



e-GRO Alert

Zonal Geranium Chlorosis

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As the weather warms up and light levels increase, growers producing zonal geraniums may discover chlorosis-like symptoms, despite having a good fertility program. You may have purchased an excellent soil, and used the best watering techniques, but the chlorosis symptoms arrive just as the season picks up speed. I am seeing quite a bit of this in Georgia this spring, especially with really busy growers and small family growers. It is not a mystery, but rather a specific response zonal geraniums exhibit that we need to be aware of. First, I'll describe what's happening, and then we'll cover the simple steps can eliminate the problem.

To begin, most plant roots have the ability to exude acid. Some do so readily in response to ammonium fertility. It is assumed that this release of acidity is compensation for the uptake of positively charged ammonium ions. Geranium roots are somewhat unique in that they use acidity to even greater lengths. Geraniums need phosphorus to grow well. The trouble starts when the greenhouse warms up and the light levels increase mid-spring. Most growers know this is when the linear or fast, vegetative growth phase occurs and we start pushing the plants with fertility. At this point several things

happen. Greater light and temperature increase water uptake from the soil solution, and with it, the solution nutrients the plant needs. Rapid growth utilizes soil solution fertility much more quickly, and of all things, leads to a depletion of phosphorus in the soil solution. As growers, we use low phosphorus fertilizers to limit stretch of bedding plant for example. With zonal geraniums, a depletion, and the resulting deficiency of phosphorus triggers the roots to hyper-release acid into the soil. This acid makes soil-bound phosphorus more available, so the needs of the plant can be met.

There are other things that can induce this production of acid. Research by Matt Taylor et. al., showed that high soil temperatures alone can trigger this acid release. On top of that, their

Good ASHS publications by Matt Taylor, Paul Nelson and Jonathan Frantz to read on the USDA website:

J. AMER. SOC. HORT. SCI. 133(4):508–514. 2008.
Substrate Acidification by Geranium:
Temperature Effects.

J. AMER. SOC. HORT. SCI. 133(4):515–520. 2008.
Substrate Acidification by Geranium: Light Effects
and Phosphorus Uptake.



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e-GRO Alert

Volume 2, Number 5
February 2013

www.e-gro.org

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The very first signs that something may not be right with the pH of your soil. Testing at this stage will reduce crop delays and loss.



D. Cox, UMass

Here is a classic image of advance stages of Geranium pH disorder taken by Dr. Doug Cox. Don't let this happen to your Geraniums!



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research clearly showed that high light levels reduce phosphorus uptake and thus trigger the acid release problem. All three conditions exist in most greenhouses in late March and April. So you would be correct in assuming that when growing zonal geraniums, it is important to keep light levels moderate, around 3500 foot candles, and keep the light diffuse, which happens naturally if grown under plastic. If growing under glass, some geranium producers use old-fashioned white wash to accomplish this. Keep your greenhouse day temperatures under 90 degrees and maintain a moderate phosphorus fertility program. Phosphorus levels in your medium should hover around 20 ppm.

Sounds simple right? The trouble is that acidity is doing something else too. Root-induced hyper-acidifying can sometimes lower pH by as much as two units. This is a 100 x increase in acidity! When your soil pH goes from 6.7 to 4.7, the plant also hyper accumulates ions such as iron and manganese, thus your geranium expresses iron toxicity symptoms, which look a lot like a general chlorosis, or pale yellowing of the leaves. (See: Understanding Plant Nutrition: Geranium Nutrition. By Bill Argo and Paul Fisher, December 28, 2009, Greenhouse Grower Magazine).

OK, so you discover your geraniums don't look quite right. What to do? 1) Do a soil test!!! Don't assume it's an acid soil condition. If your pH is above 7.0, add iron sulfate. However, if your soil pH is below 6.2, take steps to adjust it to 6.6 as a goal. You can do this by top dressing with dolomitic limestone, or if you are a gambler, drench with a flowable lime solution. Simultaneously, you can change over from a relatively high ammonium fertility program, to one that is primarily nitrate based. Nitrate-based fertilizers induce far less root-produced acid than ammonium-based fertility programs. 2) Lower your mid-day light levels to around 3000 foot candles. 3) Try your best to keep greenhouse afternoon temperatures as cool as possible, shooting for no higher than 90 degrees. (I know, in the South, that's pretty wild dreaming). You can also apply a 50 ppm solution of magnesium sulfate (Epsom Salts) to speed up the re-greening if this chlorosis happens close to your market date.

What you do NOT want to do is increase your fertility levels. Since most soluble fertilizers have trace elements such as iron and manganese in them, you are exasperating the problem by upping the rate. Bill Argo and Paul Fisher recommend the following levels of EC: "(2:1 test equals 0.4 to 1.0; saturated media extract equals 1.0 to 2.0; pour-through equals 1.5 to 3.0). If media-EC is 1.0 mS/cm above the recommended maximum, leach with clear water." You might also consider actually dropping your fertilizer rate by 50 ppm.

Don't expect overnight results. On average, if you have a significant expression of soil pH induced chlorosis, it will take between 10 and 20 days for the treatments to reduce the symptoms to the point one cannot tell it ever happened. One final note: please be very careful if you use flowable lime. Be sure you get the recommendations right, and do make sure you wash off the flowable lime solution from leaves immediately. If your crop is in full bloom, you may need to remove any wide angle spray nozzels and set your spray pressure to low and apply the solution directly to the soil, taking care not to expose florets. It is extremely hard to remove the lime residue from the buds even if no damage has occurred. Next year? Consider increasing your lime component in your soil mix before you plant your geranium crop!