Agreement

This Agreement, dated April 4, 2017 by and among Iowa State University of Science and Technology ("University"), with offices at 1805 Collaboration Place, Suite 2100, Ames, IA 50010, Bayer CropScience LP (“Bayer”) a Delaware limited partnership with offices at 2 TW Alexander Drive, Research Triangle Park, NC, and Syngenta Crop Protection, LLC, with offices located at 410 Swing Rd., Greensboro, NC 27419 (“Syngenta”).

Bayer and Syngenta would like to co-sponsor the Project set forth below and University is willing to provide such research services based on the terms set forth below:

1. Title: Estimating the exposure to neonicotinoid residues in pollinator-attractive habitat adjacent to corn and soybean fields (the “Project”)

2. Protocol No.: Iowa State GS#138020

3. University’s Primary Researcher and contact information:

   Matthew O’Neal
   Associate Professor
   Department of Entomology
   Chair, Graduate Program in Sustainable Agriculture
   Iowa State University
   Phone: 515-294-8622
   Email: oneal@iastate.edu

   Additional Researchers (all Iowa State): Joel Coats, Steve Bradbury, Amy Toth

4. Sponsor Representative and contact information:

   Daniel R. Schmehl (primary contact)
   Scientist II
   Bayer CropScience, LP
   CropScience Division, Environmental Safety, Pollinator Safety
   2 T.W. Alexander Drive, Research Triangle Park, NC 27713
   Phone: 919-549-2810
   Email: [redacted]

   Caydee Savinelli
   Pollinator and IPM Stewardship Lead
   Syngenta Crop Protection, LLC
   410 Swing Rd., Greensboro, NC 27419
   Phone: 336-632-2283
   Email: [redacted]

   Max Feken
   Ecological Risk Assessment
   Syngenta Crop Protection, LLC
   410 Swing Rd., Greensboro, NC 27419
   Phone: 336-632-2269
   Email: [redacted]

5. Project Statement of Work: See attached Exhibit 1

6.. Project Period: March 31, 2017 - March 31, 2018

A final study report and available copies of the raw data are to be submitted to Bayer and Syngenta for review prior to the end of March 2018 and prior to any publication by University.

7. Project Budget: Fixed Sum of $301,671

7a. Bayer will be responsible for 66.85% of the Project budget ($201,671)

7b. Syngenta will be responsible for 33.15% of the Project budget ($100,000)

8. Project Payment Schedule:

Payment will be made within 60 days of receipt of invoice.

a) Bayer will be responsible for 33.425% ($100,835.50) of the fee upon completion of this Agreement

b) Syngenta will be responsible for 33.15% ($100,000) of the fee upon completion of this Agreement

c) Bayer will be responsible for the final 33.425% ($100,835.50) upon Bayer and Syngenta receipt of an interim progress report due within 30 days from the completion of the field phase (all samples have been collected) of the project.

Bayer and Syngenta shall make checks payable to "Iowa State University" and send payments to: *Sponsored Programs Accounting, 2221 Wanda Daley Drive,1810 Administrative Services Building, Ames, Iowa 50011-1004 with reference to the Project*.

9. Invoice Sponsors? Yes/No: Yes

10. University shall own the data generated from the Project. Bayer and Syngenta shall have the right to review any and all results or data (including raw data) generated by the University related to this Project. Bayer and Syngenta shall be provided opportunity for review and comment on all publications or scientific presentations thirty (30) days prior to being submitted or presented by the University to determine if any of their confidential information is contained therein. If Bayer and Syngenta raise no objection within the notification period above, then University has the right to proceed with public disclosure. All public disclosures under this Project shall acknowledge Bayer and Syngenta as appropriate. University shall have the first right to publish or present. If University chooses not to, Bayer and Syngenta shall have the right to present on all data generated from the Project two years from the expiration of the Project. University shall review any presentation thirty (30) days prior to being submitted or presented by either Bayer or Syngenta to determine if any of its confidential information is contained therein. If University raises no objection within the notification period above, then Bayer and Syngenta have the right to proceed with public disclosure. All public disclosures under this Project shall acknowledge University as appropriate.

11. University will conduct the testing in strict compliance with the Project and agrees not to deviate from the Project unless agreed by all parties. University will strictly conform to all regulations which may apply to its activities in the framework of the Project.

