

Alkaline Water Very Common in USA pH changes during the season; check it regularly

Figure 1:

If you think alkaline water doesn't affect you, think again. Below see a sampling of water pH across the country.

Region	Water Source	pHs
CA, AZ	Colorado River	7.7-8.5
ID	Snake River	7.6-8.4
CO, NM, TX	Rio Grande River	7.3-9.0
TX	Brazos, Trinity, Colorado, Guadalupe Rivers	7.2-8.5
AR, OK, KS, CO	Arkansas River	7.4-8.6
NB, KS, MO	Missouri River	7.8-8.5
MN, WI, IL, MO	Mississippi River	7.6-8.9
OH, IN, KY	Ohio River	7.0-9.0
OH, IN, IL, WI	Lake Michigan	7.5-8.5
NY	Lake Ontario	7.0-8.3
MD, VA, WV	Potomac River	7.4-7.6
PA, NJ	Delaware River	7.4-7.6
FL	Hillsborough River	7.1-8.2
MA	Little River	6.2-6.5

** 95% of national supplies contain sufficient natural alkalinity to produce pH levels from 7-9 or more

Table 2:

Procedure for testing & correcting water pH

Testing:

- Take a sample from the water source used to fill the spray tank.
- Check the pH with a pH meter or test kit.

Adjusting and calculating how much Nutrol® to add to spray tank:

- Add 1/8 ounce of Nutrol® to a measured pint of water.
- Stir well with clean glass rod or non-porous utensil.
- Check the pH as above.
- Repeat until pH is in the target range.

Correcting the pH of spray tank solution:

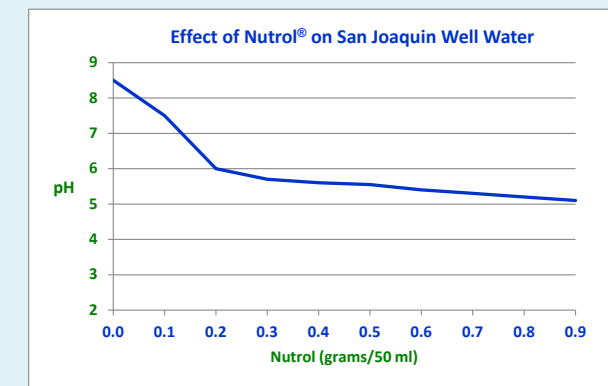
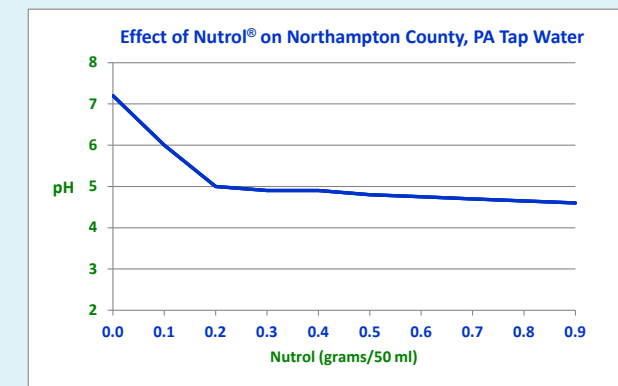
- Add half of the required water to the spray tank.
- Slowly add Nutrol® to tank while agitating water. Add 1 ounce of Nutrol® per gallon of water for each 1/8 ounce scoop used to correct the 1 pint jar test water.
- Add balance of water and agitate until Nutrol® is dissolved.
- Take sample and check pH to be certain it is correct.
- If further adjustment is needed, add more Nutrol® and re-check pH.
- Once pH is correct, add pesticides to tank.

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Chart 1: In these experiments the researcher added incremental amounts of Nutrol® to alkaline water.

NOTE: Once the pH was at equilibrium, the pH stays in a very narrow range. Typically, a 1% solution of Nutrol® will buffer the pH of water within the narrow equilibrium range.



Acknowledgements

Pest Managements Guidelines: A Cornell Cooperative Extension Publication

Effect of pH on Pesticide Stability and Efficacy: Winand Hock, Extension Pesticides Specialist, Penn State University.

