FNR 114

forestry & natural resources

WOODLAND MANAGEMENT

Spray Equipment Calibration

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Calibration is essential in any herbicide program to ensure control without seedling injury. There are numerous techniques (timing, shielding, directed nozzles, and banding) to prevent seedling injury or increase herbicide effectiveness on target weeds. In all cases, the equipment must be properly calibrated to apply the correct amount of herbicide. This applies to boom, hand, and backpack sprayers. Too little herbicide results in ineffective weed control. Excessive herbicide is wasted money and may cause seedling injury or death.

Herbicide labels specify use ranges in pounds or gallons of product per acre. The applicator must determine how much product to add to the tank or hopper. This will be influenced by size of area to be treated, tank or hopper size, and, for liquid sprays, volume of spray solution that will be applied per acre.

Volume of Solution

The volume of solution applied per acre will be influenced by speed of equipment (power or manual), operating pressure, and nozzle size. Many of these variables are fixed by the equipment available, be it a 300-gallon tractor-mounted boom sprayer, a 3-gallon hand-held garden sprayer, or a 5-gallon backpack sprayer.

All three types of sprayers can be used to treat spots around seedlings, apply bands of herbicide on each side of seedlings, or apply herbicides as a broadcast application. Realistically, tractor-mounted boom sprayers apply bands more easily because of equipment speed; hand equipment is more adapted to treating spots because of tank capacity.

Spraying bands is similar to broadcast application except a part of the field is not actually treated. Furthermore, by turning the sprayer off between seedlings or on while going over the seedlings, bands can be converted into squares or rectangles. This provides additional savings in herbicide costs and should provide adequate weed control for small trees.

Band or Circle Spraying

When plantings are treated one row or one seedling at a time, there are two predominant methods of treatment: 1) spraying bands or squares and 2) spraying circles.

Band spraying can easily be done on a small scale with backpack and garden sprayers. A single flooding or offcenter spray tip or a boom with two to four regular flat fan nozzle tips can be adapted to hand sprayers. The user has unlimited flexibility to adapt nozzle configurations to specific tree species or weed problems. For spray equipment operated at constant speed and pressure, calibration steps are outlined in Table 1. If the sprayer will be operated while walking, walk at a comfortable speed. It is much easier to calibrate the sprayer to the applicator than to force the applicator to walk at an uncomfortable speed. Motorized equipment can maintain a steadier speed with a speedometer or gear setting and tachometer reading.

Treating circles around seedlings removes equipment speed as a factor and requires attention to certain unique details of application. Spraying circles can be done with handguns attached to a tractor-mounted tank and pump or with hand-held spraying units. Pressure regulators or gauges can be purchased for hand equipment or easily adapted. These are important for a constant output per unit of time. Calibration steps for spraying circles are presented in Table 2.

Table 1. Spraying bands or squares.

CALIBRATION PROCEDURES	EXAMPLE
Step 1. Determine speed of application equipment. Measure a convenient distance; 100 feet or so is a suggested minimum length. This should be done in the field to be treated. Record the time required to travel the distance.	Step 1. You measure a distance of 120 feet. At a comfortable walk it takes 30 seconds to cover the 120 feet. $\frac{120 \text{ ft.}}{0.5 \text{ min.}} = \frac{240 \text{ ft.}}{1 \text{ minute}}$
Step 2. Measure the swatch width of your spray pattern.	Step 2. The boom, 2 nozzles, treats a swath 40 inches wide (3.3 ft.).
Step 3. Determine the nozzle output in gallons per minute (GPM). Catch and measure the output from each nozzle, usually for one minute. Measuring each nozzle separately provides a check on uniformity.	Step 3. Assume 2 nozzles with output per minute as follows: 1) 40 fl. oz., 2) 36 fl. oz. The average is 38 fl. oz. per minute per nozzle. $\frac{38 \text{ fl. oz.}}{\text{minute}} \times \frac{1 \text{ gal.}}{128 \text{ fl. oz.}} = \frac{0.3 \text{ gal.}}{\text{minute}}$ $\frac{0.3 \text{ gal.}}{\text{minute}} \times 2 \text{ nozzles} = \frac{0.6 \text{ gal.}}{\text{minute}}$ for the boom.
Step 4. Determine the acres that will be treated per minute at your operating speed. $\frac{(\text{width})(\text{length})}{\text{minute}} \times \frac{1 \text{ acre}}{43{,}560 \text{ sq. ft.}} = \frac{\text{acres sprayed}}{\text{minute}}$	Step 4. 3.3 ft. spray width (from Step 2) 240 ft./min. length (from Step 1) $\frac{(3.3 \text{ ft.})(240 \text{ ft.})}{\text{minute}} \times \frac{1 \text{ acre}}{43{,}560 \text{ sq. ft.}} = \frac{0.018 \text{ acre}}{\text{minute}}$
Step 5. Determine gallons of solution that will be applied per acre. $\frac{\text{gallons}}{\text{minute}} \times \frac{\text{minute}}{\text{acre}} = \frac{\text{gallons}}{\text{acre}}$	Step 5. $\frac{\text{gallon}}{\text{minute}}$ from Step 3; $\frac{\text{minute}}{\text{acre}}$ from Step 4 $\frac{0.6 \text{ gallon}}{\text{minute}} \times \frac{1 \text{ minute}}{0.018 \text{ acre}} = \frac{33 \text{ gallons}}{\text{acre}}$
Step 6. Determine the acres that will be treated with each tank. $\frac{\text{gallons}}{\text{tank}} \times \frac{\text{acres}}{\text{gallon}} = \frac{\text{acres}}{\text{tank}}$	Step 6. Assume a 5 gal. tank. $\frac{\text{Acre}}{\text{gallon}}$ from Step 5. $\frac{5 \text{ gallon}}{\text{tank}} \times \frac{1 \text{ acre}}{33 \text{ gallon}} = \frac{0.15 \text{ acre}}{\text{tank}}$
Step 7. Determine how much product to add to each tank. $\frac{\text{product desired}}{\text{acre}} \times \frac{\text{acres}}{\text{tank}} = \frac{\text{product desired}}{\text{tank}}$	Step 7. Assume you want to apply 4.4 pounds of Princep Caliber 90 plus 2 quarts of Roundup per acre. Acres/tank from Step 6. $\frac{4.4 \text{ lb.}}{\text{acre}} \times \frac{0.15 \text{ acre}}{\text{tank}} = \frac{0.66 \text{ lb.}}{\text{tank}}$ or $\frac{11 \text{ oz.}}{\text{tank}}$ $\frac{2 \text{ qt.}}{\text{acre}} \times \frac{0.15 \text{ acre}}{\text{tank}} = \frac{0.3 \text{ qt.}}{\text{tank}}$ or $\frac{10 \text{ fl. oz.}}{\text{tank}}$

