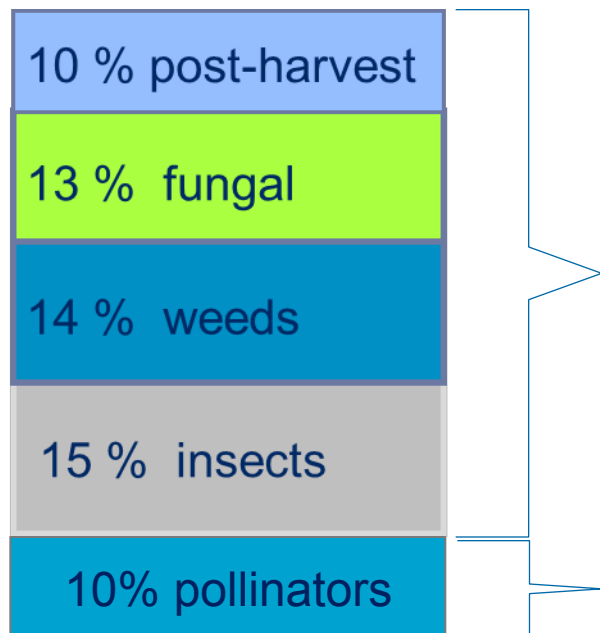


Outline

- Bees and agriculture
- Background to pesticide registration
- Neonicotinoid seed treatments and bees
- Ongoing activities to understand and minimize exposure
- Bee health activities
- Summary



Need for Crop Protection Products and Pollinators



Average global yield losses without crop protection (rice, wheat, barley, corn, potatoes, soybeans, cotton, coffee*)

Economic contribution of pollinators to global food crop production

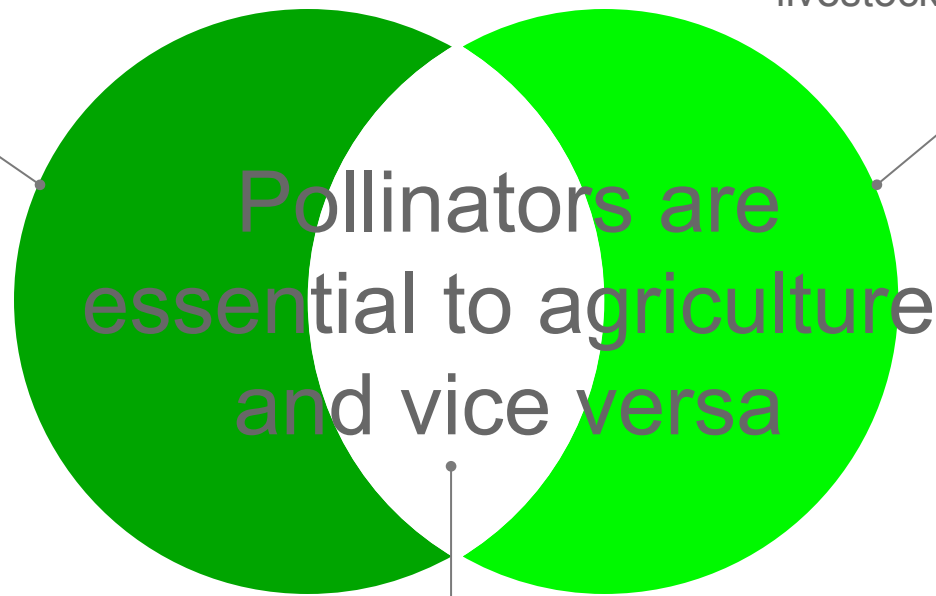
Sustainable agriculture requires efficient pollination services and responsible use of pesticides

