



## Calibration and preparation of boom sprayers

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### Introduction

This Agriculture Note is a guide to efficient maintenance, calibration and operation of boom sprays.

The control of insects, diseases and weeds is important for the growing of high-yielding crops or pasture of good quality. Applying the right amount of chemical at the right time is a major factor in ensuring successful control. Too many chemicals, particularly herbicides, may damage the crop and harm the environment; it will certainly waste money. Too little will also waste money because it will fail to give proper control.

Correct maintenance and use of spray equipment will greatly help the efficiency of spray application.

The main steps to achieve control of pests are:

- Select the right chemical and rate for the job.
- Spray at the right time and in the right conditions.
- Spray with a well prepared and accurately calibrated boom sprayer.
- Measure and mix chemicals accurately.
- Operate the sprayer accurately in the field.

### Sprayer Maintenance

Systematically inspect the sprayer. All components of the sprayer should be inspected for wear or deterioration and replaced if defective. This includes not only components of the spray equipment, pump, hoses, nozzles, etc, but also the structural elements of the boom, axles, bearings, etc. When using the sprayer, do regular maintenance as detailed below.

#### Pump

- Fill oil reservoirs or grease caps and use a grease gun on nipples (where fitted) before use.
- Re-grease every four hours, or as indicated in the service manual.

If the pump has an oil sight tube, check for chemical contamination in the oil. Any visible contamination

indicates that pump seals need replacing as soon as possible.

- After spraying, drain the tank and pump through at least 20 litres of clean water to flush out any chemical.
- Follow label instructions for disposal of the container and any unwanted contents

#### Tank and hoses

- Check all hose connections for tightness.
- Inspect hoses for leaks, wear or deterioration.
- Fill only through the strainer to ensure that no solids enter to block either the pump or nozzles.
- The main filter assembly should be removed and cleaned after each spraying period. Be careful not to damage or deform the mesh while cleaning.

#### Nozzles

- It is important that nozzles be checked regularly and replaced once the variation in flow rate varies greater than 10 per cent from their specified flow rate.
- Where a spray unit is in regular, frequent use it may be necessary to change all the nozzles at least once or twice a year.
- Nozzles of different materials wear at different rates. Brass nozzle tips wear quickly, especially with wettable powders. Stainless steel, ceramic and nylon nozzle tips wear more slowly.
- Boom height should be set to the nozzle manufacturer's specification so that they overlap appropriately. (Example: 110° flat fans with nozzle spacing of 500 mm will have a double overlap at 500 mm high or a single overlap at 350 mm high).
- Nozzles should all be the same type, material and stage of wear.
- Check nozzles for blockages and clear them by reversing them and use compressed air or a small brush. Never use metal probes and never blow through nozzles with your mouth. Clean all nozzle filters.

- Anti-drip valves should be fitted to nozzle bodies. Check that they are working correctly.

**Agitation**

- Good tank agitation is essential when mixing chemicals and for continued suspension with wettable powders or water dispersible granules.
- Provide an adequate agitation system and ensure it is working properly. Usually a by-pass return from the pump is used.

**Check nozzle outputs**

Checking nozzles individually can be very time consuming. A simple and cheap device makes this job much easier by allowing several nozzles to be tested at once (see Diagram 1).

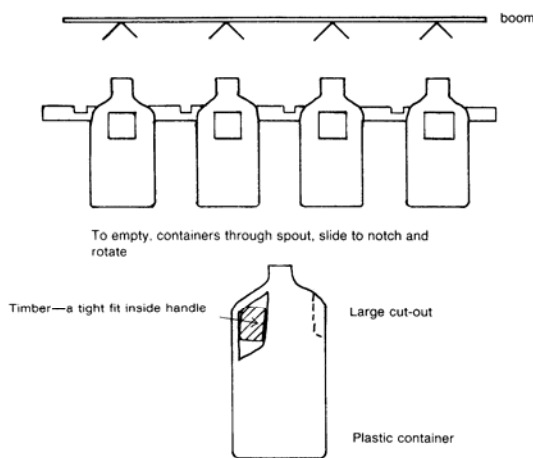


Diagram 1. A nozzle checking device for a boom sprayer

The device consists of plastic containers fitted through their handles onto a suitable length of timber. The containers are spaced to align with the nozzles on the boom and are tightly fitted so they cannot rotate while filling. Each has a large hole cut in its side so that the nozzle easily fits inside, allowing the output to be collected. To empty the containers one-by-one, slide sideways to a notch in the timber and rotate to pour water out of the spout into a measuring vessel.

For best results all the nozzles on the boom should deliver a flow rate that is within ±5% of the manufacturer’s specified flow rate for the chosen operating pressure.

