

## Calibrating hand operated sprayers

Hand-operated sprayers, such as knapsack and mistblowers, that are designed to be carried and operated manually by one person, are widely used in agriculture. They are:

- suitable for treating small areas such as nurseries, greenhouses and vegetable gardens;
- cheaper than tractor-mounted sprayers; and
- effective in restricted areas e.g. slopes and close plantings.

### Knapsack sprayers

These sprayers have a tank of up to 20 L capacity – usually carried on the operator’s back, a pressurising system and a hand lance with a pressure gauge and one or more nozzles. The lance or wand usually has a simple on-off valve.

Three systems of pressurising the liquid are available:

- a) Lever-operated sprayers use a regular pumping action to operate a piston or diaphragm pump within or near the spray tank to maintain operating pressure.
- b) Compression sprayers are filled up to two-thirds capacity and the remaining air space is pressurised by a piston-action air pump or a gas cylinder. This constant pressure forces the spray out of the tank by replacing it with air. Compression sprayers should be equipped with a pressure gauge and a relief valve.

- c) Motorised knapsack sprayers use a small two-stroke engine instead of manual pumping to force the liquid to the nozzle. The pressure is adjustable by either changing the rpm of the engine (piston pump) or with a pressure regulating valve (diaphragm pump).

### Mist blowers

Mist blowers have a fan and a flexible discharge hose. The spray mixture is fed into the air stream by gravity and fine droplets are formed by the shearing action of the high velocity air stream (90–100 metres/second).

Mist blowers are ideal for applying insecticides and fungicides in dense crops.

### Nozzles

The nozzles used in knapsack sprayers are the same as those used on boomsprayers. Hollow cone nozzles are used for insecticides and fungicides and flat fan nozzles are used for herbicides.

Nozzles and nozzle tips are available in a wide range of materials. Ceramic nozzles are the most resistant to wear, followed by plastic and stainless steel. Brass nozzles wear quickly.

### Pressure

Most hand-operated sprayers operate at moderate to low pressure (300 – 600 kPa). Droplet size and flow rates can be regulated by adjusting the pressure.

The higher the pressure, the smaller the droplets. The lower the pressure, the larger the droplets.



Once the pressure and droplet size are determined it is important to maintain the same pressure.

Pressure gauges on the hand lance make it easy to adjust and control the pressure.

With mist blowers, pressure is not important. However, air velocity and volume are critical because they reduce markedly at lower speed affecting droplet size and coverage. Spray at maximum rpm to maintain air velocity and air volume.

## Calibration

All hand-operated sprayers need to be calibrated at the start of the spray season and kept in good operating condition. This will ensure that the correct rate of chemical is applied to the target plant.

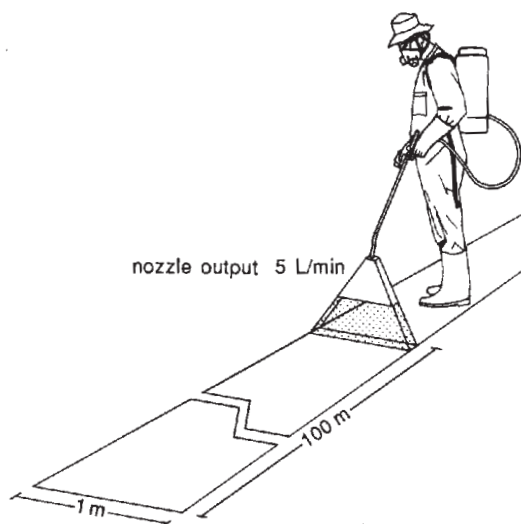
Follow these steps to calibrate a knapsack sprayer:

- 1) Measure the spray width of the nozzle(s) on a dry surface (in metres).
- 2) Spray a test area at the intended pressure and walking pace. Record distance (in metres) covered in one minute (min).
- 3) Measure the nozzle output in litres over one minute in a measuring jug (L/min).

The spray volume can be calculated by the following formula:

Application rate (L/ha)

$$= \frac{\text{nozzle output (L/min)} \times 10,000}{\text{spray width (m)} \times \text{walking speed (m/min)}}$$



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For example:

$$\begin{aligned} \text{Nozzle output in 1 minute:} &= 5 \text{ L} \\ \text{Spray width:} &= 1 \text{ m} \\ \text{Walking speed:} &= 100 \text{ m/min} \\ \text{Application rate (L/ha)} &= \frac{5 \times 10,000}{1 \times 100} \\ &= \frac{50,000}{100} \\ &= 500 \text{ L/ha} \end{aligned}$$

Mist blowers can be calibrated by the following method:

- 1) Fill the tank with water up to a defined mark.
- 2) Spray over a measured distance of 100 m.
- 3) Measure the volume of water (in Litres) required to top up the tank to its previous mark in litres (L).
- 4) Multiply the measured water (L) from step 3 by 100 to obtain the application rate L/ha.

## How much to put in a tank

The following formula can be used to determine the amount of product needed for each tank.

Product/tank (L or kg)=

$$\frac{\text{recommended rate (L/ha or kg/ha)} \times \text{tank size (L)}}{\text{application rate (L/ha)}}$$

For example:

$$\begin{aligned} \text{Recommended product dosage:} & 5 \text{ L/ha} \\ \text{Application rate:} & 500 \text{ L/ha} \\ \text{Tank size:} & 20 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Product/tank (L/ha)} &= \frac{5 \times 20}{500} \\ &= \frac{100}{500} \\ &= 0.2 \text{ L or 200 ml} \end{aligned}$$

In this example 200 ml of the product is added to a 20 L knapsack sprayer to give the recommended rate of 5 L/ha.

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