Crop Protection , Apiculture and Agriculture Intersect



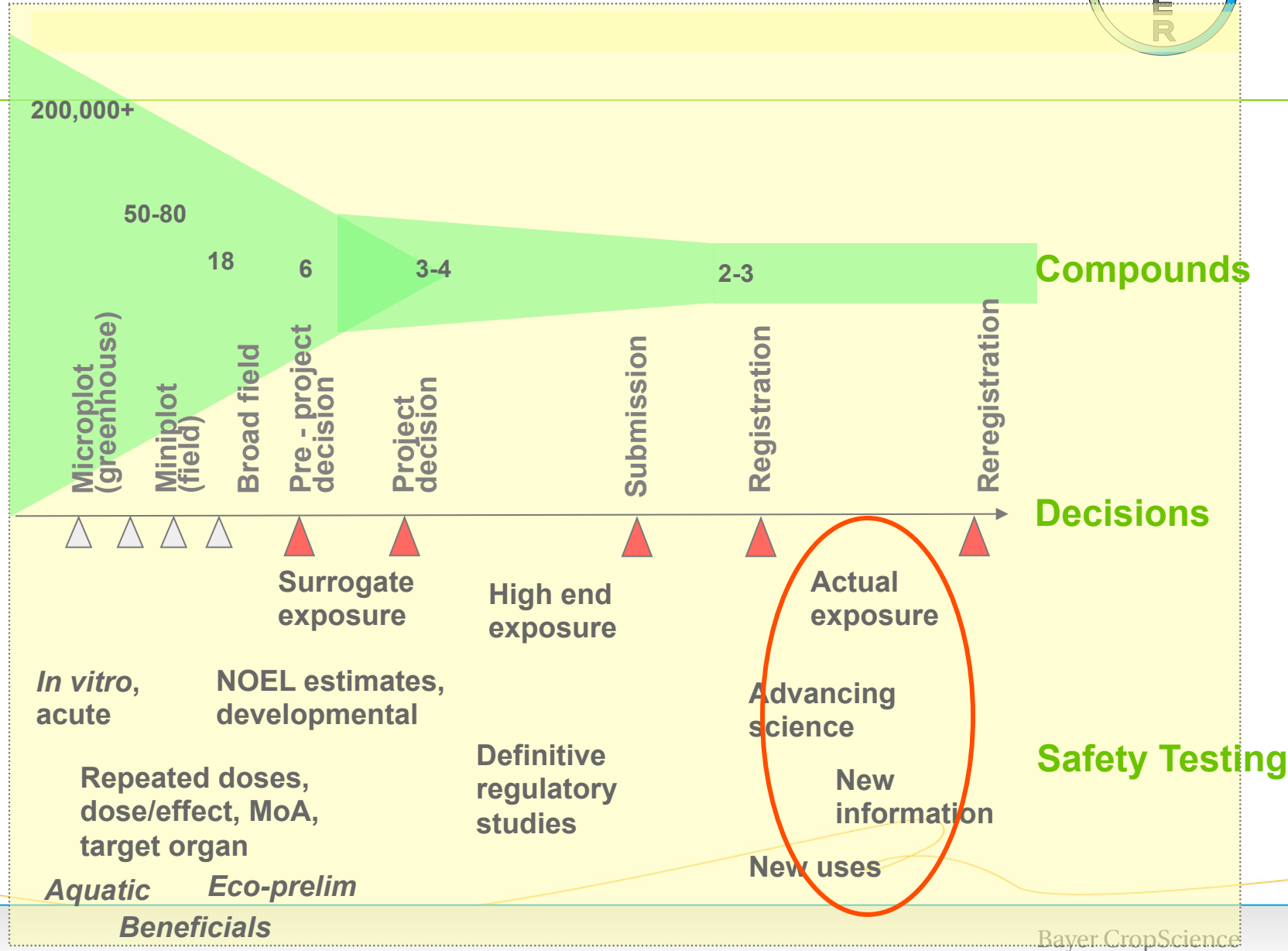
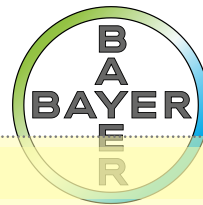
Beekeeping*: The art, science, and business of managing honey bees for the production of hive products and bee stock, and for pollination services.

Farming*: The science, art, and business of cultivating soil, producing crops, and raising livestock.



Crop Protection Industry: Development of products to protect crops, livestock and bees. The supply, production and improvement of seeds often requiring pollination services.