**Calibration**

Chemicals should be applied evenly and at the prescribed rate. An accurately calibrated boom will ensure that this is achieved. Calibration of boom sprayers **is not** just a once-a-year activity; it should be checked regularly to ensure that the prescribed rate is maintained.

There are many methods of calibrating a boom spray. An accurate and simple method is explained below.

**Safety**

Never calibrate the boom with chemical in the tank. Always use clean water and flush out the boom before checking flow rates.

**Calibration steps**

1. **Determine the “Boom Factor”.** Measure the distance between nozzles along the boom in millimetres, then divide by 100. For example, 500 mm spacing, then divide the number by 100, giving a Boom Factor of 5.
2. **Time tractor.** Run the tractor over a distance 100 metres at a speed and engine revolutions per minute (rpm) suitable for spraying. Record the time taken in seconds, the tractor gear and engine revs.
3. **Select spraying pressure.** Choose a suitable operating pressure between 200-350 kPa for flat fan nozzles or 300 kPa or greater for hollow cone nozzles. It should be noted that while hollow cones can be operated up to 1000 kPa there is an increased risk of spray drift. Set the pressure at the engine rpm to be used.
4. **Measure nozzle outputs.** Park the tractor and operate at the selected pressure and engine rpm. Measure the outputs of the nozzles (in mL) for the number of seconds it took to travel 100 m. Average the outputs.

**Example:** Where 3 nozzles have outputs of 250, 270, 245 in mL.

$$\text{Average output (mL)} = \frac{250 + 270 + 245}{3} = 255 \text{ mL}$$



Photo1. Check sprayer and calibrate using water only.

5. **Calculate the water rate.**

$$\text{Water rate (L/ha)} = \frac{\text{average output (mL)}}{\text{Boom Factor}}$$

**Example:** If the Boom Factor is 5 and the average nozzle output is 255 mL in the time it took to travel 100 m.

$$\text{Water rate (L/ha)} = \frac{255 \text{ mL}}{5} = 51 \text{ L/ha}$$

6. **Calculate the chemical requirement.** Once the water rate is known, the tank mix can be calculated and made up. If the tank is not completely filled, only the amount of water used should be entered in the equation instead of tank capacity.

**Example:** if the tank capacity is 2000 L and the chemical rate from the label is 2 L/ha.

$$\text{Chemical/tank} = \frac{\text{tank capacity (L)} \times \text{chemical rate (L/ha)}}{\text{water rate (L/ha)}}$$

$$\text{Chemical/tank (L)} = \frac{2000 \text{ L} \times 2 \text{ L/ha}}{51 \text{ L/ha}}$$

$$= 78.4 \text{ L of chemical per tank}$$

When spraying always use the same gear, revs and nozzle pressure. Any changes will alter the applied dose of chemical.

### Mixing the Chemicals

- Read the label directions.
- Liquid chemical should be measured out in a graduated measuring cylinder, **or**
  - Wettable powders should be weighed out and mixed with enough water to form a slurry in a small container **or**
  - Granular materials should be weighed out and dissolved in a small volume of water.
- Mixing hoppers or loaders fitted to the tank make the operation easier and safer and should be used where available according to the manufacturer's specification.
- Add the measured chemical to a small volume of water in the tank with the agitator operating.
- Fill the tank to the required volume.
- Use fresh clean water free of suspended organic matter or clay. Some chemicals are deactivated when they contact these materials. Some water may not be suitable.
- Wear suitable personal protective equipment and clothing.

### When Spraying

#### **Continually observe that:**

- The pressure is correct
- Speed is correct and constant
- Nozzles are operating correctly
- Boom height is correct
- The agitator is functioning
- Do not stop the tractor while the spray unit is spraying as this will result in an over dose on that spot.

### Marking

- Use some form of marking system (eg. dye in spray, foam marker, etc.).
- Do not leave missed strips between runs.
- Do not overlap runs as this will double the application rate.



Photo 2. Well maintained and calibrated boomspray completing an effective spray job.

### After spraying

- Do not store chemical in the spray unit because some chemicals break down, or clog up the sprayer.

#### **Clean the Sprayer**

- Follow any decontamination procedures on the label.
- Where no directions are given on the label at least carry out the following rinsing process:
  - Flush clean water through equipment, with nozzles removed so dirt is rinsed out of lines.
  - Regularly clean exterior of spray equipment.
  - Remove nozzles and filters, wash and replace.
  - Never leave spray material in spray unit.

### Further Information

- DPI Chemical Standards website - [www.dpi.vic.gov.au/chemicalstandards](http://www.dpi.vic.gov.au/chemicalstandards);
- DPI Senior Chemical Standards Officers  
Alan Roberts Bendigo (03) 5430 4416  
David Stewart Benalla (03) 5761 1532  
Les Toohey Hamilton (03) 5573 0715
- Chemical resellers and agronomists.

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