# Grow the Crop

# Handout 11

# Calibration of Equipment



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## CALIBRATION

**Definition:**

***Calibration*** - Calibration in terms of pesticide application refers to the process of calculating and/or setting the delivery rate of the application using the application equipment. This may be done purely on the volume delivery per time interval or be based on an area volume rate.

### Spray equipment calibration

To ensure that the targeted pest or disease is controlled adequately, it is essential that the spraying mixture is applied in a sufficient quantity to cover the crop or animal. In addition, the coverage must be uniform. It is extremely important that spraying equipment must be calibrated correctly before it is used to apply spraying material, as the calibration of the equipment will determine the quantity of spraying material that will be applied to each tree, field or animal.

Spraying machines have a pump that pumps liquid from the spray tank through nozzles. These nozzles consist of spinners and discs. The spinner determines the droplet size, angle of the spray and a hollow or full cone. The discs have different size holes, which will determine the quantity of spraying material delivered. The quantity of spraying material delivered will also depend on the pressure of the pump (see table 3).

The following information is required to complete the calibration:

- Litres required per tree, animal or per hectare.
- Tree spacing in the row.
- Tractor speed.
- Number of nozzles to be used.
- Pump pressure.

The key is to work out how many litres per minute the spraying machine must deliver if it travels at a fixed speed, and how many trees or field ($m^2$) are passed at this speed.

**Example of a mist blower for an orchard**

Litres required per tree = 25ℓ

Tree spacing = 3.0m

Tractor speed = 33.3 meters per minute (2.0 km/hour)

**Trees sprayed** = 33.3 m/min divided by 3.0m tree spacing = 11.1 trees sprayed per minute

**Total litres required per minute** = 11.1 trees x 25ℓ/tree = 277.5 ℓ/min

This applies to a spraying machine that sprays both sides. For a machine that sprays on one side only, divide by 2: 277.5 ÷ 2 = 138.8 ℓ/min

Number of nozzles on spraying cart = 72

Litres required per nozzle = 277.5 ÷ 72 nozzles = 3.85 litres/nozzle

Pump pressure = 20 bar (2,000 kPa)

From the table, look under the 2000 kpa column and select a combination of spinners and discs to give 3.85 (or close to) litres per minute per nozzle. In this case, D4 disc + 45 spinner. It is important to select a combination of nozzles that will give the most efficient coverage. A popular combination for a good medium covering spray is to alternate 45 and 56 spinners with D3 discs to give good outside canopy coverage (45 spinners) and some degree of penetration (56 spinners).

Nozzle Delivery at Various Pressures in Litres/minute:

| | 700 kPa (100 psi) | 1000 kPa (150 psi) | 1400 kPa (200 psi) | 2000 kPa (300psi) | 2700 kPa (400psi) |
|---|---|---|---|---|---|
| 23 spinner D1 | 0.405 | 0.470 | 0.526 | 0.620 | 0.697 |
| D1.5 | 0.492 | 0.586 | 0.660 | 0.790 | 0.900 |
| D2 | 0.606 | 0.720 | 0.800 | 0.950 | 1.060 |
| D3 | 0.680 | 0.790 | 0.910 | 1.060 | 1.210 |
| D4 | 0.870 | 1.060 | 1.210 | 1.440 | 1.660 |
| D5 | 1.060 | 1.290 | 1.440 | 1.740 | 2.000 |
| D6 | 1.210 | 1.480 | 1.700 | 2.050 | 2.340 |
| 25 spinner D1 | 0.590 | 0.700 | 0.795 | 0.966 | 1.100 |
| D1.5 | 0.780 | 0.930 | 1.060 | 1.250 | 1.440 |
| D2 | 0.950 | 1.100 | 1.290 | 1.550 | 1.740 |
| D3 | 1.100 | 1.330 | 1.520 | 1.820 | 2.080 |
| D4 | 1.710 | 2.050 | 2.350 | 2.840 | 3.250 |
| D5 | 2.050 | 2.460 | 2.840 | 3.410 | 3.940 |
| D6 | 2.065 | 3.220 | 3.680 | 4.500 | 5.190 |
| 45 spinner D1 | 0.720 | 0.850 | 0.970 | 1.170 | 1.320 |
| D1.5 | 0.950 | 1.170 | 1.320 | 1.630 | 1.850 |

| | | | | | |
|---|---|---|---|---|---|
| D2 | 1.210 | 1.440 | 1.660 | 2.010 | 2.310 |
| D3 | 1.360 | 1.667 | 1.930 | 2.350 | 2.690 |
| D4 | 2.120 | 2.570 | 2.950 | 3.600 | 4.200 |
| D5 | 2.690 | 3.250 | 3.750 | 4.620 | 5.300 |
| D6 | 3.520 | 4.350 | 5.090 | 6.210 | 7.200 |
| 56 spinner D1 | 0.870 | 1.060 | 1.250 | 1.510 | 1.740 |
| D1.5 | 1.250 | 1.550 | 1.780 | 2.150 | 2.460 |
| D2 | 1.480 | 1.780 | 2.080 | 2.540 | 2.910 |
| D3 | 2.010 | 2.460 | 2.840 | 3.480 | 4.050 |
| D4 | 3.300 | 4.010 | 4.660 | 5.720 | 6.580 |
| D5 | 4.550 | 5.570 | 6.410 | 7.880 | 9.080 |
| D6 | 6.600 | 7.720 | 9.320 | 11.450 | 13.170 |

Before the spraying machine starts with the application, the coverage must be checked in case a fine tuning is required. Possibly a few nozzles should be closed to avoid wastage or maybe the nozzle size towards the top of the spraying machine needs changing to ensure better coverage of the tree.

It is important to remember that the speed of the PTO should be 540 rpm. This aspect is often ignored and can lead to incorrect pressure being delivered by the pump and thus lower volumes of spraying material being applied.

The nozzles and spinners referred to above are made from metal, ceramic or plastic. The advantage of ceramic nozzles and spinners are the fact that they do not wear easily and can be used for many years. Conversely, nozzles and spinners manufactured from metal wear easily and must be replaced at the beginning of each season. Ceramic nozzles and spinners are not as versatile as the metal type as they lack in different sizes. Also, ceramic nozzles and spinners are relatively expensive and break easily if they are not handled with care.