Preventing Decomposition of Agricultural Chemicals by Alkaline Hydrolysis in the Spray Tank: A.J. Seaman and H. Riedel, NY's Food and Life Sciences Bulletin No. 118, Cornell University.

Effect of Water pH on the Chemical Stability of Pesticides: Howard Deer and Richard Beard. Pesticides No. 14, Utah State University Extension.

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Alkaline Hydrolysis Can Cost You Time and Money Wasted Product, Poor Results, Re-sprays and Extra Manpower Can Result

Have you ever applied a pesticide or herbicide and it didn't work? You may have thought that it was caused by applicator error, pest resistance or the chemical itself; however, it could very well be the pH of the water and tank solution that caused the problem. As a result, even though you used the right chemical for the target pest or weed, you find yourself not knowing if a re-spray will work any better than the first spray. Checking the pH of the tank solution and buffering it (if the pH is too high for the chemistry you are applying) will pay dividends in reduced pesticide costs, consistent optimal performance and peace of mind.

The impact of pH on pesticides

Here is what the University of Nevada has to say about pH and its impact on pesticides: *"The characteristics of water used in a spray mix influence the effectiveness of some pesticides. One of the most important is the pH of the water.... Water with a pH higher than 7 is alkaline. Many pesticides...undergo a chemical reaction in the presence of alkaline water that reduces their effectiveness. This reaction is called alkaline hydrolysis. The pesticide is hydrolyzed and rendered ineffective when it is mixed with water with a pH greater than 7. The more alkaline the water, the more rapidly the pesticide breaks down."*

"The hydrolysis can be very fast when the water is greater than 8 or 9. For every unit increase in pH, the rate of hydrolysis increases 10 times. Some pesticides

begin to break down as soon as they are combined with alkaline water in the tank, especially when the pH is very high. As a consequence, the active ingredients start to change to inactive ingredients before the pesticide even leaves the tank!"

Raymond Cloyd of The University of Illinois advises: *"Insecticides and miticides are more susceptible to alkaline hydrolysis than fungicides and herbicides. Many insecticides and miticides...degrade under alkaline conditions. For example, Malathion, Kelthane, Dylox, and Turcam are very sensitive, degenerating within a few hours after diluted in alkaline water...."*

Other pest-control materials can be affected by high pHs. For example, a pH of 8 can reduce the efficacy of Bacillus thuringensis (Dipel, Thuricide, and Javelin) toxins and the insect growth regulator azadirachtin (Azatin)". **See Table 1**

So take the time to check the pH of the water and the tank solution (before and after you add the other components of the tank mix), and buffer the water to the manufacturer's recommended pH range.

NOTE: Never buffer solutions containing fixed copper or lime fungicides, including Bordeaux, copper oxide, basic copper sulfate, copper hydroxide, etc. or lime.

Plant damage will occur if these and similar chemicals are applied at an acidic pH.

Nutrol® EPA Registered Tank Buffer Prevents Alkaline Hydrolysis

And.... it's a Bio-Fungicide & Water-Soluble P & K Fertilizer

Nutrol® is a unique product. Its versatility, safety and multi-purpose capabilities make it a must have tool in your arsenal of turf and crop fertility and disease control products.

Nutrol® is an EPA registered fungicide that can suppress and eradicate powdery mildew (when used alone) and several soil and foliar diseases when tank mixed with Prudent® fertilizers (see Nutrol label for details). Nutrol is also a highly concentrated, low salt index, water soluble P & K fertilizer that quickly corrects phosphate and potassium deficiencies.

And equally important, Nutrol® is an excellent tank buffer that will acidify and buffer distilled water to a pH range of 4.5 – 5.5. Many pesticides can start to lose their efficacy immediately if they are mixed with alkaline solutions. By adding Nutrol® to the tank you can buffer the tank solution and ensure that pesticide and herbicide applications are effective and are delivered to the target pest at the manufacturer's desired activity. This means *fewer re-sprays, more consistent performance, and reduced chemical usage and labor costs.*

Nutrol® is a true buffer. Not only will it acidify water but, once the tank solution reaches equilibrium, it will maintain a constant pH while you mix and apply the chemical.