12. The parties agree that any dispute relating to the construction or performance of this Agreement may be resolved by suit in any United States district court for the judicial district in which the Project will be performed or in which University is located.
Either party may terminate this Agreement with sixty (60) days written notice. Upon termination, University will be compensated for all actual and allowable expenses and all non-cancellable obligations properly incurred or encumbered prior to the date of termination.
The expiration or termination of this Agreement shall not supersede the parties' obligations with respect to any provision that survives expiration or termination of this Agreement by its terms. In addition, the following Sections shall survive: 7, 10, 12,14, and 15.

13. This Agreement constitutes the entire agreement of the parties and merges all prior discussions and agreements between them respecting the subject matter hereof, including but not limited to sponsored program agreements, prior non-disclosure agreements and other like research and form agreements relating to research projects. No modification or waiver of this Agreement shall bind either party unless it is in writing and is signed and accepted by the parties hereto.

14. Intellectual Property ("IP") means any patentable inventions and/or copyrightable matter first conceived and/or reduced to practice in the performance of the Project. IP shall not include the background intellectual property of either party or University faculty scholarly publications. "University IP" means any IP wherein the inventorship consists of University Researchers. "University Researchers" means the principal investigator and other University employees working under his/her supervision performing research under the Project pursuant to this Agreement. University IP will be owned by the Iowa State University Research Foundation, Inc. ("ISURF") on behalf of University. "Joint IP" means any IP wherein the inventorship consists of at least one of both a University Researcher and an employee or agent of Bayer and/or Syngenta; Joint IP will be owned jointly by ISURF and Bayer and/or Syngenta.

    Intellectual property and tangible materials developed outside the performance of the Project by a party shall continue to be owned and/or controlled by that party and no right to it, expressed or implied, is granted by this Agreement.

    Notwithstanding anything herein to the contrary, in all circumstances University shall retain rights in University IP and Joint IP to practice and have practiced the inventions of the University IP and Joint IP for research and educational purposes.

15. Each party shall be liable for any breaches of this Agreement by its officers, employees, representatives and consultants. Bayer and Syngenta determine independently whether results from the Project are suitable for the particular use intended by them. Neither Party shall be responsible or liable for any injuries or losses that may result from the implementation or use by the other of the results from the Project.
No Warranty. All results of the Project are provided "AS IS," WITHOUT WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED. UNIVERSITY MAKES NO REPRESENTATION OR WARRANTY THAT THE USE OF THE PROJECT RESULTS WILL NOT INFRINGE ANY PATENT OR OTHER PROPRIETARY RIGHT.

16. This Agreement shall bind and inure to the benefit of the successors and assigns of the entire business of the respective parties; and it will not be assigned by any party without the prior written consent of the other parties, provided however that any party shall be permitted to assign this Agreement to an affiliate without consent.

17. Researcher agrees that he/she/it will not accept federal funding for the Project, or any research directly related to the Project, or involve any federal agency in the Project or such testing without first obtaining Bayer's and Syngenta's prior written consent.

18. This Agreement may be executed in three or more counterparts, each of which shall be deemed an original but all of which together shall constitute one and the same instrument. PDF execution and delivery of this Agreement are legal, valid, and binding execution and delivery for all purposes.

IN WITNESS WHEREOF, the parties have entered into this Agreement as of the last date set forth above.

Bayer CropScience LP

Name: David L Fischer

Printed Name: David L. Fischer

Title: Director

Iowa State University of Science and Technology

DocuSigned by:
May Wu
9D2523A9C14F489...

Name: May Wu

Printed Name: May Wu

Title: Senior Negotiator

Syngenta Crop Protection, LLC

Name: _____

Printed Name: _____

Title: _____

Read and understood:

Name: Matthew O'Neal

Printed Name: Matthew O'Neal

Title: University Researcher

16. This Agreement shall bind and inure to the benefit of the successors and assigns of the entire business of the respective parties; and it will not be assigned by any party without the prior written consent of the other parties, provided however that any party shall be permitted to assign this Agreement to an affiliate without consent.

17. Researcher agrees that he/she/it will not accept federal funding for the Project, or any research directly related to the Project, or involve any federal agency in the Project or such testing without first obtaining Bayer's and Syngenta's prior written consent.

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IN WITNESS WHEREOF, the parties have entered into this Agreement as of the last date set forth above.

