

BOOM SPRAY CALIBRATION GUIDE

GENERAL

Boom sprayers need to be correctly calibrated in order to deliver the desired amount of chemical onto the target.

A poorly calibrated boom sprayer may result in:

- Increase in chemical costs
- Increase in crop effect
- Decrease in efficiency
- Potential loss in yield

Even a minor 10 % change in flow rate will add up to large sums...

Therefore it is advisable to calibrate the boom sprayer at least every 12 months. This is less complicated than many people think. The following procedure is aimed to provide a practical on-farm guide.

The following equipment is needed:

- A watch, displaying seconds
- A jug, displaying a volume scale
- At least one new nozzle of the type fitted onto the boom
- Nozzle tip reference tables to determine flow rates and spray quality (available from Nufarm/Croplands)

- Calculator
- Nozzle cleaning brush
- Tape measure, or other device to measure a distance of 100m

Before starting the calibration the spray equipment needs to be checked to eliminate basic faults.

- Nozzles – all fitted nozzles should be of the same type and size. Their spray pattern should be even (nozzles and strainers may need to be cleaned and may need to be replaced if necessary).
- Boom – hoses and joints should be checked for leaks. All systems should be in operating order.
- Tank – should be half filled with water.

The boom spray calibration is affected by two main factors:

- Travel speed (Step 1) and
- The output of nozzles (Step 2 – 5)

In the following procedure these two factors are checked independently, but ultimately, they are inseparably linked together.

STEP 2: CALCULATION OF NOZZLE FLOWRATE

At first it is necessary to work out what the nozzle output should be. The nozzles can then be checked to see if they are delivering the flow rate they are supposed to deliver. For this calculation three things need to be determined:

- 1) What is the preferred application speed (already measured)
- 2) What is the preferred water rate per ha
- 3) What is the nozzle spacing on the rig

Application Volume

The desired application volume in L/ha can be obtained from pesticide labels or other publications from manufacturers (e.g. Nufarm Boom Spray Application Guide).

EXAMPLE

The product used was Roundup PowerMax® for control of summer weeds and the information from Nufarm advised that 40 - 70 L/ha was a sufficient water rate. Because the paddock contained stubble, it was recommendable to use a higher water rate. Therefore the 70 L/ha rate was chosen.

Nozzle spacing

The most common spacing between nozzles on boom sprayers is 50 cm. It is important to be sure about the correct nozzle spacing, and if in doubt, measuring is advisable.

EXAMPLE

The measurement was 50 cm (0.5m).

Calculation

A simple formula is transforming all this 'large scale' application information into a single, easy to measure 'output per nozzle, per minute' figure.

$$\text{L/min/nozzle} = \frac{\text{L/ha} \times \text{km/h} \times \text{W (m)}}{600}$$

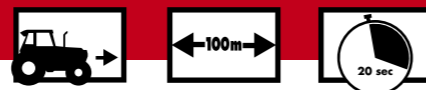
| | |
|--------------|--|
| L/min/nozzle | = Nozzle flow rate in litre per minute |
| L/ha | = Water application rate per hectare |
| Km/h | = Driving speed |
| W | = Width of nozzle spacing in m |
| 600 | = Constant |

EXAMPLE

The desired water rate was 70 L/ha, applied with a speed of 18 km/h and the boom had a nozzle spacing of 50 cm:

$$\text{L/min} = \frac{70 \text{ L/ha} \times 18 \text{ km/h} \times 0.5 \text{ m}}{600} = 1.05 \text{ L/min}$$
 To achieve this goal every single nozzle needed to deliver 1.05 L/min.

STEP 1: SPEED CALIBRATION



To measure travel speed accurately it is important to do so by travelling over an exact distance (commonly 100 m) and to measure the time it takes to travel that distance. To mark the precise distance the use of a measuring tape is essential. Permanent markers will make this measured stretch a handy tool on farm.

It is advisable to undertake the calibration in the gear and RPM's the applications are commonly done with. The tank should be half filled. Sufficient run up assures that the starting line is crossed already travelling at desired speed. It is worthwhile to repeat the procedure at least twice to eliminate

any possible error. The travel speed in km/h can then be calculated from this simple formula:

$$\text{km/h} = \text{Distance (m)} \times 3.6 / \text{time (sec)}.$$

EXAMPLE

It took 20 sec (measured twice to be sure) to travel 100 m.
 The speed is $100 \text{ m} \times 3.6 / 20 \text{ sec} = 18 \text{ km/h}$.

STEP 3: SELECTING PRESSURE AND SPRAY QUALITY

Nozzles deliver different flow rates and droplet sizes (more commonly called spray quality) at varying pressures.

The pressure needed to produce a certain flow rate for a specific nozzle type and size can be found in specific tables (Croplands Optima Catalogue, Nufarm Nozzle Charts, TeeJet® Catalogue).

For efficacy and legal reasons it is important to be clear about the spray quality a specific nozzle type is going to produce. If in doubt an advisor should be consulted. For example, it is not desirable to calibrate and set up a nozzle type and size that can only spray FINE to MEDIUM spray quality when the chemical that is going to be put out has to be sprayed with a COARSE to VERY COARSE spray quality. To minimise chemical loss through drift it is advisable to choose a set up that is producing the coarsest spray quality without compromising efficacy.

Desired spray quality information can be obtained from chemical labels or additional information put out by manufacturer (e.g. Nufarm Boom Spray Application Guide, Croplands Optima Catalogue).