Lifecycle Assessment of Pesticide Safety





Safety Standard for Pesticides

- Pesticides only registered after meeting an exacting safety standard
 - No unreasonable adverse effects on the environment
 - Reasonable certainty of no harm to humans
- Regulatory determination made only after
 - A more extensive and diverse testing scheme than for any class of chemistry
 - Risk based evaluation of hazard (toxicity) and exposure
 - Introduction of appropriate mitigation statements on the product label
- Post-registration , information increases and development continues
 - More realistic exposure data is developed
 - Real world experience incl. incident data is acquired (approved and misuse)
 - Additional scientific investigations are conducted
 - Technological improvements occur– equipment, formulation etc.
- Registration review

Addressing concerns around bees

Neonicotinoid Seed Treatments – a case study



- In April 2008 11,500 bee colonies suffered losses in Upper Rhine Valley in Germany at the time of planting neonicotinoid treated seed
- Investigations revealed that:
 - For some seed batches, the application quality and use of film coatings was substandard leading to higher dust levels
 - Most of the pneumatic vacuum planters used in the Upper Rhine Valley exhaust the emissions upward or to the side.
 - Later than normal planting window
 - Small field sizes (≤ 10 acres) in close proximity to flowering crops (Oil Seed Rape)
 - Dry weather and windy conditions led to dust drift
 - Colonies recovered
- Conclusion
 - Must ensure properly treated seeds and active stewardship



Neonicotinoid Seed Treatment

- risks and benefits

■ Risks

- High toxicity to bees
- Need to minimize exposure



■ Benefits

- Application independent of weather conditions
- Fewer spray applications
- Positive effect on the health and vigor of the plant
- Reduced environmental impact due to lower application rates and less area treated
- Low mammalian toxicity

Reducing Risk = Reducing Exposure

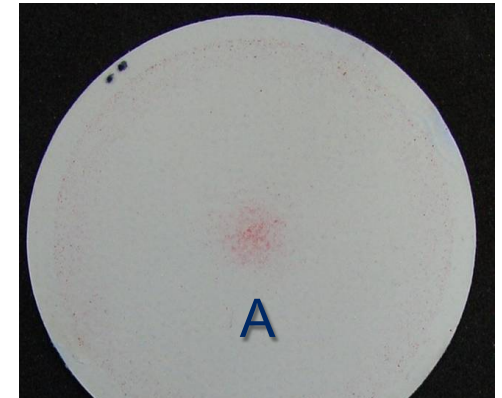


Toxicity DOES NOT equal risk

$\text{Risk} = \text{Hazard (Toxicity)} \times \text{Exposure}$

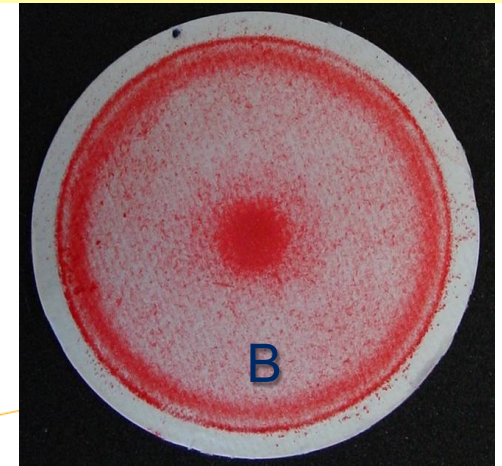
- The toxicity of a pesticide remains constant regardless of its use
- The exposure to a pesticide is dependent on the conditions surrounding its use
- The risk associated with using a pesticide can only be reduced (mitigated) by decreasing the potential for exposure

