Corn Dust Research Consortium (CDRC)

Executive Summary & Recommendations

Reviewed and approved by the CDRC.

For further Information contact:

Pollinator Partnership
423 Washington Street, 5th Floor
San Francisco, CA 94010
USA
info@pollinator.org

Val Dolcini
President and CEO
Pollinator Partnership
530.400.6100
Vdolcini@pollinator.org

Laurie Davies Adams
Executive Director Emeritus
Pollinator Partnership
415.260.8092
LDA@pollinator.org

Kelly Rourke
Program Coordinator
Pollinator Partnership
415.362.1137
KR@pollinator.org

Tom Van Arsdall
Public Affairs Director
703.507.4746
TVA@pollinator.org

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Executive Summary

From 2013-2017 the CDRC assessed the interactions that honey bees were having with pollen and nectar sources during corn planting. In addition to pollen usage and foraging preference, the neonicotinoid residues present in or around potential pollen sources were examined where possible. The effectiveness of an alternative planting lubricant was also examined at one of the four study locations to determine if drift and concentrations of residues were reduced compared to graphite and talc products.

Each of the study centers had different experimental designs and protocols, even when investigating the same question. Because of these differences, which were encouraged by the CDRC, the executive summary illustrates highlights rather than combined conclusions in some instances.

Investigations of pollen usage showed that the majority of pollen collected by honey bees came from woody tree and shrub species, during planting. Salix and Acer species were most commonly used, as were members of the family Roseceae. Herbaceous pollen was less commonly collected. After planting there was a shift in pollen collection to more herbaceous dominated species with clover (Trifolium hybridum) being most common. Honey bees were noted to visit dandelion (Taraxacum spp.) very commonly during this period, although this pollen only accounted for a small amount of pollen returned to the hive, suggesting that they use these flowers as nectar sources.

The concentrations of neonicotinoids within bee-collected pollen during planting were significantly higher than after planting. The data from trees/shrubs and herbaceous plants suggest that the availability of different species of flowering resources relative to the time of corn planting can influence the exposure of honey bees to neonicotinoid insecticides and will vary with the environmental conditions of the year.

Bee mortality results associated with planting activities varied between the replicates, with some showing increased mortality with planting activities (Iowa and Ohio) and some showing no difference in mortality (Nebraska).

Neonicotinoid residues measured using vertical sticky traps and volumetric air samplers downwind during tillage events were much lower than the residues collected during planting (Guelph). The concentration of neonicotinoids captured at the field edge by either method was similar to those at the neighboring field edge downwind. **The CDRC results are not consistent with other research regarding the extent to which synthetic lubricants reduce net emission of dust-borne pesticide during planting of treated seed; however, the CDRC research showed sufficiently significant reductions to warrant use of these synthetic lubricants compared to talc or graphite.**

Efforts to reduce the amount of emitted dust with planter modifications and efforts to place bees in locations that minimize their exposure during planting are recommended.

Introduction and background

Honey bees living near corn fields can have multiple routes of exposure to pesticides. Exposure may be by contact (dust, soil), by ingestion (pollen/nectar/water), or a combination of these exposure routes. The focus of this discussion is exposure via dust from the planting of treated corn seeds.

Corn planting throughout the U.S. and Canada typically occurs from late April to early May when the fields are sufficiently dry to enter with equipment. Corn seeds currently in use by farmers are very frequently treated with pesticide(s). Under humid conditions, treated seeds may become sticky and require a lubricant/fluency agent to move effectively through pneumatic planting equipment; talc and/or graphite are frequently used as seed flow lubricants in the larger pneumatic planters to ensure uniform seed drop. Abrasion of treated seed coatings can result in particles containing pesticide residues mixing with the fluency agents to produce a contaminated "dust" (aka fugitive dust), which can be released by the air exhaust system during planting or subsequent cleaning of the equipment. This "dust" has the potential to be deposited on soil, water, and flowers within and adjacent to corn fields where foraging honey bees, and other pollinators, may be exposed to the pesticide(s).

