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POLLINATOR PARTNERSHIP

March 18, 2014

Dr. Reed Johnson,
Assistant Professor
Department of Entomology
Ohio State University – OARDC
1680 Madison Ave.
Wooster, OH 44619

Dear Dr. Johnson:

Congratulations! You have been chosen as a recipient of a Corn Dust Research Consortium (CDRC) Research Grant. USD$157,224.00 ($99,854 for Project 1 and $57,370 for Project 2) will be awarded for the purpose of the project, Assessing strategies to reduce honey bee exposure to dust emitted during planting of treated corn seeds in Ohio - A research proposal addressing Projects 1 and 2 of the Corn Dust Research Consortium 2014 RFP.

In signing this agreement, you agree to the following criteria:

- To follow requirements outlined in the original CDRC Request for Proposals (http://www.pollinator.org/PDFs/CDRC_RFP2014.pdf)
- To follow the requirements outlined in Appendix A (attached)
- An initial payment of 70% of the total award will be issued upon receipt of the this signed contract
- A written progress report is due Friday, August 1, 2014 to Jennifer Tsang at jt@pollinator.org. Upon approval of the narrative and financial report, the second payment of 20% of the total award will be issued.
- A written final narrative is due by December 1, 2014.
- A written final narrative and final financial report is due by Monday, December 1, 2014 to jt@pollinator.org. Once approved, the final 10% of the total award will be issued.
- We encourage photography or videography documentation from the onset of methods, experimental plots locations and in field activity for use in explaining the methodology and illustrating observations.

Please sign both copies of this letter. Failure to return one signed copy of the agreement within two weeks will jeopardize the grant. Retain one for your records and return the other copy to:

Pollinator Partnership
Attn: Jennifer Tsang
423 Washington St. 5th Fl.
San Francisco, CA 94111

By signing below, you are agreeing to acknowledge the Corn Dust Research Consortium (CDRC) in all announcements of research results. All press releases and release of research results need to be preapproved by the Pollinator Partnership.

Additionally, the PI agrees to be available for a conference call with the CDRC members to discuss research results on Wednesday, December 10, 2014 at 2PM EST.

Research data is not to be released outside of the CDRC group without an agreed upon

I have read and understand the terms and conditions of this agreement

1

OSU PI Signature Date

date between P2 and the principal investigator. Our tentative suggested data release date is February 1, 2015.

Failure to complete the project within the allotted one year grant period will entitle the Pollinator Partnership, in its discretion, to terminate this agreement and seek a return of grant funds. Unexpended funds will be returned to the Pollinator Partnership with the submission of the Final Report.

This agreement is executed as of the date of the last signature and is effective through January 7, 2015 at which time it will expire, unless extended by an executed modification, signed and dated by all properly authorized, signatory officials.

We look forward to working with you and hearing of your progress. Please send final reports, questions, and comments to Jennifer Tsang at jt@pollinator.org.

Sincerely,

Laurie Davies Adams
Executive Director, Pollinator Partnership

March 18, 2014
Date

Kim C. Carter
Signature (Authorized signer(s) in the OSU Office of Sponsored Programs)

Kim C. Carter
Printed Name (Authorized signer(s))

Associate Director
Title

Office of Sponsored Programs
Organization

3/20/14
Date

Funds for your grant will be sent from the Pollinator Partnership to your organization via check after receipt of this signed agreement. Please CLEARLY write the mailing address below:

Payable To:

Organization:

Street:

City / State / Zip:

Telephone Number:

Fax Number:

Contact Email Address:

LOGISTICS

Payment

- An initial payment of 70% of the total award will be issued upon receipt of the this signed contract
- A written progress report is due August 1, 2014. Upon approval of the narrative and financial report, the second payment of 20% of the total award will be issued.
- A written final narrative is due by December 1, 2014.
- A written final financial report is due Wednesday, January 15, 2015. Once approved, the final 10% of the total award will be issued.

Reporting

Email the completed report documents as a single PDF to Jennifer Tsang at jt@pollinator.org. Expectations for the progress and final reports are outlined on the separate report document.