Established Equipment and Protocol for Standard Comparison of Dust-Abrasion



A: Good ST quality sample

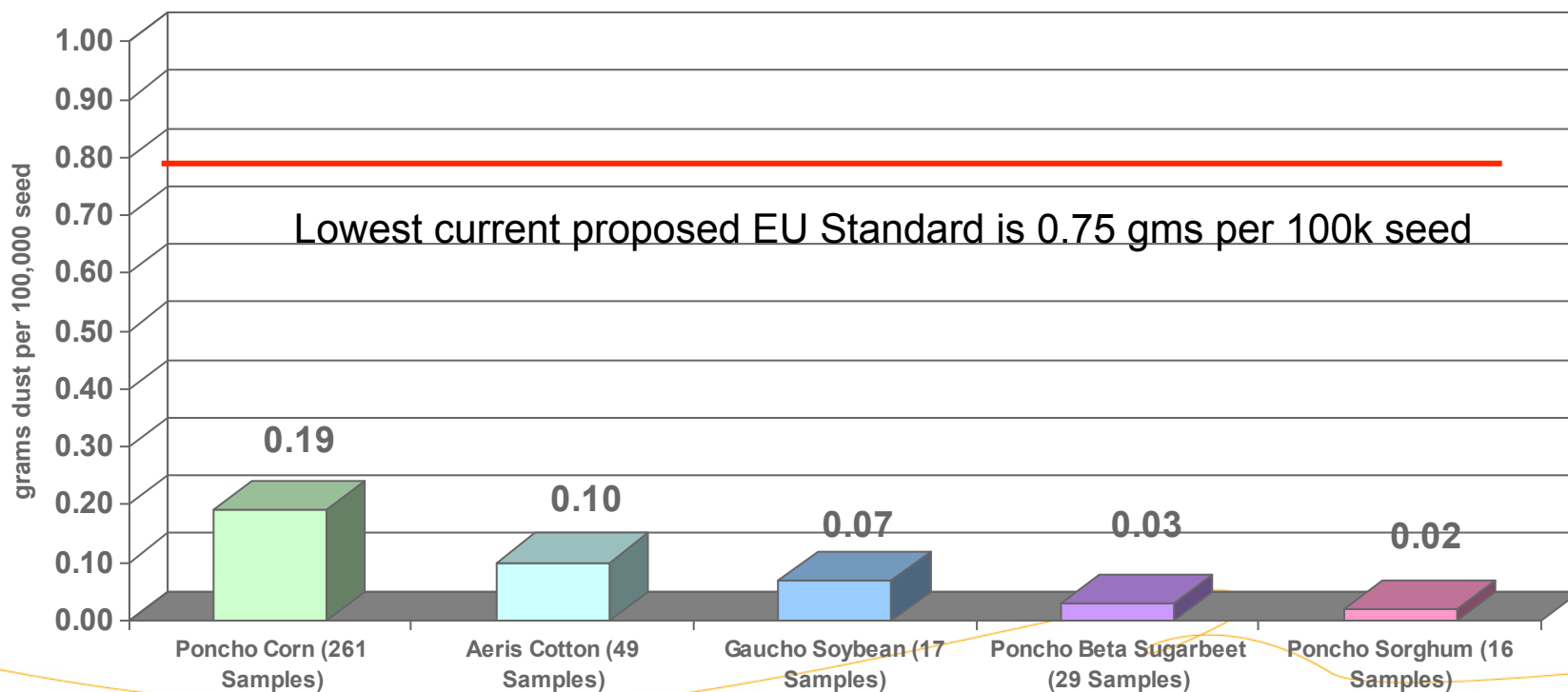
B: Bad ST quality sample



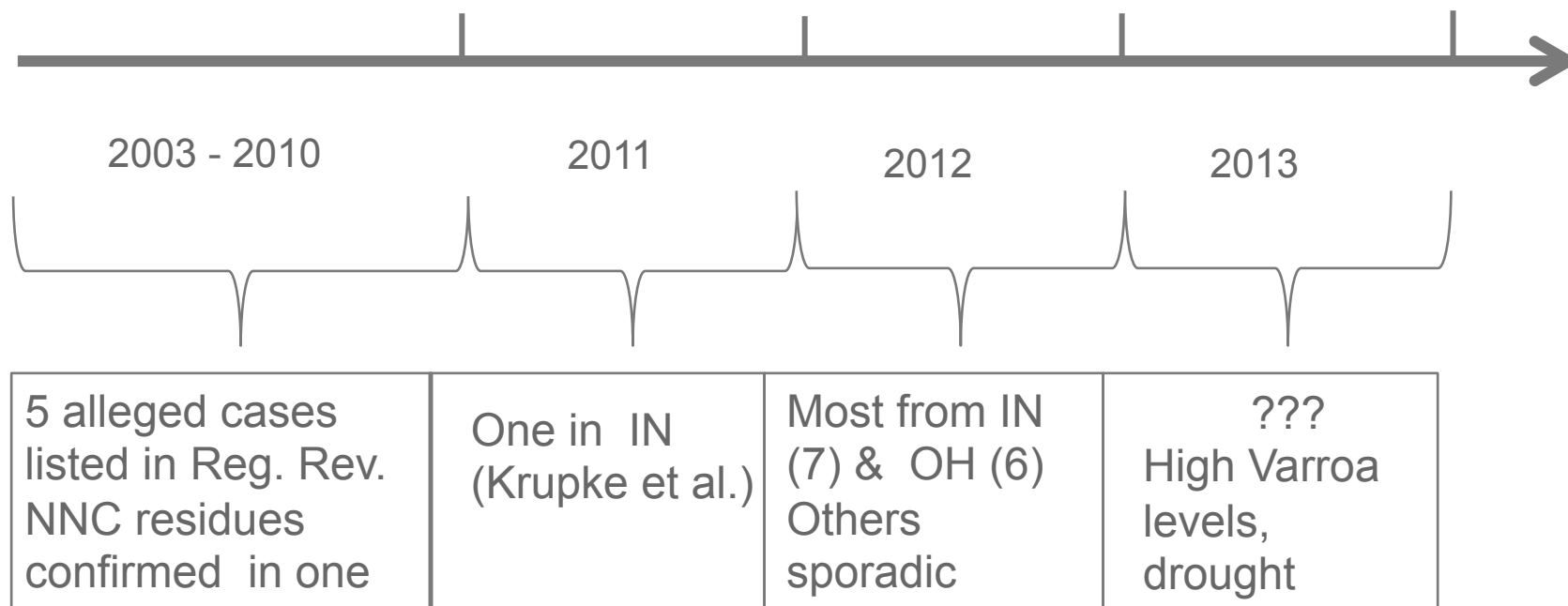
Heubach Dust Testing – Commercially Treated Seed Samples – Seed Applied Insecticides



