

Learning Objectives

When you have completed this section, you should be able to:

- choose equipment to apply mosquito and black fly larvicides and adulticides
- calibrate the equipment and calculate the amount of product required to complete the application

Control of Mosquito Larvae

A variety of equipment may be used to apply mosquito larvicides. The equipment used primarily depends on the type of formulation chosen and the size of the area that you wish to treat.

- **Capsules and Briquettes**

Capsules and Briquettes are typically applied by dropping the capsule or briquette into the larval habitat using no application equipment other than a gloved hand. The recommended application rate on the pesticide label is stated as the number of capsules/briquettes per 375 litres of water, or per 10 square metres of surface area.

To determine the number of capsules/briquettes to use based on surface area use the following method:

Measure the width and length of the pond in metres at several locations. Calculate the average width and length of a site. The area in square metres is calculated as follows:

$$\text{average width(m)} \times \text{average length(m)} = \text{area (square metres or m}^2\text{)}$$

For example; if the average width of a site is 7.8 m and the average length is 4.5 m the area is calculated as follows:

$$(7.8) \times (4.5) = 35.1 \text{ m}^2$$

If the application rate is one capsule per 10 m², you should distribute 3 to 4 capsules/briquettes to the site.

Volume of Water

To calculate the volume of water in a site, first calculate the area as above. Then measure the depth of the pond at several locations. Calculate the average depth. The volume in cubic metres is calculated as follows:

$$\text{depth(m)} \times \text{area(square metres)} = \text{volume(cubic metres or m}^3\text{)}$$

For example: if the surface area is 1050 m² and the average depth is 0.65 m the volume is calculated as follows:

$$(0.65) (1050) = 682.5 \text{ m}^3$$

If the application rate specifies use one capsule/briquette per 375 m³, you would apply two briquettes to the area.

● Granular Formulations

Hand Application: Granular formulations may be applied to small areas by spreading the granules with a gloved hand. However, it is very difficult to obtain an even application or maintain the recommended application rate using this technique.

To hand apply granular formulations first calculate the surface area as described in the section on Capsules and Briquettes. Refer to the label to establish the application rate. The rate will usually be shown as kg product/ha. Since small sites are usually measured in m², you must convert this application rate to m². One hectare is 10,000 m². If for example the application rate on the label is 6.0 kg product/ha, this is the same as 6.0 kg/10,000 m² or 0.0006 kg/m² or 0.6 g/m².

For example, for a site that is 35.1 m², you need to apply:

$$(35.1) \times (0.6) = 21.1 \text{ g of product to the site.}$$

Manual Spreaders: Granular formulations are often applied over larger areas with seed and fertilizer spreaders. They consist of a bucket or a sack that holds several kilograms of granules. The operator rotates a handle, which spins a plate number under the bucket or sack, hurling the chemical that falls onto it outwards in all directions. Although difficult to calibrate, manual spreaders are adequate when resources are limited.

To calibrate a manual spreader for the application of granular formulations:

- 1 Load the bucket/sack half-full with the granule formulation chosen.
- 2 Walk at the speed that you will use during the application. Open the flow lever and turn the handle consistently to make sure the swath width is constant.
- 3 Measure the resulting swath width.

- 4 Calculate the distance needed to walk a tenth of a hectare using the following formula.
$$1,000/(\text{your swath width in metres from "3"}) = \text{the number of metres you must walk to treat one tenth of a hectare}$$
- 5 Select the rate you will use from the label and determine how much product is needed to treat a tenth of a hectare. For example if the recommended rate is 5.0 kg product/ha, divide the 5.0 by 10 to obtain the amount that should be used on one tenth of a hectare. In this example it would be 0.5 kg or 500 g.
- 6 Place the amount of product required to treat the one tenth of a hectare (in our example 500 g of granules) in the bucket/sack. Adjust the flow lever so that the granules run out when you walk the distance calculated in "4". This will take several tries and adjustments before you obtain the adjustment of the flow lever. Once you have established how far to open the flow lever, mark this adjustment on the spreader so that it can be easily used during application.

It is extremely difficult to walk at a constant rate through mosquito larval habitats, especially spring Aedes sites.

Motorized Spreaders: Motorized back-pack spreaders with a two-cycle engine may be used to apply granular formulations. These use an air blast to spread granules and are significantly more expensive than manual spreaders. These applicators are also fairly heavy; a significant consideration while walking through mosquito larval habitats.

The calibration technique is similar to that used for manual spreaders.

- 1 Set the throttle at the normal running speed for the applicator and the machine. Mark this position on the machine.
- 2 Half-fill the reservoir with the granules that you will be using and operate the spreader while walking at the speed you will use during application.
- 3 Measure the swath width.
- 4 Calculate the distance needed to walk a tenth of a hectare using the following formula.
$$1,000/(\text{your swath width in metres from "3"}) = \text{the number of metres you must walk to treat one tenth of a hectare}$$
- 5 Select the rate you will use from the label and determine how much product is needed to treat a tenth of a hectare. For example if the recommended rate is 5.0 kg product/ha, divide the 5.0 by 10 to obtain the amount that should be used on one tenth of a hectare. In this example it would be 0.5 kg or 500 g.

