NC - How to Protect Honeybees During Wide-Area Mosquito Applications

The North Carolina Department of Agriculture and Consumer Services (NCDA&CS) has many available options to help mitigate pesticide exposure to bees during wide-area mosquito spray programs and still offer viable, economical, and effective mosquito control. Our protection modes rely heavily on two notification options for beekeepers.

NOTIFICATION – Voluntary and Mandatory Options

In April of 2016, the NCDA&CS became a member of FieldWatch. FieldWatch is a software program that supports communication, collaboration, and cooperation between crop growers, beekeepers, and pesticide applicators to help minimize any accidental exposure to pesticides. Beekeepers use the part of the program known as BeeCheck.

Once beekeepers have registered the locations of their hives in BeeCheck, registered pesticide applicators are able to log on and see the location of all beehives registered in their area of particular interest. There has been great success over the last few years with the use of this program. Municipalities and County Governments can also access the locations and contact information for beekeepers by registering their pesticide applicators. The BeeCheck program is by far the most accurate and inclusive method for beekeepers to become notified of pending applications whether they be by ground for routine spraying, or aerial equipment before making wide-area mosquito applications following a hurricane. NCDA&CS can also download the GPS locations of hives within a certain county and provide this data to aerial applicators to download for use within their spraying systems. BeeCheck and all the FieldWatch platforms, are free, voluntary, and non-regulatory programs that have been a great resource for beekeepers and pesticide applicators across our state.

Below is the link to register your hives on BeeCheck.

https://beecheck.org/

Pesticide Applicators may register at the following link to access FieldCheck to see apiaries registered in their area: https://driftwatch.org/signup#applicator

The NCDA&CS, Plant Industry Division also has an Apiary Registration Program that provides for mandatory notification under the NC Pesticide Law of 1971 to beekeepers of any aerial application of pesticides that is toxic to bees. This notification carries a 1-mile Radius notification area from the apiary and notice must be given with at least 48 hours before the application takes place. The cost is ten dollars per apiary. Below is a link to the Apiary Registration Form.

https://www.ncagr.gov/plantindustry/Plant/apiary/documents/2019ApiaryRegistrationForm.pdf

The regulation under the NC Pesticide Law requiring notification of these registered apiaries is below.

02 NCAC 09L .1009 NOTIFICATION OF APIARIES

(a) Any person who hires the services of an aerial applicator to apply a pesticide labeled as toxic to bees, shall notify, based on available listings of registered apiaries, the owner or operator of any registered apiary located within one mile of the target area not less than 48 hours nor more than 10 days prior to the beginning of a single application or a seasonal spray schedule, giving the approximate time of day of application and type of pesticide to be used.

(b) "Notification" for the purposes of this Paragraph is defined as follows:

- (1) written communication by:
  - (a) U.S. mail,
  - (b) Notification left at residence, or
  - (c) Notification left at alternate address as designated on the honeybee registration list.
- (2) oral communication by:
  - (a) telephone,
  - (b) personal communication, or
  - (c) verbal communication with an alternate person as designated on the honeybee registration list.

(3) digital communication by:
(a) electronic mail or
(b) instant cellular text messaging.

(c) The Pesticide Section shall distribute new registrations of beekeepers and their alternates by U.S. mail on the first of each quarter (January 1, April 1, July 1, and October 1) to all farmers growing crops within one mile of the apiaries that are identified on the "Apiary Registration Form" of the Plant Industry Division. The list of revised registered apiaries shall become effective on the fifth day of the first month in the quarter stated in this Rule. The registration of apiaries shall be effective for the calendar year that they are registered.

History Note: *Authority G.S. 143-443(b)(4); 143-458; 143-463; 143-466;*

LOCAL HEALTH DIRECTOR OPTIONS:

Many times, after a severe hurricane or tropical storm with a high amount of rainfall and impending flooding, local health directors can apply for certain exemptions for wide area aerial spraying to control significant public health pests such as mosquitoes in their respective counties. In such event there are certain exemptions from The NC Pesticide Board's Regulations that can be granted. Below is the Regulation regarding these exemptions.

