



St. Augustine Orchid Society

www.staugorchidsociety.org

Calcium and Magnesium – The Other Macronutrients

by Sue Bottom, sbottom15@hotmail.com

My understanding of what is and what should be in the fertilizers we use for our orchids has evolved over time. First you learn that the three letters on fertilizer container represent the percentage of nitrogen, phosphorus and potassium present in the fertilizer. Then you get treated to a missive on the nitrogen forms, the nitrate and ammoniacal nitrogen that are available to your plant and the urea nitrogen that is not easily used by your orchid. Then you learn about micronutrients, the trace amounts of iron, copper, boron and all the rest.

The current buzz is about the calcium and magnesium required for your plants to thrive. They may be present in your water supply in adequate amounts although you will only know this if you have your water tested or if you learn to recognize the signs of their deficiency. Calcium and magnesium are considered macronutrients along with nitrogen, phosphorus and potassium. If you remember your high school chemistry, calcium and magnesium are both listed in the second column of the Periodic Table so they tend to react similarly in chemical reactions. However, they are absorbed and used in your orchids very differently.

Calcium and Your Orchid. You know that we people require calcium for healthy bones. Orchids use calcium similarly, to build cell walls among other things. It is absorbed through the root tips and pulled through the plant via the xylem during the transpiration process, being transported from the roots to the leaves and newly growing parts of the plant. It is phloem immobile, so it cannot be translocated from older leaves to newer leaves. Thus calcium deficiency will first appear at the most rapidly expanding tissue, like new growths and leaves.

Examples of Calcium Deficiency in Cattleyas



The most rapidly expanding tissue is affected first, such as new growths and leaves



You might think your plant has black rot, but this problem is physiological rather than pathological

Calcium deficiency occurs when there is rapid plant growth in the absence of sufficient calcium. If you like fresh tomato sandwiches from your garden, you've learned that calcium



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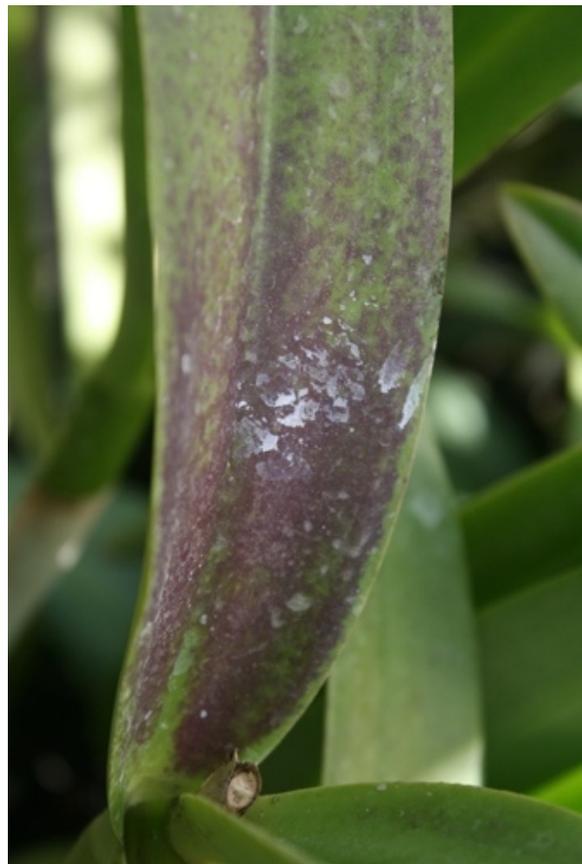
deficiency is what causes blossom end rot in tomatoes. Cattleyas are the orchids most prone to calcium deficiency, particularly those that grow very rapidly during the warm, sunny, moist summer season. You may mistake the symptoms of calcium deficiency for the dreaded black rot that can plague your cattleyas during the hot season. But this tissue damage is not from water molds, it is caused by insufficient calcium to produce new tissue. Roy Tokunaga of H&R Nurseries reports that supplying sufficient calcium to your plants will not only reduce the incidence of black rot but may even protect the plant from infection by the water molds that cause black rot.

Magnesium and Your Orchid. Your plants use magnesium to produce chlorophyll, which is used in the photosynthesis process as well as other metabolic processes. Like calcium, magnesium is absorbed by the roots and carried through the plant in the xylem during normal transpiration. Unlike calcium, magnesium can also be carried in the phloem that transports organic nutrients like sucrose throughout the plant wherever needed. This means the magnesium can be translocated from older leaves to newer leaves. Thus magnesium deficiency will first occur in the older leaves that are sacrificed for the new growth.

