Government of **Western Australia**
Department of **Health**

Equipment Calibration

Calibration variables

The calibration of any application equipment can be performed with an understanding of three basic parameters; **speed, swath**, and, **output.**

Speed

This may be the walking speed for ground-based larviciding or the driving speed for ultra-low volume (ULV) space applications. Speed has an inverse relationship to the application rate. The faster the speed, the lower the application rate and vice versa.

Swath

Swath refers to the spread of product from the delivery point. It may be in one direction or both sides of the delivery point. Usually the amount delivered will taper off at the extremes of the swath requiring some overlap.

Output

Output is the amount of product delivered over time and has a direct relationship to the application rate. The higher the output, the higher the application rate. Adjusting output (including changing dilution) is the easiest way to fine turn the application rate.

Collect, measure and calculate

Some equipment will come with manuals that have output values for various formulations. Table 1 outlines how you might measure some of the basic calibration parameters, in order to calculate your application rate.

Table 1. Examples of how to measure speed, swath and output for various applications

Parameter	Application	Method to measure parameter
Speed[1.]	Vehicle	GPS, Speedometer.
	Walking/vehicle	Distance covered in a set time.
Swath[2.]	High volume liquid applicators	Spray a cemented area with water to measure spread.
	Solid formulations	A line of cloth bags.
	Liquid aerial applications	A line of die cards.
Output	Liquid aerial applications	Spray into a measuring cylinder for a set time.
	Small hand-held equipment	Weigh the chemical tank before and after spraying for a set time.
	Solid formulations	Collect in a catch bag for a set time and weigh.
	Liquid/Solid tank	Fill with known volume and measure the time it takes to empty.

[1]If measuring speed for ground application it is best to measure speed during an actual application.

[2]Use a swath width that is within the equipment or an operator's capability i.e. if you can spray out to 6 m at a stretch but can easily spray out to 4 m then you may like to use 4 m as your swath.

Worked calibration examples

Granular larvicide calibration example

Granular larvicides can be applied by hand, granule applicator, mechanical (e.g. backpack) applicators and other means. Before applying, you will need to determine the flow rate of the equipment. This can be done as a trial using old stock in a location that will not impact on the surrounding environment or members of the public. Alternatively, and depending on the equipment to be used, you may be able to identify the flow rate from the machine specifications.

Once the flow rate is determined, this can be adjusted to give appropriate application (e.g. 3 kg/ha) for coverage speed (e.g. walking pace). Depending on the desired application rate, flow rate of your equipment and coverage speed, you may need to dilute granular chemical formulations further using a similar substrate (e.g. clean sand of similar diameter) to avoid over-applying.

Equipment	Application method	Measure	Measuring Method	Result
Quad-bike fitted with a C-Dax rotary spreader	1 operator driving vehicle	Speed (speedometer)	Predetermined based on safe operating speed at: 10 km/hour.	167 m /minute
		Swath (width of area covered)	Using line of cloth collector bags, spreader is driven past a number of times to determine swath.	8 m either side = 16 m spread
		Output volume	Spreader slide opened halfway. Volume dispensed into a bucket over 1 minute.	1.5 kg/min

Calculations

Area covered (m) /min	167 m (distance travelled) x 16 m (swath) = 2672 m^2/min
Area covered (ha) /min	$\frac{2672m2}{1000m2}$ = 0.2672 Ha/minute
Desired application rate	4 kg/Ha
Volume chemical required per unit area based on area covered (ha/min)	4 kg/Ha x 0.2672 Ha/min = ~ 1 kg/min

Liquid larvicide (and wettable granules) calibration example

These formulations can be applied by pressure knapsack, backpack liquid applicator, boom sprays and other equipment designed for liquid chemicals. Generally, these chemicals can be diluted in clean water. With some formulations, such as *Bacillus thuringiensis* var *israelensis* (*Bti*), you will need to ensure regular agitation of the mix to avoid concentrates clogging supply lines and nozzles.

The flow rate of your equipment can be determined using water only, or you may be able to refer to the machine specifications. Once this is known you will need to vary the concentration of the emulsion/mixture or the flow rate to provide the correct application for your coverage speed (e.g. walking pace).

Equipment	Application method	Measure	Measuring Method	Result
Truck mounted 500L tank, hose, reel, Product is water dilutable	2 operators, 1 controlling the wand, the other helping with the hose.	Speed (distance travelled over 1 minute)	Operators "apply" water to a cemented area at a speed and sweep which they thought was sustainable in a normal larval habitat for 1 minute	33 m /minute
	Parked vehicle, application along the entire reach of the fully extended hose; vehicle will be moved to complete the next section.	Swath (width of area covered)	Width of area wet: as above	3 m wide area was wet
		Output volume	Volume produced in 1 minute: Wand set on course spray & sprayed into a measuring jug for 1 minute.	5000 ml/min

Calculations

Area covered (m) /min	33 m (distance travelled in 1 min) x 3 m (width of area covered) = 99 m^2
Area covered (ha) /min	$\frac{99m2}{1000m2}$ = 0.0099 Ha/minute
Desired application rate	1000 ml/Ha
Volume chemical required per unit area based on area covered (ha/min)	1000 ml/Ha x 0.0099 Ha/min = ~ 10 ml/min
Measured output volume	5000 ml/min
Dilution required	5000 ml (output volume) – 10 ml (desired volume) = 4990 ml (diluent)
Dilution rate	10:4990 = 1:499 ; Use 1 litre product in 500 L tank

Fogging calibration example

Ultra-low volume (ULV) and thermal fogging are best applied in low wind conditions at and after dusk or around dawn, when the adults of most mosquito species are most active. An average droplet size of 10-20 µm (1 µm or micron = 1/1000 mm) is most effective against populations of flying adult mosquitoes. Droplets of under 10 µm in size should be avoided as these will be subject to rapid evaporation and degradation of the active component. Large droplets (say >50 µm) should also be avoided as these will quickly fall to earth where they will have no effect on flying adult mosquitoes.

Calibration of new equipment and calculating the correct mixture for new chemicals may require some thought and time (see example below). Once established, the procedure and mixture should be written down so that it can be done routinely.

The following is an example of how to undertake calibration prior to ULV space spray application.

Equipment	Application method	Measure	Measuring Method	Result
Truck mounted ULV space sprayer. Product is oil dilutable	1 operator driving vehicle	Speed (speedometer)	Predetermined based on safe operating speed at: 10 km/hour	167 m /minute
		Swath (width of area covered)	Predetermined at: 50 m (based on its specifications the ULV sprayer can achieve 91.4m swath but the roads are 50m apart so the swath is set to this width)	50 m
		Output volume	Pre-set at: 200 ml/min	200 ml/min

Calculations

Area covered (m) /min	167 m (distance travelled) x 50 m (swath) = 8350 m^2/min
Area covered (ha) /min	$\frac{8350m2}{1000m2}$ = 0.835 Ha/minute
Desired application rate	24 ml/Ha
Volume chemical required per unit area based on area covered (ha/min)	24 ml/Ha x 0.835 Ha/min = ~ 20 ml/min
Set output volume	200 ml/min
Dilution required	200 ml (output volume) – 20 ml (desired volume) = 180 ml (diluent)
Dilution rate	20:180 = 1:9 ; Use 1 litre product with 9 L diluent oil

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