02 NCAC 09L .1006 EXEMPTIONS

No person or procedure or spraying and spreading system for aerial application of pesticides shall be exempt from any of the provisions of this Section except under these conditions

(4) Any local health director or aerial applicator licensed under the subcategory of public health pest control, under supervision of such local health director when conducting a control operation for disease vectors or other pest of public health significance shall be exempted from 2 NCAC 9L .1002(j), General Requirements; .1003, Drift Control; and .1005(b) through (e), Restricted Areas, provided such local health director or his authorized designee notifies the secretary of the Board prior to initiation of subject operation and submits the following information:
(a) name of aerial applicator or contractor,
(b) location and general description of operation area(s),
(c) identity of target pest(s),
(d) brand name(s) and EPA registration number(s) of the pesticide(s) to be used,
(e) scheduled date(s) of application(s), and
(f) outline of nature of operation.

Approved pesticide(s) shall be applied in compliance with label requirements.

Again, NCDA&CS can assist local governments with identifying the location of all apiaries within the spray area.

MOSQUITO CONTROL ACTIVE INGREDIENTS - INFORMATION

Many products are used for routine adult mosquito control and during the aftermath of storms. There are two active ingredients that are commonly used during wide-area spray programs. They are deltamethrin and naled, and are found in products such as DeltaGuard and DiBrom, respectively. Below are links produced by the National Pesticide Information Center (NPIC) that cover many of the questions concerning these two products used during ultra-low volume applications, such as those after storms.

General questions about naled - http://npic.orst.edu/ingred/naled.html

General questions about deltamethrin - http://npic.orst.edu/factsheets/DeltaGen.html

Other products that may be used are listed in this table from the 2020 NC Agricultural Chemicals Manual. These active ingredients and brand names mentioned in the chart below may also be researched on NPIC's website found at http://npic.orst.edu/ .

Community Pest Control

M. Waldvogel, Entomology and Plant Pathology Extension and M. Reiskind, Entomology and Plant Pathology Research

NOTE: Insecticides recommended for use by Certified Applicators only. For rodents, see Animal Damage Control, Chapter 9.

Table 5-12A. Community Pest Control — Mosquito Adults[1]

Read pesticide labels carefully. Some pesticide products are not approved for application to edible plants. Avoid spraying flowering plants when bees are actively foraging.
KEY: Dv 0.9 = 90% of the spray volume droplets are smaller than value given VMD = Volume Median Diameter; *u*m = micrometer