Administrative Contact

Jennifer Tsang
Marketing Director
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Assessing strategies to reduce honey bee exposure to dust emitted during planting of treated corn seeds in Ohio

A research proposal addressing Projects 1 and 2 of the Corn Dust Research Consortium 2014 RFP

PI:

Reed Johnson, Assistant Professor

Deptartment of Entomology

Ohio State University – OARDC

1680 Madison Ave.

Wooster, OH 44619

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E-mail: johnson.5005@osu.edu

Co-PI:

Harold Watters, Assistant Professor

Ohio State University Extension

Field Specialist Agronomic Systems

1100 S. Detroit St.

Bellefontaine, OH 43311

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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 Description

This project aims to develop a greater understanding of the use of floral resources by honey bees in and around cornfields during corn planting. The act of planting seed corn coated with a seed treatment releases small amounts of insecticide into the environment in the form of dust (Nuyttens et al., 2013). This dust may settle on the surface of flowers adjacent to corn fields and honey bees may collect this dust as they go about collecting nectar and pollen from these blooms. By understanding what bees are foraging on during corn planting in corn-dominated agroecosystems, and how bees are exposed to corn seed treatment dust in that context, it may be possible to manipulate available floral resource to reduce bee exposure to seed treatment insecticides.

We propose to examine pollen and nectar sources utilized by honey bees during spring corn planting at the three apiaries studied in 2013 and two additional sites. We will perform landscape analysis to understand how floral use is related to landscape features (e.g., amount of floral-rich habitats within the surrounding landscape, distance of these floral-rich habitats to corn planting sites and to bee colonies). The ultimate goal is to develop recommendations for best management practices that growers can follow in order to minimize exposure of honey bees to seed treatment dust while maintaining as much foraging habitat for honey bees as possible.

The first-year's results indicated that honey bees predominantly collected pollen from mass-flowering woody species during corn planting. Residues of neonicotinoids (primarily clothianidin, imidacloprid, and thiamethoxam) were detected in pollen samples collected during corn planting. However, the levels of neonicotinoid residues in sorted samples were highly variable, ranging from 0 to > 400 ppb in each pollen category. The variation is likely associated with the proximity of the pollen sources to corn planting sites, i.e., sources located within the "risk zone" of seed dust drift may contain high levels of neonicotinoid resides.

Methods

Apiary setup and landscape analysis

Apiaries will be established at six sites, including the three sites that we studied in 2013 plus three additional sites in the same area of Central Ohio west of Columbus. All sites will be located in the corn-dominated landscape of Central Ohio with at least 15 km separating each site from its nearest neighbor.

In early April, four overwintered colonies, consisting of 1-2 boxes filled with brood and bees, will be installed at each apiary. All four of these colonies will be equipped with bottom mounted pollen traps that are easily turned on and off

(Sundance I). A drop-zone dead-bee trap (40"x20") will be placed in front of each colony, and dead bees will be collected and counted twice per week.

Concurrently, quantitative floral surveys will be conducted using established techniques (Williams et al., 2012) on a weekly basis to determine the diversity and phenology of floral resources in the several habitat types surrounding each apiary. It will be assumed that the assemblage of flowering plants in each habitat type is representative of flowering plants in similar habitat types over the foraging range of the colonies at the various sites.

Voucher plant specimens will be collected during floral surveys, and pollen will be sampled from plants to augment the current reference collection for pollen identification.

For the corn field in closest proximity to the apiary site we will collect data on the specifics of the planting operation. Planter type, Make, Model and Serial Number will be recorded. The type of corn seed planted will also be recorded as well as any seed lubricant used.

Pollen collection

Pollen will be collected from colonies on a rotating basis, to minimize any detrimental effects of pollen collection on colony nutrition and success, with traps being emptied and pollen traps being activated or deactivated on each trip to the apiary. Pollen collected from two colonies at each site on each collection date will be weighed, then half of collected pollen will pooled for use in all subsequent analyses.

Prior to corn planting, pollen will be harvested from these traps on a semiweekly basis, using the same protocol followed in 2013. To better capture the temporal variation in pollen assemblage and levels of corn seed treatment dust contamination associated with the period of corn planting, pollen will be sampled more intensively, at 48-hour intervals, during the period when corn is observed being planted in nearby fields by us or county Extension agents. Our semiweekly sampling schedule will resume for two weeks after local corn planting is complete. We anticipate collecting 2-5 semiweekly pollen samples prior to corn planting, 5-7 every-other-day pollen samples during corn planting and 3-4 semiweekly pollen samples after corn planting. Pollen collected at each site on each collection date will be weighed and then stored in glass jars at -20°C for further analyses.

