

**Department of Pesticide Regulation  
Environmental Monitoring Branch  
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**September 2019**

**STUDY #325: PROTOCOL FOR ANALYSIS OF NEONICOTINOID AND FUNGICIDE  
CONCENTRATIONS IN SOIL CORES FROM TREATED LETTUCE FIELDS**

**I. INTRODUCTION**

Neonicotinoid insecticides are used to control various insect pests in lettuce fields by soil application at the time of planting or by seed treatment. Fungicides can also be applied as a seed treatment to protect against seedling rot and disease in lettuce. The California Department of Pesticide Regulation (DPR) has provided funding to the University of California Cooperative Extension (UCCE) in Monterey County to conduct a field experiment assessing neonicotinoid and fungicide concentrations in irrigation runoff from treated lettuce fields. For this study, two neonicotinoid insecticides (clothianidin and imidacloprid) and one fungicide (azoxystrobin) will be used. Azoxystrobin, clothianidin, and imidacloprid are all considered highly mobile and persistent in soil and are listed in regulation on the Groundwater Protection List (Title 3 of the California Code of Regulations, section 6800[b]) as pesticides with the potential to leach to groundwater in California. Therefore, in addition to assessing concentrations of these pesticides in irrigation runoff, DPR will also assess the fate and transport of azoxystrobin and imidacloprid in the soil root zone. Staff from DPR's Groundwater Protection Program (GWPP) will conduct soil core sampling from the experimental plots at some pre-determined time (i.e., determined as a function of scheduled irrigation inputs) after the planting of the lettuce seeds. Results from this study may be used to evaluate the fate and transport of the pesticides in the soil root zone by means of water balance and unsaturated zone modeling.

For this study, imidacloprid in particular will be applied directly to the soil in one set of treatment blocks and applied as a seed treatment in a separate set of blocks. An objective of the study will be to measure the differences in the fate and transport of imidacloprid through the soil root zone between the two imidacloprid application methods for a lettuce crop. The overall goal of the study will be to further our understanding of the leaching behavior of imidacloprid and azoxystrobin through the soil root zone of an irrigated crop (i.e., lettuce irrigated with sprinklers) and their subsequent potential to contaminate the underlying groundwater supply.

Currently, funding has been provided to UCCE to conduct the field experiment during the summer of 2019 and to repeat the experiment during the spring or summer of 2020. At present, funding to the United States Geological Survey (USGS) laboratory to analyze soil core samples is only

available for the first experiment to be conducted in 2019. Determination to provide funding for soil core sampling and subsequent laboratory analysis by the USGS for the second experiment to be conducted in 2020 will be made after the conclusion of the first experiment.

## **II. PERSONNEL**

Soil core sampling will be conducted by GWPP staff from the Environmental Monitoring Branch of DPR under the general direction of Joy Dias. Project personnel include:

Project Leader/Senior Scientist:	Nels Ruud
Field Staff:	Murray Clayton, Kevin Richardson, Nels Ruud
Analytical Chemistry:	United States Geological Survey

Please direct questions regarding this study to Nels Ruud at (916) 324-4167, e-mail: <Nels.Ruud@cdpr.ca.gov>.

## **III. SAMPLING AND ANALYTICAL METHODS**

The field experiment will take place at the United States Department of Agriculture-Agricultural Research Service (USDA-ARS) Spence research farm in Salinas, California. Pesticide applications will be made at the time of lettuce seed planting following a randomized complete block design with four replicates:

1. Control (no pesticide application)
2. Lettuce seed treatment with both clothianidin and azoxystrobin
3. Lettuce seed treatment with azoxystrobin and direct soil application of imidacloprid
4. Lettuce seed treatment with both azoxystrobin and imidacloprid

Prior to lettuce seed planting, project collaborators from the USGS will collect surface soil samples (0 to 30 centimeter depth) from several of the treatment plots to measure background concentrations of clothianidin, azoxystrobin, and imidacloprid in the surface soil. At the pre-determined time after the initiation of the experiment, GWPP staff will collect 2-3 soil cores (5 feet in depth per core) from a treatment block receiving the lettuce seed treatment with azoxystrobin and direct soil application of imidacloprid. During the same sampling event, GWPP staff will also collect 2-3 soil cores from a treatment block receiving the lettuce seed treatment with both azoxystrobin and imidacloprid. Soil will be sampled in 6-inch increments for each 5-foot core resulting in 10 samples per core submitted for pesticide analysis. One additional soil sample will be collected from each core and used by the USGS laboratory for quality control purposes. Eleven total soil samples will therefore be collected from each core. A total of 44 to 66 soil samples from the 4 to 6 soil cores extracted will be delivered to the USGS analytical laboratory in Sacramento for pesticide analysis. Soil sampling, chain-of-custody documentation, and transport of the samples to the USGS laboratory will be conducted per standard operating procedure (SOP) number FSSO002.00 (Garretson, 1999).

Additional soil cores from the treatment plots will be collected by GWPP staff for the purpose of characterizing the soil physical and chemical properties that would influence the fate and transport of pesticides in the subsurface at the Spence site and be required to generate the input data for an unsaturated zone model. These properties likely will include bulk density, texture analysis, organic matter content, soil moisture content, and soil adsorption coefficients.

#### **IV. DATA ANALYSIS**

The collected soil samples will be analyzed for the two pesticides by the USGS laboratory in Sacramento, California. Results of the USGS laboratory soil analysis for pesticide concentrations will be sent to DPR in an Excel spreadsheet and in a final technical report. GWPP staff will review the measured concentrations and potentially use the data to conduct unsaturated zone fate and transport modeling of azoxystrobin and imidacloprid in a simulated soil characteristic of the soil found at the Spence research farm site. Results from the data review and modeling will be documented in a technical report for this study by GWPP staff.

#### **V. TIMETABLE**

- September 2019: UCCE initiates first lettuce seed treatment field experiment
- October 2019: GWPP staff conducts post-treatment soil core sampling
- TBD: USGS analyzes soil samples for pesticides and provides report of findings to DPR
- TBD: GWPP staff reviews laboratory results, conducts modeling, and documents findings in a technical report

#### **VI. REFERENCES**

Garretson, C. 1999. SOP FSSO002.00. Soil sampling, including auger and surface soil procedures. California Department of Pesticide Regulation, Sacramento, California.