Sprayer Set-up and Calibration to Band Spray for Field Nursery Weed Control©

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INTRODUCTION

Cultivation or herbicides can be used to maintain a weed-free strip 30 to 46 cm (12 to 18 in.) wide during the first year of nursery production. The strip can be widened annually to a maximum of 0.6 to 0.9 m (2 to 3 ft) on each side of the row. There is no need to spray middles that can be later cultivated. Vegetation in the middle is not harmful to the nursery crop, as long as a sufficiently wide, weed-free strip is maintained in the row. Vegetated middles reduce erosion and provide support for traffic. While band spraying reduces the amount of chemical required by 33% to 50%, it can require a longer application time, since the middle must be driven 1 to 2 times with a small tractor.

RIGGING TO BAND SPRAY

While it is possible to rig a nozzle on the rear of a spray tank to spray a band along the row, the nozzle can not be watched as easily as one mounted in front. Most prefer mounting a spray arm with a single nozzle on the front bumper. A 0.9 to 1.2 m (3 to 4 ft) length of 3-cm-square (1.25-in.) metal tubing can be mounted horizontally on the front bumper. A 46-cm (18-in.) length of 2.5-cm (1-in.) tubing can be slid inside of the bigger tube to achieve horizontal adjustment. Drill and weld a nut with a bolt to tighten it in place. A few more minutes of welding will provide vertical adjustment, which is required to control band width.

Attach a nozzle on the end of the 2.5-cm (1-in.) tube. Run a reinforced spray hose to the nozzle from the tank, perhaps under the tractor, avoiding hot areas that might melt the hose. To reduce driver fatigue and increase safety, run the hose across the right rear fender (for right-handed operators). Cut the hose and install a $^1/_4$ turn-ball valve. Add a second hose and valve if spraying both sides. This prevents the driver from having to reach behind to turn the spray off — particularly while slowing down, turning the tractor around, and trying to avoid running over end-row plants. A few more minutes of welding will provide vertical adjustment. Vertical adjustment will control the band width.

Adding another short tube and another nozzle to the other side of the longer tube will cut trips in half; driving each middle once instead of twice, spraying both sides of each middle. If the rows are not perfectly straight, satisfactory weed control will still be achieved by a 46- to 61-cm (18- to 24-in.) band sprayed on each side (Table 1).

Most pre- and post-emergent herbicides require no more than 192 to 288 L·ha (20 to 30 gal per acre) of water. One needs to refer to the label for instructions. More than the recommended spray volume wastes time in filling up more often and often does not increase control.

Table 1. Calibration for band width based on the course length.

Band width (inches)	Course length (ft)	Band width (inches)	Course length (ft)
14	292	22	185
16	255	23	177
18	226	24	170
19	215	26	157
20	204	28	146
21	194	30	136

Many drivers insist on seeing a lot of spray water. The TeeJet 8003 or 8004 will generally produce the desired 240 to 288 $L \cdot ha^{-1}$ (25 to 30 gal per acre) of spray water. Smaller tips produce a finer mist that wind can interfere with. It is possible to apply 96 to +961 $L \cdot ha^{-1}$ (10 to 100 + gals per acre) of spray water with different tips.

Standard flat fan spray tips require a minimum of 270 kPa (30 psi) to develop a full pattern. An XR (extended range) tip will devleop a full pattern at 135 kPa (15 psi). Both will operate up to 414 kPa (60 psi). The VisiFlo tip is color coded for convenience. The code on a tip might read XR8004VS. They have a stainless steel center.

An off-center (OC) tip reaches out further and is useful in some applications, but they do not provide a feathered edge, which is not good when spraying a row from both sides — since either a void or an overlap is achieved. For example, an OC-03 will apply the same volume as an 8003. An off-center tip is available in most sizes. Brass off-center tips cost about $7.00 U.S.A. compared to $2.50 U.S.A. for regular flat-fan-tip (nozzles).

SPRAYER CALIBRATION

Calibration is the process of modifying or adjusting a sprayer to give the desired application rate with uniform coverage. Applying pesticides correctly is very important. Herbicide labels require an amount per acre — not an amount per volume of water like most insecticides and fungicides. Before you can determine how much herbicide to add to a tank, you must first determine how many gallons of water the sprayer is applying per acre (output). There is more than one accurate method to determine sprayer output.

THE 1/128TH OF AN ACRE METHOD

This method is based on a gallon of liquid containing 128 fluid ounces (fl oz). If an area equal to 1/128th of an acre is sprayed for calibration purposes — the number of fluid ounces applied is equal to the application rate in gallons per acre. If we catch sprayer output for a time equal to the drive time — the ounces caught equals the gallons per acre. There are no mathematical formulas.

The key to the successful use of the 1/128th acre method is to select the proper course length, accurately measure the course, timing while driving the course and measuring the output.

When spraying a band, use the effective band width to determine the course length to drive and time (Table 1). If using a spray boom, use the nozzle spacing. Catch the output for the same time period. The procedure is outlined below, but you can ask your local nursery extension agent. They may calibrate the sprayer while showing you how.

CALIBRATION STEPS FOR BANDING SOIL APPLIED PESTICIDE

The number of gallons of water sprayed (output) per acre must be known before the amount of product to add to the tank can be calculated (Willis and Luckwood, 1988).

