



# CALIBRATING A BACKPACK SPRAYER FOR CHEMICAL MOWING

Tips on Working Safely with Pesticides in North Carolina

## Working With a Crew

Prepared by Jeff Owen, Area Extension Forestry Specialist, Mountain Horticultural Crops Research and Extension Center, Fletcher, NC.

It is easy to keep track of your own sprayer and to recognize when something has changed or gone wrong. Keeping a crew of sprayers calibrated is more complex. Whether they work from a premixed nurse tank or by mixing each backpack individually, crews of workers must adjust their speed to a leader who sets a reasonable pace.

**Do not pre-mix herbicide in your nurse tank based on a rule of thumb. Calibrate your sprayers first.**

The crew must walk together in a line to apply herbicide at the same rate. The leader determines the average time it takes him to cover 340 square feet (see steps 1-5 on page 1). All the sprayers are then calibrated to his time interval and output. This may require that some sprayers be outfitted with different sized nozzles (see step 3 below).

### Adjust calibration to terrain.

1. Because nurse-tank mixtures are based on calibrated walking speed, use different nurse tanks (or nurse-tank mixtures) for gentle and difficult terrain. For example, a farm might have 20 acres of gently rolling land and 15 acres of very steep land that would be slow-going. One nurse tank can be used to treat all easy-walking areas. A different nurse tank can be used for the difficult terrain or slow-walking areas. Once a nurse tank is mixed to a calibrated walking speed, it should all be applied at that pace.
2. Only put as much water into the nurse tank as will be needed on that site for a selected walking speed. For example, applying Roundup® to 20 acres in 8 gallons of water per acre will take 160 gallons of water.

### Matching the leader's calibration time.

3. Equip each backpack sprayer with the appropriate TK or TQ nozzle and a pressure flow regulator. No matter what the sprayer capacity, all sprayers should be filled with the same total amount of water (not 4, 3.5, or 3 gallons together). Check all the sprayers for the crew leader's timed interval to make sure that they are all spraying similar amounts of water in that time interval (see page 2, step 6). If the amount applied by any sprayer varies from the leader's sprayer by more than 1 ounce (which is equal to 1 gallon per acre), you may need to clean the filter and nozzle, or you may need to change the nozzle. Adjust and recalibrate until all sprayers are within 1 ounce of the leader's sprayer.
4. Once all sprayers in the crew are putting out the same pattern and spray volume, calculate the amount of herbicide needed in the nurse tank. First calculate the amount of Roundup® needed per gallon of water (rate of Roundup® divided by gallons of water applied per acre). Then multiply the amount of Roundup per gallon by the number of gallons of water in the nurse tank. Add the material to the nurse tank and mix.

**Example:**  $\frac{4 \text{ oz. Roundup}^{\circledR}/\text{Acre}}{8 \text{ oz. Roundup}^{\circledR}/\text{gal. of water}} = 0.5 \text{ oz. Roundup}^{\circledR}/\text{gal. of water}$

$0.5 \text{ oz. Roundup}^{\circledR}/\text{gal.} \times 160 \text{ gal. of water} = 80 \text{ oz. Roundup}^{\circledR}$

### Monitor application.

5. If any sprayers in the crew are finishing early or lasting longer than the rest of the crew, their sprayer is no longer calibrated. Check for trash in the filter or nozzle. Adjust the sprayer and re-calibrate or replace the sprayer with one that is checked to match the calibrated output.
6. A crew leader can use a digital metronome to lead with a more uniform pace. The grower or crew leader can periodically check the pace of the spray crew without interrupting them. For example, if the original calibration was for an 11-tree distance in 18 seconds, the crew can be timed to see how long it actually takes them to cover an 11-tree distance. For small differences from the original calibrated time (time off from 18 seconds), the crew can be told to walk faster or slower. For big differences in pace, the crew should re-calibrate their sprayers.

### Adding to a partially-filled nurse tank

7. Sometimes it may be necessary to re-mix the nurse tank if material is left over or the crew needs to change its pace and therefore re-calibrate. Divide the actual number of gallons of mix still in the nurse tank by the total number that was initially mixed. Multiply the amount of Roundup® initially added to this tankful by the decimal just calculated. This will give you the amount of Roundup® still in the tank. Subtract this amount from the amount needed for the next tankful of Roundup® mix.

**Example:**  $\frac{20 \text{ gallons left in nurse tank}}{160 \text{ initial gallons}} = 0.125 \text{ gallons}$

$0.125 \times 80 \text{ oz. initial Roundup}^{\circledR} = 10 \text{ oz. Roundup}^{\circledR} \text{ left in tank}$

When the lead sprayer was re-calibrated to the crew's slower walking speed, 9 gallons of water per acre were applied. The area to be treated for the remainder of the day is 7 acres. Thus, 63 gallons of water are needed in the tank.