Average Grams Dust per 100,000 Seed - Commercial Seed Samples - Heubach Dustmeter at Bayer CropScience Seed Technology Center



Alleged Bee Incidents involving Neonicotinoid Seed Treatment in the U.S.



- 2012 - possible cause of increase: awareness, publicity, weather, willingness to report? Combination of all of these indicated.
- Trace residues found in dead bees in IN. No measurable residues in OH
- BCS investigated one incident in IN (detect) and MN (no detect)

Recent Literature Studies (1)

Krupke et al. study

- Apparent small bee kill incidents investigated
- Field experiment conducted to measure exposure
 - Exposure levels in soil, pollen, whole flowers do not explain how a bee kill happened
 - Concentration in waste talc very high, but samples were only collected from inside a planter, no measurement of what was released into the environment
- No long-term colony-level impact noted



Recent Literature Studies (2)

Tapparo et al study and others from Girolami group

- Bees trained to fly through dust exhaust cloud during simulated planting
- Effects seen on individual bees, no colony level effects
- Minimal effects on individual bees from contact with contaminated flowers, or ingestion of guttation droplets; bees had to fly through the planter exhaust stream for effects to be prevalent
- Exposed bees placed in cages in laboratory
- Normal humidity – nearly all bees survived
- Very high humidity – most bees died
- No long-term colony-level impact

Practical Experiences with Neonicotinoid Treated Seeds in the U.S.



- Despite hundreds of millions of acres being planted with neonicotinoid treated seed there have been very few reported, acute bee losses

- There has been no demonstrated effect on bee colony health associated with use of clothianidin or other neonicotinoid-based insecticides



- Activities, however, to understand and minimize exposure and reduce the likelihood of effects are appropriate to help protect an important tool for growers

Ongoing Activities to Understand and Minimize Exposure



- Understanding exposure routes
 - Bee Health investigations
 - Sentinel hives
 - Mid-West Corn Seed Treatment Exposure Study
- Improving the technology
 - Optimizing product formulation, seed treatment recipes
 - Monitoring treated seed samples for abrasion standards
 - Developing alternative lubricants to talc to reduce dust
 - Improved equipment to treat seed
 - Planter modifications
- Increased communication and stewardship

Bee Health Investigations in 2013: Response Preparations



- Build on Bayer's experiences from 2012 in investigating alleged incidents around corn planting time
- Better understand potential product related issues, complementing any official investigations
- Contacting State Lead Agencies in Mid-west, seed partners, major bee organizations, pest control applicators, EPA , USDA for help and advice on implementation
- A dedicated toll-free number available for questions or concerns around bee health has been established



Bee Health Investigations in 2013: Resources Available



- Investigation team consisting of over 30 trained individuals:
- Bee experts for hive inspections
- Technical field experts to survey agricultural surroundings
- Analytical experts to collect residue and bee samples for analysis
- Standardized protocols and SOP's for conducting investigations
- iPad application to aid data collection (beta testing)
- Rapid response capability and fast analytical turn around time
- Intent is to supplement official investigations by focusing on sites that will help address mitigation/stewardship needs if warranted