TYPE OF APPLICATION Insecticide and Formulation	Mixing Instructions and Application Equipment	Application Rate at 10 mph	Droplet Size Requirements on Label (*u*m)	Precautions and Remarks
Ground Application				
bifenthrin 7.9L	0.33 to 1.0 fl oz/gal water in backpack or hydraulic sprayer			Apply at a rate of 1 gallon per 1,000 square feet for thorough coverage of lawns and/or ornamentals.
Clove oil (Nature-Cide)	1:9 to 1:39 dilution in water		Outdoors – apply to wet surfaces but not to the point of run-off.	Treat with mist or spray around landscape plants, turf, ground cover, under decks, around building foundations where mosquitoes may rest.
deltamethrin (Suspend Polyzone)	0.33 to 1.0 fl oz/gal water in backpack or hydraulic sprayer			Treat with mist or spray around landscape plants, turf, ground cover, under decks, around building foundations where mosquitoes may rest.
etofenprox (Aqua Zenivex E20)	Apply undiluted or up to 1:4.5 dilution	Varies with dilution	VMD-7-30 *u*m Dx 0.9 < 50 *u*m	Do not apply more than 0.18 lb per acre per site per year. Do not make more than 25 applications per site per year.
garlic oil% (ATSB concentrate)	38 fl oz/gal water in a backpack or hydraulic sprayer			Apply at a rate of 15 ounces per 100 linear feet to vegetation 1 to 5 feet above the ground wetting both surfaces of foliage to the point of runoff. Do not apply with handheld or truck-mounted cold ULV or thermal foggers or by aircraft.
lambda-cyhalothrin (Cyonara 9.7, Demand CS, Cyzmic CS)	0.8 fl. oz/gal. water in backpack or hydraulic sprayer			Treat resting areas on structures as well as surrounding shrubs.
malathion 96.5% concentrate (Fyfanon ULV)	Use undiluted on aerosol ULV sprayer.	2 to 4.3 fl oz	VMD < 30 *u*m Dv 0.9 < 50 *u*m	Do not spray when wind speed is more than 5 mph.
	Dilute 3.9 to 5.2 gal to 100 gal with No. 2 fuel or diesel oil; use in thermal fog sprayer.			Avoid direct application to vehicles; these insecticides may damage paint. Apply when air temperatures are cool and wind speed is 3 mph or less. Toxic to fish, aquatic invertebrates, and wildlife.
naled (Dibrom) 87.4% concentrate	10 fl oz to 10 gal No. 2 fuel or diesel oil; use in thermal fog sprayer.	80 gal/hr	VMD < 40 *u*m Dv 0.9 < 75 *u*m	Toxic to fish, aquatic invertebrates, and wildlife. Restricted Use Pesticide.
	Dilute 0.5 gal to 5 gal with soybean oil or HAN; use in ULV sprayer.	6 to 12 fl oz/min	VMD < 40 *u*m Dv 0.9 < 75 *u*m	Do not directly apply to water or to areas where runoff into water is likely to occur.
permethrin 10% to 57% concentrate	Apply undiluted or mix with refined mineral or soybean oil.	0.31 to 15 oz/min depending on dilution	VMD = 150 to 300 *u*m	Permethrin 57% is not for use in residential misting systems. Do not allow drift onto cropland, poultry ranges or potable water supplies. Do not use on crops used for food or forage.
permethrin (Permanone) 10% EC	Dilute 1:20 with water (6.5 fl oz/ 1 gal of water).			Treat surfaces using course wet spray. Do not allow runoff or drift into waterways or storm drains.
permethrin (20%) and piperonyl butoxide (20%) (Aqua-Reslin)	Dilute 1 gal with 2 to 12 gal water	2.1 to 9 oz/min depending on dilution	VMD < 30 *u*m Dv 0.9 < 50 *u*m	Dilute with water only. Toxic to fish and aquatic invertebrates. Can be used as barrier spray on building foundations (maximum height of 3') and vegetation around structure but not within 100 feet of lakes and streams. Structural applications to areas other than foundation limited to crack & crevice.
permethrin and piperonyl butoxide (Permanone 31-66, Biomist 4+12 ULV)	Dilute 1 gal to 2.4 gal with light weight oil; use in ULV sprayer.	0.5 to 3 fl oz/min	VMD < 30 *u*m Dv 0.9 < 50 *u*m	
prallethrin (1%) and sumithrin (5%) and piperonyl butoxide (5%) (Duet)	Apply undiluted in aerosol ULV sprayer	2.5 to 7.5 oz/min	VMD = 8 to 30 *u*m Dv 0.9 < 50*u*m	Do not allow drift onto pastureland, rangeland, or potable water supplies.
rosemary oil, Geraniol, Wintergreen (Essentria IC3)	1 to 8 oz of Essentria IC3 per gallon of water	43 gal	2 gallons per 1,000 square feet	1 to 3 fluid ounces of Essentria IC3 per gallon of water. Treat harborage areas such as shrubbery and vegetation where mosquitoes/flies may rest.
sumithrin and piperonyl butoxide (Anvil 10+10 ULV or 2+2 ULV)	Use undiluted or dilute 10+10 formulation with light mineral oil.	1.3 to 18.6 oz/min	VMD < 30 *u*m Dv 0.9 < 50*u*m	Apply through a standard ULV cold aerosol or non-thermal aerosol (cold fog) generator.
Fixed Wing Aerial Application				
etofenprox (Aqua Zenivex E20)	0.00175 to 0.007 oz (undiluted) per acre	Varies with dilution	VMD <60 *u*m Dx 0.9 < 100 *u*m	Do not apply at altitudes below 100 feet. Do not apply more than 0.10 lb per acre per site per year. Do not make more than 25 applications per site per year.
malathion 96.5% concentrate (Fyfanon ULV)	Use undiluted	2.6 to 3 fl oz/acre	VMD <60 *u*m Dx 0.9 < 100 *u*m	Toxic to fish, aquatic invertebrates, and wildlife. Do not directly apply to water or to areas where runoff into water is likely to occur. Do not retreat a site more than 3 times in any one week except in emergencies. Do not spray by fixed wing aircraft below 100 feet or by helicopter below 75 feet.

