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PESTICIDE NEWS

Spring tips to preparing various types of pesticide application equipment.

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Spring is a busy time for Montana applicators, with long hours focused on seeding, cultivating, fertilizing and preparing field equipment. Many applicators focus on purchasing pesticide products while neglecting to calibrate the output of their spray equipment. A finely tuned ground sprayer in the fall may deliver a vastly different spray output in the spring. Rusted nozzles, ruptured seals, or rust in the lines may eventually lead to uneven spray patterns or a significant departure from desired target rates. This often leads to loss of revenue, toxicity towards beneficial plants, or limited efficacy towards targeted pests. Applicators can avoid costly application errors by following a few simple steps in the spring.

Inspect Spray Equipment. It is not uncommon for a leaky backpack sprayer to saturate unwary applicators with pesticide product while spraying, or for a hose on a boom sprayer to leak from loose fittings. These dangerous situations can be alleviated if an applicator takes a few minutes to inspect his or her equipment. Check pumps, lines, hose clamps and fittings for leaks while assessing entire sprayer for rust, wear and breakage. An applicator should also take considerable time inspecting nozzles. A nozzle is composed of four items including a spray tip, screen (strainer), cap, and nozzle body. Screens should be inspected for debris and replaced if necessary. Spray nozzle pattern should be assessed for

Table 1. Common backpack sprayer nozzles, uses and swath width.

Nozzle Type	Site / Use	Swath
Adjustable	Variable. Spot spray, gardens or tree spraying. Less accurate	Wide or Narrow
Flat Fan Spray	Most common. Paths, gardens, and rangeland spot spray	Moderate
Hollow Cone	Spot spray, complete penetration, brush and small trees	Moderate
Jet Stream	Tree applications or crevice applications	Narrow
Flood	High output nozzles, fertilizers	Wide Swath

uniformity by activating nozzles over gravel or concrete. Nozzle tips should be replaced or cleaned if the spray pattern seems uneven. Likely suspects include rust, sand particulates, or simply a worn nozzle. Select nozzle tips which are rated for your application type (Table 1).

Calibrating Handsprayers. The goal of calibration is to ensure that the output (gallons per acre; GPA) of a sprayer equals the output which is recommended on the pesticide product label. The 128th acre shortcut method can be used for calibrating a backpack sprayer.

1) Measure an 18 ½ ft. x 18 ½ ft. area which represents a 128th acre.
2) Fill the backpack sprayer with water and increase pressure in the tank to a level that will be consistently maintained while spraying.
3) Time how long it takes to spray this 128th acre area with water at a constant speed and pressure (Note: Ensure uniform coverage without dripping). Repeat 3 times and calculate the average time required (*Example: 92 seconds to spray 128th acre)*.
4) Spray into a measuring container for that amount of time. The number of ounces collected can be converted directly to GPA *(Example: Collected 40 ounces from nozzle in 92 seconds which equals 40 GPA)*.

Inaccurate calibration is often caused by not maintaining a consistent spray routine that is identical to the actual spray situation. It may be necessary to calibrate your sprayer while walking backwards, as walking backwards while spraying pesticides will minimize exposure. Always remember to keep pressure as even as possible while using gentle arcing patterns. See the MSU PocketGuide for calibrating Handsprayers at http://www.pesticides.montana.edu/Reference/CalibrateHandSprayerfinal.pdf.

Calibration of Boom Sprayers. Accurate calibration of boom sprayers is a combination of assessing uniform nozzle flow and determining the output rate of your sprayer. You should always start with checking all nozzles on spray boom for uniformity.

Step #1. Nozzles may be worn or damaged, preventing uniform spray coverage. All nozzles across a boom need to be applying the same amount of liquid within a certain error range (usually 10% on either side of average). Clean and/or replace any nozzles that fall outside of the error range. When assessing nozzle uniformity follow these steps:

- Collect water from each nozzle for 1 minute. Measure volume.
- Determine average nozzle output.
- Determine the acceptable error range (usually within 10%).
- Replace or clean nozzles outside of 10% range and re-test.

Step #2. Determine the output of your boom sprayer using the shortcut method. With this method, one ounce discharge per nozzle equals one gallon per acre output. Preset course lengths must be obtained by comparing your nozzle spacing with table 2.

Table 2. Defined course lengths.