Microscopic pollen identification

The floral sources of sampled pollen will be identified by color and by traditional microscopic palynological methods (Erdtman et al. 1969; Kopp et al. 2000). A 5% subsample of corbicular pollen (determined by weight) from each site and for each collection date will be sorted into distinct color classes, and the relative proportion of each color class will be estimated by weight (Dimou et al., 2006). In 2013 we sorted a 10% subsample of pollen balls, but this was extremely labor intensive and, given the additional sites and sampling proposed for 2014, we feel that the loss of very rare species from this analysis is justified

since those rare species are unlikely to be major routes of corn seed treatment dust exposure.

For microscopic palynological analysis, a 10% subsample from each color class will be blended in 1:1 water/glycerin solution and mounted in basic fuchsine jelly on glass slides. Pollen samples will be compared with reference pollen using a compound microscope (400X – 1000X magnification) and identified to the lowest possible taxonomic level (most often genus).

If a color class contains pollen of multiple taxa, which was common with some grey-yellow color classes in 2013, we will measure the average grain size and relative frequency of each taxon in 1000 pollen grains of that color class and then calculate the proportion of each taxon within the multi-floral color class using the formulas described in O'Rouke and Buchmann (1991). The final amount of pollen from each plant taxon, in grams, will be determined for each site at each collection date and corrected for color categories containing multiple taxa.

Molecular pollen identification

To improve the confidence of morphological pollen identification, a molecular metagenomic approach will be employed to complement the microscopic data. We first used this with pollen collected during corn planting in 2013 and have successfully sequenced the "plant barcode gene", ribosomal ITSII, from mixed pollen samples. We are currently in the data processing phase in which we are demultiplexing the reads, aligning them to their respective ITSII gene sequences, and generating a qualitative species list of plants foraged on at each time period. Preliminary analyses are very encouraging and we propose to use this molecular approach to validate microscopic identification with pollen collected during corn planting in 2014. The cost for sequencing continues to drop rapidly and we are confident that we can get the desired validation for 2014 pollen collections with a single run on the Illumina miSeq sequencer at a fraction of the cost of the 454 sequencing that we proposed in 2013.

After collecting pollen, 5% subsamples will be homogenized, from which 50 mg subsamples will be used for DNA extraction and purification. With extracted DNA, PCR amplification and sequencing of the plant ITSII region, a region commonly used for phylogenetics, can be used to determine what floral taxa are present in pollen samples. In the past year's study, the inconsistent nature of the ribosomal cassette region, which contains ITSII gene repeats that are differentially repetitive across taxa, presented a major obstacle to making this molecular analysis quantitative. In the coming year, we hope to develop a quantitative molecular method by using the non-repetitive, single copy plastid genes rbcl and matK (CBOL Plant Working Group, 2009). Alternatively, quantitative morphological data may be correlated to gene copy number to enable the calculation of correction coefficients for various plant taxa. In the case of the latter, having an additional year of metagenomic and morphological data will increase the predictive power of such corrective coefficients.

Determination of corn seed treatment insecticides in collected pollen

For chemical residue analysis of neonicotinoids and neonicotinoid metabolites pollen will be submitted to the USDA-AMS lab in Gastonia, NC, where tests will be performed. For pollen collected before and after planting five grams of bulk pollen collected at each site on each collection date will be submitted for neonicotinoid residue analysis.

For pollen collected during corn planting we will sort the pollen balls collected from each site on each date into three categories determined by habitat type and abundance: Woody Rosaceae (e.g. apple and hawthorn, which was the most abundant pollen during corn planting in 2013), other woody species (e.g. maple and willow), and herbaceous plants (e.g. dandelion and mustards). These pollen categories separate plants that could potentially be managed in fields or field margins (herbaceous plants commonly found in fields and field margins, roadsides, and sometimes in residential lots) from plants that are more permanent features of the landscape (woody and woody Rosaceae). After sorting, 1-5 g of pollen from each category will be submitted for neonicotinoid residue analysis.

