Three Tips for Preparing Pesticide Equipment

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Many applicators focus on purchasing pesticide products while neglecting to calibrate the output of their spray equipment or test the quality of their water being used for spray applications. 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. High pH may lead to a 50% loss of efficacy with many glyphosate or 2,4-D amine solutions. This often leads to loss of revenue, and/or limited efficacy towards targeted pests. Applicators can avoid costly application errors by following a few simple steps in the spring.

#1 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. Screens should be inspected for debris and replaced if necessary. Spray nozzle pattern should be assessed for 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).

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

#2 Calibrating Sprayers. 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 backpack sprayers, boom sprayers and broadjet sprayers without pesky mathematical formulas. See the MontGuide titled "Calibrating Ground Sprayers Using Shortcut Methods" or the calibration PocketGuides at www.pesticides.montana.edu by selecting 'References'. Applicators can then easily determine exactly how much product to add to a spray tank with this formula:

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

#3 Test Water Quality. Water quality can significantly lower pesticide performance of many pesticide products. Vast areas of Montana harbor ground water with less than ideal pH and / or hardness for spraying common pesticides.

pH. The pH value describes the acidity and alkalinity of a solution. A small number of water (H_2O) molecules break into hydrogen (H+) ions hydroxide (OH-) ions and the balance between the two is measured as pH. The pH ranges from 0 – 14:

- pH = 7…..neutral (H+ equals OH-)
- pH > 7…..alkaline (more OH-)
- pH < 7…..acid (more H+)

Weak acid pesticides such break down (dissociate) quickly to smaller molecules when mixed in an alkaline solution (pH > 7). Some common pesticides that are susceptible to pH levels over 7.0 would be 2,4-D amine, glyphosate, glufosinate ammonium, ammonium salt of imazethapyr, and a wide range of carbamates and organophosphates insecticides. Weak alkaline pesticides such as the sulfonyl-urea class (Ally, Escort, Amber, Harmony Extra, Express, and Accent) break down (dissociate) quickly when mixed in an acid solution (pH < 7). Applicators should test their water prior to a spray application using a pH meter or pH litmus strips.

If pH is a problem then applicators should consider alternative water sources or adding a buffering agent to adjust pH. These buffers can lower the pH of the spray solution from alkaline to slightly below 7.0 for weakly acidic pesticides. Some examples of commercially available buffering agents are Buffer Xtra Strength (Helena Chemical Co.), Buffer (Ladda Co.), Spray-Aide (Miller Chemical), Class Ballast (Cenex/Land O'Lakes), LI 700 (Loveland Industries), Trifol (Wilbur Ellis), Super Spread 700 (Wilbur Ellis), etc… A detailed listing is available in the online compendium of herbicide adjuvants at: http://www.herbicide-adjuvants.com/.

Hard water. The term water 'hardness' refers to presence of metals with a positive charge of more than 1 such as calcium (Ca++), magnesium (Mg++), and iron (Fe++). Total hardness is typically measured in parts per million. These cations can further reduce the effectiveness of weak acid pesticides, especially if the pH of the water is above the ideal range. The effect happens because of the pesticide dissociating into positively and negatively charged components and the cations in the water binding with the negatively charged portion of the pesticide. This results in molecules that either can't be absorbed by the target pest, enter at a slower rate, or form insoluble salts. Hardness can range anywhere from 0 to over 800 ppm

Follow these guidelines regarding hardwater:

- Always read and follow precautions regarding hardness on the pesticide product label.
- Weak acid pesticides such as clopyralid, 2,4-D amine, glyphosate and dicamba may lose efficacy if hardness exceeds 150 ppm, especially if pH > 7.0.
- 2,4-D amine formulations can be totally deactivated if hardness > 600 ppm.
- Many other herbicides will lose efficacy if hardness > 400 ppm if iron is present.

Hardness can be reduced with addition of dry ammonium sulfate $(NH_4)_2SO_4$ at 8.5 to 17.5 lb per 100 gallons of water, or liquid fertilizers (such as 28%N, 32%N, or 10-34-0) at a rate of 1.25 – 2.5 percent per 100 gallons. It works by reducing the pH and also through SO_4^{--} combining with hard water cations. Performance might be enhanced further by addition of a non-ionic surfactant.

For more information on water quality applicators should access the new MontGuide titled 'Pesticide Performance and Water Quality' at www.pesticides.montana.edu by selecting 'reference materials'.

For More Information

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