EXAMPLE

To control summer weeds, the chemical chosen was Roundup PowerMax, selecting a COARSE spray quality, according to the Nufarm Boomspray Application Guide.
 The boom was fitted with AirMix® 025 nozzles. According to the Nufarm Nozzle Chart reference, the pressure set up needed to be around 3.3 bar to get the desired flow rate of 1.05 L/min. The Nufarm Nozzle Chart showed that at 3.3 bar this nozzle type and size is producing a COARSE spray quality. Therefore this nozzle type was suited for the planned application.
 The boomsprayer needed to be set up to spray at 3.3 bar to deliver the desired flowrate and spray quality.

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STEP 4: PRESSURE SET-UP

All the theoretical work on nozzle flow rates is now finalised. At least one old nozzle needs to be replaced with a new nozzle of the same type (the old nozzles may be worn). The sprayer can be turned on now and the desired pressure can be selected. If the pressure gauge is measuring the pressure at the nozzle end, measuring can start now.

However, many gauges are measuring the pressure at the pump end. In this case one nozzle needs to be replaced with a nozzle pressure Gauge (obtainable from Croplands) to measure the correct pressure at the nozzle end. As a rule of

thumb, if the pressure between pump and nozzle end varies by more than 20 % there is a serious pressure drop and the system should be checked.

The tank should be filled with water only since all table values are based on water.



STEP 5: MEASURING NOZZLE FLOW RATE

While spraying, a jug must be placed underneath the new nozzle to collect fluid for a duration of 60 seconds. Effectively this is measuring the output per nozzle per minute.

If the output is too much for the scales of the jug, the time may be halved to 30 sec. In this case the measured volume needs to be doubled to refer back to a per minute output. The measured volume can now be compared to the theoretical value calculated above.

Depending on the difference, the pressure may need some fine-tuning to obtain exactly matching flow rate values.

Individual nozzle outputs may vary. Therefore, measurements should be repeated with a minimum of three nozzles per

boom section to check for nozzle wear. All outputs should be within a 10% range. If more than one nozzle is out of range, the whole nozzle set should be replaced.

EXAMPLE

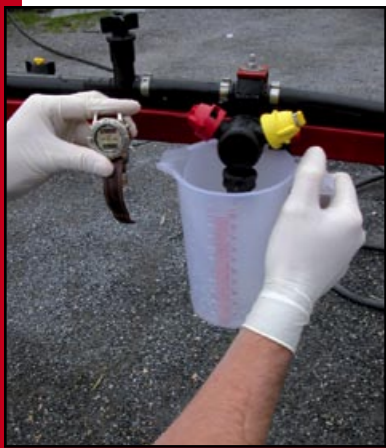
An old Airmix 025 was replaced with a new one. The pressure was set at 3.3 bar at the nozzle end. The measured flow rate of the new nozzle was 1.0 L/min. Therefore the pressure needed to be slightly increased to 3.5 bar and the flow rate was brought up to the desired 1.05 L/min for the new nozzle.

The boom had 5 sections and therefore measurements needed to be repeated for three nozzles in each section. Results were:

| | | | | |
|------|-------------|------|-------------|-------------|
| 1.05 | 1.00 | 1.05 | 1.00 | 1.15 |
| 1.05 | 1.15 | 1.05 | 1.00 | 1.00 |
| 1.05 | 1.00 | 1.05 | 1.15 | 1.00 |

Three of the nozzles had a flow rate differing by around 10 % from the desired out put. A re-check of those three nozzles gave the same result. Therefore, there was little confidence in the future performance of the whole set. The two-year-old set needed to be replaced.

After replacement, the new nozzles were checked again and flow rates were uniform at 1.05 L/min.



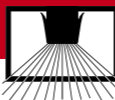
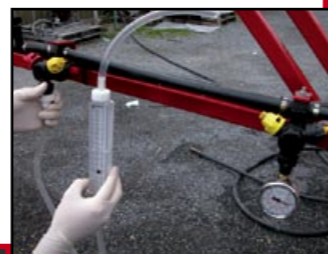
STEP 5B: ALTERNATIVE MEASURING OF NOZZLE FLOW RATE

Rather than using a jug and timer, an instant Tip Tester can be used. This method is not as accurate but handy to do a quick check or compare many nozzles in a short space of time.

The Tip tester has a rubber seal that is placed tightly over the nozzle.

The actual flowrate coming out of the nozzle pushes up a little ball in a tube.

By looking at the position of the ball the flow rate can be read directly from a scale (see picture).



STEP 6: AUTOMATIC RATE CONTROLLER

Many boom sprayers are set up with automatic rate controllers that will allow a constant per ha output with varying speeds by adjusting the flow rate. The two main factors governing the system are again the precise measuring of:

- Speed
- Flow rate

At the initial set up of the machinery, precise inputs into the rate controller would have assured precise operation. However, over time, machinery will wear, therefore, it is important to check if initial inputs are still in calibration.

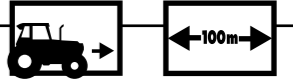
Flowmeter

The greater the water volume measured the more precise the outcome will be. It is not practical to obtain overall boom flow rates through nozzles. Therefore the easiest way is to take off a section of boom hose (all other sections need to be closed) and to fill a measuring drum up to the 100 L mark. The 100 L volume can then be compared to the volume measured by the flowmeter. If necessary controller inputs need to be adjusted (refer to individual controller handbooks).



Speed

The actual procedure to reset the rate controller will be different from system to system but in principal it will be the same. An exactly measured 100 m distance (see Step 1) needs to be travelled and compared to the distance calculated by the rate controller. If necessary the controller inputs need to be changed (refer to controller handbook).



CROPLANDS CALIBRATION KIT



Croplands order code: RP-034

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