

Aerial Droplet Characterization STANDARD OPERATING PROCEDURES (SOP) FOR THE U.S.A. Version 1.1 | March 2024

Aerial applications to control adult mosquitoes require specific equipment and spray parameters for successful applications. Calibration and droplet characterization are an essential part of ensuring the equipment produces droplets sizes and application rates within the label requirements. Directions from the equipment manufacturer or vendor, pesticide registrant or a test facility using a wind tunnel, laser-based measurement instrument or an appropriate method for droplet size estimation using glass/acrylic slides on rotary impingers must be used to adjust equipment to produce acceptable droplet size spectrum.

The aerial applications can be done using various equipment and types of atomizers. The following table indicates the standard “typical” types of aircraft/atomizer combination.

Table 1: Standard aerial adulticide set-ups

Equipment Type	Atomizer Type
Helicopter	Micronair AU6539 (electric)
Fixed-Winged Aircraft	Micronair AU4000 (wind-driven)

It is important to correctly calibrate equipment flow rate using the specific spray parameters used for the application (speed, swath, spray volume) to achieve the desired application rate prior to any treatment. For the Micronair atomizer set-ups, the output from each atomizer is controlled by its Variable Restrictor Unit (VRU) or orifices located in line just before each Micronair (Micron Group, Herefordshire, UK). Select the correct VRU setting (see atomizer manual) or orifice size to place in line of each side of the boom and conduct static flow test to ensure the correct flow rate is achieved. Record the VRU setting, or orifice size and pump pressure setting required for each nozzle to achieve the desired flow rate. Calibration of the spray equipment is done using a timed collection method and measuring actual output in gallons per minute (GPM). The following items will be needed to complete calibration; collection bags or bucket(s), a measuring cup, and a stopwatch.

If static calibration is possible, all personal protective equipment (PPE) listed on the label should be used while conducting calibration. (Mixers, loaders, applicators, and other handlers must wear long-sleeved shirt, long pants, shoes, socks, proper eye protection, and gloves.) To calibrate flow rate first prime the system to ensure flow of fluid and all air pockets have been removed from the lines. Place and hold a plastic bag, with one corner cut out of it, over each atomizer (this will require multiple people) on the boom. Place a bucket underneath the bag to catch the fluid out of the atomizers. Turn on the engine and allow the system to reach full throttle; then turn on the spray. Once material begins flowing out of the atomizers and into the buckets, the timer starts. Continue to run the system for 60 seconds, collecting material in buckets. After 60 seconds, shut down the system and stop collecting material. Measure the

amount of fluid in the buckets together with the measuring cup. Adjust equipment (VRU setting, orifice size, or pump pressure) if needed and repeat until three similar desired flow rates are achieved.

Calculating Flow Rate:

Gallons per Minute (GPM) = (Spray Volume (GPA) x Speed (mph) x Swath (ft)) ÷ 495

Droplet Characterization Methodology

The effects of flight speed and, for non-rotary nozzles, nozzle angle on the droplet size spectrum must be considered.

Droplet characterization of ULV droplets can be conducted by collecting data on the droplet size and density at different sampling stations using rotating droplet impingers (spinners) and the A-Drop™ analysis program. Other than the aircraft, the following items will be needed to complete droplet characterization: ultraviolet dye (Tinopal® OB (BASF Corporation, Florham Park, NJ), droplet spinners with tripods (3), 1/8" (or 3 mm) Teflon coated acrylic rods, Teflon coated 1" glass slides, cones, and ultraviolet microscope with digital camera.

Each droplet characterization run should be conducted in the same manner relative to speed, flow rate, application rate and swath at an altitude of 15-foot above the top of the impingers (typically 25 ft altitude).

Weather related to humidity, wind speed, and wind direction at the site will be monitored and recorded during characterization. A device capable of recording temperature will be placed 5 feet from the ground, on a tripod.

Setting up Sampling Stations: A droplet sampling line should be established and set up into the wind (Figure 1). The sampling line should include three droplet sampling stations, each station including two droplet spinners. One spinner with two Teflon coated 3 mm acrylic rods and one spinner with two Teflon coated 1" slides. The droplet collection stations should be placed 50 feet apart from each other and labeled A, B and C.