Investigation of Hives



Investigation of Fields



Investigation of Planting



Investigation of
Surroundings

Bayer CropScience

Dead Bee Drop Zone Traps





Sentinel Hives Program in Corn Growing Areas

- Retrospective investigations have limitations
- Will actively monitor and report on selected “healthy” honey bee colonies from participating beekeepers in 2013
- Will monitor: intra-hive mortality with dead bee traps, varroa mite, tracheal mite, and Nosema loads etc.
- Will record landscape data surrounding the colonies
- Will analyze for neonicotinoids and other pesticide residues
- Initiated the program in Indiana and pursuing proposal in Ontario



Mid-West Corn Seed Treatment Exposure Study



- Bayer and Syngenta are partnering with other stakeholders to sponsor and oversee field research to identify best practices for reducing bee exposure
 - Funds given to Pollinator Partnership who prepared RFP
 - CDRC Steering Committee reviews bids, oversees study conduct
 - Study conducted by research team (multiple universities)
 - 2013 work to focus on
 - Seed lubricants (PE wax vs. Talc/Graphite)
 - Vegetation management in/around fields prior to planting
 - Additional research likely in 2014
 - Develop further BMP recommendations for growers and beekeepers

POLLINATOR PARTNERSHIP

Request for Proposals - February 4, 2013

Pollinator Partnership – Corn Dust Research Consortium

Call for Research Proposals Related to Reducing Honey Bee Exposure to Dust Emitted During Planting of Treated Corn Seeds

Background

The Pollinator Partnership has formed a Corn Dust Research Consortium (CDRC) to fund, oversee, and advise on two proposed research projects to further our understanding of best management practices for mitigating seed treatment exposure to honey bees during corn planting. The Pollinator Partnership has issued CDRC invitations to stakeholders from crop protection, seed production, farm equipment, corn growing, beekeeping, academic, governmental and conservation organizations.

The Corn Dust Research Consortium is seeking research proposals from North American researchers addressing two specific approaches to the issue.

Research Priorities and Funding

We anticipate funding (from pooled resources of \$320,000) proposals that address two questions: **Project 1- Use by Honey Bees of Flowering Resources In and Around Cornfields, and Project 2 - Efficacy of Seed Lubricant Products.**

A Major Initiative: Reduce Dust by Replacing Talc as a Lubricant in Planters



- BCS developing an alternative planter lubricant to replace talc and reduce dust emissions from planters
- Significant decrease in both total dust (90%) and active ingredient dust emissions (65%) have been observed from the vacuum exhaust of planters in laboratory testing
- Testing in Southern Hemisphere now
- Large scale tests in U.S. with multiple manufacturers in 2013
- Goal to launch in 2014



Application advancements



High Volume Batch Treater



Pelleting Equipment



High precision Downstream Technology

- New technology has brought +/- 2% accuracy to high volume facilities
- Seed testing for treatment quality characteristics.
- Improvement of quality is a combination of equipment, process controls and materials applied to the seed.
- Seed treaters are upgrading equipment training and stewardship initiatives.
- Seed coatings are becoming a standard with heavier loadings
- Seed treaters are more frequently engaging seed coating and applications experts to improve their product quality

SeedGrowth Stewardship Activities Equipment Modifications - Europe



Amazona Retrofit Kit

Planters and agricultural practices very different in Europe. Mid-West Corn Seed Treatment Exposure Study will inform U.S. needs