$\frac{4 \text{ oz. Roundup}^{\circledR}/\text{acre}}{9 \text{ gal. water/acre}} = 0.44 \text{ oz. Roundup}^{\circledR}/\text{gal. of water}$

$0.44 \text{ oz. Roundup}^{\circledR}/\text{gal.} \times 63 \text{ gal. of water} = 28 \text{ oz. Roundup}^{\circledR} \text{ needed}$

Add 18 oz. of Roundup® (28 oz. Roundup® needed in new tankful – 10 oz. already in the tank) of Roundup® to 63 gallons of water (20 gallons of mix in the tank plus an additional 43 gallons of water).



Many North Carolina Fraser fir Christmas tree growers are using Roundup® Original or an identical formulation at reduced rates to suppress weed growth between rows of trees (middles). This fact sheet describes a method for calibrating backpack sprayers for this "chemical mowing" process.

### EQUIPMENT RECOMMENDED FOR CHEMICAL MOWING

- Single nozzle backpack sprayer
- 150 degree (wide-angle) nozzle, Tee Jet brand: TK or TQ series.
- 50 mesh nozzle screen
- Yellow pressure regulator (14 psi.) (Available from Solo Company)
- Stop watch or watch with second hand
- 2-quart measuring cup
- Graduated cylinder or any device capable of fine measurement

### BACKPACK SPRAYER PREP

1. Clean the nozzle and screen in soapy water with a soft brush. (Never use a knife or wire to clean nozzles. It will ruin them.)
2. In a place away from any wells or water supplies, rinse the spray tank thoroughly and partially fill it with clean water.
3. Reinstall the nozzle and screen.
4. Pressurize the sprayer and check output for even pattern on a dry surface. If the pattern is uneven, replace or clean nozzle. Inspect the sprayer for leaks.

### BACKPACK SPRAYER CALIBRATION

1. Always calibrate in the field you are planning to treat.
2. Add 1-2 gallons of clean water to the backpack. Walking at a steady pace, practice spraying down the center of the rows while keeping the 150 degree nozzle about knee high. The goal is to cover the middles, 5-6 feet across, without waving the nozzle back and forth. Foliage at the base of trees will be hit without damage as long as the recommended rates and date windows (see table on the next page) are followed accurately.
3. Divide 340 by the measured spray width to determine the length of the calibration course. The result will give a calibration course area of 340 square feet (340 square feet = 1/128th of an acre).
4. Tag a tree down the row that comes closest to the specified distance.
5. Using a consistent, comfortable pace, record the number of seconds it takes to spray the calibration course. Take an average of at least two trips, once in each direction. Always use the pressure regulator.

## BACKPACK SPRAYER CALIBRATION CONTINUED

6. While standing still and using the same pressure applied in the calibration course, spray into the cup for the same number of seconds it took to walk the course. The number of ounces collected is the exact number of gallons per acre (GPA) being applied (1 oz. = 1/128th of a gallon, therefore, # oz. per 1/128th of an acre = # gal. per acre).

[Note: When spraying a 6-foot wide swath and using a TK-2 or TQ-15004 nozzle, yellow (14 psi) pressure regulator, and a comfortable walking speed, you should obtain an output in the range of 7-12 gallons of water per acre. Under windy conditions, fine droplet size can contribute to drift and uneven treatment. Use a nozzle with a larger opening to increase droplet size and reduce drift (a TK4 instead of a TK3, for example). You should use the same rates per acre and date recommendations with these larger nozzles. Re-calibration will be necessary.

7. Now that you have determined your output in GPA, you can mix Roundup® with water at the rate you intend to apply (see table below). Divide the amount of herbicide you want to apply per acre by the GPA measured in calibrating the sprayer.

If you prefer to premix Roundup® in a nurse tank, you may stop at this point and mix. **Be aware that you must maintain the pace established during calibration to maintain your accuracy.**

8. Decide on the volume of mixture you will be carrying per backpack. Then multiply this volume by the ounces of Roundup® per gallon. This will give you the amount of herbicide to add to each backpack. For better accuracy, use the three gallon mark on the backpack. Make sure it is level when filling.
9. Use a graduated cylinder marked in millimeters to measure Roundup®. One ounce equals roughly 30 milliliters. Simply multiply your ounces of Roundup® per backpack by 30 to get milliliters per backpack tankful.

## Fraser Fir Growth Stages and Roundup® Original Application Rates for Chemical Mowing

|                                  | Nov-Mar  | Apr       | May | June             | July | Aug               | Sept   | Oct |
|----------------------------------|----------|-----------|-----|------------------|------|-------------------|--|-----|
| <b>FRASER FIR GROWTH</b>         | Dormancy | Bud swell | BB* | Shoot elongation |      | Foliage hardening |  |     |
| <b>ROUNDUP® APPLICATION RATE</b> |          | 8 oz./A** |     | 4 oz./A          |      | 8 oz./A           | Spot Treatments at 32 oz./A to Eliminate undesirable weeds |     |

\*BB = Bud Break

\*\*Discontinue 8 oz./A rate about 10 days into fullfledged bud break

**Warning!!** When spraying in fields where trees are getting larger and closer together, it is easy for the spray nozzle to get within 18 inches of the tree foliage. This causes the rate of Roundup® hitting the tree foliage to rise greatly, and unexpected damage can occur, even at the 4oz. per acre rate. **Solution!! When you pass between larger trees close together, lower the spray nozzle to avoid hitting tree foliage at close range.** When Roundup® is applied at exactly the recommended rate, this “close range” damage has only occurred between May 10th and July 10th.