Nectar collection and analysis

Nectar will be sampled from two colonies at each site on a weekly basis to 1) determine nectar sources that may be poorly represented in pollen ball analyses and 2) to assess the overall concentration of neonicotinoids in nectar collected at this time of year. To collect nectar collected during a particular week a frame of relatively new empty drawn comb will be rinsed with distilled water and the rinsate will be checked for pollen content using microscopic methods to determine the presence of existing pollen. The frame will then be placed in a spot inside the colony on the periphery of the brood nest where nectar deposition is observed. Nectar in the designated frame will be collected from at least 50 cells using a 200 microliter pipette. Nectar samples from each site will be pooled by date and stored at -20°C. To identify floral origins of the nectar the residual pollen in nectar will be examined using standard methods to determine honey origin (Louveaux et al. 1978; von der Ohe et al. 2004).

To determine if nectar is a potential route of neonicotinoid exposure for bees, 5 g of nectar collected before, during, and after corn planting at each site will be submitted for chemical analysis of neonicotinoid residues.

Landscape analysis and floral assessment in fields

We will define the total landscape of each apiary as the area contained by a 3 km radius centered on the location of the hives. In the week prior to the expected start of corn planting fields in the foraging range of each apiary will be surveyed from the road to assess the relative abundance of in-field floral resources or "weeds" that could be attractive to bees. Fields will be scored by the same student that scored fields in 2013 and will assign a score of "not attractive", "mildly attractive" or "attractive" for each field. This attractiveness score of crop fields, in conjunction with our floral surveying of other non-field habitat types, will be integrated into a map of floral resources available in each apiary's foraging area using GIS (QGIS Development Team, version 1.8).

A second visual survey of all crop fields will be conducted in June, after corn and soybeans are up, to determine which fields corn was planted into. These crop field data will also become available in January 2015 in the freely available USDA-NASS "Crop Data Layer" (http://www.nass.usda.gov/research/Cropland/SARS1a.htm) These satellite-based field designations will be incorporated into analysis when they become available. However, as the final report for this project is due in November 2014 we will not be able to use these data in generating our final report.

These maps of corn planting activity and floral resources will be used to identify plausible "risk zones" where attractive flowers occur either within or in close proximity to planted cornfields. The spatial extent and distribution of these risk zones, interpreted in light of the bee foraging and exposure data yielded from our pollen analysis and the drift data from Project 2 will provide insight into how alternative landscape management might alter the dynamics of honey bee neonicotinoid exposure in corn-rich agroecosystems.

Project 2: Efficacy of Seed Lubricant Products

A technical solution is needed to reduce the emission of corn seed treatment insecticide active ingredients during planting. Planter modifications and improvements in the adherence of treatments to the seed have been offered as solutions (Nikolakis et al., 2010; Biocca et al., 2011). However, one of the simplest potential solutions that could be immediately adopted by most corn growers, is a change in the seed lubricant used during planting. Talc, which is a traditional seed lubricant for pneumatic planters, can become very highly contaminated with seed treatment insecticides and may be contributing to the problem of honey bee exposure (Krupke et al., 2012). Indeed, the use of new seed lubricants are recommended as a "Best Management Practice" for reducing bee exposure to seed treatment insecticides during corn planting in Canada (http://www.hc-sc.gc.ca/cps-spc/pest/agri-commerce/pollinators-pollinisateurs/index-eng.php)

We will compare traditional talc or graphite seed lubricants with Bayer Crop Science's polyethylene-based seed fluency agent on 1) the quantity of active ingredient emitted during seed planting and 2) the distance that active ingredient travels. As much as possible, we will seek to follow the protocol outlined in the CDRC 2014 request for proposals with the explicit goal of augmenting data collected from previous studies on the effectiveness of this seed fluency agent conducted at Guelph and Purdue.

