INTEGRATED PEST MANAGEMENT

MU Guide

PUBLISHED BY MU EXTENSION, UNIVERSITY OF MISSOURI-COLUMBIA muextension.missouri.edu/xplor/

Effects of Water pH on the Stability of Pesticides

Fred Fishel, Department of Agronomy

What is pH?

The pH level of the water used in a pesticide spray mix influences the effectiveness of some pesticides. The term pH (potential of hydrogen) refers to a measure of the concentration of hydrogen ion (H^+) and hydroxide ion (OH^-) in a solution. If hydrogen predominates, the solution is acidic; if hydroxide predominates, the solution is basic, or alkaline.

A logarithmic scale of 0 to 14 is used to measure pH. A pH value of 7 indicates neutrality. Values below 7 indicate acidic conditions; pH values above 7 indicate alkaline conditions. Because a logarithmic scale is used in measuring pH, a pH of 6 is 10 times more acidic than a pH of 7, and a pH of 5 is 100 times more acidic than a pH of 7.

How does pH affect pesticides?

Some pesticides, particularly carbamate and organophosphate insecticides, undergo a chemical reaction in the presence of alkaline water (water that has a pH value greater than 7). The reaction is known as *alkaline hydrolysis,* and it reduces the effectiveness of the pesticide's active ingredient.

Depending on the specific chemical properties of the pesticide, the pH of the mix water and the length of time that the pesticide is in contact with the water, the breakdown can happen relatively rapidly. Spray-mix water with a pH value between 8 and 9 can cause a rapid hydrolysis to the point that the degree of pest control is greatly diminished or lost.

Chemical breakdown of a pesticide is commonly referred in terms of its half-life. A half-life is the period of time it takes for one-half of the amount of pesticide in the water to degrade. Each half-life that passes reduces the amount of pesticide present in the water by one-half; that is 1 to ½ to ¼ to ⅛ to 1/16, etc. Table 1 summarizes the half-life of pesticides with varying pH values that are commonly used in Missouri.

Is alkaline water a concern in Missouri?

Many water sources in Missouri have pH values between 7 and 9, or neutral to alkaline. There is some variability in these values even if they are within the same hydrologic region of the state. Both surface and ground water pH values fluctuate over time and even seasonally.

If you know that your mix water has a pH of 7.5 or greater, consider lowering the pH, especially if you are applying a pesticide that is sensitive to high pH. A pH of 4 to 7 is recommended for mixing most pesticides; a value of 5.5 to 6.5 is ideal.

If your spray rig will be left to stand for several hours or overnight before the contents are applied, consider adding a buffering agent to prevent alkaline hydrolysis.

How can I determine the pH of the water I use to mix with pesticides?

The fastest way to determine the pH level of water is to test it with a pH meter or test paper. Paper test strips are the least expensive; however, they can be unreliable and vary by as much as 2 pH points. A pH meter will provide the most reliable and consistent readings. Meters are available commercially for $50 to $400.

More expensive models are extremely precise and may have the ability to conduct additional measurements such as electrical conductivity. The less expensive models usually have the capability to provide a pH reading within 0.1 to 0.2 points accuracy.

A final option is to have the water professionally monitored. The University of Missouri's Soil & Plant Testing Laboratory conducts water pH analyses. Call (573) 882-0623 for information and instructions on submitting samples, or visit them on the Web at *http://www.soiltest.missouri.edu*. You can also submit samples through your county University Outreach and Extension office.

When should a pesticide be buffered in the spray tank?

Product labels will direct you to avoid mixing the pesticide with alkaline water. You may also see statements that the activity of the pesticide will be reduced under alkaline conditions. The directions will state that a buffering or acidifying agent should be added to the spray tank. Some pesticidal materials should not be acidified under any circumstances; their labels will contain specific statements.

What are buffering agents?

Buffering agents are a type of pesticide spray mix adjuvant. All adjuvant materials are added to the chemical formulation or spray tank to make the application more effective, safer or easier for the applicator.

Various commercially available buffering agents will acidify spray solution. Like pesticides, their labels should be read and followed closely. The amount to add will depend upon the initial pH, the volume of water, and the desired final results.

Conclusion

Determining the pH of the spray mix water and adding a buffering agent, if necessary, is inexpensive compared with the cost of losing a pesticide's effectiveness. Many of Missouri's water sources are alkaline by nature, and the addition of a buffering agent to the spray mix is an easy and economical way to guarantee maximum results from your pesticide applications.

Table 1. Half-life of pesticides at varying pH values.

Active ingredient	pH 6.0	pH 7.0	pH 8.0	pH 9.0
Azinphos-methyl		10 days		12 hours
Captan		8 hours	10 minutes	2 minutes
Carbaryl	100–150 days	24–30 days	2–3 days	1–3 days
Carbofuran	200 days	40 days	5 days	3 days
Chlorpyrifos		35 days	22 days	
Diazinon		70 days		29 days
Dimethoate	12 hours			1 hour
Disulfoton	32 hours			7 hours
Malathion	8 days	3 days	19 hours	
Methomyl	54 weeks	38 weeks	20 weeks	
Phosmet		12–24 hours	4 hours	
Parathion		17 weeks	29 days	
Propargite	331 days			1 day
Trichlorfon	4 days	6 hours	1 hour	

Note: Values are generalized estimates and may vary considerably depending upon factors other than pH.

OUTREACH & EXTENSION
UNIVERSITY OF MISSOURI
COLUMBIA

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Ronald J. Turner, Director, Cooperative Extension, University of Missouri and Lincoln University, Columbia, MO 65211. ■ University Outreach and Extension does not discriminate on the basis of race, color, national origin, sex, religion, age, disability or status as a Vietnam era veteran in employment or programs. ■ If you have special needs as addressed by the Americans with Disabilities Act and need this publication in an alternative format, write ADA Officer, Extension and Agricultural Information, 1-98 Agriculture Building, Columbia, MO 65211, or call (573) 882-7216. Reasonable efforts will be made to accommodate your special needs.