Examples of Magnesium Deficiency



Cattleyas grown in bright light with insufficient magnesium may exhibit mottling indicative of chlorophyll damage



Leaves may turn a reddish purple after exposure to cold if they are magnesium deficient. Correct this with a megadose of Epsom Salts (1 tsp/gal).



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Calcium and Magnesium Supplements. There are lots of options for supplying additional calcium and magnesium to your orchids, from prepackaged fertilizers to special additives. You can also top dress pots with powdered dolomitic lime that will supply both calcium and magnesium to your plants although it may also raise the pH of your potting mix. Gypsum (calcium sulfate) is an alternative for supplying calcium without raising the pH of the mix. There are controlled release fertilizer formulations that also contain calcium and magnesium. You can add water soluble supplements like calcium nitrate and Epsom salts, though you would never add the calcium and magnesium supplements concurrently because they will react and precipitate into a sludge. The amount of calcium and magnesium supplied by several supplements is given in the table below. I am not aware of any calculation for estimating the amount of calcium or magnesium that is released to your plants from top dressing with timed release fertilizer.

Some Water Soluble Supplements for Supplying Calcium and Magnesium				
	Addition Rate (tsp/gal)	Concentration (ppm)		
		Nitrogen (N)	Calcium (Ca)	Magnesium (Mg)
Peters Excel Cal Mag Special 15-5-15 5% Ca 2% Mg	1/4	49	16	6
	1/2	97	32	13
	1	194	65	26
Calcium Nitrate	1/4	50	62	-
	1/2	101	124	-
Epsom Salts (Magnesium Sulfate)	1/8	-	-	16
	1/4	-	-	33
	1/2	-	-	66
	1	-	-	130
	3	-	-	395

The amount of calcium and magnesium present in your water will define how much supplementation is required. You can send a sample of your water to [JR Peters](http://www.jrpeters.com) for analysis and they'll throw in a fertilizer recommendation or you can send a sample of your water to a laboratory like [QAL](http://www.qal.com) for analysis, at a cost of less than \$40. Approach your orchid society for sponsoring water tests on local water supplies so a general recommendation can be made for what fertilizer regimen is optimum in your area. In St. Augustine, our shallow well water is very alkaline, high in total dissolved solids and calcium but has very little magnesium. I use pond water during the warm season. It is a mixture of well water and the more pure rainwater so it is low in alkalinity, dissolved solids, calcium and magnesium.

St. Augustine Water Quality		
Constituent	Well Water	Pond Water
Alkalinity (ppm)	430	46
Total Dissolved Solids (mmhos/cm)	1.02	0.32



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Calcium (ppm)	164	26
Magnesium (ppm)	7	4

Clearly the water in our area is calcium rich and magnesium poor, so using Epsom salts should be an integral part of our fertilizer regimen. I set a target nitrogen level of 50 ppm suitable for cattleyas, and use additional timed release fertilizer on my heavy feeders like the catasetums. In the growing season when watering using the low alkalinity pond water, I use about 1/4 tsp/gal of cal mag fertilizer plus a little less than 1/8 tsp/gal of Epsom salts. During the winter resting season when watering with the warmer, highly alkaline well water, I use 1/8 tsp/gal of 21-5-20 fertilizer and almost 1/4 tsp/gal of Epsom salts. I fertilize every time I water, and I should be more rigorous about flushing the pots monthly with fresh water.

Fertilizer Regimen to Provide Full Suite of Plant Macronutrients			
	Target Nutrient Levels (ppm)	Summertime - Pond Water (ppm) 1/4 tsp/gal Cal Mag Fertilizer 3/32 tsp/gal Epsom Salts	Wintertime - Well Water (ppm) 1/8 tsp/gal 21-5-20 Fertilizer 3/16 tsp/gal Epsom Salts
Nitrogen	40 - 100	52	40
Phosphorus	10 - 20	13	4
Potassium	40 - 100	43	32
Calcium	40 - 80	41	164
Magnesium	20 - 40	23	29

Once you know the calcium and magnesium content of your irrigation water, it is easy to tailor a fertilizer regimen for your specific conditions. For those of us in Florida with highly alkaline, high calcium and magnesium deficient water, fertilize with equal parts of a balanced fertilizer like 20-20-20 or 20-10-20 and Epsom salts. Your plants will reward you with increased vigor and loads of flowers.