

Best Management Practices for Integrated Mosquito Management,

Recommendations of the

**Florida Mosquito Control Association
and
Florida Department of Agriculture and Consumer Services**

2012

PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide Florida mosquito control agencies with a uniform guide to Best Management Practices in Integrated Mosquito Management (BMP-IMM). This Florida Mosquito Control Association (FMCA)-approved guide provides direction for mosquito management practices that meet all requirements put forth by the Florida Department of Agriculture and Consumer Services (FDACS) and the Florida Department of Environmental Protection as related to BMP-IMM measures and documentation.

INTRODUCTION

The Florida Legislature has declared in Chapter 388 of the Florida Statutes that it is the public policy of this State to achieve and maintain such levels of arthropod control as will protect human health and safety, foster the quality of life of the people, promote the economic development and facilitate the enjoyment of its natural attractions by reducing the number of pestiferous and disease-carrying arthropods (Florida Mosquito Control: The state of the mission as defined by mosquito controllers, regulators, and environmental managers. 2009. Connelly and Carlson eds. UF, IFAS, Florida Medical Entomology Laboratory). Since the need for mosquito control was recognized as a critical component of public health initiatives in the early twentieth century, increased knowledge of mosquito biology has driven the formulation of a variety of methodologies designed to successfully reduce both mosquito nuisance levels and mosquito-borne disease transmission. The technologies and knowledge bases from which these methodologies were derived have evolved and have been increasingly seen as complementary or synergistic in nature, providing optimal control as part of an overall strategy.

This has ultimately evolved into a strategy termed Integrated Mosquito Management (IMM). IMM has been developed to encourage a balanced usage of cultural and insecticidal methodologies and habitat manipulations in order to maximize control while minimizing adverse environmental impacts. IMM is knowledge-based and surveillance-driven, and when properly practiced is specifically designed to accomplish the following:

1. Protect human, animal and environmental health.
 2. Promote a rational use of pesticides.
 3. Reduce environmental exposure to soil, ground water, surface water, pollinators, wildlife and endangered species as a result of mosquito control activities.
 4. Utilize biological controls (native, noninvasive predators) to conserve and augment other control methods when practical and prudent.
 5. Utilize source reduction (elimination, removal or reduction of larval mosquito habitats) where practical and prudent.
 6. Use target specific pesticides at the lowest labeled effective rates to the extent possible.
 7. Emphasize the proper timing of applications.
- A. Personnel** – All personnel handling or applying pesticides intended to control arthropods on property other than their own individual residential or agricultural property must be

licensed by FDACS, in the category of “Public Health Pest Control” or be supervised by a properly licensed individual.

- B. Surveillance** – Surveillance is the backbone of all IMM programs. It identifies problem species and relative population trends in order to direct and evaluate control methods. It is a required component of IMM in order to undertake any type of control measure.

Larval/Pupal Surveillance:

1. Visually inspect potential larval mosquito habitat for the presence of larval mosquitoes.
2. Determine the major species of mosquito present, larval density, larval stage and the extent of infestation using standard procedures.
3. Determine the most appropriate means of control based on the:
 - a. Habitat stability to produce emergent adult mosquitoes
 - b. Observed larval species’ biology
 - c. Observed and/or estimated larval density and instar development
 - d. Habitat type
 - e. Target area proximity to humans and other potentially affected animals
 - f. Acreage of target habitats Acreage of larval mosquito habitat.
 - g. Estimates on larval re-infestation
4. Arthropod Control Plan as accepted and practiced by the local organized program Evaluate the efficacy of control practices applied at the first opportunity and at a minimum of one (1) treated site for each major treatment zone.
5. Make observations of unexpected environmental response to control practices applied at the first opportunity and at a minimum of one (1) treated site for each major treatment zone.