In 2008, a large number of honey bee colonies in Germany were affected by the drift of dust generated through the abrasion of treated seed during planting. Since that time there has been concern regarding the extent to which one class of pesticides, i.e., neonicotinoid insecticides, can move off-site and represent a route of exposure for bees foraging in the vicinity of fields where neonicotinoid-treated seeds have been planted. Although the incident in Germany was attributed to a combination of factors (i.e., lack of a suitable sticking agent for the pesticide on the seed, seeding equipment that vents upward, dry windy conditions and an abundance of oilseed rape (canola) in full bloom immediately adjacent to the fields being planted), subsequent research (Krupke et al. 2012; Tapparo et al. 2012) has indicated that fugitive dust may still represent a route of exposure even where suitable sticking agents are used and seeding equipment vents downward.

The Corn Dust Research Consortium

The Corn Dust Research Consortium (CDRC) was formed in early 2013 at the request of the Pollinator Partnership, which provides administrative oversight to the CDRC, to explore potential exposure routes of honey bees to seed treatment dust as well as potential options to mitigate exposure. The CDRC secured the funding for and conducted the oversight of research into two specific corn dust/honey bee interactions in 2013 and 2014.

Question 1) What are the flowering resources available to and used by honey bees in and around corn fields during planting?

Question 2) What is the efficacy of a newly proposed fluency agent relative to talc and/or graphite in reducing the abrasion of treated seed coatings within planters during planting and the subsequent levels of pesticide-contaminated dust released into the environment?

Research teams addressing question 1 conducted work in three states (Ohio, Iowa, and Nebraska) and one province (Ontario). Question 2 was addressed by the research team in Ohio. Findings and a summary report of the 2013 and 2014 study years can be found at http://www.pollinator.org/PDFs/July2015CDRCFINAL.pdf. In 2015 the CDRC revisited these two research questions with an additional RFP solicitation and four project areas.

Project 1- Use by Honey Bees of flowering resources in and around cornfields during spring planting, and how this behavior can be effectively managed to reduce exposure to pesticide dust and residues;

Project 2 - The long-term health consequences of exposure of honey bee colonies to dust emitted during planting of neonicotinoid treated corn seeds;

Project 3 – The efficacy of CDRC recommendations in preventing honey bee exposure to corn dust; and

Project 4 - Efficacy of seed lubricant products

In 2015, the research team from Montana addressed project area 2, the team from Ohio addressed all four projects and the team from Ontario addressed project area one. The research team from Iowa did not continue into 2015.

The goal of the consortium in addressing these project areas is to utilize data from research conducted in during the 2013, 2014, and 2015 corn planting seasons across four North American locations to develop best practice guidance for future corn planting seasons, thereby reducing potential exposure of honey bees to fugitive dust during planting.

It was clear from the beginning that the CDRC could not address all aspects of pollinator exposure, and given limited resources and time, the decision was made to be focused in our efforts. The sampling was focused solely on the potential exposure to honey bees

with respect to corn planting. No other species or other crops were considered by CDRC-funded studies.

More than a dozen stakeholder groups that comprise the CDRC invested their time and resources to ensure that the research was conducted and presented in the most un-biased, open, and useful form. The participating stakeholders represent interests from various aspects of this situation and include members from:

American Beekeeping Federation
American Seed Trade Association
American Honey Producers Association
Association of Equipment Manufacturers
Bayer CropScience
BASF
Canadian Honey Council
Farm Equipment Manufacturers Association
Industrial Minerals Association - North America
National Corn Growers Association
Pollinator Partnership
Syngenta
University of Maryland

In addition, reviews of protocols and study results have been provided by the U.S. Department of Agriculture's Agricultural Research Service (USDA ARS), Health Canada's Pest Management Regulatory Agency (PMRA), and the U.S. Environmental Protection Agency's Office of Pesticide Programs (EPA OPP).

The CDRC research was not formed with the intent to address all questions related to potential exposure to a specific class of insecticides, *i.e.* neonicotinoids and their interaction and/or potential effects on honey bees or all pollinators. In fact, the CDRC research is NOT intended as:

- An endorsement of seed treatment, neonicotinoids, or any practice
- A program with a preconceived outcome
- A study involving any pollinator other than honey bees
- An examination of Colony Collapse Disorder (CCD)
- Applicable to any other crop until tested
- An examination of all potential routes of exposure
- An examination of potential additive, synergistic or antagonistic relationships between multiple pesticides (*e.g.*, insecticides and fungicides)

Corn Dust Research Recommendations - 2017

Pollinators provide an important ecosystem service, facilitating the production of foods and thus helping to provide food security. Concerns have been raised about the declining populations of some pollinators, and attempts have been made to identify the factors underlying these declines. Pesticides are among the potential contributors to such declines, and much is known about their toxicity and how they are being used, but there is a need for a better understanding of potential mechanisms of exposure and their consequences.