Nozzle Spacing or Band Width	Course Length (ft.)
18”	227
20”	204
30”	136
36”	113
40”	102

If you have another nozzle width use this formula to determine course length: 340.3 / nozzle spacing in feet. Example for 1.5 ft spaced nozzles: (340.3 / 1.5 ft = 227 ft)

a) Define course length (example: 20” nozzle spacing = 204’ course length)
b) Travel course while timing at speed you will be spraying. Conduct the test 3 times and obtain the average time (example: traveled 204’ in 30 seconds)
c) Collect liquid from 1 nozzle for that time (collected 30 ounces from 1 nozzle in 30 seconds).
d) Determine GPA. Ounces of liquid collected = Gallons Per Acre (example: 30 ounces = 30 GPA)

For more information see the MSU PocketGuide on calibrating boom sprayers at http://www.pesticides.montana.edu/Reference/CalibrateBoomBroadjetSprayerPROOF823.pdf.

Calibrating Boomless Nozzles. An applicator can calibrate their boom-less (broadjet) sprayer by using shortcut methods by obtaining a preset course length.

Step #1. A preset course length must be obtained by obtaining your broadjet spray swath width and plugging it into table 3. The broadjet spray swath width is the width of your spray passes.

Table 3. Defined course lengths for calibrating broadjet sprayers.

Spray Swath Width (ft)	Course Length (ft)
10’	340
15’	226
20’	170
25’	136
30’	113

If you have another spray swath width use this formula to determine course length: (340 / spray swath width in ft)*10.

Step #2. Travel course while timing at speed you will be spraying. Conduct the test 3 times and calculate the average time (example: traveled 340' in 30 seconds)

Step #3. Collect liquid from all nozzles that contribute solution to the spray swath width for that amount of time (collected 300 ounces from 1 broadjet nozzle in 30 seconds).

Step #4. Divide ounces collected by 10. This will equal the GPA of your spray equipment. (example: 300 ounces collected / 10 = 30 GPA)

For more information see the MSU PocketGuide on calibrating broadjet sprayers at http://www.pesticides.montana.edu/Reference/CalibrateBoomBroadjetSprayerPROOF823.pdf.

Adjusting your output. An applicator may adjust the output of the sprayer by adjusting spray speed or pressure. Doubling your spray speed will decrease the output of the sprayer by ½, while decreasing spray speed will increase output of sprayer. Pressure may be adjusted to fine-tune your calibration. Nozzles can only operate between recommended pressure ranges. See the nozzle manufacturer guidelines for ideal pressure ranges for your nozzles.

Proper Tank Mixing. Once calibrated it is necessary to determine amount of solution to mix, amount of pesticide product to add to tank and area you can cover. You can also use the conversion chart to aid in tank mixing (Table 4).

Determine area your tank can cover. Use this formula to determine the amount of acres you wish to cover with your tank.

- Sprayable Acres = Gallons in Tank ÷ Gallons Per Acre (GPA)

Determine spray solution needed in tank. To determine the amount of spray solution needed in tank, an applicator could multiply the output of the sprayer (GPA) by the number of acres you wish to spray.

- Spray Solution Needed in Gallons = Gallons Per Acre (GPA) x Acres

Determine product to add to tank. The amount of pesticide product (per gallon of solution) to add to the tank is easily determined by dividing the recommended rate (must be in acres) by the output of your sprayer.

$$\text{Amount of Pesticide Product to add per Gallon of Solution} = \frac{\text{Product Label Recommendation (per acre)}}{\text{GPA (Gallons Per Acre)}}$$

For example: Your product label recommends a rate of 8 oz / acre and your sprayer was calibrated at 20 GPA. 8 oz / 20 GPA = 0.4 ounces pesticide product per gallon solution. If you have a 5 gallon tank multiply 5 x .4 ounces. Add 2 ounces of pesticide product to the 5 gallon tank..

Table 4. Useful conversion factors.

Multiply	By	To Get
Acres	43,560	Square Feet
Cups	8	Ounces
Gallons	128	Ounces
Grams	.001	Kilograms
Grams	0.035	Ounces
Hectares	2.47	Acres
Kilograms	2.205	Pounds
Liters	.264	Gallons
Meters	3.28	Feet
Miles / Hour	88	Feet / Minute
Ounces	2	Tablespoons
Pints	.125	Gallons
Pints	16	Liquid (oz)
Pounds	16	Ounces
Pounds	453.6	Grams
Quarts	32	Ounces
Tablespoon	0.5	Ounces

For More Information

Applicators can access calibration reference guides at www.pesticides.montana.edu by selecting 'reference materials'. Contact MSU Distribution at 406-994-3213 to order hardcopies or the MSU Pesticide Education Program (Cecil Tharp, 406-994-5067, ctharp@montana.edu) for more information.