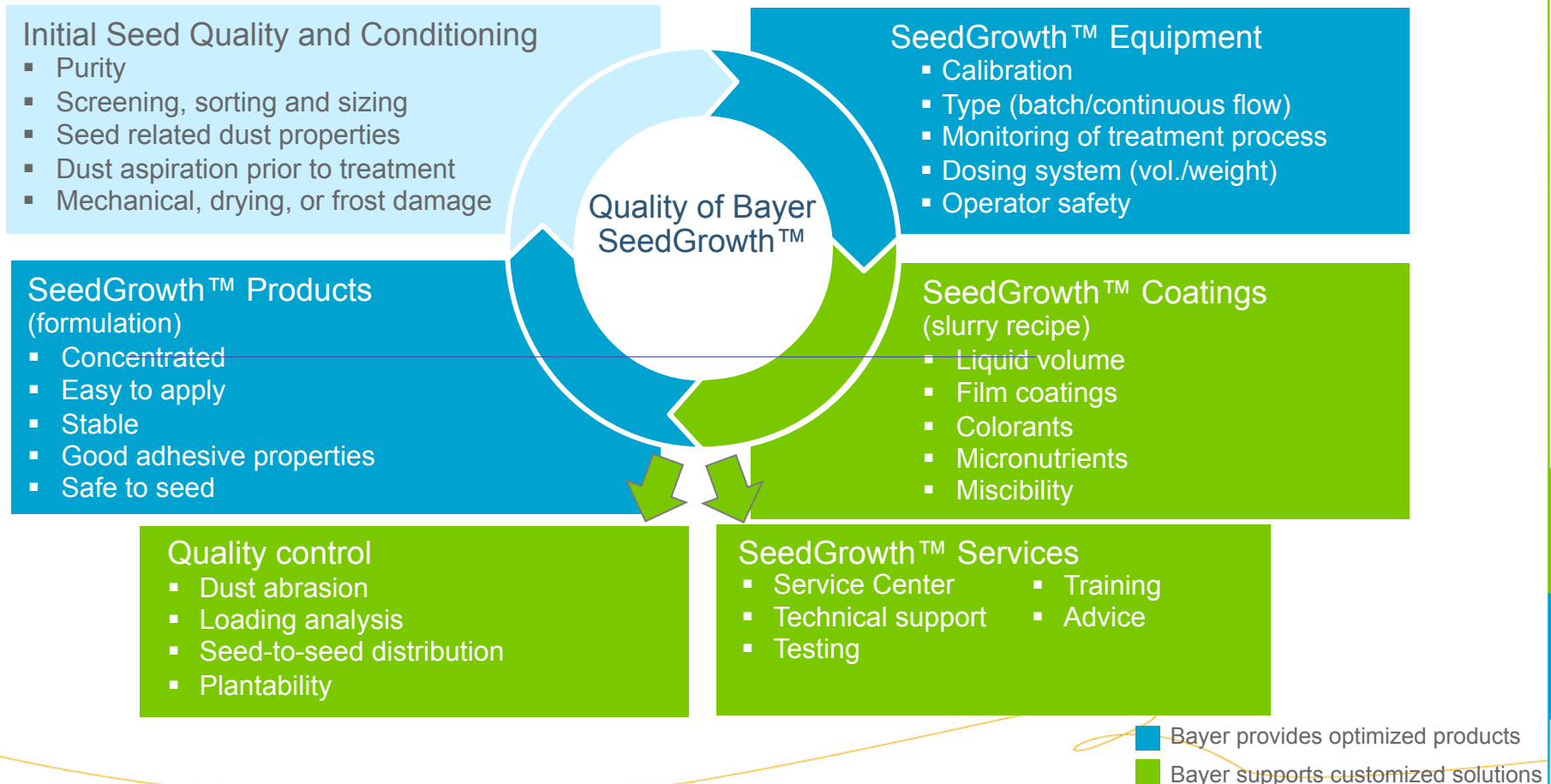
SweepAir™ Technology



Bayer SeedGrowth™ - A fully integrated system



Factors influencing seed treatment quality and stewardship





Quality Standard Initiative

Key components of the Quality Standard Initiative:

- Apply to high-quality, clean seeds
- Use only successfully tested and recommended application recipes
- Use of recommended film coatings
- Use of appropriate seed treatment application equipment
- Monitor quality of representative samples of commercially treated seed
- Quality standards for workforce/training



Will help ensure:

Increased safety and efficiency of seed treatment products for the environment and the user dismissal

Bayer CropScience is responsible for providing high-quality products to seed company partners who can help ensure high-quality seed treatments.

Stewardship brochures – distributed by meetings, conferences, training sessions, web posting, email to stakeholders and mailing to state officials



Recommendations for Good Seed Treatment Management

As a grower, you play an important role in helping protect the health of our honey bee population as well. This guide provides recommendations for responsible stewardship practices and proper seed treatment management that can help you maximize the benefits to your operation by supporting bee health and ensure a healthy environment and abundant food supply for future generations.

Live by the Label

For seed handling best practices, follow label directions and recommendations. Additionally, these guidelines will help protect you and the environment:

- Do not use treated seed for human or animal consumption or for processing.
- Keep out of reach of children, livestock and wildlife.
- Store under appropriate conditions.
- Wear protective clothing and gloves when handling treated seed and cleaning equipment. Avoid contact with skin and respiratory tract.
- Do not reuse empty seed bags for purposes other than storing the original treated seed.
- Observe all plant-back intervals and grazing restrictions.