The CDRC was established to study one potential route of insecticide exposure for honey bees that is associated with the planting of neonicotinoid-treated coated corn seeds. Some of the planters used to plant these treated seeds may result in some abrasion of the coatings, and generation of dust (referred to as fugitive dust or dust-off) containing insecticide residues that can then be dispersed into the environment in and around the planted fields. Research funded by the CDRC has investigated the transmission of fugitive dust, how it can result in exposure to honey bees in the local environment, and what the consequences may be for honey bee colonies. The CDRC recommendations are based on data from three years' work at four separate institutions. The original CDRC goal was to be as helpful as possible in influencing the behaviors of all stakeholders with respect to the corn growing season.

Several steps will need to be taken to reduce exposure of honey bees to neonicotinoids in dust from abraded treated seed coatings that can be released during planting. Contributions are needed from every sector involved – from farmers, beekeepers, pesticide and lubricant manufacturers, equipment manufacturers, seed dealers, seed treatment application operations, government agencies and regulators, extension agents, agricultural and commodity organizations, and agricultural media. **The CDRC recommendations in bold are identified as having come directly from the results of the CDRC research.** Other recommendations are supported by work outside the CDRC research program. All recommendations have been vetted with the members of the CDRC; and, within the group there is general agreement that the recommendations though based on three years' data will benefit from further research. Recommendations are presented as a part of an incremental approach that will need to be tried and tested, monitored and adaptively managed.

RECOMENDATIONS

A. Farmers

- **Use abrasion-reducing lubricants in pneumatic planters during planting to reduce dust. The CDRC results are not consistent with other research regarding the extent to which synthetic lubricants reduce net emission of dust-borne pesticide during planting of treated seed; however, the CDRC**

research showed sufficiently significant reductions to warrant use of these synthetic lubricants compared to talc or graphite.

- **All research sites showed that during the corn planting window (approximately two weeks) honey bees foraged primarily on the pollen of woody shrubs and trees including apples, crab apples, hawthorns, maples and/or willow in areas outside of treated fields. These are important foraging sources to honey bees, particularly when sufficiently distant from the planting area to be unaffected by dust but within the foraging range of the honey bee. Bee-attractive woody pollen sources can be vulnerable to drift of pesticides in exhausted dust when corn is planted within 50 meters of such forage.**
- **Remove flowering vegetation within fields through tillage, mowing or use of herbicides where appropriate prior to planting.**
- Follow the principles of Integrated Pest Management (IPM). Get information at http://www.northeastipm.org/ and https://www.epa.gov/managing-pests-schools/introduction-integrated-pest-management.
- Follow all directions on treated seed container labeling and take precautions to reduce dust and drift, especially with respect to wind speed and weather conditions during corn planting. As stewards of the land, farmers play a significant role in the health of pollinators by reducing drift during corn planting. See the Guide to Seed Treatment Stewardship http://seed-treatment-guide.com/.
- Minimize unnecessary use of seed treatment insecticides. Use them only when needed, such as where historic pest infestations are above threshold or high risk factors for pest pressure have been anticipated or determined. While untreated seeds are available, they may need to be ordered in the fall prior to spring planting
- Seeding equipment foils and baffles are available that can help deflect dust downward thereby reducing drift. Please see https://www.iso.org/standard/61136.html for further information, though these standards refer to equipment design, not necessarily foils or baffles.
- Clean and maintain planting equipment regularly and carefully. Keep in mind that dust left in the hopper can still cause harm. In cleaning and maintaining planting equipment avoid generating additional dust and avoid contaminating areas with wash water. The dust needs to be scrubbed or filtered out of the exhaust and placed below ground or properly disposed of.
- Communicate with beekeepers to ensure that they are aware of planting timing and can take appropriate precautions to protect colonies (see below).

- If planting cover crops, choose varieties that are not in bloom during corn planting.
- Properly store and handle seeds by adhering to recommendations on the seed treatment tag. Treated seed should be protected from direct sunlight, extreme heat and moisture and kept in a well-ventilated area.

