California Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring Branch
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STUDY 197: ENVIRONMENTAL MONITORING OF INSECTICIDE APPLICATIONS FOR CONTROL OF THE GLASSY-WINGED SHARPSHOOTER (revised)

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I. INTRODUCTION

The California Department of Food and Agriculture (CDFA) proposes to use ground applications of carbaryl, imidacloprid, cyfluthrin, or possibly other insecticides to control glassy-winged sharpshooter (GWSS) infestations in California. GWSS (*Homalodisca coagulata*) is a serious pest in Central California. It can feed on over 70 species of crop and ornamental plants. It poses a serious threat to vineyards due to its ability to spread *Xylella fastidiosa*, the bacterium that causes Pierce's disease in grapes. GWSS can also vector diseases to almond, alfalfa, oleander and citrus (UC, 1999).

The Environmental Monitoring Branch of the Department of Pesticide Regulation (DPR) will conduct monitoring of selected insecticide treatments to provide information on concentrations of the chemical in various environmental media that may include surface, irrigation, and storm runoff water, soil, foliar residue, produce, and air. In the event that ecologically sensitive areas are present, toxicity to aquatic organisms will also be determined in surface water. This proposed monitoring plan follows the general models in previous studies of carbaryl and other insecticides applied in gypsy moth eradication projects (Neher et al., 1983; Weaver et al., 1983) and in Japanese beetle eradication projects (Segawa, 1988).

This proposed monitoring plan would be followed for each application event meeting the monitoring criteria. More than one application event may be monitored; the total number of events to be monitored will be decided when the extent of the treatment program is known. The final matrices and total numbers of samples collected will be determined once this information is available. The monitoring data will be used by CDFA to assess proper application rate and coverage and to estimate public and environmental exposure to the application.

II. OBJECTIVE

The objectives of this study are to

1) Measure the amount of carbaryl, imidacloprid, cyfluthrin or other insecticide in surface, irrigation, and storm runoff water, soil, foliar residue, produce, and air.
2) Measure movement of imidacloprid (or other insecticides of high leaching potential) in soil.

3) Measure dissipation half-live of insecticide in soil, if sprayed.

III. PERSONNEL

This study will be conducted by Environmental Monitoring staff under the general direction of Randy Segawa, Senior Environmental Research Scientist. Key personnel include:

Senior Environmental Research Scientist: John Troiano
Project Leader: Johanna Walters
Field Coordinator: Shifang Fan
Laboratory Liaison: Carissa Ganapathy
Analyzing Laboratory: California Department of Food and Agriculture, Center for Analytical Chemistry
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IV. STUDY DESIGN

The current GWSS infestation is spread from Imperial County in Southern California to Butte County in Northern California. Previously monitored counties include Imperial, Tulare, Fresno, Sacramento, Butte, Santa Clara, and Contra Costa where applications occurred in urban areas. Applications in agricultural areas have not been monitored at this time. Future monitoring will focus in counties where previous monitoring by DPR has not occurred or if a pesticide other than carbaryl, imidacloprid, or cyfluthrin is used. In addition, a monitoring agreement between DPR, CDFA, and the County Agricultural Commissioner must be reached. Monitoring may be conducted in both agriculture and urban areas.

Monitoring in agricultural areas may include the following:

Tank or Drip-line Samples will be collected at the sites selected for monitoring of environmental matrices. This is to ensure that correct rate of chemical has been applied.

Foliar Residue Samples will be collected if the materials are applied by foliar spray. Samples will be collected prespray, immediately postspray and at elapse of reentry interval.

Soil/Lysimeter Samples will be collected in the event that chemicals with high leaching potential are used by soil drench, band or furrow application, or chemigation. Data will be used assess the movement of chemical in the soil profile to prevent groundwater contamination.

Ground Water Samples will be collected from wells in proximity to highest application and site with shallowest groundwater. Pre-application samples and post application samples will be collected. Time and number of samples taken will be dependent on the movement of the insecticide as determined by the soil/lysimeter monitoring.

Air samples will be collected for foliar applications only. Samples will be collected in the highest use area to measure ambient insecticide concentrations before, during, and for 24 hours after application.

Surface waterways containing irrigation runoff will be monitored, both prior to and following applications to determine insecticide concentrations. Additionally, accessible storm runoff sites will be monitored during rain runoff events to determine concentrations due to wash off from exposed surfaces. During the first rain event after the initial application, samples will be collected at points of discharge and/or at areas of concern for aquatic organisms. The number and frequency of samples collected will depend on availability and sensitivity of water bodies and on the intensity and duration of the runoff event.

Aquatic toxicity. If the application areas have ecologically sensitive site, surface water samples may be tested for aquatic toxicity. DFG will assist in the selection of aquatic species for toxicity testing. The species selected will depend upon the origin of the water samples. Toxicity testing will use U. S. Environmental Protection Agency (1993) and American Society for Testing of Materials (1992) methods. Water quality parameters (alkalinity, hardness, electrical conductivity, ammonia, pH, dissolved oxygen, and water temperature) will also be measured.

Monitoring in urban areas may include the following:

Tank Samples will be collected as described previously.

Produce samples will be collected before application and after the elapse of the designated preharvest interval for each crop. Samples will be analyzed for total residues.

Soil. In the event that soil is treated or heavily impacted from the sprays, samples will be collected from application sites. Collection will occur immediately after spray to determine the maximum concentrations in treated areas. Dissipation sampling for soil may be performed to determine half-lives using standard statistical methods.

Air samples will be collected in the same manner as described previously.

Surface waterways containing residential runoff will be monitored, both prior to and following applications to determine insecticide concentrations. Additionally, storm runoff samples may be collected as previously described.

