The Effect of Water pH on Pesticide Effectiveness

Overview

When pesticides are mixed with water, they begin a process called hydrolysis that involves the reaction of water with the chemical components of the pesticide. The bonds within the pesticide molecules are broken down into less active or inactive byproducts. This breakdown significantly influences the persistence of pesticides in the environment, as well as their effectiveness. The persistence of pesticides is described in terms of half-life, or the length of time needed for half of the pesticide's active ingredient to degrade. The shorter the half-life, the less stable the pesticide, and the more rapidly it will degrade.

The rate of degradation from hydrolysis depends on several factors, including pH, temperature, and chemical structure of the pesticide. In general, hydrolysis occurs more rapidly when mixed with acidic or alkaline water than at a neutral pH. Warmer temperatures also tend to increase the rate of reaction. As a result, pesticides applied in hot, humid, or highly acidic/alkaline environments may degrade faster, reducing their effectiveness and potentially requiring additional treatments to provide the desired level of pest control.

Stability of pesticides at different pH levels

The stability of active ingredients can vary across pH levels. In general, a neutral pH of 6-7 will be ideal for most pesticides. Depending on the characteristics of the water used for mixing, growers may need to adjust the pH of the water before adding any pesticides for mixing and application. The table below shows the relative stability of selected products used in greenhouse and nursery ornamental plant production.

Degradation Rate of Pesticide		
Slow	Moderate	Rapid

Fungicide	Active Ingredient	Optimum pH	Acidic (pH 4-6)	Neutral (pH 7)	Alkaline (pH 8-9)
Artavia™ 2 SC	Azoxystrobin 22.9%	6			
Dornic™ 720 F	Chlorothalonil 54.0%	7			
Celoxid™ SC	Cyazofamid 34.5%	7			
Stergo™ GR	Mefenoxam 1.0%	7			
Stergo™ MX	Mefenoxam 22%	7			
Gravex™ 20 EW	Myclobutanil 19.7%	7			
Gunner™ 14.3 MEC	Propiconazole 14.3%	7			
Talaris™ 50 WSP	Thiophanate-methyl 50%	6.5			
Talaris™ 4.5 F	Thiophanate-methyl 46.2%	6.5			

INSIDER INTEL

Herbicide	Active Ingredient	Optimum pH	Acidic (pH 4-6)	Neutral (pH 7)	Alkaline (pH 8-9)
Ceridian™ 2 EC	Clethodim 26.4%	6			
Vendra™ II	Fluazifop-p-butyl 24.5%	7			
Semera™ SC	Flumioxazin 41.4%	6			
Semera™ 51.0% WDG	Flumioxazin 51%	6			
Empero™ Q-Pak	Halosulfuron-methyl 5%	7			
Empero™	Halosulfuron-methyl 75%	7			
Spirus™	S-metolachlor 83.7%	7			
Sertay™	Sulfosulfuron 75%	7			

Insecticide	Active Ingredient	Optimum pH	Acidic (pH 4-6)	Neutral (pH 7)	Alkaline (pH 8-9)
Fervid™	Abamectin 2.0%	6.5			
Quasar™ 8.5 SL	Acetamiprid 8.5%	7			
Atrevia™ 3.0% SL	Azadirachtin 3.0%	6			
Actuate™ SC	Bifenazate 22.6%	6.5			
Battalion™ 2 EC	Bifenthrin 25%	6			
Piston™	Chlorfenapyr 21.4%	6			
Eschaton™ 5 WDG	Etoxazole 5%	7			
Airaxo™	Flonicamid 50%	5			
Hexcel™ EW	Hexythiazox 11.93%	7			
Mineiro™ 2 F Flex	Imidacloprid 21.4%	6			
Devenir™	Pymetrozine 50%	6			

Insect Growth Regulator	Active Ingredient	Optimum pH	Acidic (pH 4-6)	Neutral (pH 7)	Alkaline (pH 8-9)
Synterra™ WSP	Cyromazine 75.0%	6.5			
Defiance™ 0.86 EC	Pyriproxyfen 11.23%	6			

Plant Growth Regulator	Active Ingredient	Optimum pH	Acidic (pH 4-6)	Neutral (pH 7)	Alkaline (pH 8-9)
Berati™ 10 XC	Paclobutrazol 4%	6.5			
Berati™	Paclobutrazol 0.4%	6.5			

Atticus