Growers will be selected from the west central to southwest Ohio row-crop producing area. Growers here are more likely to possess the larger 16- and 24-row planters equipped with center fill air assisted delivery systems. Site evaluation and grower evaluation will take place in late March into early April. Finding the best combination of planter, site and cooperative grower will occur

with a farm visit and discussion with operator and manager. A trial such as this with planter stops, changes in seed and lubricant, clean up procedures and test stand setup will require a patient and willing participant. A pool of cooperative growers in this area currently exists from past on-farm research trials. Watters has a short list of possible cooperators to approach, and if necessary this window will open to contact fellow extension educators to find the best producers likely to fill our needs. For this procedure some discussion of planning the operation will find those best cooperators. Once cooperators are identified then placing the trial in the best field setting will be discussed and planned. A back-up plan will also be established for each participating grower.

A minimum of three paired sites will be located in west to southwest Ohio. With a fourth site located and held as a backup to insure the likely success for the trial. If feasible, and enough cooperating growers can be identified, we will sample from as many six paired sites.

Planter type, including Make, Model and Serial Number will be recorded as well as the type of seed and insecticide seed treatment on the seed to be planted at each site pair. A sample of the seed to be planted will be retained for potential analysis in a Heubach dustmeter. The same planter and seed will be used on paired sites that are at least 20 acres in size. The local weather conditions will be determined at each field using a portable weather meter prior to planting at each site.

Seed treatment dust release and distance traveled will be accomplished using Krupke-style dust collection stations. These collection stations are constructed from a stake and hold sets of five microscope glass slides in a horizontal orientation 30 cm above the ground, to estimate dust deposition on herbaceous flowers, and five additional microscope slides in a vertical orientation 2m above the ground to intercept dust blowing by. Slides will be attached using tape to a paper bag, or will be held in a frame. In either case, the area of slide covered by the holder will be standardized and accounted for. Slides will be treated with aerosol Tangle-Trap Sticky Coating to intercept and hold dust particles.

The planter will have been cleaned out using standard techniques and randomly assigned to use either the conventional seed lubricant (talc or graphite) or the Bayer Fluency Agent, either of which will be added according to specifications. As in the Guelph study in 2013, the first 100 m of the field will be planted and then the collection stations will be erected in the portion of the field that has already been planted. This will standardize the landscape in which the stations are placed and will avoid problems with placing collection stations in ditches, roads or the property of other landowners.

Stations will be pushed into the ground so that the horizontal and vertical dust collectors are at the correct distance above the ground (30 cm and 2 m).

Stations will be placed at the edge of area planted (0 m), as well as 10, 50 and 100 m down wind. Three rows of detectors will be set up in this configuration.

Planting will again commence after station placement until 150 m of field is planted perpendicular to the wind direction. The number of passes required will vary depending on the size of the planter.

Dust collection stations will be removed immediately after planting and slides will be organized and stored at -20°C.

The planter will be cleaned and the procedure will be completed again with the same planter and seed, but in a different field using the second seed lubricant.

Slides will be prepared for focused neonicotinoid residue analysis by the USDA-AMS lab in Gastonia or another lab using LC/MS/MS. The quantity of neonicotinoid insecticide detected on the slides will be divided by the area of the slides, minus the area covered by tape, then converted to µg per m^2 for analysis and comparison with other studies.

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Budget Justification

Project 1:

PI Johnson requests funding for ¾ of a month ($6477) to contact and make arrangements with corn growers, manage and move bee colonies, train staff and analyze and interpret results. One post-doc with experience in beekeeping, pollen identification and conducting floral surveys will be funded for 7 months, ($28,957). A visiting scholar will assist in pollen slide preparation, pollen sorting and GIS analysis for 7 months ($11,770). One undergraduate researcher will contribute to beehive management and floral surveying for 2 months ($4163).

Travel between Wooster, Columbus and the six field sites will require approximately 20 trips ($3000). Twenty-four overwintered colonies will be needed. Approximately 14 hives are available, so 10 more will be purchased at $200 each from a local beekeeper ($2000). Additional beekeeping supplies will also be needed ($500).

For pollen collection and microscopic analysis we will need to purchase slides and bottles ($200). For the molecular identification we will purchase the NEBNext DNA Library Prep kit and NEBNext Multiplex Oligos for Illumina, plus other molecular reagents ($1200). The sequencing and bioinformatic analyses will take place at the OSU MCIC on the Wooster campus and will make use of the Illumina miSeq machine available there ($3000).