Adult Surveillance:

1. Use adult mosquito collection traps, landing rates or citizens’ service requests to determine adult mosquitoes’ density, species of concern and the extent of infestation. Methods include
 - a. CDC-style light trap baited with CO₂ (carbon dioxide or dry ice) may be used to provide local or regional information on the relative population density and species of host-seeking female mosquitoes
 - b. Traps optimized for collection of container-breeding mosquito species may be used to provide information on local container-breeding species
 - c. Landing rates counts may be used to provide information on the density and species of host-seeking female mosquitoes that are targeting humans
 - d. Other traps such as truck traps, suction traps and New Jersey light traps may be used to provide information about mosquito species, gender and population density dynamics
2. Determine the most appropriate means of applied control based on the:
 - a. Observed adult species biology
 - b. Incidence, frequency and virulence of mosquito transmitted human diseases within the mosquito population
 - c. Level of estimated adult emergence from observed mosquito pupal and late instar

larval stages concentrations as may indicate adult mosquito population changing dynamics

- d. Density of adult mosquitoes observed (see 'Action Thresholds Examples')
 - e. Target area proximity to humans and other potentially affected animals
 - f. Consideration of the need to protect animals from mosquito transmitted disease and annoyance effects by adult mosquitoes
 - g. Habitat type
 - h. Acreage of the infestation estimated
 - i. Arthropod Control Plan as accepted and practiced by the local organized program
3. Evaluate the efficacy of control practices applied at the first opportunity and at a minimum of two (2) separate treatment zones for each treatment night when two or more zones are treated.
 4. Make observations of unexpected environmental response to control practices applied, at the first opportunity and at a minimum of two (2) separate treatment zones for each treatment event or period certain when two or more zones are treated.

Resistance Surveillance:

1. Perform larval bioassays on field-collected larvae for larvicides and adulticides used. Respond to any decrease in susceptibility observed and tested by changing to the use of an alternate product with a different mode of action.
2. Alternatively, perform adult bottle bioassays on adults reared from field-collected larvae.
3. Target bioassays to the mosquito species identified as receiving the greatest larvicide and adulticide control pressure.
4. Evaluate pupal stage responses to methoprene-based products. Respond to any decrease in pupal susceptibility by changing to the use of an alternate product with a different mode of action.

Disease Surveillance:

1. Where economically feasible, maintain a mosquito-borne disease surveillance program using sentinel flocks of chickens to monitor the presence of mosquito vectors that carry and may transmit mosquito-borne virus within appropriate the mosquito control jurisdiction.
2. Utilize the weekly "Florida Arbovirus Surveillance" reports published by the Florida Department of Health as a means of tracking regional and statewide arboviral activity.

C. Control Methods

Source Reduction:

1. Determine the feasibility of eliminating oviposition sites.
2. Encourage proper water management by public and/or private agencies responsible for storm water retention and/or detention structures and for ditch and

impoundment maintenance.

Larval/Pupal Control:

1. The larvicide used shall be any U.S. Environmental Protection Agency (US EPA) registered mosquito larvicide and approved by FDACS.
2. Make all applications in accordance with the approved product label's directions.
3. Follow the Arthropod Control Plan as accepted and practiced by the local organized program.
4. Target applications for only the habitat where mosquito larvae are present or where mosquito larvae are expected to be present based on historical observations, site topography of other standards as acceptable by professional mosquito control documentation.
5. Larval control may be performed using ground or aerial equipment, depending on product label's directions, target habitat accessibility, scope of infestation and the potential measured for disease risks as determined by vector species' larval identification and other population dynamics observed.
6. The larvicide, its formulation, application rate and method of dispersal chosen is based on:
 - a. Larvicide label directions
 - b. Habitat stability to produce emergent adult mosquitoes
 - c. Observed larval species' biology
 - d. Observed and/or estimated larval density and instar development
 - e. Habitat type
 - f. Target area proximity to humans and other potentially affected animals
 - g. Acreage of target habitats
 - h. Estimates on larval re-infestation
 - i. Larval susceptibility to applied control agent(s) employed
 - j. Arthropod Control Plan as accepted and practiced by the local organized program
7. Rotate chemical control products between varying modes of action to combat development of resistance.