Table 2. Spraying circles.

CALIBRATION PROCEDURES	EXAMPLE
Step 1. Decide on size of treated area around each seedling.	Step 1. Decide to treat a circle 4.5 feet in diameter. $\text{Area of a circle} = \Pi(r)^2 = 3.1416 \times (\frac{4.5}{2})^2 = 16 \text{ sq. ft.}$
Step 2. Determine the time required to treat the selected area. Lay out the selected treatment spot on the ground or driveway, and measure the time required to adequately cover the area at a preselected pressure. If this is done on a driveway, this is also a good time to check consistency of coverage. Treating circles uniformly is difficult because of constantly changing radius as the circle is treated. Watch the treated spot to see that it dries uniformly. Wet and dry areas in the treated spot indicate uneven application.	Step 2. After pressurizing the sprayer, treating the 4.5-foot circle requires 10 seconds.
Step 3. Determine the number of seedlings, i.e., the number of treated spots, to be treated with each gallon of solution by measuring the volume of spray solution applied to each treated spot. At the same pressure used in Step 2, collect the spray water in a container for the same length of time and measure the volume in some convenient unit such as fluid ounces or cups.	Step 3. In 10 seconds, the sprayer applies 4 ounces of water when caught in a measuring cup. $\frac{1 \text{ seedling}}{4 \text{ ounces}} \times \frac{128 \text{ ounces}}{1 \text{ gallon}} = \frac{32 \text{ seedlings}}{\text{gallon}}$ or $\frac{1 \text{ seedling}}{0.5 \text{ cup}} \times \frac{16 \text{ cups}}{1 \text{ gallon}} = \frac{32 \text{ seedlings}}{\text{gallon}}$
Step 4. Determine the number of seedlings that can be treated with each tankful. $\frac{\text{gallons}}{\text{tank}} \times \frac{\text{seedlings}}{\text{gallon}} = \frac{\text{seedlings}}{\text{tank}}$	Step 4. The sprayer has a 3 gallon tank; $\frac{\text{seedlings}}{\text{gallon}}$ from Step 3 $\frac{3 \text{ gallons}}{\text{tank}} \times \frac{32 \text{ seedlings}}{\text{gallon}} = \frac{96 \text{ seedlings}}{\text{tank}}$
Step 5. Determine the acres treated around each seedling. $\frac{\text{square feet}}{\text{seedling}} \times \frac{1 \text{ acre}}{43{,}560 \text{ sq. ft.}} = \frac{\text{acre}}{\text{seedling}}$	Step 5. $\frac{\text{square feet}}{\text{seedling}}$ from Step 1 $\frac{16 \text{ square feet}}{\text{seedling}} \times \frac{1 \text{ acre}}{43{,}560 \text{ sq. ft.}} = \frac{0.00037 \text{ acres}}{\text{seedling}}$
Step 6. Determine the acres to be treated with each tank. $\frac{\text{seedlings}}{\text{tank}} \times \frac{\text{acre}}{\text{seedling}} = \frac{\text{acres}}{\text{tank}}$	Step 6. $\frac{\text{seedlings}}{\text{tank}}$ from Step 4; $\frac{\text{acres}}{\text{seedling}}$ from Step 5 $\frac{96 \text{ seedlings}}{\text{tank}} \times \frac{0.00037 \text{ acres}}{\text{seedling}} = \frac{0.036 \text{ acres}}{\text{tank}}$

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Table 2. Spraying circles. (continued)

CALIBRATION PROCEDURES	EXAMPLE
Step 7. Determine the amount of product to be added to each tank. $\frac{\text{product desired}}{\text{acre}} \times \frac{\text{acres}}{\text{tank}} = \frac{\text{product desired}}{\text{tank}}$	Step 7. Assume you want to apply 4.4 pounds of Princep Caliber 90 plus 2 quarts of Roundup per acre. $\frac{\text{acres}}{\text{tank}}$ from Step 6. $\frac{\text{4.4 lb. product}}{\text{acre}} \times \frac{\text{0.036 acres}}{\text{tank}} = \frac{\text{0.16 lb.}}{\text{tank}}$ or $\frac{\text{2.6 oz.}}{\text{tank}}$ $\frac{\text{2 qt. product}}{\text{acre}} \times \frac{\text{.036 acres}}{\text{tank}} = \frac{\text{.07 qt. product}}{\text{tank}}$ or $\frac{\text{2.3 oz.}}{\text{tank}}$ or $\frac{\text{4.5 tablespoons}}{\text{tank}}$

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