B. Beekeepers

- **Position hives away from areas where drift of corn dust can settle on herbaceous or woody plants during planting. Prevailing wind direction and wind speed may be helpful indicators for placement.**
- **Supplement the hive with internal feeding during and right after corn planting, and provide clean water to reduce the need for bees to seek water from sources in and adjacent to corn fields that may have been contaminated by fugitive dust.**
- **Protect supplemental food and water from dust drift.**
- Bees that are exposed to fugitive dust can have greatly improved recovery through post-exposure supplemental feeding and access to clean water. This action has the potential to mitigate long-term effects of exposure.
- If possible, reduce foraging of bees on the days of planting by confining bees to colony and/or by providing supplemental feeding source protected from dust drift.
- Communicate with growers/producers when you have hives in the area to be seeded.
- Clearly label hives with your contact information.
- Check hives regularly and report incidents to state/tribal lead agencies and/or EPA. https://www.epa.gov/pollinator-protection/report-bee-kills

C. Pesticide and lubricant manufacturers

- Continue work to improve seed treatments and fluency agents to reduce dust and dust movement at planting to further reduce risk to bees. This includes reduction in the generation and movement of contaminated dust off-field (*e.g.,* improved sticking agents and coatings, and improved fluency agents).
- Ensure the lowest effective labeled rate of neonicotinoid treatment is applied to the seed.
- Offer fungicide-only seed treatment options.
- Avoid/limit post-processing of treated seeds.

- Reach out to farmers, and help make them aware of the potential for pollinators to be exposed to contaminated dust and of the importance of farmers implementing recommended actions to reduce bee exposure.

D. Equipment manufacturers

- **Ensure that equipment users understand the importance of bee protections and the value of using lower-drift lubricants.**
- **Reduce aerial mobility of insecticide-laden particles by directing dust downward through planter design including foils and deflectors in equipment.**
- Provide mechanical means to reduce the movement of dust from fan exhaust during planting using equipment design principles and verification methods established in internationally recognized standards (ref. ISO 17962:2015, Agricultural machinery – Equipment for sowing – Minimization of the environmental effects of fan exhaust from pneumatic systems - https://www.iso.org/standard/61136.html).

E. Seed dealers

- **Adhere to quality control measures outlined in http://seed-treatment-guide.com/wp-content/uploads/2014/12/ASTA-Seed-Guide-Application.pdf**
- Support bee health by providing outreach to producers to make wise seed choices and to follow best seed planting practices.
- Offer untreated seeds as an option for farmers, and make it clear that this option is available.
- Take care in all production, movement, and storage of treated seed before and after it is used in planting. All abrasion of seed or residue from production has the potential to contribute to fugitive dust.

F. Provincial, state and federal government agencies and regulators

- Provide financial and instructional support for maintaining trees and shrubs outside drift areas for bee forage during planting season.
- Provide guidance for the reduction of attractive herbaceous forage in and around corn fields.
- Fully fund governmental provisions to ensure that pollinator forage area enhancement can increase and be sustained.
- Encourage application of the lowest effective labeled rate of neonicotinoid treatment on the seed.

- Ensure that both insecticide-treated and fungicide-only seeds are available, and educate farmers about this option.
- Ensure that IPM practice information is available to the producer.
- Provide a responsive structure for bee-incident reporting and be sure that it is understood and used by beekeepers. Ensure that incident report procedures are adequately funded and operate in a timely fashion commensurate with the urgency of this situation for honey bees and beekeepers.
- Ensure that seed bag labeling is clear and that growers are aware of the potential risk posed by planter dust.
- Dedicate transportation corridor and rights-of-way plantings to support the establishment of pollinator habitat.
- Reach out to farmers, and help make them aware of the situation and of the importance of farmers implementing recommended actions to reduce bee exposure from dust-off.

G. Extension agents, agricultural and commodity organizations, and agricultural media

- Ensure that IPM practice information is available to the grower/producer.
- Educate the beekeeper in practices that will safeguard bees.
- Educate beekeepers on bee-incident reporting.
- Educate growers/beekeepers so that label directions are clearly understood.
- Help agricultural producers, seed dealers and other stakeholders become aware of the situation and encourage them to adopt recommendations from this report to reduce bee exposure.