It's error-free since you can't add too much Nutrol® to the tank (see Chart 1).

Nutrol® is easy to use:

- Determine the manufacturer's recommended pH for the product you intend to apply.

- Check the pH of your water. Perform a jar-test to determine how much Nutrol® is needed to buffer the water to the desired pH. (see Table 2 and Chart 1 for procedures).

Note: a 1% solution is the typical application rate.

- Add half the water to the tank.

- Slowly add Nutrol® to tank while agitating the solution.

- Add the remaining water and continue agitation. Nutrol® is completely soluble.

- When pH reaches the desired pH add other components to the tank.

- Apply immediately after mixing.

Nutrol® is available from your local Performance Nutrition® dealer in two easy to use package sizes: 50 pound bags, and, in cases holding 5 x 8 pound "Acre-Pack" bags (1 – 2 bags treat 1 acre).

Table 1: Information about the Half Life of Pesticides at Different pH					
Common Trade Names	Chemistry	Optimum	Alkaline	Neutral	Acidic
		pH	(pH 8-9)	(pH 7)	(pH 4-6)
Weedar	2,4-D amine	4.5	Unstable	Stable	Stable
Dithene	Acophthalic	7	16 days	46 days	40 days
Assail	Acetamiprid	5 to 6	unstable	stable	unstable
Mitac	Avantra	9.2	35 hours	15 hours	1.2 hours at 5.1
AATrex, Atratol, Fogard, Gesaprim, Griffex, Mebazine, Primatol A, Vectal	Atrazine	Decomposes slowly in alkaline solutions; rapidly if lime is present.			
Guthion, Azinil	Azin-phosmethyl	5.5	12 hours	10 days	17 days
Heritage	Azoxystrobin	Stable over a wide range of pH.			
Acrole, B 401, Bactinos, Bactis Dipel, Faray, Genral, Lavelin, Vectolac	Bacillus thuringiensis	<7-8.0	Incompatible with highly alkaline materials.		
Turcam, Dycarb, Genate, Multamat, NC 6897, Niomil, Rotate, Sedox, Seedoxin, Tattoo	Bendiocarb	5	45 minutes	3 days	48 days
Tabstar	Bifenthrin	Stable over pH range 5 to 9			
Agrocit, Benlate, Benosan, Fundazol, Tersan 1991	Benomyl	5	Unstable	1 hour	80 hours at 5.0
Captaf, Captanea, Captazel, Captal, Merpan, Meteorol, Orthocidol, Phytocap, Sepicap, Sereve	Captaf	5	30 minutes	8 hours	32 hours at 5.0
Sevin, Arylam, Bug Master, Carbamec, Carbamine, Crunch, Denapon, Devicarb, Dicarbam, Hexavin, Karbaspray, Murvin, NAC, Patrin, Ravyon, Savit, Septene, Tercyl, Thinsec, Tornado, Tricarnam	Carbaryl	7	24 hours	24 days	100 days
Furadan, Furacarb, Bay 20843, Carbasol, Carbamip, Chinufur, Curaberr, Keratufuran, Mex, Pflanzfuran, Ranapart, Yalton	Carbofuran	5	3 days	Stable	Stable
Lorsban, Dursban	Chlorpyrifos	5	1.5 days	Stable	Stable
Banckardier, Bravo, Dacoral 2767, Easterns Ternol, Farber, Jupital, Ole, Pflanzlich, Repulse, Taleberg, Tulficide	Chlorothalnil		Stable	Stable	Stable
Apollo	Clofentezine		4.8 hours	34 hours	
Junction	Copper hydroxide & Manganese	5	Optimum range of 4 to 7		
Ammo, Cymbush	Cypermethrin	4	35 hours	Stable	Stable
Green-Gut, D.Z.N., Spectricide	Diazinon	7	3 weeks	10 weeks	2 weeks
Banvel	Dicamba	5.5	Unstable	Unstable	Stable at 5 – 6
Kelthane	Dicofol	5	1 day	5 days	20+ days
Cygon, DeFend, Dimate	Dimethoate	4	48 minutes	12 hours	21 hours
Gowan Dimethoate E267	Dimethoate	5	1 hour	12 hours	20 hours
Ortho Diquat	Diquat	Stable at pH 7 or below; decomposes in alkaline conditions.			
Di-syston	Disulfoton	5	7 hours	32 hours	60 hours
Thiodan	Endosulfan	6.5	Unstable	Stable	Stable
Ethion	Ethion	8	8.4 weeks		
Baytex	Fenthion	Incompatible with alkaline material.			