This fact sheet was prepared with information adapted from Doug Hundley, Avery County IPM Program, Avery County Extension Center. The procedures have been developed and tested by the Avery County IPM Research Group and the North Carolina Cooperative Extension Service involved in the On-Farm Grower Participant Research Project.

The information in this document is for educational purposes only. Individuals who use agricultural chemicals are responsible for ensuring that the intended use conforms to the product label and complies with current regulations. The use of a brand or common name of a product in this publication for such educational purposes does not imply endorsement by CropLife Foundation or North Carolina State University or preference over similar products registered for the same use.

### KEYS TO SUCCESS

1. Follow the recommended rates. This will suppress weeds and allow beneficial groundcover to flourish.
2. The person treating the field should always do the calibration.
3. When spraying the field, maintain the same speed, pressure, and nozzle height used in calibration.
4. It may be necessary to re-calibrate for different areas of the field if some areas are much steeper than others, or for differences in energy levels (time of day).
5. Allow the groundcover to green-up before treatments.
6. To allow most weed seeds to emerge before treating, let the tallest weeds reach at least 12 inches.
7. The calibration instructions provided in this publication are based on the active ingredient and adjuvant content of Roundup Original®.

Technical Reviewer: Wayne Buhler, Ph.D., College of Agriculture and Life Sciences, NC State University

**For questions regarding human health and pesticides, call the Carolinas Poison Center 1-800-848-6946 (1-800-84TOXIN).**

## Examples for each step of the calibration procedure.

There is space below (or beside) each example to use as a worksheet for your operation. It may help to photocopy this page and complete it each time you calibrate.

1. Divide 340 by the measured spray width to determine the calibration course.

**Example:** Spray width is 6 ft., therefore the course length is 57 ft.

$$\frac{340 \text{ ft.}}{6 \text{ ft.}} = 56.6666, \text{ round off to } 57 \text{ ft.}$$

$$340 \text{ ft.} / \text{ \_\_\_ ft.} = \text{ \_\_\_\_\_ ft. course length}$$

2. Tag a tree down the row that comes closest to the specified distance:

**Example:** Based on 5 ft. tree spacing, mark the 11th tree from starting point to establish the calibration course.  $\frac{57 \text{ ft.}}{5 \text{ ft.}} = 11.4, \text{ round off to } 11$

$$\text{Course length in feet } \_\_\_\_ / \text{ Tree spacing in feet } \_\_\_\_ = \_\_\_\_ \text{ trees to count off.}$$

3. Take an average of two trips to determine the time it takes to spray the course:

**Example:** Based on trips that took 16 and 18 seconds each, the average time to spray to the 11th tree is 17 seconds.  $\frac{16 \text{ sec.} + 18 \text{ sec.}}{2} = 17 \text{ seconds}$

$$(\text{trial \#1 } \_\_\_\_ \text{ seconds} + \text{trial \#2 } \_\_\_\_ \text{ seconds}) / 2 = \_\_\_\_ \text{ seconds.}$$

4. Collect spray in a cup for number of seconds it took to walk the course. Number of oz. collected = number of gallons per acre (GPA) being applied.

**Example:** After spraying into a measuring cup for 17 seconds, you collect 7.5 oz. of water. **7.5 oz. per 340 square feet = 7.5 gallons per acre.**

$$\_\_\_\_ \text{ oz collected} = \_\_\_\_ \text{ gallons per acre.}$$

5. Divide amount of herbicide you want to apply per acre by the GPA.

**Example:** For application in April, recommended Roundup® rate is 8 oz. per acre.  $\frac{8 \text{ oz. per acre}}{7.5 \text{ gal. per acre}} = 1.06 \text{ oz. Roundup® for each gallon of water}$

$$\_\_\_\_ \text{ oz. per acre} / \_\_\_\_ \text{ gal. per acre} = \_\_\_\_ \text{ oz. Roundup® for each gallon of water}$$

6. Determine ounces of Roundup® needed per 3-gallon backpack load.

**Example:** 1.06 oz. Roundup® x 3 gallons = 3.18, round off to 3.2 oz. Roundup® per three gallons of water

$$\_\_\_\_ \text{ oz. Roundup®} \times 3 \text{ gallons} = \_\_\_\_ \text{ oz. Roundup® per three gallons of water}$$

7. Convert to milliliters

**Example:** 3.2 oz. X 30 milliliters per oz. = 96 milliliters of Roundup® in three gallons of water

$$\_\_\_\_ \text{ oz.} \times 30 \text{ milliliters per oz} = \_\_\_\_ \text{ milliliters of Roundup® in three gallons of water}$$