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KEY: Dv 0.9 = 90% of the spray volume droplets are smaller than value given VMD = Volume Median Diameter; *u*m = micrometer

TYPE OF APPLICATION Insecticide and Formulation	Mixing Instructions and Application Equipment	Application Rate at 10 mph	Droplet Size Requirements on Label (*u*m)	Precautions and Remarks
Fixed Wing Aerial Application (continued)				
naled (Dibrom) 87.4% concentrate	Use undiluted.	0.5 to 1 fl oz/acre	VMD = 60 *u*m Dv 0.9 < 115*u*m	Toxic to fish, aquatic invertebrates, and wildlife. Do not directly apply to water, except when necessary to target areas where adult mosquitoes are present or to areas where runoff into water is likely to occur. Do not exceed 104 fl oz per year.
naled (Dibrom) 87.4% concentrate	Dilute 50 to 100 fl oz to 100 gal with No. 2 fuel oil or diesel oil.	1 gal/acre	VMD = 60 *u*m Dv 0.9 < 115*u*m	Toxic to fish, aquatic invertebrates, and wildlife. Do not directly apply to water, except when necessary to target areas where adult mosquitoes are present or to areas where runoff into water is likely to occur. Do not exceed 104 fl oz per year.
permethrin (20%) and piperonyl butoxide (20%) (Aqua-Reslin)	Dilute 1 gal with 2 to 12 gal water	2.1 to 9 oz/min depending on dilution	VMD < 60 *u*m Dv 0.9 < 100*u*m	Dilute with water only. Toxic to fish and aquatic invertebrates.
prallethrin (1%) and sumithrin (5%) and piperonyl butoxide (5%) (Duet)	Apply undiluted on aerosol ULV sprayer	0.41 to 1.24 oz/ac	VMD = < 60 *u*m	Do not allow drift onto pastureland, rangeland, or potable water supplies.
sumithrin and piperonyl butoxide (Anvil 10+10)	Use undiluted.	3.8 to 5.7 fl oz/acre	VMD < 60 *u*m Dv 0.9 < 80 *u*m	

[1] Avoid direct applications to flowering plants when pollinators are active. Do not allow drift onto adjoining non-target areas. When treating residential properties, cover or remove pet food and water sources, grills, swimming pools and children's toys. Note: Treatment of structures (exterior or interior) requires a P-phase Structural Pest Control License in North Carolina.

OTHER RESOURCES

Below are a list of links and documents that were published by Dr. David Tarpy and Dr. Michael Waldvogel of North Carolina State University. This list gives good information to beekeepers and pesticide applicators during these times of wide-area mosquito applications. Any new articles that are posted that pertain to widespread mosquito spraying following a hurricane will be added here and can be found at the North Carolina State University Extension Website (https://entomology.ces.ncsu.edu).

https://entomology.ces.ncsu.edu/2017/09/protective-measures-of-beehives-during-hurricanes-2/

https://entomology.ces.ncsu.edu/2018/09/bee-kind-if-you-spray-for-mosquitoes/

https://entomology.ces.ncsu.edu/2018/09/information-from-the-ncdacs-to-beekeepers-concerning-hurricane-florence/

https://entomology.ces.ncsu.edu/2018/09/how-to-protect-your-beehives-from-mosquito-spraying-following-a-hurricane/