Effect of pH on Pesticide Stability and Efficacy

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Has a grower ever come up to you and complained that the insecticide you sold him or that you custom applied for him didn't do a good job of controlling his insect problem? You probably attributed the reduction or lack of control to either a bad batch of chemical, poor application or pest resistance; or maybe the farmer just didn't know what he was talking about. But how many of you ever bothered to check the pH of the water prior to mixing the chemical?

If you look closely at the pesticide label, chances are you will find a statement cautioning you against mixing the pesticide with alkaline materials such as lime or lime sulfur. The reason is that many pesticides, particularly the organophosphate insecticides, undergo a chemical reaction in the presence of alkaline materials which destroys their effectiveness. This reaction is called alkaline hydrolysis and occurs when the pesticide is mixed with water with a pH greater than 7. The more alkaline the water, the more rapid the breakdown of the pesticides.

Lime and lime sulfur are often mentioned on pesticide labels because they are sometimes added to spray tanks. However, they are not the only materials that provide sufficient alkalinity for this reaction to occur. Caustic soda, caustic potash, soda ash, magnesia or dolomitic lime, liquid ammonia — all of these provide alkaline conditions in which susceptible pesticides can readily be hydrolyzed to inactive organic compounds.

It has been shown recently that, in may areas of the United States, water supplies have sufficient natural alkalinity to cause hydrolysis of certain pesticides. This means that a pesticide may begin to break down as soon as it is added to the tank. In practical terms, this means that the degree of pest control may be somewhat less than desirable, or even

nonexistent, because a certain amount of the active ingredient will be decomposed to an inactive form before it ever reaches the plant and the pest. And if a spray rig is allowed to stand several hours or overnight before spraying out the contents of the tank, as much as 50 percent or more of the active ingredient may be decomposed.

Lower the pH in Our Spray Tank

If your water supply is alkaline, especially if the pH is 8 or greater, and you are using a pesticide that is sensitive to hydrolysis, you should lower the pH of the water in the spray tank. A pH in the range 4-6 is recommended for most pesticide sprays. You can adjust your spray solutions to the 4-6 pH range by the use of adjuvants that are marketed as buffering agents.

- Buffer-X (Kalo Lab.)
- Nutrient Buffer Spray
  - 0-8-0 Zn Fe
  - 0-16-9 Zn
  - 10-12-0 Zn
  - 8-8-2 Zn Mn
- Spray-Aide (Miller)
- Sorba-Spray(s) (Leffingwell)
  - 6 different products
- Unite (Hopkins)

There are a few pesticide materials that should not be acidified under any circumstances. Sprays containing fixed copper fungicides (including Bordeaux mixture, copper oxide, basic copper sulfate, copper hydroxide, etc.) and lime or lime sulfur should not be acidified. But if the product label tells you to avoid alkaline materials, chances are good that the spray mixture will benefit by adjusting the pH to 6 or slightly lower.

Which Pesticides Are Affected by Alkaline Water?

Although there is a great deal of variability, in general we find that insecticides are affected more severely by alkaline water than fungicides and herbicides. Among the insecticides, the OP and carbamates are decomposed much more rapidly than the chlorinated hydrocarbons.

Many manufacturers provide information on the rate at which their products hydrolyze. This rate is usually expressed as "half-life" or the "time it takes for 50 percent hydrolysis or breakdown to occur." With trichlorfon or DYLOX, for example, the time for 50 percent hydrolysis at pH 8.0 is 63 minutes; at pH 7.0, 50 percent breakdown occurs in 386 minutes; and at pH 6, 80 hours. This means that if the pH of your spray water is 8 and one hour elapses between the time you add the insecticide to your spray tank and the spray dries on the foliage, 50 percent of the active ingredient has already decomposed. But if your water has a pH of 6, it is not likely that you will lose any significant activity during the process of application.

For a more complete listing of specific pesticides and their half-lives as various pHs or information regarding water testing, please contact your local Cooperative Extension agent.

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