Bayer CropScience LP

Name: _____

Printed Name: _____

Title: _____

Iowa State University of Science and Technology

Name: _____

Printed Name: _____

Title: _____

Syngenta Crop Protection, LLC

Name: Russell Underwood

Printed Name: Russell Underwood

Title: Technical Leader Environmental Safety

Read and understood:

Name: _____

Printed Name: Matthew O'Neal

Title: University Researcher

Exhibit 1: – Statement of Work / Protocol

Estimating the exposure to neonicotinoid residues in pollinator-attractive habitat adjacent to corn and soybean fields

Problem statement:

Neonicotinoid movement to adjacent off-field habitat may occur from the movement of neonicotinoids through the soil, and dust from the planting of neonicotinoid-treated corn and soybean seed. The extent of and potential risk to pollinators from neonicotinoid movement into these adjacent pollinator habitats like STRIPS is unclear. Although published data sets to date suggest that neonicotinoids can be present in pollinator habitats, these studies report great variation in the concentrations and thus the potential exposure for pollinators. This uncertainty is leading the National Resources Conservation Service (NRCS) and public citizens to question whether adding pollinator and monarch habitat in close proximity to farm fields is harmful to visiting pollinators and is contributing to the removal or placement of pollinator-attractive habitat near agricultural lands. **We propose to measure neonicotinoid exposure in pollinator habitats adjacent (within 1-3 m) to fields planted with neonicotinoid-treated corn and soybean seeds, to determine any potential risk to visiting bees and monarch larvae.**

We will collaborate with the Iowa State University (ISU) Science-based Trials of Row crops Integrated with Prairie Strips project (STRIPS) experimental sites to characterize imidacloprid (and major metabolites), clothianidin, and thiamethoxam exposure found in pollinator-attractive plants located within the prairie strips. Since 2007, this multi-disciplinary team has investigated the use of diverse, native, perennial vegetation (i.e. prairies) sown as strips within crop fields for the delivery of regulatory and support services for crop production (https://www.nrem.iastate.edu/research/STRIPs/). Results have shown that small amounts of prairie can yield disproportionate benefits to soil, watersheds and biodiversity. When prairie is planted along the contour of a crop field or at the base, these perennial habitats capture water, sediment, and nutrients moving from the adjacent crop. Published research by the STRIPS team has demonstrated that the addition of a prairie strip can reduce runoff by 47%, and retain 4.3 times more phosphorus and 3.3 times more nitrogen than fields without a strip (Zhou et al. 2010; Schulte-Moore et al., *in review*). Furthermore, these prairie strips increase biodiversity, including native plants, birds, insects and pollinators (Cox et al. 2014, Schulte-Moore et al., *in review*).

The prairie plants used within the STRIPS project include several species which are attractive to pollinators (Tuell et al. 2008). When combined in a mixture, prairie plants can provide a season-long source of nectar and pollen that increases the abundance and diversity of pollinators compared to plants commonly found in a farm landscape (Gill et al. 2014). Adding perennial flowering plants to farm land can deliver insect-derived ecosystem services, like pest control and pollination, to adjacent farmland (Isaacs et al. 2009). When these plantings include milkweed, they can provide breeding habitat for monarch butterflies. Currently, the NRCS *Monarch Butterfly Wildlife Habitat Evaluation Guide* (NRCS, 2016) ***recommends no new placement of monarch breeding habitat within 125 feet of crop fields that are treated with herbicides or insecticides***. A similar restriction is associated with implementation of pollinator

conservation practices (i.e., CP42). Employing a buffer of this size would make a significant area of land unavailable for the establishment of bee and monarch butterfly habitat. For example, in Story County, Iowa, a 125 ft buffer around corn and soybean fields would eliminate approximately 84% of rural roadside habitat and 38% of grassland, including CRP land, pastures, railroad right-of-ways, riparian corridors and wetlands from habitat enhancements. However, a risk-based rationale for the buffer has not been published. This underscores the important need to more accurately determine the risk of neonicotinoid exposure to pollinators (e.g. honey bees and monarchs) to better inform conservation actions such as buffers to pollinator habitat.

