

A Dynamic Duo

Tips on how you can get the most out of your water quality and fertilizer programs.

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First, get a water test

Testing your irrigation water can help determine an appropriate fertilizer program that sufficiently meets nutritional requirements while managing optimal substrate media pH. There are many labs available that offer water quality testing.

Regardless of the lab you choose, make sure to measure some specific horticultural parameters. These include pH, alkalinity, electrical conductivity (EC), primary (i.e., nitrogen, phosphorus, potassium) and secondary (i.e., calcium, magnesium, sulfur) plant macronutrients, as well as micronutrients such as iron. Sodium and chloride, which can negatively affect plant growth in large quantities, are also valuable to measure.

The quality of your "clear water" or water directly from your main irrigation source (e.g., wells, ponds, city water, etc.) without any additional inputs (e.g., fertilizer, acids, bases) should be determined year to year, as water quality can change, even seasonally. At a minimum, it's a good idea to have your water tested annually.

Table 1. Examples of acid- and basic-forming fertilizers.

All-Purpose Acid-Forming Fertilizers	Calcium Containing Basic-Forming Fertilizers
21-5-20	15-0-15
20-10-20	15-0-14
20-7-20	15-0-0
20-3-19	14-0-14
19-2-19	13-2-13
18-8-17	
15-3-25	

The relationship between alkalinity and substrate pH

Alkalinity is a measure of the dissolved bicarbonates and carbonates (typically associated with calcium, magnesium and sodium) in water. If calcium and magnesium bicarbonate sound a lot like limestone to you, that's because they are! Unless steps are taken to mitigate excessive alkalinity, the accumulation of these bicarbonates in the growing media will cause soil pH to rise. This will in turn affect the availability of essential nutrients for the plants, as most of them become less available as soil pH rises.

Alkalinity can also be described as buffering capacity or resistance to pH change. Low alkalinity water offers little or no resistance to pH changes coming from acids (e.g., sulfuric acid) and fertilizers. High alkalinity water overwhelms or lessens the effects of acids and bases, and becomes the controlling factor of media pH.

How fertilizer affects substrate pH

Fertilizers can have a significant impact on raising or lowering substrate pH. The relative "acid-forming" or "basic-forming" ability of a given fertilizer is primarily

determined by the percentage and/or ratio of ammonium and nitrate in the fertilizer.

For example, fertilizers with high amounts of ammonium (e.g., 21-7-7) are considered acid-forming fertilizers, whereas fertilizers containing predominantly nitrate forms of nitrogen (e.g., 15-0-15) are considered basic-forming. The relative acid/basic-forming ability or "Potential Acidity or Basicity" of a fertilizer can typically be found on most fertilizer labels below the guaranteed analysis (Figure 1). Please reference Table 1 for commonly used examples of acid- and basic-forming fertilizers.

Bringing alkalinity back into the conversation, we can now combine our understanding of how both alkalinity and fertilizer choice work together to influence substrate pH. Each plant species has an optimal substrate pH in order for all the required macro and micronutrients to be available for plant uptake.

Poinsettias, for example, have an optimal substrate pH of 6.0 to 6.5. If we go below or above this range, micronutrients can become overly available (i.e., nutrient toxicity, Figure 2) or unavailable (i.e., nutrient deficiency, Figure 3) for

plant uptake, respectively. We can manage substrate pH by rotating between acid- and basic-forming fertilizers in an appropriate schedule based on the alkalinity of the irrigation water. As shown in Table 2, a poinsettia grower with an alkalinity level of 100 ppm CaCO₃ would irrigate their crop twice with an acid-forming fertilizer and then use a basic-forming fertilizer on the third irrigation. ▶

guaranteed analysis F1313

Total nitrogen (N)	20%
8.00% ammoniacal nitrogen	
12.00% nitrate nitrogen	
Available phosphate (P2O5)	10%
Soluble potash (K2O)	20%
Magnesium (Mg), total	0.1500%
0.1500% water soluble magnesium (Mg)	
Boron (B)	0.0200%
Copper (Cu)	0.0100%
0.0100% chelated copper (Cu)	
Iron (Fe)	0.1000%
0.1000% chelated iron (Fe)	
Manganese (Mn)	0.0500%
0.0500% chelated manganese (Mn)	
Molybdenum (Mo)	0.0100%
Zinc (Zn)	0.0500%
0.0500% chelated zinc (Zn)	

Derived from: ammonium nitrate, monopotassium phosphate, potassium nitrate, magnesium sulfate, boric acid, iron EDTA, manganese EDTA, zinc

Potential Acidity: 401 lbs. Calcium carbonate equivalent per ton. Information regarding the contents and levels of metals in this product is available on the internet at: <http://www.aapfco.org/metals.html>

WARNING: This product contains Molybdenum (Mo) and may be harmful to ruminant animals foraging on grass where applications have been made.

Figure 1. Example fertilizer label for Jack's 20-10-20.

Table 2. Fertilizer rotation frequency based on alkalinity level range.

Water Alkalinity (ppm CaCO ₃)	Rotation for Low pH Plants (pH 5.3-5.8)		Rotation for High pH Plants (pH 6.0-6.5)	
	Acid Fertilizer	Basic Fertilizer	Acid Fertilizer	Basic Fertilizer
0-79	2	1	1	1
80-149	3-4	1	2	1
150+	4	1	3	1