Aquatic toxicity sampling may be conducted according to the conditions previously described.

Leaf residue will be collected from foliar applications. Samples will be collected prior to application and after the spray has dried.

V. SAMPLING METHODS

Tank/Drip-line Samples. Distinct, well-mixed tank or drip-line samples will be collected into a plastic 500mL bottle from the application hose nozzle or end of drip-line. Samples will be kept on wet ice until analysis.

Soil. In the event that soil is sprayed in an agricultural setting, drenched, or chemigated, fields with vulnerable soil will be selected. At each field, four soil cores or lysimeter probes will be

collected at randomly selected subsites within an application site. Soil cores or lysimeter samples will be collected to a depth of 5 feet or deeper depending on leaching potential of the chemical used. Soil samples will be analyzed at 6-inch intervals and lysimeter samples will be pulled at 1-foot intervals. The soil cores will be placed into a glass jar and sealed with an aluminum foil lined lid (Garretson, 1999). The number of soil cores collected and corresponding soil weight will be recorded on each sample's chain of custody (COC). Lysimeter water samples will be stored in amber bottles. Soil samples will be stored on dry ice or refrigerated at -20°C until extraction. Lysimeter water samples will be stored on wet ice or refrigerated at 5°C until extraction.

In the event that soil is sprayed or heavily impacted in an urban setting, four soil cores will be collected at four randomly selected subsites within an application site. Two soil samples will be collected at each application site. Soil cores will be collected by inserting a 6.3-cm internal diameter (i.d.), stainless steel cylinder into the soil to a depth of 2.5 cm. The soil cores will be placed into a glass jar and sealed with an aluminum foil lined lid. The number of soil cores collected and corresponding soil weight will be recorded on each sample's chain of custody (COC). In the field, samples will be stored on dry ice or frozen at -20°C until extraction.

Air. In the event that chemical is applied by foliar spray, centrally located site(s) in the treatment area, will be sampled to measure outdoor ambient air concentrations of insecticide. Sites must be accessible at all hours, protected from any direct spray, and have electrical power to run the samplers. Air samples will be collected according to the following schedule: (1) 12-24 hours prior to application, (2) duration of application plus one hour, and (3) duration of 24 hours after application.

Sample will be collected using XAD-2 tubes (SKC#226-30-02) and an SKC air sampler (SKC#224-PCXR8) calibrated at approximately 3 liters-per-minute. Samplers will be located outdoor in open areas. Samples will be stored on dry ice or frozen at -20°C until extraction.

Surface water. Field runoff samples within treated fields may be sampled according to SOP FSWA008.00 (Spurlock, 1999). Surface water samples outside treatment area will be collected using a depth-integrated sampler (D-77) with a 3-liter Teflon® bottle and nozzle (Jones, 1999). Five to twenty vertical depth integrated samples will be composited at each site. At sites where the water is well mixed, or D-77 sampler cannot be used, due to insufficient water depth or access, a grab sample will be collected. Grab samples will be collected as close to center channel as possible using a 10-liter stainless steel bucket or a grab pole consisting of a glass bottle at the end of a 5-foot pole. Samples will be preserved (if needed) by acidification with 3N hydrochloric acid to a pH between 3.0 and 3.5, and then stored on wet ice or refrigerated at 5°C until extraction (Bradley, 1998). Toxicity samples if needed will be delivered on wet ice to the CDFG Aquatic Toxicity Laboratory within 30 hours.

Ground Water Sampling will be conducted according to the following SOP's: FSWA006 and FSWA001.00 (Marade 1996 and 1998).

Dislodgeable and Total Leaf Residue. Leaf residue samples are collected from one type of plant within each site with the before and after application samples at each site collected from the same plants. Dislodgeable samples consist of 40 one-inch-diameter leaf punches collected into a

4-ounce glass jar, sealed with a Teflon®-lined lid, and stored on wet ice or refrigerated at 5°C until extraction until extraction. Total leaf residue samples consist of a minimum of 100 grams of terminal shoots of less than 0.5 cm diameter (generally shoots from secondary or tertiary growth) with leaves included collected into a quart mason jar with a foil lined lid and stored on dry ice or frozen at -20°C until extraction.

Produce. Produce will be sampled prior to application and after their respective preharvest interval has elapsed. Approximately one pound of produce will be collected into either a quart glass mason jar with an aluminum foil lined lid or wrapped in aluminum foil and placed in a plastic Ziploc® bag and stored on dry ice or frozen at -20°C until extraction.

VI. CHEMICAL ANALYSIS / TOXICITY TESTING

Chemical analysis will be performed by the CDFA's Center for Analytical Chemistry. Analytical methods are validated and quality control measures are described in Segawa (1995). In the event that toxicity testing is deemed necessary, DFG's Aquatic Toxicology Laboratory will perform aquatic toxicity tests on surface water samples and measure totals of alkalinity, hardness and ammonia.

VII. DATA ANALYSIS

Concentrations for dislodgeable residues of insecticide on foliage will be reported as micrograms per square centimeter ($\mu g/cm^2$), total residues of insecticide in foliage will be reported as parts per million (ppm), and soil concentrations will be reported as ppm or $\mu g/g^2$ on a wet weight and dry weight basis. Concentrations of insecticide in air will be reported as both micrograms per cubic meter ($\mu g/m^3$) and parts per trillion (ppt), water concentrations will be reported as both micrograms per liter (µg/L) and parts per billion (ppb), and produce concentrations will be reported at ppm. Tank sample results will be reported as percent active ingredient. When sample size permits, means, percentiles and frequency histograms will be presented. Toxicity results will be reported as percent mortality. Water concentrations will be compared with toxicity data to aid in the interpretation of toxicity test results.

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