Recent published research indicates neonicotinoid applied to crops can be found in adjacent pollinator-attractive habitat (Mogren and Lundgren 2016, Paola and Kaplan 2015, Pecenka and Lundgren 2015, Botías et al., 2015, 2016;) and found within pollen collected by honey bees (Long & Krupke, 2016; David et al., 2016). As noted by Krupke et al. (2012), dust produced during the planting of corn and soybean seed treated with a neonicotinoid can collect on flowers in and around a crop field, serving as a route of exposure to honey bees. Furthermore, imidacloprid, clothianidin, and thiamethoxam have been detected in Iowa streams, presumably due to subsurface flow (Hladik et al., 2014), which raises the possibility that non-target plants downslope of the cropped field could absorb neonicotinoids systemically. Two studies provide preliminary evidence of the potential for systemic uptake of neonicotinoids in milkweed near crop fields. Paola and Kaplan (2015) did not find clothianidin in the leaves of common milkweed plants located 0–50 m from two corn fields in Indiana, but approximately 15% of the plants at a distance of 50–90 m from the fields had detectable levels (minimum detection level for the HPLC-MS/MS method not provided). While the concentration range of clothianidin in plants with detectable levels was not provided, the maximum concentration of clothianidin present in one plant was 14 ng/g. Using an ELISA method, Pecenka and Lundgren (2015) reported detectable levels of clothianidin in approximately 65% and 35% of common milkweed plant leaves sampled in June and July, respectively, within 1.5 m of corn fields in Brookings County, South Dakota. Mean concentrations ranged from 0.4 (June) to 0.69 ng/g (July), with a mean of 1.14 ng/g in plants with detectable levels. Consequently, honey bees, native bees and monarchs could be exposed to neonicotinoid insecticides through ingestion of pollen (bees), nectar (bees and adult monarchs) and milkweed leaves (monarch larvae).

Although these studies note that neonicotinoids can be present in habitat provided for pollinators, they have not confirmed if this results in exposure that is within the range that would produce effects. EPA has determined that a level of concern (LOC) for adverse effects on honey bee colonies is 25 ppb for imidacloprid and is 19 ppb for clothianidin/thiamethoxam for a nectar route of exposure. The LOC for pollen is expected to be higher than nectar because less pollen is consumed by a bee relative to nectar. These EPA values and any additional new information that may be available will be used to conduct a risk analyses for lethal and sub-lethal exposures to bees and monarchs.

Outreach from the STRIPS project has resulted in several farm-landowner cooperators (n = 30) incorporating prairie strips of varying amounts and locations to fields committed to corn and soybean production. These cooperators are interested in this practice because it can reduce erosion and the movement of nutrients off-farm. As part of an on-going research program, researchers at ISU are continuing to explore how this practice can improve ground

and surface water. However, cooperators have expressed strong interest in how practices like STRIPS and the NRCS's pollinator conservation practices increase the amount of pollinators to their farms. In a recent survey, cooperators questioned if these practices "serve as a sink that lures in pollinators, which then could be harmed by pesticides used on adjoining crops?" (Arbuckle 2017). Given the current uncertainty regarding the potential movement of neonicotinoids from cropland to adjacent habitat, there is a need to address this with data collected in a farm-setting. A collaboration between ISU and Bayer researchers are interested in collecting these data at a subset of these farms, to characterize the magnitude of neonicotinoids into these prairie habitats. By working with farmers participating in the STRIPS project, *we will study this exposure in a 'worse-case scenario', as the prairie strips are placed at the base or within sloping fields such that water and soil moves into them.*

Objectives for this study are:

1) Characterize the exposure of neonicotinoid residues in these adjacent pollinator-attractive habitats and;
2) Use deterministic estimates to assess the potential of residues in pollen, nectar and leaves measured in these habitats to cause adverse effects to bees and monarch larvae.

We will measure the occurrence and magnitude of neonicotinoids in soil, leaf tissue and the nectar and pollen take from honey bees collected in the act of foraging on these prairie plants. This estimation will be made at several key time points during the growing season.
***Note**: The proposed project scope and budget is limited to a single year, but our intention is to request additional funding after year 1 to extend this project to a second year to confirm that exposure estimates are consistent between years.