- 6 Place the amount of product required to treat the one tenth of a hectare (eg. 500 g of granules) in the reservoir and adjust the flow so that the granules run out when you walk the distance calculated in “4”. This will take several tries and adjustments before you obtain the adjustment of the flow. Once this adjustment has been established mark it on the spreader so that it can be used during application.

- **Liquid Sprayers**

Formulations such as emulsifiable concentrates, solutions and wettable powders may be applied with a variety of equipment depending on the size and financial resources of the program.

Backpack Sprayers

Backpack Sprayers are used to apply liquid or wettable powder formulations in relatively small mosquito control programs. They are often an effective method of application in sites that have little emergent vegetation. If there is a large amount of emergent vegetation the spray may not penetrate the vegetation and get into the water.

Back pack sprayers generally use compressed air above the spray mixture to push the spray mixture out of the tank, through a hose and nozzle. The output of the sprayer is dependent on the pressure used, the nozzle type and the speed at which you walk during the application. The compressed air above the spray mix is supplied by a manual pump that is operated with one hand while the hose and nozzle of the sprayer are held with the other. This can make walking in a mosquito larval habitat awkward.

To calibrate a back pack sprayer:

- 1 Measure and mark an area that is 100 square metres (for example 10 m by 10 m; 20 m by 5 m).
- 2 Make certain that the sprayer is working properly and fill the spray tank with water. Mark the water level on the outside of the tank, or mark the water level on a measuring stick.
- 3 Pump the air pressure to the point that will be used during application. You must maintain the pressure as constant as possible to maintain an even application rate. A pressure gauge on the wand is useful for this purpose.
- 4 Spray the marked area. Walk at the pace that you will use during application.
- 5 Measure the amount of water required to refill the spray tank to the mark on the measuring stick or on the tank. This is the output per 100 square metres.
- 6 Calculate the total area one tank will treat as follows:

$$\frac{\text{litres}}{\text{100 m}^2} \times 100 = \text{litres}$$

(The 100 in this equation is the area measured in step 1. If you use a larger or smaller area you must replace the 100 in the equation with the area you used measured in m².)

For example; if the amount of water required to treat 100 m² was 5.5 l, then calculate the area one full tank will treat as follows:

$$\frac{5}{5.5} \times 100 = 90.9 \text{ m}^2$$

- 7 To establish how much product should be added to the tank if the label provides you with a rate per 100 square metres, you use the following equation:

$$\frac{\text{litres}}{100 \text{ m}^2} \times \text{area} / 100 \text{ m}^2 = \text{litres}$$

For example if you are using the backpack sprayer that will treat 454 m² and the label specifies a rate of 50 ml/100 square metres, the amount you add to the full tank is:

$$\frac{50}{100} \times 454 = 227 \text{ ml}$$

- 8 To establish how much product should be added to the tank if the label provides you with a rate per hectare, you use a similar equation, as follows:

$$\frac{\text{litres}}{10,000 \text{ m}^2} \times \text{area} / \text{ha} = \text{litres}$$

For example, if you are using the backpack sprayer that will treat 454 m² and the label specifies a rate of 5.0 l/ha, the amount that you would add to a full tank would be:

$$\frac{5}{10,000} \times 454 = 0.227 \text{ l}$$

Power Sprayers

Power sprayers are comprised of tank, pump, hand gun or wand, check valve, pressure regulator, pressure gauge and hose. These may be mounted on an all terrain vehicle or truck. Power sprayers are calibrated in the exact same fashion to that described above for a backpack sprayer. However, the area that you treat may have to be larger than 100 square metres. The larger the area treated during calibration, the more accurate the result.

Control of Black fly Larvae

The amount of product required to treat each site is based on the flow rate of the stream. To calculate the amount of product needed:

- Calculate stream flow in cubic metres per second (m³/sec)
(m³/sec=average depth (m) x average width (m) x average velocity (m/sec);
 - measure average stream depth
 - measure average stream
 - measure average velocity by using a flowmeter or by timing a floating object travelling a distance of at least 3 metres. When timing a floating object the average velocity is approximately 0.67 of the surface velocity for streams with a rocky bottom, and 0.9 for a mud bottom. (Multiply the surface velocity by either 0.67 or 0.9 to calculate the average velocity.

For example; you have established that the average width of the stream is 2.5 m and the average depth 0.5 m. It requires 5 seconds for a small object to float 7 metres. The surface velocity is calculated as follows:

$$\frac{7}{5} = 1.4 \text{ m/s}$$

The bottom of this stream is rocky; therefore, the average stream velocity is:

$$(1.4) (0.67) = 0.94 \text{ m/second}$$

The stream flow in m³/second is:

$$(2.5) (0.5) (0.94) = 1.18 \text{ m}^3/\text{second}$$

- Find the pesticide application rate from the label (mls of product needed/m³/sec).
- Multiply the rate from the label times the stream flow to obtain the total amount of product needed.