Adult Control:

1. The adulticide used shall be any US EPA registered mosquito adulticide approved by FDACS.
2. Treatment may be made at or above existing action thresholds (see attached examples) in compliance with state regulations. Target applications for only the habitats where adult mosquitoes are present.
3. Follow the Arthropod Control Plan as accepted and practiced by the local organized program .
4. Adult control may be performed using ground or aerial equipment, depending on product label's directions, target habitat accessibility, scope of infestation and the potential measured for disease risks as determined by vector species' adult identification and other population dynamics observed.
5. The adulticide, its formulation, application rate and application method of dispersal selected is based on:

- a. Adulticide label directions
 - b. Susceptibility of the major target species to the control agent
 - c. Observed species biology
 - d. Habitat type
 - e. Target area proximity to humans and other potentially affected animals
 - f. Acreage of infestation
 - g. Arthropod Control Plan
6. Timing of treatment should be performed as close as possible to the most active adult mosquitoes' behavioral host-seeking time periods for the major target species.
 7. Utilize maps of appropriate scale to continually monitor major sources of larval/adult mosquitoes in addition to documenting areas where control measures have been instituted. These maps should define treatment areas and can be used as appropriate in the Pollution Discharge Management Plan.

Quality Control

1. Application equipment shall be calibrated and maintained per equipment manufacturer's specifications and timetables.
2. Equipment shall be calibrated at least one (1) time per year and as specified by product label direction's instructions upon the maintenance or adjustment of mechanical parts of the units that disperse larvicide and adulticide products.
 - a. Chemical dispensing equipment shall be calibrated gravimetrically or volumetrically.
 - b. Adulticide aerosol droplet generating equipment shall have the droplet size spectra characterized by rotary-impactor method, waved-slide method or other industry-accepted method of droplet spectra measurement.
3. Actual insecticide application volume shall be compared against expected dispensed volume after missions are performed to confirm expected settings of equipment calibrations. If expectations are not met then recalibrate.
4. Where economically feasible, track treatments using GPS/GIS technologies. Evaluate spray track data periodically for qualitative and quantitative purposes.

Spill Prevention and Response

1. Spray equipment will be routinely examined for any condition which is or may contribute to treatment material leakage. Upon discovery of leakage repair the equipment.
2. Appropriate spill response kits will be present on vehicles transporting and applying pesticides and at all pesticide loading and storage locations. Spill kits will be inventoried yearly and updated or restocked when necessary.
3. All loaders and applicators will annually attend spill response training which will cover response procedures to a hazardous materials spill.

Record Keeping

1. The results of all surveillance activities will be maintained electronically, as hard copy or both.
2. Records of all data related to pesticide treatments made will be maintained

electronically, as hard copy or both.

3. Records will be retained for three years minimum as per FDACS regulations.

Action Thresholds Examples

The following are examples of surveillance methods and associated action thresholds which meet FDACS regulations. A baseline for any surveillance method can be any logical value. For instance, the lowest monthly average of a particular surveillance site during the active mosquito season may be used as a baseline.

Ground ULV Truck Treatment:

1. Two times Truck Trap baseline
2. Two times Landing Rate baseline
3. Two times CDC Light Trap baseline
4. Two times New Jersey Light Trap baseline

Aerial Treatment:

1. Three times Truck Trap baseline
2. Three times Landing Rate baseline
3. Three times CDC Light Trap baseline
4. Three times New Jersey Light Trap baseline

Surveillance Baseline Example

Truck Trap Route Baseline and Action Thresholds

Truck Trap Route		Baseline	X 2	X 3
Site 1	Rt 1	4	8	12
Site 2	Rt 2	9	18	27
Site 3	Rt 3	8	16	24
Etcetera	Rt 4	4	8	12