METHODS

Study locations*-** We have identified ***10 commercial farms in central Iowa that have established prairie strips within them and will plant neonicotinoid-treated corn and/or soybean seeds in 2017. Up to two honey bee hives at each location will be placed at each commercial farm to ensure that honey bees are present at the farms. Farmers will provide us with data on the crop planted, whether talc/graphite/fluency agent was used during planting, what tractor model was used for planting, and what type and A.I. concentration of seed treatments were used. We will work with the participating farmers to collect historical data regarding cropping history and neonicotinoid use (both seed-applied and foliar applied) through the beginning of 2016. If the farmer cooperators are agreeable, we may collect treated seed and conduct a Heubach test (sent to Bayer for analysis) to assess the generation of dust produced from the treated seeds.

***Sampling periods*-**We will collect samples at six time-points during the growing season (Table 1). These time periods are selected to help determine the likely source of neonicotinoids to the prairie strips by subsurface movement through the soil or by dust at planting. We will monitor weather data throughout the season, so any potential peaks in neonicotinoid residues resulting from rain events and increased water flow throughout the field would be captured in the data. Sampling trips to a field will be timed with optimal weather for honey bee foraging. Weather data will be collected at nearby NOAA and ISU weather stations.

Sample types-We will collect soil, leaves of select prairie plants, and the pollen and nectar from honey bees foraging on plants within these prairies. For all of the types of samples collected, we will focus on the edge of prairie that most immediately intercepts soil and dust from the upland crop area.

Soil samples: Soil cores (15cm depth) will be collected 30cm into the prairie edge adjacent to the crop field. Each sample will be placed within a plastic bag.. We will collect 5 sub-samples per location per sampling interval. Each sub-sample collected per location per sampling interval will be pooled together prior to analysis. The pooled samples will be labeled with contents, date of sampling, and weight (calibrated, tared balance) and placed in a -20°C freezer immediately upon return to the laboratory until needed for residue analyses
*Therefore, the target number of samples for this section =10 locations X 6 sampling intervals = **60 samples**)*

Leaf tissue samples: Leaf tissue samples will be collected to estimate the magnitude of neonicotinoid uptake into the plants. Milkweed leaf tissue will be prioritized for at least one of the collected plant species per location and sampling interval to characterize exposure to monarch larvae. During the pre-planting sampling period, we may not encounter any flowering plants. If so, we will collect leaf tissue from plants such that we can assess if plants have taken-up neonicotinoids remaining in the soil from the previous growing season(s). Throughout the study, we will focus on plants flowering during each sampling period and milkweed regardless of its flowering status. Although the plant communities will vary among sites, there are several species that were included in the initial seed mixes at all sites and are known to be highly attractive to pollinators (Tuell et al. 2008). We will initially target this sub-set of species for plant-tissue sampling and later honey bee collections (Table 1). We will include other plants if they are in bloom and noticeably being used as forage by honey bees. This former category will likely include clover (multiple species) and dandelion. Although we note *Asclepias incarnate* in Table 1, we will collect leaf tissue from plants of multiple milkweed species if available. Samples will be labeled with contents (plant species), date of sampling, and weight (calibrated, tared balance) and will be placed within a -20°C freezer immediately upon return to the laboratory until residue analysis. Leaf tissue from at least 10 individuals of each plant species (up to 3 species per sampling date) will be collected on each sampling date.
*Therefore, the target number of samples for this section = 10 locations X 6 sampling intervals X 3 plant species = **180 samples***

Table 1. Sampling period and candidate plants for leaf sampling*

Sampling period	**Plants common name (species name)**
Pre-planting (March)	Dandelion, Golden alexanders (*Zizia aurea*)
Planting (late April-May)	Golden alexanders (*Z. aurea*), Canada anemone (*Anemone canadensis*), purple prairie clover (*Dalea purpurea*)
Post-planting (June)	Canada anemone (*A. canadensis*), angelica (*Angelica atropurpurea*), cinquefoil (*Potentilla fruticosa*).

Post planting (late June)	cinquefoil (*P. fruticosa*), swamp milkweed (*Asclepias incarnate*)
Post planting (July)	Partridge pea (*Chamaecrista fasciculate*), Cup plant (*Silphium perfoliatum*), Coneflower (*Ratibida pinnata*),
Post planting (August)	Cup plant (*S. perfoliatum*) horsemint (*Monarda punctata*), goldenrod (*Solidago speciosa*, *S. rigida*)
*Throughout the sampling period we will collect leaf samples from milkweed when available, regardless of flowering status.	