Chemical analysis service is requested to detect neonicotinoid pesticides in 108 pollen samples sorted by floral type (collections every 2 days for 12 days of corn planting at each of 6 sites, sorted into 3 floral classes), plus 36 bulk pollen samples collected outside the planting period. Chemical analysis is also requested for detecting neonicotinoids from 18 nectar samples collected before, during and after planting at the 6 sites. In total 162 samples will be submitted to

the USDA-AMS lab for neonicotinoid screening at a cost of $207.50 each ($33,615).

A professional video production team from the OSU College of Food, Agricultural, and Environmental Sciences Communications and Technology will be hired ($1000) to capture video of bees in the corn planting setting and the experimental procedures associated with the work proposed.

In total $99,854 is requested for Project 1.

Project 2:

PI Watters requests funding for 1 month ($10,449) to contact growers and set up sites, to perform the work of Project 2 and to train and coordinate an undergraduate field assistant, who will be employed for 2 months ($4,163). Additionally travel money is requested to make at least 4 visits to each site to set up and perform the experiment ($1000). Dust collectors will be constructed and consumables replaced, plus coolers and storage will be required for sample transport from the field. A video camera and tripod will be needed ($400) to record the planting process, as the unpredictability of the planting schedule will not allow scheduling with a videography crew. Chemical analysis will be required for neonicotinoid dust on 30 microscope slide detectors from each of 6 sites, plus 6 samples of dust from planters and 18 flower samples, for 204 samples at a cost of $207.50 each ($42,330). In total $57,370 is requested for Project 2.

Research timeline: Project 1

- March: Locate three suitable apiary sites in corn growing areas in Ohio (in addition to the three previously studies sites). Coordinate with growers to get serial numbers for planters, seed type planted and arrange for notice of planting. Order overwinter colonies and build up colonies already present. Construct additional drop zone dead bee traps and order additional pollen traps and beekeeping equipment. Hire undergraduate assistant.

- April – May: Install colonies at sites. Collect and store pollen and honey samples. Survey fields within foraging-range of apiaries and assign "attractiveness" score. Perform weekly floral surveys in representative habitat types and assemble pollen reference collection. Have video recorded and take photographs of bees and researchers in action.

- June – October: Retrieve colonies from field sites and monitor for long-term success. Sort and process pollen samples for microscopic and molecular analyses. Process honey samples for microscopy-based analysis. Identify floral sources for pollen and honey. Analyze floral survey and landscape data. Submit collected sorted pollen for chemical analysis.

- November: Analyze and summarize results and prepare final report for submission to the CDRC

- December – January: Coordinate with other CDRC-funded researchers to integrate results across North America and publish a peer-reviewed paper or papers.

Research Timeline: Project 2

- March - April: Identify cooperating growers and sites to conduct research. Contact Bayer Crop Science or Syngenta to get fluency agent. Construct dosimeter stakes. Hire undergraduate assistant.

- April – May: Prepare dosimeters and perform experiment in coordination with growers. Record data about planter make and model and seed used. Collect and store dosimeter slides, flowers and dust. Record video and take photographs of corn planting, lubricant use and dust collection.

- June: Submit samples for neonicotinoid residue analysis.

- July-November: Analyze and summarize results and prepare final report for submission to the CDRC

REED M. JOHNSON

Professional Preparation
Wabash College, Biology, B.A. 1998
Wake Forest University, Biology, M.S. 2002
University of Illinois at Urbana-Champaign, Entomology, Ph.D. 2008

Appointments
2011-present: Assistant Professor, Dept. of Entomology, The Ohio State University.
2009-2011: Postdoc. Res. Assoc., Dept. of Entomology, University of Nebraska—Lincoln.