What is pH?

pH is a scale that expresses the concentration of hydrogen (H) ions in a solution. It represents the acidity and alkalinity of a solution on a range between 1 and 14. A pH of 7 is neutral, less than 7 is acid and more than 7 is alkaline.

What does "half-life" mean?

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 in the water by one half, i.e. 100% to 50% to 25% to 12.5% to 6.25%, etc.

Information about the Half Life of Pesticides at Different pH, Continued					
Common Trade Names	Chemistry	Optimum	Alkaline	Neutral	Acidic
		pH	(pH 8-9)	(pH 7)	(pH 4-6)
Fusilade	Fluazifop-P-butyl	4.5	17 days	147 days	455 days
Cutless	Flupyrifamid	Stable over a wide range of pH.			
Revolver	Formasulfuron	7			
Corral	Formetanate		3 hours	14 hours	17.3 days
Aliette	Fosetyl-al	6	unstable	stable	stable
	Glyphosate	<7.0	Should not be mixed with alkaline materials.		
RoundUp	Glyphosate	3.5-4.0			
Admiral, Merit	Imidacloprid	7.5	Greater than 31 days at pH 5-9		
Rovral, Chipco 26019	Iprodione	Chemical breakdown at pH above 8.0			
Cythion, Fyfanon	Malathion	6	19 hours	3 days	15 days at 6.0
Ridomil, Subdue Maxx	Metaxyl	5 to 9	Buffer to a pH of less than 7.5		
Lannate	Methomyl		Unstable	Stable	Stable
Nudrin	Methomyl		39% loss in 6 days		Stable at 5.5 - 6
Manar	Metsulfuron methyl isozonate	>7	May degrade in acid solutions in 24 hours.		
Nova	Myclobutanil	Not affected by pH.			
Diflora	Naled	5	48 hours	Stable	Stable
Vydate	Oxmyl	5	30 hours		Stable at 4.7
Parathion, Metacide, Thiophos	Parathion	7	29 hours	120 days	
Prowl	Pendimethalin		Stable	Stable	Stable
Amibush, Astro, Pounce	Permethrin	4	Unstable	Stable	Stable
Zolone	Phosalone	6	Stable	Stable	9 days
Insidan	Proxone	4.5	4 hours	12 hours	13 days at 4.5
Dimecron	Phosphamidon		30 hours	13.5 days	74 days
Thimet	Prochloraz chloride	6	Unstable	Stable	Stable
Ornite, Comite	Propargite	6.0	1 day at 9.0	331 days at 6	17 days at 3
Orbit	Propiconazole	Stable at pH 5 to 9			
Princep	Simazine	5	24 days		96 days at 5.0
SpinTor	Spinosad	6	200 days	stable	unstable
Matador	Tau-fluvalinate	6.5	Unstable	Stable	Unstable
Gardona	Tetrachlorvinphos		80 hours	44 days	53 days
Cleary 3336	Thiophanate-methyl	6 to 7	Unstable	Stable	Unstable
Bayleton	Triadimefon	Stable over a wide range of pH.			
Dylon	Trichlorfon	6	63 minutes	6.5 hours	3.2 days at 6.0
Monument	Trifloxy sulfuron-sodium	7			
Insignia	Pyraclastrobin	Stable over a wide range of pH.			
Treflan	Trifluralin	Very Stable	Stable	Stable	Stable