- Hook up the sprayer and ensure that it works properly. If the sprayer has not been used since last season, remove all spray tips, filters, plug, and filter from the bottom of tank. Flush the tank, replace the plug, add water, and flush the entire system with clean water. Fill the tank at least half full with clean water. Replace strainers and tips.
- Ensure the pressure gauge works and that the pressure can be adjusted with the pressure regulator valve. Standard flat fan spray tips require a minimum of 270 kPa (30 psi) to achieve their full pattern. Up to 414 kPa (60 psi) may be required when spraying a post-emergent herbicide down into dense, tall vegetation. A liquid-filled pressure gauge is easier to read. Repair leaks as needed.
- Determine the desired spray width and how to achieve it. Raising or lowering the nozzle body is okay to make width changes when spraying a band. A spray boom is generally carried 43 to 48 cm (17 to 19 in.) above the target to achieve a proper spray pattern.
- Standard flat fan spray tips spray a feathered edge on both sides so that the rate will not be double or a void left when mounted side by side on a boom. Approximately 30% of the band is feathered and not full rate.
- Operate the sprayer at the desired RPM and pressure, but at a slower gear in order to determine the effective spray width. The spray pattern will be more visible with the greater volume of water applied at the slower speed. It will also be easier to see on concrete, asphalt, gravel, etc.) Work on level ground and out of the wind. This is the most important step to be accurate. Measure the total width of the pattern and subtract 30% to determine the actual effective band being sprayed. (When actually spraying, adjust nozzle height for soft vs. firm ground.)
- Accurately measure and clearly mark a course length based on the width of the spray band (20-inch band). See Table 1, or calculate by dividing 340 ft^2 by the spray width in feet; (divide width in inches by 12; a 20-inch band is 1.67 ft). [(340 ft^2 is 1/128th of one acre) (1 acre = 43,560 ft^2) (43,560 divided by 128 = 340).]

- The driver who will be making the application should assist. The driver should know the preferred gear and rpm; otherwise, determine a safe speed that can be used over the entire farm. Make this determination by driving and spraying down a typical row, not on a hard surface.
- Time the tractor and sprayer operating through the course. Do a running start instead of a dead start from the line. (Begin 10 ft before reaching the starting line, with everything operating: the gear, rpm, psi, etc.) Don't hesitate to repeat if the driver will be more comfortable or more confident with a different gear or placement of the nozzle, etc.
- Repeat the procedure on the return trip, then average them.
- Park the tractor. With the engine running at the same rpm, psi, etc. — catch the output for the travel time in a bucket. Measure very accurately in fluid ounces. The ounces caught equals gallons per acre. Any changes in rpm require re-timing on the course. Output should remain the same as long as the gear, rpm, pressure, spray tip size, etc. remain the same. Recalibrate annually, and when pumps and tires are replaced.

To increase output: Increasing spray pressure and/or slowing tractor speed will make slight increases in output. Changing to a larger spray tip is the easiest way to increase output (Table 2).

Table 2. Output in gallons based on spray tip size and outputs. Standard flat fan spray tips, operated at 30 psi and 4 mph, will spray the following amounts per sprayed acre. Most nursery band-spraying applications are made at tractor speeds of 1.6 to 3.9 kph (1 to 2.4 mph). The output will be greater at slower speeds.

Spray tip (no.)	Output (gal/acre)	Spray tip (no.)	Output (gal/acre)
8001	06.4	8006	39
8002	13	8008	52
8003	19	8010	64
8004	26	8015	97
8005	32		

To decrease output: Decreasing spray pressure and/or increasing tractor speed will make slight decreases in the output. Changing to a smaller spray tip is the simplest and easiest way to decrease output (Table 2). You will need to re-time the tractor if you change the gear or rpm.

Use this formula once the output is known to determine the acres sprayed per tank and the amount of product to add to the tank. It is not the tank size, but rather the number of gallons that you use.

$$\frac{\text{Gal in tank}}{\text{gal applied/acre (or output)}} \times \text{Amount of product desired per acre} = \text{Amount of product to add to tank}$$

To determine the amount of product (i.e., Surflan, Princep, etc.) to add to each tank, multiply the amount of pesticide desired per acre, times the number of acres sprayed with each tank (i.e., 2 acres below) — 2 × 2 qt Surflan/acre = 4 qt added to a 50-gal tank. Two acres covered: 2 qt/ acre. An example:

$$\frac{\text{50-gal tank}}{\text{25 gal sprayed/acre}} = 2 \text{ acres/tank} \times \text{2-qt Surflan/acre} = \text{4-qt Surflan per 50-gal tank}$$

If a 46-cm (18-inch) band is sprayed on both sides of a row — a 0.9-m (3-ft) strip is sprayed per row. Spraying a 0.9-m (3-ft) strip in a 1.8-m (6-ft) row spacing treats half of the field. Two acres are driven in order to spray 1 acre. Four acres are driven to spray 2 acres, which can be done with one 50-gal tank that applies 25-gal of water per acre. More examples:

$$\frac{\text{50 gal tank}}{\text{30 gal sprayed/acre}} = 1.67 \text{ acres/tank} \times 2 \text{ qt} = 3.33 \text{ qt/tank of 50 gal.}$$

Since it is difficult to measure a fraction of a unit, convert to ounces or liquid ounces, i.e., 0.33 qt × 16 fl oz = 5.28 fl. oz., so, 3 qt and 5.28 fl. oz. = 3.33 qt; or 3.33 qt × 16 = 53.28 fl. oz.

Problem: We have sprayed several tanks, and need to spray one more block. We estimate 15-gal of solution to spray the final block. How much chemical to mix? Answer: 1.2 qt or 38 fl oz will be required.

$$\frac{\text{15 gal in tank}}{\text{25 gal sprayed/acre}} = 0.60 \text{ acres/tank} \times 2 \text{ qt} = 1.2 \text{ qt / 15 gal}$$

Whether using a liquid or powder, the liquid ounces or dry ounces, or pounds or quarts — the unit used in the formula will stay the same.

LITERATURE CITED

Willis, J.B., and **D.W. Luckwood.** 1988. A guide to proper sprayer calibration. University of Tennessee Extension Publication No. 1276.