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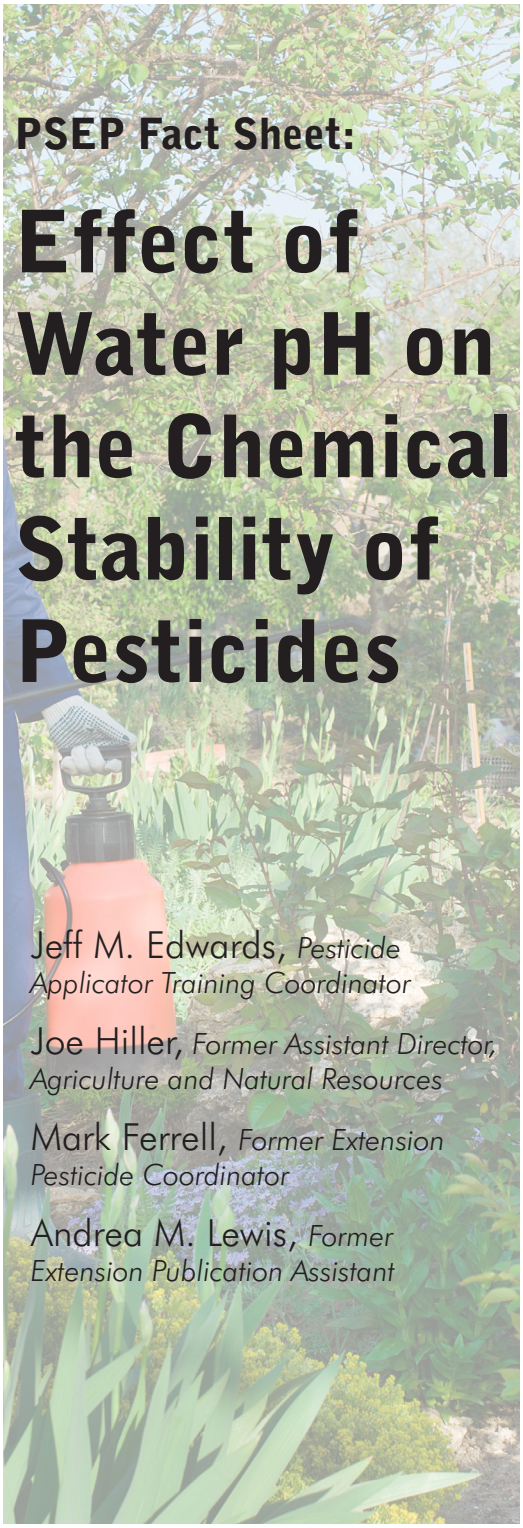

PSEP Fact Sheet:

Effect of Water pH on the Chemical Stability of Pesticides

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Most pesticide formulations such as dry flowables, emulsifiable concentrates, and wettable powders are designed to be diluted with water as the carrier. A water pH higher than 7 can cause some pesticides to undergo degradation or chemical breakdown, a process known as hydrolysis. In general, insecticides are much more susceptible to hydrolysis than are fungicides, herbicides, defoliants, or growth regulators. Organophosphate and carbamate insecticides are more susceptible than chlorinated hydrocarbon insecticides. Some pyrethroids exhibit susceptibility to hydrolysis.

Tables reporting the pH of water sources across the U.S. list only a few states that have water with a pH below 7. The remainder all have sources with varying degrees of alkalinity. Both surface and ground water supplies usually contain sufficient natural alkalinity to produce pH levels between 7 and 9.

Some pesticides hydrolyze very rapidly. The hydrolysis rate can be rapid in a pH range of 8 to 9. For every pH point increase, the rate of hydrolysis will increase by a factor of about 10. The severity of losses due to alkaline hydrolysis is governed by the degree of water alkalinity, the susceptibility of a pesticide, the amount of time a pesticide is in contact with water, and the temperature of the mixture.

The solution to the problem is to lower the pH of water to the optimum range of 4 to 7 before mixing it with a pesticide. Do this by adding the recommended rate of a buffering or acidifying agent. The buffering effect starts from the time of mixing in the tank and continues until the water has evaporated from a spray droplet lying on a leaf. Buffering does not affect the residual activity of a pesticide. Some materials, such as fixed copper fungicides like basic copper sulfate, copper oxide, and Bordeaux mixtures, should not be buffered because an acid solution may cause the metals to solubilize and produce a phytotoxic effect when sprayed on plants. Products used to acidify tank solutions may be acidifying agents used alone or in combination with surfactants or fertilizers.

A pH meter is the most satisfactory and accurate method of determining the pH of water. The use of test papers such as litmus paper can be unreliable and can be as much as 2 pH points in error. There are available liquid color indicators (example: Bromothymol Blue) that can indicate pH to within a half point. Water sources, both surface and ground, can and do change in pH with the passage of time. A change in pH is usually toward a more alkaline condition.

In summary, know the pH of water that is to be used with pesticides and the susceptibility of the pesticides to hydrolysis. Do not mix pesticides until just prior to the time of application. Mix only quantities that can be used within the shortest time possible. If conditions dictate, adjust the pH of the water to an optimum level.

Common Name	Trade Name	Half-Life* at Different pH values**
acephate	Orthene	pH5 = 40 days, pH7 = 46 days, pH9 = 16 days
azinphos-methyl	Guthion	pH5 = 17 days, pH7 = 10 days, pH9 = 12 hours
bendiocarb	Ficam, Turcam	pH7 = 4 days, pH9 = 45 minutes
captan	Orthocide	pH7 = 8 hours, pH8 = 10 minutes, pH10 = 2 minutes
carbaryl	Sevin	pH7 = 24 days, pH8 = 3 days, pH9 - 1 day
carbofuran	Furdan	pH7 = 40 days, pH8 = 5 days, pH9 = 3 days
chlorothalonil	Bravo, Daconil	Stable below pH7, pH9 = 38 days
chlorpyridos	Dursban, Lorsban	pH7 = 35 days, pH8 = 22 days, pH10 = 7 days
diazinon	Knox-Out, D.Z.N.	pH5 = 14 days, pH7 = 70 days, pH9 = 90 days
dimethoate	Cygon, Dimate	pH4 = 21 hours, pH6 = 12 hours, pH9 = 1 hours
disulfoton	Di-system	pH5 = 60 hours, pH6 = 32 hours, pH9 = 7 hours
malathion	Cythion, Fyfanon	pH7 = 3 days, pH8 = 10 hours, pH10 = 2 hours
methomyl	Lannate	pH6 = 54 weeks, pH7 = 38 weeks, pH8 = 20 weeks
photmet	Imidan	pH7 = 12 hours, pH8 = 4 hours, pH10 = 1 minute
propargite	Omite, Comite	pH3 = 17 days, pH6 = 331 days, pH9 = 1 day
tricholoran	Dylox	pH6 = 4 days, pH7 = 6 hours, pH8 = 1 hour

*Half-life is the period of time it takes for one-half of the amount of pesticide in water to degrade. Each half-life that passes reduces the amount of pesticide present in water by one-half, i.e. 1 to ½ to ¼ to 1/8 to 1/16, etc.
** These values are generalized estimates and reflect trends, but half-life periods may vary considerably. Hydrolysis depends on other factors besides the pH of a solution including temperature, formulation, and other pesticides and adjutants that are in a spray tank.
Source: Loveland Industries, Inc. 11/91 (Wilbur-Ellis 5/93)

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