Improving Pesticide Performance With pH Meters

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Have you ever noticed a control problem with a pesticide? Even if you haven't noticed a control problem, how do you know that you are getting the most effectiveness out of your pesticide applications? Effectiveness is influenced by many things, such as equipment, the applicator and the environment. One component not often considered or checked is spray tank solution pH.

WHAT IS pH?

pH is a measure of the concentration of hydrogen and hydroxide ions in solution. It is measured on a logarithmic scale from 1 to 14, with 7 being neutral. Below 7 is considered acidic. Above 7 is consider alkaline. The pH of a solution is ever changing. Over time pH changes due to changes in water treatment, weather patterns, the environment, etc. Even fertilizers can change the pH of water. For example, a phosphate fertilizer causes water to become more acidic and urea causes water to become more alkaline (Seaman and Riedl, 1986).

HOW DOES pH EFFECT PESTICIDES?

Certain pesticides break down in water. The breakdown of a chemical in alkaline water is called alkaline hydrolysis. Insecticides are the most susceptible pesticide to alkaline hydrolysis (Seaman and Riedl, 1986). Although much less common, acid hydrolysis is the breakdown of a chemical in acidic water. The speed and severity at which chemicals break down in water is influenced by the pesticide, water pH, length of time and water temperature (Park and Chong, 2010). Spray tank solution pH is most affected by the carrier water used to dilute pesticides. To avoid pesticide degradation, the pH of carrier water should be checked regularly.

TESTING pH

pH should be tested at a minimum once a month. A more optimum strategy would be to check the spray tank pH each day you spray. Use the following procedure to test the pH.

1. Allow the carrier water to run briefly to clear any stagnant water from the hose/pipes.
2. Fill the spray tank half way with carrier water. The goal is to test the water that will be used in the spray tank. An

(Continued on Page 21)

Figure 1: General guidelines for pesticide compatibility with carrier water.

Common Names	Brand Names	Acidic (pH < 6)	Alkaline (pH > 6)
Insecticides			
Acephate	Orthene	Fine	Sensitive
Bifenthrin	Talstar	Fine	Fine
Carbaryl	Sevin	Fine	Sensitive
Chlopyrifos	Dursban	Fine	Sensitive
Clothianidin	Arena	Fine	Fine
Imidacloprid	Merit	Fine	Test
Spinosad	Conserve	Fine	Test
Thiamethoxam	Meridian	Fine	Test
Trichlorfon	Dylox	Fine	Sensitive
Fungicides			
Azoxystrobin	Heritage	Fine	Sensitive
Chlorothalonil	Daconil	Fine	Fine
Fenarimol	Rubigan	Fine	Fine
Fosetyl Al	Aliette	Fine	Fine
Mefenoxam	Subdue Maxx	Fine	Test
Propiconazole	Banner Maxx	Fine	Fine
Thiophanate methyl	Cleary 3336	Fine	Sensitive
Triadimefon	Bayleton	Fine	Fine
Herbicides			
Chlorsulfuron	Corsair	Sensitive	Fine
Glyphosate	RoundUp	Fine	Test
Sethoxydim	Vantage	Fine	Fine

* Park and Chong, 2010; Seaman and Riedl, 1986

pH Meters-

(Continued from Page 20)

alternative to filling the spray tank is to fill a jar with water.

3. Check the pH of the water. It is best to test the water soon after filling as the water pH will change with time.

4. Buffering agents should be added as needed to correct pH imbalance. Remember to test the compatibility of buffering agents with the pesticides you will be using. In addition, if a solution will be left for a long time (i.e. overnight) a buffering agent should be added to prevent a change in pH.

5. Re-check the pH.

6. Add pesticides.

TECHNOLOGY TO MEASURE pH

pH measurement technology ranges from high to low tech and high to low priced. On the low tech/price end are pH test strips, which cost around $5 for 100 strips. pH test strips are a piece of paper that when dipped in a solution react to the solutions pH by turning a color. The user matches the strip to a color guide to determine the pH of the solution. As you can imagine the accuracy of pH test strips is extremely low, with an accuracy of +/- 2 on the pH scale. One source for pH test strips is Gempler's. Superintendents should use hand-held electronic pH meters, which cost $25 to $200 dollars. With hand-held electronic pH meters you get what you pay for. If you spend less than $50 do not expect to get a quality meter that will last a long time. If you spend over $50, you will get the following features: waterproof, temperature compensation, floats in water, calibration samples, and replaceable sensors. I have seen several superintendents use multiple $25-50 pH meters in a year due to "accidents," where higher end models tend to last several years. A couple of good pH meters are Spectrum Technologies FieldScout SoilStik and Oakton Waterproof pH Testr.

There are even more expensive models on the market, such as the IQ 150 pH Meter for $715. These pH meters are very accurate and come with many other features, such as a probe to determine soil pH. In my experience, the greater accuracy and extra features do not justify the additional expense for a superintendent. If you plan to do other pH testing, then it is possible one of these models would work better for you.

When was the last time you checked the pH of your carrier water? If it has been a while, I suggest you invest in a meter and start checking the pH of your carrier water regularly. It could be the best $100 you spend this year, when you consider the potential increased pesticide efficacy.

(Editor's Note: Aaron Johnsen is a Professional Product Advisor with WinField Solutions and an adjunct lecturer at the University of Wisconsin - River Falls. He can be reached at arjohnsen@landolakes.com or 651.895.2601. ***Sources:*** *Seaman, A.J. and H. Riedl. 1986. Preventing decomposition of agricultural chemicals by alkaline hydrolysis in the spray tank. New York's Food and Life Bulletin 118: 1-7. Park, D. and J-H. Chong. 2010. A question of quality. Golf Course Industry 22 (3): 44-48.)*