Honey bee collected pollen and nectar sampling: We will collect on honey bees foraging directly on plants in bloom to collect pollen and nectar. We will prioritize collecting honey bees foraging on the plant species which leaf tissue was collected. We will insure a population of honey bees at each location by placing up to two hives either within or immediately adjacent (within 10-15 m) to a prairie strip. Honey bees will be collected manually at the flower (eg. nets or jars containing dry ice), the plant source will be recorded and bees placed in vials and immediately placed on ice. We will attempt to collect 200 honey bees per location per sampling interval. If the sample size is considered unsatisfactory due to low nectar content within the honey stomach or unfavorable weather conditions for flight, we will return within 3 days to collect more honey bee foragers. Honey bee samples will be placed in a freezer (-20°C) immediately upon return to the laboratory until further processing. Processing for pollen and nectar will be made within 3 months from the initial collection of forager bees. The pollen will be removed from the pollen baskets (corbiculae) and placed in amber vials labeled with contents, date of sampling, date of processing and weight of sample (calibrated and tared balance). Nectar will be removed from the honey-stomachs of individual bees and placed within amber vials labeled with contents, date of sampling, date of processing and weight of sample (calibrated and tared balance). The nectar and pollen samples will be stored in -20° C container until additional processing is required. For the purposes of analysis, we will combine the pollen and nectar from each bee into one sample per sampling date. Transit stability samples will be prepared by Bayer and shipped frozen to ISU prior to field sampling. The transit samples will be used to ensure the stability of each of the analytes and the relevant metabolites in pollen and nectar. The transit stability sample set will consist of two pollen unfortified controls, four fortified pollen samples, two nectar surrogate controls, and four fortified nectar surrogate samples. Fortified samples will be amended with the target analytes and the relevant metabolites at approximately 0.10 ppm of each analyte.

Therefore the target number of samples for this section (not including transit stability samples) = 10 locations X 2 matrices (pollen/nectar) X 6 sampling intervals = ***120 samples****.*

Neonicotinoid residue analysis: Dr. Joel Coats will coordinate the analysis of soil, plant, nectar and pollen for neonicotinoid residues using LC/MS-MS. The analyses will include imidacloprid (and the major metabolites imidacloprid-5-hydroxy and imidacloprid-olefin), clothianidin, and thiamethoxam. ISU and Bayer will work together prior to start of these analyses to select standards and receive training for the Toxicology graduate student regarding analytical methods.

In addition to analyzing the samples collected above for neonicotinoids, Dr. Coats and the Toxicology graduate student will compare the estimates from select samples using both LC/MS-MS and ELISA. This comparison will include a subset from which at least one neonicotinoid was detected. If a second year of funding is available, we can further explore which technique may provide the best estimate of neonicotinoid concentration with spiked samples using a pre-determined concentration.

Standard solutions:
Primary Standards – Stock solutions will be prepared from high-purity analyte and high-purity isotopically-labeled (deuterium) for internal standards. The analysis method will be optimally developed to detect and quantify imidacloprid, imidacloprid-5-hydroxy, imidacloprid-olefin, clothianidin, and thiamethoxam in the matrices. Acetonitrile will be used as the solvent for standard solutions.
Secondary standards – Primary standards will be diluted to prepare secondary solutions of the primary analyte and internal standard.
Calibration standards – A range of dilutions of the analyte will be prepared for development of standard curves and spike-and-recovery analyses.

Extraction procedures:
Specific methods from Bayer will be utilized to extract samples of pollen, nectar, leaves, water, and soil from the field sites. Samples will be stored before extraction and after extraction according to best practices provided by Bayer CropScience.

Analysis:
Quantitative analysis of the analytes in the environmental matrices will be carried out using LC/MS/MS. Reverse-phase HPLC will be conducted using a methanol and water gradient solvent system (with ammonium bicarbonate). Solid-phase extraction cartridges (HLB) will be used for cleanup of the sample extracts. There are several instruments available for the Toxicology graduate student to use for analysis of the samples. The Chemical Instrumentation Facility charges $25/hr for use of an Agilent LC/MS/MS, while the Veterinary Diagnostic Laboratory has a similar instrument and would also charge by the hour for its use, after training of the grad student. In both cases, the special rates are for Iowa State University researchers only.

