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WATER QUALITY AND ACIDIFICATION

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One of the most important factors in growing a quality crop is the water you use. For many growers in the Upper Midwest, water can present some problems. We often have both high water pH and alkalinity. High pH can limit plant growth by limiting nutrient availability in the medium. This article will discuss how you can alter your water pH to insure that your water source will not limit plant growth. Some of the infomation in this article was taken from an excellent article written by Dr. David Hartley which appeared in the first issue of the Professional Poinsettia Growers Association Bulletin.

Water pH is the measure of the concentration of hydrogen ions and hydroxyl ions in water. The term pH is a way of expressing acidity or basicity. The optimal levels for plant growth generally range from 5.8 to 6.5. Alkalinity is a measure of the water's ability to neutralize acids and is expressed as the amount of calcium carbonate ($CaCO_3$) equivalents in the water (mg/l). Bicarbonates, carbonates and hydroxide ions contribute to the alkalinity of water. The pH measurement of water is not always a good indicator of alkalinity. It is possible for a water sample to have a high pH and a low alkalinity measurement. In this case it may take very little acid to neutralize the water to levels acceptable for plant growth. Water pH is relatively easy to control when the alkalinity is low. Altering water pH is more difficult when the water alkalinity is high.

Water with high alkalinity can increase the pH of growing media and restrict the uptake of nutrients, especially micronutrients (see article in the January 1992 issue of the bulletin). Alkalinity can be controlled by using acid fertilizers if the alkalinity level is not too high. More often, in our area, alkalinity is controlled with the use of mineral acids such as phosphoric, nitric or sulfuric acid.

High water pH and alkalinity can decrease the effectiveness of pesticides and growth regulators.

Reducing water pH and alkalinity is a simple procedure.

Before you attempt to adjust your irrigation water pH you must consider your water pH, water alkalinity and the type of acid you want to use.

Most soil testing services will provide this information with a standard water test if you request it.

Table 1. *To determine Factor A by the water pH.*

Raw water pH	A	Raw water pH	A
6.5	.103	7.6	.468
6.6	.184	7.7	.475
6.7	.249	7.8	.480
6.8	.301	7.9	.484
6.9	.342	8.0	.487
7.0	.374	8.1	.490
7.1	.400	8.2	.492
7.2	.421	8.3	.494
7.3	.437	8.4	.495
7.4	.450	8.5	.496
7.5	.460	8.6	.497

High water pH and alkalinity can decrease the effectiveness of pesticides and growth regulators. Chemicals may have no or decreased effectiveness if the pH of the water used to mix the pesticide is too high. It is, therefore, advisable to neutralize water before adding pesticides or growth regulators.

Reducing water pH and alkalinity is a simple procedure. However, working with acid solutions requires some caution. Primary considerations in working with acid solutions include:

1. Acids are corrosive and need to be handled with care.
2. Always pour acid into water when diluting it to avoid adverse reactions.
3. Acids can corrode iron and galvanized pipes and release toxic levels of zinc and other metals into your irrigation water. Use plastic pipes whenever possible.
4. Make sure your injector is designed to be used with acid. Corrosiveness of an acid can ruin the head of your injector.
5. Because of the reaction of acids with some chemicals, whenever possible use a two-headed injector to prevent chemical reactions you don't want.
6. Don't use phosphoric acid in propagation mist water. Growing points on cuttings and young plants can be deformed from excess phosphorus. If pH and/or alkalinity is a problem, you may need to switch to rain water or deionized water.

The Poinsettia - The Journal for Poinsettia Professionals, Volume 1, contains a formula for calculating the amount of acid to add to neutralize your water. Before you attempt to adjust your irrigation water pH you need to know your water pH, water alkalinity and the type of acid you want to use. Most soil testing services will provide this information with a standard water test if you request it. By knowing these factors and using the tables shown in this article you can easily calculate the amount of acid you need to use in your water.

To calculate the amount of acid you need, use the following equation:

A x B x C = the amount of acid per measured volume of water

Factor A is taken from Table 1 and is associated with initial water pH.

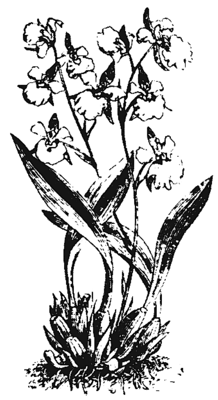
Factor B is the milliequivalents per liter (meq/l) of $CaCO_3$ in the water. This is a measure of alkalinity. Most water analyses report alkalinity in mg $CaCO_3$/l or ppm $CaCO_3$. To determine meq/l, divide the mg $CaCO_3$/l or ppm $CaCO_3$ by 50.

Table 2. *To determine Factor C depending on the acid being used.*

Acid Source	Fluid Oz. 1,000 Gal. Water	Milliliters/10 Cubic Meters Water
75% Phosphoric	10.6	828
85% Phosphoric	8.74	683
93% Sulfuric	3.72	290
614% Nitric	15.6	1218

Table 3. *Determine the amount of plant nutrients each acid contributes to irrigation water.*

Acid	Element	*ppm Supplied in* 1 fl. oz./ 1,000 gal.	100 ml/10 Cubic Meters
75% Phosphoric	23.9%P	2.93	3.75
85% Phosphoric	27.0%P	3.55	4.55
93% Sulfuric	30.4%S	4.2	5.6
61.4% Nitric	13.6%N	1.4	1.9



Factor C is taken from Table 2 and is associated with the type of acid you desire to use.

Sample Calculation:

Assume your water pH is 7.5 and the alkalinity is 439 mg $CaCO_3$/l. You have 75% phosphoric acid available to use for water treatment. Using the tables given you can calculate the amount of acid needed to lower your water pH to 6.4.

Remember A x B x C = ounces of acid needed/ 1000 gallons of water.

From Table 1 the factor for pH 7.5 is 0.460.

Factor B is calculated by dividing 439 mg $CaCO_3$/l by 50 which gives 8.78 milliequivalents (meq/l) of $CaCO_3$.

Factor C, from Table 2, for 75% phosphoric acid is 10.6.

Therefore,

.460 x 8.78 x 10.6 = 42.8 oz.

(realistically 43 oz.) of 75% phosphoric acid per 1000 gallons of water to lower the pH to 6.4.

Remember that when you are adding acid to irrigation water, you are also adding the nutrient associated with the acid. Table 3 shows how much nutrient is being added when applying different acids. The amount of phosphorus added in our example is 125 ppm.

Remember that when you are adding acid to irrigation water, you are also adding the nutrient associated with the acid.

Information for this article has been taken from:

The Poinsettia - The Journal for Poinsettia Professionals. 1992. Volume 1. pp. 2-5.

The Ball Red Book. 1991. 15th Edition. pp. 243-258.

Greenhouse Management. 4th Edition. pp. 234-237.