

Invited Presentation Articles

Mosquito Adulticide Efficacy Data and EPA Insecticide Registration: A Global Perspective

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Overview

- EPA requires data for public health pests including any pesticide claims for mosquito control.
- Aerial application data.
- Ground ULV application data.

Efficacy = Benefit

- Showing that an application is efficacious against mosquitoes when applied according to the label demonstrates one of the benefits of an adulticide application.
- Do applications reduce the risk of vector-borne disease transmission? How is such a benefit measured?

Global Resurgence of Mosquito-Borne Disease

- Malaria transmission is increasing and spreading. Yellow fever continues to be a problem.
- Dengue fever is increasing all over the Americas and occurs in the Southern U.S. regularly.
- West Nile Virus in the Americas.
- Demand and need for mosquito control.

Human Population Movement and Mosquito-Borne Disease Resurgence

- Urbanization
- Colonization
- Ag Labor
- Refugees
- Airport transportation and intercontinental travel

West Nile Virus

- Enters U.S. in 1999???
- Previous sporadic outbreaks in other parts of the world included Africa, Europe and Asia including the Middle East.
- Upon entry into the U.S., the virus replicated within the bird population and quickly became a North American epidemic.
- Widespread mosquito adulticide applications were and are necessary.

WNV 1999-2001
WNV 1999-2002

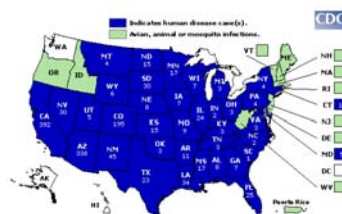
West Nile Virus in the United States, 1999-2001



West Nile Virus in the United States, 1999-2002



WNV 2003
WNV 2004



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Adulticide Application Methods

- Ground - cold and thermal fogging.
- Residual surface spraying on the rise.
- Aerial spraying.
 - Thermal;
 - Rotary atomizers;
 - ULV;
 - High pressure nozzle systems;
 - Flat fans etc.

Data Development

- Aerial applications to include:
 - Flight height, speed and direction;
 - Nozzle type, number, orientation;
 - Flow rate (GPM) and pressure at the nozzle;
 - Swath width;
 - Droplet size and measurement method(s) w/calibration;
 - Droplet size distribution;
 - Droplet drift distance;
 - Type of spray system (rotary, ULV, etc.).

Optimum Droplet Size

- Droplets need to be small enough to be produced in sufficient number for adequate coverage
- They need to be of a size (VMD) that can be carried an adequate distance down wind within the target zone
- But they also need to be large enough to impinge readily on the body surface of the mosquito.

Report Climatic Conditions

- Temp
- Wind speed and direction
- Inversion? Measure temp differences.
- RH
- Kitoon meteorology profiles by Adapco

Droplet Collection

- Rotary slides – collect drops and measure
- Yarn – assay for pesticide residue
- Cards – indicates presence of droplets
- Dyes that enable fluorometric analysis
- Bioassays with mosquitoes

Droplet Characterization

- Some data submitters use wind tunnels to characterize the droplet size spectrum before doing field trials in order to select the proper nozzle type.
- Other devices may be used in research but little data have been submitted to EPA in support of efficacy studies.

Typical Ground ULV Droplet Collection



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Bioassays and Collection of Drops/Residues

- Caged mosquitoes placed downwind at 30-500m intervals for up to 1.5 km.
- Control cages are placed upwind.
- Rotary slide spinners placed next to cages.
- Yarn used hung near cages to collect drops to measure and document pesticide residue.
- Cages are about 2-3 meters above the ground.
- Foil or cards placed at ground level to collect drops.

Cage with Yarn



Rotary Slide Impinger



Droplet Number

- The number of droplets available from a given volume of liquid is inversely related to the cube of the diameter.
- NMD data are calculated and the droplet density is also reported at collection stations. Lots of small drops are necessary to kill mosquitoes. “Shotgun approach”
- Small drops also stay suspended longer increasing the likelihood of mosquito kill.

The Toxic Dose

- Toxicity studies have shown it takes different drop sizes of specific adulticides to deliver the toxic dose capable of killing a single mosquito.
- Species susceptibility varies with each insecticide making efficacy evaluations necessary.

Directions for Use - Labeling

- Incorporate directions for use based on registrant proposals, EPA knowledge of mosquito control practices, and EPA evaluation of efficacy data studies.

Next steps.

- Discuss how new measurement technology and methods can be incorporated into efficacy evaluations and labeling.
- Discuss the use of manufacturer specifications for droplet size on EPA labels and drift models.
- Reiterate the need to demonstrate the efficacy of aerial and ground ULV applications.