Award
Eastern Apicultural Society of North America, Student Award, 2009

Professional Service
Chairman, NRCA-SAES Multistate Research Project NC1173: Sustainable Solutions to Problems Affecting Bee Health. 2012-2014
Trustee, Foundation for the Preservation of Honey Bees. 2013-present
Board Member, American Association of Professional Apiculturists. 2011-present

Publications
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Funding History

Jasinski, J. and Johnson R. 2014. Ohio Vegetable and Small Fruit Research & Development Program. Evaluating pesticide effects on squash bees in cucurbits. $4,300

Johnson R.M. EPA-RARE Program. 2013-2015. Data analysis and experimental design concerning bee kill incidents in the Upper Midwest associated with neonicotinoid pesticide treated seed plantings. $149,895

Johnson R.M. 2013-2014. Project Apis m. Effects of "bee-safe" insecticides and common insecticide-fungicide combinations on queen and worker larval development. $83,660

Janini T.E. and Johnson R.M. Eastern Apicultural Society. 2013. Effects of neonicotinoid/fungicide/adjuvant pesticide combinations commonly encountered by honey bees on pumpkins. $5,000

Johnson R.M. Pollinator Partnership Corn Dust Research Consortium. 2013. Use by honey bees of flowering resources in and around cornfields in Ohio. $78,206

Courses Taught

Pesticide Science. Entomology 5800 (3 credits). The Ohio State University. Fall 2013. Co-taught with Celeste Welty.

Beekeeping. Entomology 2900 (3 credits). The Ohio State University. Spring 2013 and 2014.

HAROLD D. WATTERS

Institution and location	*Degree*	*Field of study*
The Ohio State University	MS	Agronomy and Crop Science
The Ohio State University	BS	Natural Resources Development

Positions

- Jan 2012 to present, Assistant Professor & Field Specialist Agronomic Systems, Ohio State University Extension, Agriculture & Natural Resources, Ohio State University Extension
    - Apr 2004 to present, Agronomic Crops Team Coordinator, College of Food, Agricultural, and Environmental Sciences, The Ohio State University
- Apr 2009 - Dec 2011, Assistant Professor/ County Extension Director/ Agriculture & Natural Resources Educator, Ohio State University Extension, Ohio State University Extension Champaign County
- Jun 2008 - Mar 2009, Educator III/ County Extension Director/ Agriculture & Natural Resources Educator, Ohio State University Extension, Ohio State University Extension Champaign County
- Oct 2007 - Jun 2008, Extension Educator III, Agriculture & Natural Resources for Champaign County, CFAES / West Region, College of Food, Agriculture and Environmental Science, Ohio State University Extension Champaign County
- Apr 2005 - Sep 2007, Extension Educator II, Agriculture & Natural Resources for Champaign County, CFAES / West Region, College of Food, Agriculture and Environmental Science, Ohio State University Extension Champaign County
- Aug 2002 - Apr 2005, Extension Agent II, Agriculture & Natural Resources and Community Development, CFAES / Southwest District, College of Food, Agriculture and Environmental Science, Ohio State University Extension Miami County
- Sep 1998 - May 2002, Agronomic Systems Manager, Monsanto Corp.
- Sep 1993 - Sep 1998, Senior Field Biologist, BASF Corp
- Sep 1988 - Sep 1993, Product Development Agronomist, Calgene, Inc.
- Apr 1984 - Mar 1987, Market Development Agronomist, BASF Corp., Ohio

Selected Honors

- Mar 2013, 2012 Agronomist of the Year Ukraine Farmer-to-Farmer Program, USAID Farmer to Farmer Program, Bridges CNFA Ukraine
- Jul 2010, Search for Excellence Extension Program Award, Sustainable Agriculture: State Winner (Team Award), NACAA, National Association of County Agricultural Agents
- Oct 2009, Service Award Division Chair - A-9 Professional Practitioners, Chairman, American Society of Agronomy
- Oct 2009, Service Award ICCA Certification Board, International Certified Crop Adviser Program, American Society of Agronomy

Selected Publication

Dorrance, A.E., Cruz, C., Mills, D., Bender, R., Koenig, M., LaBarge, G., Leeds, R., Mangione, D., McCluer, G., Ruhl, S., Siegrist, H., Sundermeier, A., Sonnenberg, D., Yost, J., Watters, H., Wilson, G., Hammond, R. "Effect of Foliar Fungicide and Insecticide Applications on Soybean in Ohio." Plant Health Progress. Vol. online, no. Plant Health Progress doi: 10.1094/PHP-2010-0122-01-RS. (Jan 2010): online. http://www.plantmanagementnetwork.org/sub/php/research/2010/soybean/. (Published).

