Spray Drift Study in Orchard/Vineyard to Support Orchard Airblast Drift Modeling Effort

Project No.:   **WATER14**

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A. Summary

This project adds on to a related project under the ABC/ANR spray Technology Grant with a single objective to conduct airblast spray trials in the field to generate spray drift data that will be used to validate a computer model. The model is intended to be used by regulators for evaluating spray drift risk of airblast spray applications by estimating pesticide exposure values. This work is of significant relevance in the sense that the ability of regulators to evaluate drift exposure values more realistically will minimize the severity of regulations affecting growers. The scope of this project is the acquisition of resources (supplies, materials, equipment, & instruments) to be shared among three commodity groups (almond, citrus, and grape) and supplemental funding for personnel for the purpose of collecting complete spray drift data in almond for validating the ongoing development of the drift model. In the project year covering **April 1 to December 31, 2020**, we pursued and obtained all the funding required for all three crops. We built all the sampling structures needed for the field experiment, purchased all the shared resources, and configured/ tested the instruments for the field data collection. We also installed the complete instrumentation setup in the table grape experiment which followed the same EPA-approved protocol to be used in this project. That served as a rehearsal for the impending almond data collection effort. We found that the sampling structures functioned as desired and improved the logistics for efficient data collection. We identified limitations of each component and identified ways to maintain proper function during the field experiment. This learning will be critical in the almond experiment planned for May/June 2021.

B. Objectives

1. Goals and specific objectives of the proposal

   The project goals and objective are summarized in Figure 1 below.

   LONG-TERM GOAL. Our long-term goal in this project is to provide an evaluation tool that assists the regulatory community to perform more informed pesticide drift risk assessment of airblast spray applications in almonds based on real application parameters rather than assumed parameters.

   SHORT-TERM GOAL. We proposed a project to collect a large dataset in almond orchard spray applications to support the ongoing development of an orchard airblast spray drift model for the regulatory community. The drift model considers spray movement from the edge of the orchard to off-site locations downwind.

   The SPECIFIC OBJECTIVE which our project seeks to accomplish is to conduct airblast spray trials to generate spray drift data for validating a mechanistic airblast spray drift risk assessment model being developed to estimate exposure values.
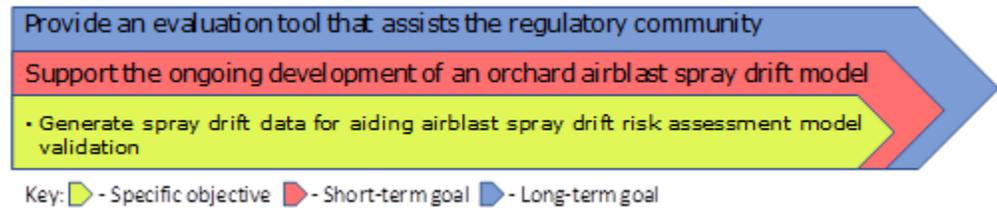

Figure 1. Project goals and objective.

   The SCOPE of this project is the acquisition of resources (supplies, materials, equipment, & instruments) to be shared among three commodity groups (almond, citrus, and grape) and supplemental funding for personnel for the purpose of collecting complete spray drift data in almond for validating the ongoing development of the drift model.

2. Annual outputs or milestones

   Within the scope of this project, we completed acquiring all the multi-commodity shared resources (materials, equipment, and instruments). We built all the sampling structures needed for the field experiment, purchased all the shared resources, and configured/ tested the instruments for the field data collection. We also installed the complete instrumentation setup in the table grape experiment which followed the same EPA-approved protocol to be used in this project. That served as a rehearsal for the impending almond data collection effort.

C. Annual Results and Discussion

1. Activities and outputs

During the project year, we pursued and obtained the remaining funding from the Citrus Research Board required to complete the airblast spray drift field study for all three crops. This adds to funds secured for almond (including for this project) and grape (from the California Table Grape Commission, the Washington State Wine Commission, and E & J Winery). We built all the sampling structures needed for the field experiment, purchased all the shared resources (supplies, materials, equipment, & instruments), and configured/tested the instruments for the field data collection. Figure 2 shows three different types of sampling structures built that hold different combinations of horizontal samplers in accordance with the protocol: a) holds flat card, artificial foliage, and horizontal string; b) holds flat card and artificial foliage; and c) holds either flat card or artificial foliage. Figure 3 also shows the field setup of the sampling structures for the table grape field experiment, the same setup that would be used in the almond experiment. It includes vertical string sampling structures.
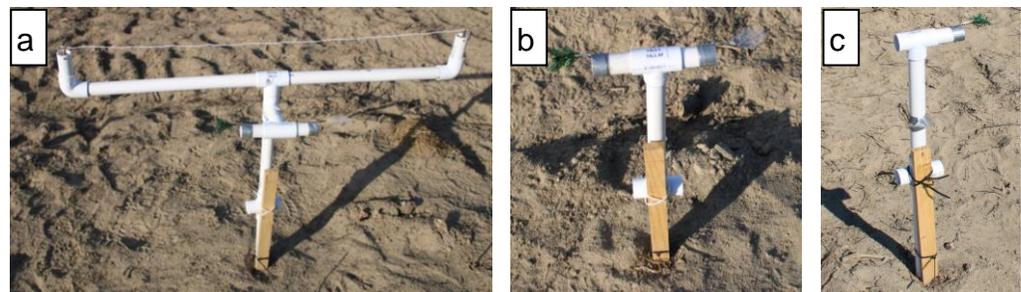

Figure 2. Built sampling structures for different sampler combinations: a) holds flat card, artificial foliage, and horizontal string; b) holds flat card and artificial foliage; and c) holds flat card or artificial foliage.