For example, if the application rate from the label states that you should use 100 ml/m³/sec you would apply:

$$(1.18) (100) = 118 \text{ ml of product}$$

- Dilute the larvicide with water to obtain a total volume sufficient for the injection period of 15-30 minutes.

- The diluted larvicide may be applied with a variety of spraying equipment; however, the most practical is usually a compressed air sprayer such as a backpack sprayer. These sprayers are used to apply the product across the entire stream, to ensure good mixing, and that the appropriate period of time is used for the application.

Control of Mosquito and Black fly Adults

- **Residual Sprays**

Residual treatments are applied to the foliage and structures in an area where mosquitoes rest during the day. The products may be applied using back pack compressed air sprayers or power sprayers. These pieces of equipment have been described in the mosquito larval control section above.

Most of the products registered for this use express application rates on a percentage basis. For example, the label will state use a 0.5 to 1.0% active ingredient spray. To calculate the amount of product to add to the tank use the following formula:

$$X = \frac{(S) (A)}{C}$$

- X = The amount of concentrate required;
- S = The percent active ingredient in the spray;
- A = the amount of spray to be prepared;
- C = the percent of the active ingredient in the concentrate.

For example, if you have a concentrate that has 25% active ingredient, and you wish to make 40 litres of a 1.25% active ingredient spray solution, how much concentrate would you put in the tank?

$$X = \frac{(1.25) (40)}{25}$$

$$X = 2 \text{ L} \quad 6 \text{ L}$$

These application rates may also be expressed as a proportion. For example, the label may specify the use 2 L of concentrate in 25 litres of water. To calculate the amount you will put into your tank if your tank holds 125 Litres.

$$\frac{2}{25} \times 125 = 10 \text{ L}$$

- **Thermal Foggers**

Thermal foggers have an engine which forces a mixture of pressurized diesel fuel and insecticide into a mixture of hot engine gases. The mixture is broken into small particles, vaporized and discharged into the cooler air where the vapour condenses into fine particles or fog. The fogger must be thoroughly warmed up before opening the insecticide/diesel flow line. Many formulations are available premixed and can be added directly to the reservoir of the thermal fogger. Follow the instructions provided with the thermal fogger to calibrate the equipment. The amount of concentrate that you use is usually calculated as a percentage or proportion as described above.

- **Ultra Low Volume Application**

Ultra Low volume sprayers dispense insecticide droplets that are less than 20 microns at a low volume. The concentrated insecticide is forced through an air stream where the insecticide is sheared into very fine droplets.

Before calibration of an ultra low volume sprayer, you must take a sample of droplets to measure to ensure that the droplets are within an effective range. Check the manufacturers directions for droplet collection and measurement. Most formulations used in this type of application come ready made and do not have to be diluted. If dilution is required use the calculations for percentage or proportion described above.

Review Questions

1. You are using a capsule formulation to control mosquitoes in a site that measures on average 12 m wide and 17 m long. The label specifies the use of one briquette per 100 m². How many briquettes would you use?
2. You are using a briquette formulation to control mosquitoes in a site that measures 30 m wide and 5 m long and has an average depth of 0.7 m. The application rate on the label specifies the use of 1 briquette for every 375 m³ of water. How many briquettes should be used in the site?
3. You have been asked to calibrate a backpack sprayer. You measure an area 5 metres wide and 20 metres long. To treat that area, you find that you require 7 l of water. The total tank capacity of the sprayer is 25 l. How much area will one full tank treat?
4. Using the backpack sprayer you calibrated in question 3, how much product would you add to the full tank if the label states apply 45 g/100 m².

5. Using the backpack sprayer you calibrated in question 3, how much product would you add to the full tank if the label states apply 3.7 kg/ha?

6. You wish to control black flies in a stream that is 3.5 m wide with a depth of 1.7 m. You have measured the surface velocity and found that a floating object travelled 10 m in 5 seconds. The bottom of the stream is mud. What is the stream flow in cubic metres/ second?

7. The pesticide label says to apply 356 ml/m³/second to control black flies. How much product would you use to treat the stream in question 6?

8. You have been asked to control adult mosquitoes using a residual spray. The pesticide label says that the percentage of active ingredient in the spray should be 0.75%. The pesticide concentrate that you are using is 33.3% active ingredient. How much pesticide concentrate do you need to make 250 l of spray mix?

9. You have been asked to control adult black flies using a thermal fog. The label says that you should add 0.5 l of pesticide concentrate to 10 l of diesel fuel. The tank on the thermal fog machine that you have has a capacity of 22 l. How much concentrate is required to make 22 l of mix?