Study Personnel:

Study collaborators and define each person's role and responsibility (% TIME ON PROJECT)

a. **Matthew O'Neal**- ISU/Lead Project Coordinator (ISU)- responsible for synthesizing study protocol, coordinate sampling methods (soil, plant and honey bees) coordinating study and managing personnel and sampling logistics. (10%)
b. Joel Coats- Conduct residue analyses and provide residue data interpretation. (5%)

c. Steve Bradbury- Assist in experimental design, data interpretation and risk assessment. (5%)
d. Amy Toth- Assist in suppling honey bee hives and experimental design. (1%)
e. Dan Schmehl- Bayer project coordinator, will assist with the design, conduct, and interpretation of the study.
f. Michael McCarville (Bayer)- Interface with growers participating in the study
g. Personnel to be hired for this project
    i. Post-doctoral scientist/field technician- This person will be hired for a 12-month period to aid in conducted field work and sample collection and preparation. This person will also aid the toxicology student in processing samples for analysis. (100%)
    ii. Toxicology graduate student- This person will be hired for 12 months, with a target start date of late spring. The student would help process samples and conduct the residue analysis. With assistance from Coats, O'Neal, Bradbury and the post-doc, they will summarize these data. (100%)
    iii. Field coordinator- Tim Youngquist of the STRIPS project will aid in communicating with the farmer cooperators as well as collecting historical data from each location, as well as assist in collecting field and farm data (planter, seed type and rates of planting). This support is only for a fraction of Tim's yearly salary. (10%)
    iv. Hourly field assistants- We require at least two undergraduates to assist the post-doc and at times the Toxicology. These students will aid in field work, data collection, driving to field sites. The estimated cost is based on 40 hours per week for the summer. However their hours will range from 20-40 hours per week depending upon the field work and sampling processing needs, which will begin before the summer field season.

BUDGET JUSTIFICATION

Personnel- We do not require summer salary for the PI's (Drs. O'Neal, Coats, Bradbury) as they have 12 month appointments, and supervising the following personnel is consistent with their professional responsibilities at ISU. Rather, this request is for personnel costs associated with field work, data collection, and analysis (see above section under 'study personnel'). All personnel request includes fringe benefits required by ISU and tuition for the toxicology graduate student.

Materials- We request $5,000 for materials related to collecting and processing the field-collected samples. We request $36,000 for materials related to collecting and processing samples (360 samples) to complete residual analysis using an LC/MS-MS instrument on ISU campus. Glassware at $14,000, Solvents at $12,000, Sample Clean-up Materials at $6,000, and

General Lab Supplies at $4,000 totaling the $36,000. We also request $10,000 for twenty honey bee hives and hive maintenance to include re-queening and mite management ($500/hive).

Equipment- $5,000 for a -20 C freezer with an Ethernet connection for communicating failures and temperature increases (e.g. intelligent wifi refrigerator). Samples of forager bees, pollen, nectar, leaves and soil will be frozen and stored prior to further processing or residual analysis.

Travel- We request funds to rent a mini-van ($513/month) to transport research personnel to field locations for an 8 month field season ($4104). Funds are requested for travel of two team members to visit Bayer North American headquarters for training opportunities ($2,500) and conference travel for two team members ($2000).

Publication costs- We request funding for publishing of our findings within an open access journal ($2000).

Other- Residual analysis-$55,080- is $153 per sample to complete residual analysis (n = 360 samples). This includes cost of using an LC/MS-MS instrument on the ISU campus as well as labor.

Indirect costs (IDC) are at 26% for this project for all direct costs except tuition and equipment.

Source	details	amount/salary/stipend	Fringe ben.	total requested
Personnel	Field technician/post doc	$45,300	32.9%	60,204
	Toxicology technician/grad student	25,080	9.8%	27,538
	Field coordinator	6,000	34.5%	8,070
	hourly labor	14,080	0.6%	14,164
Tuition	For toxicology grad student	11,080		11,080
Equipment	Freezer	5,000		5,000
Materials	Field & Lc/MS-MS Supplies	41,000		41,000
Materials	Honey bee hives	10,000		10,000
Other	residual analysis	55,080		55,080
Travel	Field & training	8,604		8,604
Publication	Open access journal	2000		2000
Sub Total				242,740
IDC				58,931
Total				**$301,671**

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