Figure 3. Field setup showing installed horizontal sampling structures and vertical string sampling structures.

We assembled and configured the meteorological instruments in the lab and tested it to gain familiarity with the data collection and to fix any issues ahead of the field experiment. We also installed the complete instrumentation setup in the table grape experiment, following the same EPA-approved protocol to be used in this project. Figure 4 shows the meteorological instrumentation: a) assembled and configured in the lab; and b) installed in the field during table grape spray drift experiment.
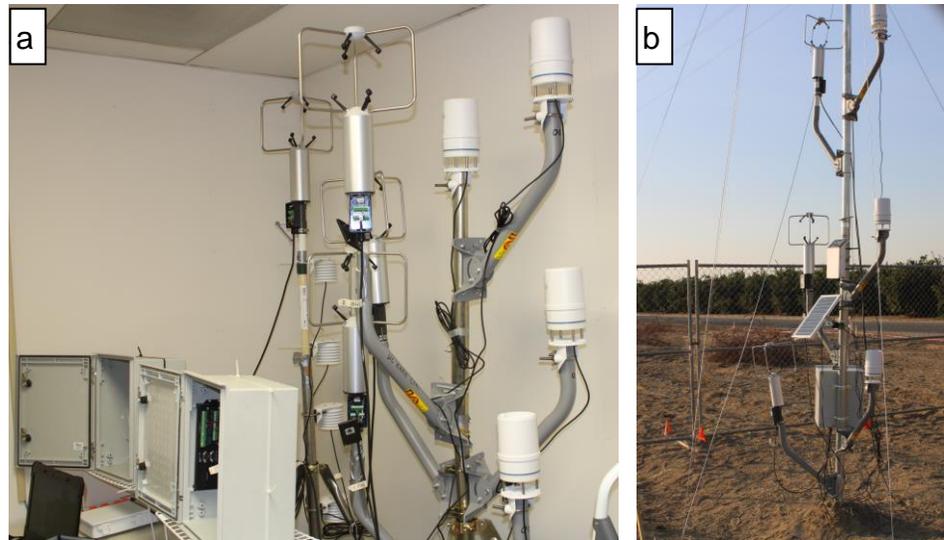

Figure 4. Meteorological instrumentation: a) assembled and configured in the lab; and b) installed in the field during table grape spray drift experiment.

2. Significance

Securing all the funds needed for data collection in all three crops is a significant progress toward achieving the goal of this project. It enabled us to acquire and prepare all the resources needed. Moreover, conducting the complete data collection in one of the crops (table grape) demonstrates readiness for the same data collection in almond. Working through the process served as a rehearsal and gave the project personnel more experience and readiness than earlier for a successful completion of the data collection in almond. We look forward to repeating the experiment in citrus in March 2021 which would build more experience before conducting the same experiment in almond in May 2021. The findings and learning do not change the approach, next steps or other conclusions based on this year's results.

D. Outreach Activities

There was no outreach activity specifically accomplished for this project during the project year.

E. Materials and Methods

1. Materials used and methods to conduct experiment

   The multi-commodity shared resources consisted of materials for spray sampling, instruments for meteorological data acquisition, and equipment for canopy characterization and data analysis. The sampling materials included pegs, plastic poles, PVC pipes, target holders, clamps, petri dishes, and string towers. The PVC pipes were used to build structures for holding horizontal samplers. Tripod stands were included to hold vertical string towers. A variety of fasteners and other accessories were used in accomplishing this. The instruments for meteorological data acquisition was split for two meteorological stations, within canopy and in the open field about 600 ft away from the edge of the orchard. They include instruments eight 3D sonic anemometers (Young's 3D Ultrasonic Anemometer, R.M. Young Company, Traverse City, MI), eight all-in-one weather sensors (ATMOS 41, METER Group, Inc., Pullman, WA), four data loggers (CR1000 or similar), and climate data outside the orchard. The equipment for canopy characterization was a LAI-2200C Plant Canopy Analyzer. We also purchased a dedicated laptop computer and software needed for configuring the instruments/equipment.

2. Challenges or unforeseen developments

   The objective of the project to which this project added could not be achieved within the original timeline due to delays in securing all the funds needed, although much progress had been made. The delays prevented the performance of the subsequent activities of setting up and conducting the field experiment. Given the delays and considering expected changes in tree canopy characteristics, it was determined that the practical time for conducting the field data collection in almond would be May 2021 at which time all the necessary resources would have been secured. Fortunately, that project was granted a no-cost extension with the same end date as this project.

F. Publications that emerged from this work

No publications have emerged from this work yet.