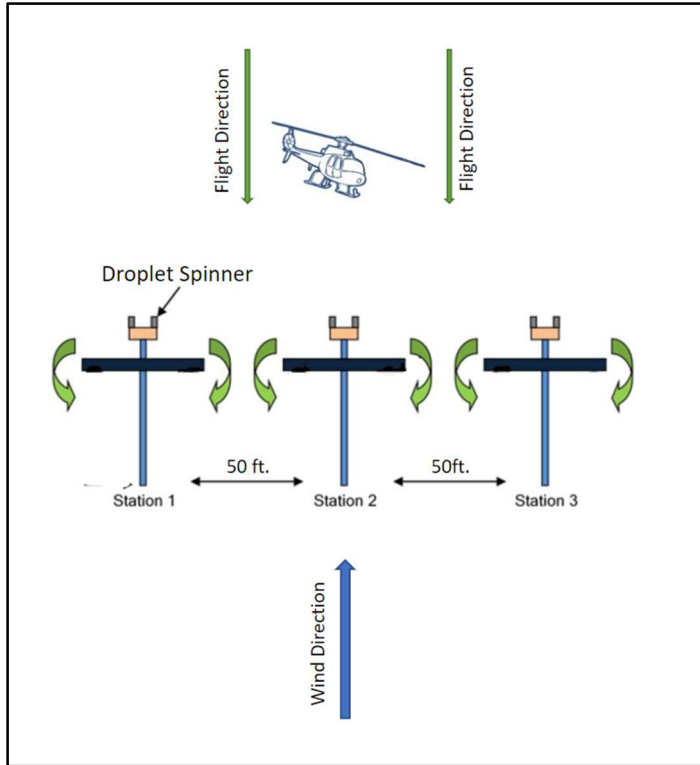


Figure 1

Replicates: At least one application (run) at the prescribed application rate will be conducted for the evaluation, which equates to three replicates per characterization run.

Before Application: The Micronair atomizers or nozzle tips should be set to deliver appropriate droplet size for aerial ULV applications. Spray equipment must be adjusted so that the volume median diameter (VMD) is less than 60 microns ($Dv\ 0.5 < 60\ \mu m$) and that 90% of the spray is contained in droplets smaller than 115 microns ($Dv\ 0.9 < 115\ \mu m$). Initially the atomizer rotational speed will be set according to the atomizer manual, to deliver proper flow rate and droplet size (see treatment listed above). After each run, analysis should be done to determine average droplet size on the 3 mm rods and/or 1" slides prior to the next run. If droplet size is not within desired range, equipment adjustment should be done prior to the next run.

Ultra-violet dye (Tinopal OB) should be added to the product prior to filling the application equipment tank, allowing the droplets to be visible on the acrylic rods during droplet analysis. The dye will be added at a ratio of 2 grams of dye per liter of product. After adding the dye to the product, stir or shake mixture well, before adding it to the spray tank. The dye allows for a more accurate analysis ensuring no other types of droplets are being read such as water, gasoline and other pollutants.

Application: The characterization applications will be conducted only during stable atmospheric conditions. Wind conditions should be in a consistent direction and should not be greater than 8 mph during the characterization. The ULV aircraft will be flown across the test plot as shown in Fig. 1 and into the wind. The ULV spray will be turned on 100 feet before the sampling

stations and turned off 100 feet after the sampling stations for each treatment. The helicopter flight line should be in line with the droplet spinners stations, slightly off center to ensure droplets land on collection rods (figure 1) and should fly at 15' altitude above spinners or as low as safely possible. Spray parameters used for the application should be recorded.

Large road cones or other highly visible objects could also be provided for the pilot to see the flight line on approach. During the application the wind speed, wind direction and humidity in the general area where the characterization is conducted should be noted.

After Application: Ten minutes after the application the acrylic rods and slides should be collected from each station and placed in a transfer box (where the droplets will not be smeared or contaminated) for analysis by ADrop™.

ADrop™ - Droplet Analysis

After collecting the droplets from the characterization run, the droplet images need to be captured and an analysis program is used to count and measure each droplet on each image.

Refer to “SOP for Droplet Analysis & ADrop” for specifics on using ADrop.

Application equipment must be tested at least annually or when switching products to confirm that pressure at the nozzle and nozzle flow rate(s) are properly calibrated.