Preplanting

When preparing for planting, review this checklist:

- Eliminate or reduce flowering weeds in fields to be planted.
- When opening seed containers and when filling or emptying the planting equipment, avoid exposure to dust.
- Avoid adding excess dust from the bottom of the seed container to the planter.
- Follow planter manufacturer recommendations for use of talc or graphite (avoid using more than recommended).

Planting

When it's time for planting, consider these guidelines:

- Minimize off-site movement of dust from treated seeds during planting.
- Be aware of wind speed and direction, particularly in areas with flowering crops which could attract pollinators.
- To protect birds and mammals, treated seed must be incorporated into the soil at proper planting depth, in particular at row ends and field corners.

Storage, Disposal & Cleaning

After planting is completed, review this checklist:

- Ensure that any leftover treated seed is returned to the original containers and properly stored for future use.
- Do not reuse empty seed containers for purposes other than storing original treated seed.
- Dispose of empty bags or bulk seed boxes according to state or local regulations and container return policies.
- Clean planters and seed boxes away from sensitive environmental areas, especially those that are attractive to pollinators.
 - Use a broom or shop vacuum to minimize dust release.
 - If compressed air is used, take care to minimize dust drift.
- Dispose of unusable treated seed according to state or local regulations. Offer seed for ethanol conversion to a properly permitted facility if available.

Storage & Transport

Protect your treated seed by reviewing the following guidelines:

- Avoid mechanical damage to treated seed.
- Store under appropriate conditions. The storage area must:
 - Have sufficient lighting and ventilation.
 - Be dry and secure.
- Transport in a way that no seeds are spilled on the highway or ground.
- If a spill occurs, treated seed should be properly disposed of according to local regulations to prevent exposure to people or the environment.
- If you have questions, concerns, or a potential incident involving bees or bee health, please call 800-334-7577 at any time.

Successful stewardship involves multiple stakeholders



- Registrants & seed companies:
 - Collaborating on comprehensive stewardship programs to ensure proper treatment of seeds and management of treated seeds
 - CLA/ASTA have developed a manual of seed treatment BMPs (release imminent)
- Manufacturers of seed coating technology:
 - research goal → less abraded dust.
- Ag equipment manufacturers:
 - Developing an international standard to guide design of planting equipment to control fugitive dust emissions.
- Beekeepers - consider ways to reduce exposure
 - Local communication with growers, register hives, restrict bee foraging at planting, move into areas after planting?
 - Practices adapted to local conditions

Bee Health is not about Pesticides

- Multiple factors affecting bee health: pests, pathogens, diseases, lack of forage etc.
- Bayer Bee Care Center : Dedicated North American research facility into the factors affecting bee health (2013)
- Compliments our European BBCC



Bayer Bee Care Center

- Will partner with multiple stakeholders involved in bee health
- Consolidates over 25 years of bee health involvement
- Ongoing activities
 - Varroacide research
 - Bee repellents
 - Small hive beetle control
 - Purification of beeswax (removal of pesticide residues)
 - Pollinator habitat and nutrition

Bayer Communication Outreach Local Engagement



■ Bayer Bee Ambassador Program

- Over 100 employees across the country trained on key topics related to honey bee management and health
- Ambassadors engage at the local level with multiple stakeholders about the value of honey bees and the challenges they face
- Direct interaction with customers and growers reinforces the need for good stewardship and awareness of bees near fields



■ Bee Tour

- Broad outreach activities planned include a mobile “bee unit” which will tour the mid west during the 6-8 weeks of planting season.
- This activity will focus on
 - “Bayer’s Commitment to Bee Health” message
 - Specific stewardship/research/good beekeeping practices





Summary

- The safety assessment of pesticides is an ongoing process throughout the lifecycle of the compound and its associated products
- Concerns have been raised around neonicotinoid seed treatments and effects on bees at corn planting
- The concern has been raised following an unusual incident in Germany in 2008 predominantly due to poorly treated seed.
- Very few reported incidents around corn planting in the U.S.
- The potential for incidents can be reduced via multiple routes: improved formulations, better lubricants, equipment developments, increased stewardship etc.
- The crop protection industry, seed coating manufactures, ag. equipment manufacturers are all proactively introducing these solutions
- Declining bee health is a different issue from acute exposure.
- Multiple stakeholders have a role if we are to improve bee health



Thank You For Your Attention