Research Support

- Oct 2013 Lindsey, L., "Stepping-up Soybean: Production, Profits, and Quality: Year 2" Ohio Soybean Council. $250,000 (USD). Multi-PI.
- Oct 2013 LaBarge, G., Watters, H., Prochaska, S., "Training and Educational Programs for Ohio's Crop Industry on Soybean Related Issues" Ohio Soybean Council. $52,570 (USD). Multi-PI.
- Jan 2013 Lindsey, L., "Stepping-up Soybean: Production, Profits, and Quality: Year 1" Ohio Soybean Council. $307,607 (USD). Multi-PI.
- Oct 2012 Taylor, N., "First Detector and Sentinel Plant Network Training, an Outreach and Education Program" U.S. Department of Agriculture. $38,418 (USD). Collaborator.
- Nov 2012 LaBarge, G., Prochaska, S., Watters, H., Arnold, G., "Increasing NMP (Nutrient Management Practice) Expertise in Blanchard Watershed" U.S. Environmental Protection Agency. $193,923 (USD). Multi-PI.
- Oct 2012 Michel, A., "Monitoring, Understanding and Managing Insect Threats to Ohio Soybean Production" Ohio Soybean Council. $56,000 (USD). Multi-PI.
- Jan 2013 LaBarge, G., Watters, H., Prochaska, S., "Training and Educational Programs for Ohio's Crop Industry on Soybean Related Issues" Ohio Soybean Council. $40,625 (USD). Multi-PI.
- Apr 2009 Watters, H.D., "West Ohio Nitrogen Management" Seed Consultant's, Inc. $1,500 (USD). Principal Investigator.
- May 2013 - Dec 2013 Watters, H., "Conservation Tillage Conference Research Grant" Conservation Tillage Conference. $2,000 (USD). Principal Investigator.
- Jan 2013 - Jun 2013 Folck, L., "Pesticide Applicator Training" OSU Pesticide Education Program. $4,394 (USD). Collaborator.
- Jun 2012 - May 2013 Lines, A., "Cochran Fellows" Cochran Fellows. $550 (USD). Collaborator.
- Mar 2013 - Sep 2013 Dotsenko, L., "USAID FtF Training & Travel to Ukraine" U.S. Agency for International Development. $11,000 (USD). Collaborator.
- Oct 2012 - Jan 2013 Hall, D., Myers, S., "OBIC, Advanced Fertilizer Materials" The Andersons, Inc. $11,732 (USD). Co-Investigator.

POLLINATOR PARTNERSHIP

CDRC REQUEST FOR PAYMENT 2014

INSTRUCTIONS: Do not change the typeface or font of this document. It should be in Arial, 10-pt font, single spaced, with page numbers. Email Jennifer Tsang at jt@pollinator.org this report as a single PDF, including any additional appendices.

CHECK ONE: ☐ **Progress Report (due 8/1/14)** ☐ **Final Report (due 12/1/14)**

☐ **Project 1** ☐ **Project 2**

FULL GRANT AWARD AMOUNT: $

AMOUNT REQUESTED (progress report-20% of total; final report-10% of total): $

PERIOD COVERED IN THIS REPORT (mm/dd/yy – mm/dd/yy):

CONTACT INFORMATION: List the Principal Investigators below, including, name, email, physical mailing address, and telephone number.

NARRATIVE REPORT
Please include an 8-page (maximum) project description for ***each*** *project. Summarize project activities and outcomes including lessons learned and problems and possible solutions that have arisen.*

TIMELINE
Is the research project on schedule? If not, please explain. What is the research timeline for the remainder of the project?

FINANCIAL REPORT
Please include a maximum 2-page detailed financial report that includes a breakdown of funds expended to-date and any in-kind hours (optional) that may have been used.

OPTIONAL
Please include any additional information you deem relevant, including photographs, charts, video, etc.

SIGNATURE OF PRINCIPAL INVESTIGATOR
By signing the below I acknowledge that all information stated in this report is true to my best knowledge. All data collected is included in this report. I have not and will not share this data with those outside of the CDRC group until I have come to an agreement with the Pollinator Partnership.

Signature	Title	Date