

Why are the Edges of the Geranium Foliage Turning Crispy?

On November 20, the production manager of a 10 acre greenhouse operation located in the Blue River Valley of Kansas paid a visit to a university extension specialist to get some help with the diagnosis of and development of a corrective strategy for a disorder that was affecting his 18,000 zonal geranium (*Pelargonium x hortorum*) stock plants. The grower brought in two plants that showed leaf edge chlorosis and necrosis of the foliage on the lower 1/3 of the plant (see photos below). No problematic symptomology appeared on the leaves in the top 2/3 of the foliage canopy, though this newer growth was slightly stunted than in previous crops at this stage of the production cycle.



The leaf sample shown above was removed from the lower 1/3 of the foliage canopy. Photos show front (above left) and back (above right) of the same leaf.

The conversation between the grower and specialist followed something like this:

GROWER: "What do you think I might have going on here? I'm also seeing these symptoms on a bunch of my zonal geranium cultivars, and very similar symptoms on my ivy geraniums, as well."

SPECIALIST: "Well, something's off-kilter. Did these plants come from rooted cuttings?"

GROWER: "Yeah. We got them in from [Ecke](http://www.ecke.com/new1/catalog_oglevee.asp)—they're Oglevee varieties—for our stock production and potted them up about 5 weeks ago. This yellowing started to become really noticeable within the last week to 10 days."

SPECIALIST: "It doesn't really look like a disease problem, but that's always something to rule out."

GROWER: "I was thinking the same thing. I swung by the Extension Plant Pathology lab on my way here, and based on visual inspection, they don't believe that disease is the problem."

SPECIALIST: "Have you had any insect problems?"

GROWER: "No. We've been able to control all the usual pests. The cuttings always seem to come in with thrips, so I always spray for thrips right away."

SPECIALIST: "Oh yeah? What chemicals did you apply this time?"

GROWER: "We hit them with [Talstar](#)

[<http://www.fmcprosolutions.com/PestControl/Products/InsecticidesTermiticides/TalstarProfessionalInsecticide.aspx>] recently."

SPECIALIST: "That's bifenthrin?"

GROWER: "Yeah. But I don't think that's the problem."

SPECIALIST: "I agree. A phytotoxicity response would not likely confine itself to the lower foliage."

GROWER: "Neither would insect feeding damage."

SPECIALIST: "OK. So tell me about your fertilization program."

GROWER: "Well, we've been using [Peter's Excel 21-5-20 Multi-Purpose fertilizer](#)

[http://petersabc.com/products_2B.php] from Scott's at about 250 ppm N applied at each irrigation.

We've got that high alkalinity problem with our water. We also incorporate pre-plant [Osmocote 14-14-14](#) [http://osmocoteisbest.com/_classicproducts/141414mo34.shtml] at a low rate, 4 lbs/cubic yard of mix."

SPECIALIST: "What's the formulation on that Peter's Excel--do you know?"

GROWER: "I think it's a 21-5-20--acid forming."

SPECIALIST: "Tell me more about your water."

GROWER: "You know, I haven't had it tested in over a year, but the alkalinity has always been high--we inject sulfuric acid to neutralize the alkalinity."

SPECIALIST: "Do you get your water from a well?"

GROWER: "Yeah. It's got a fairly high salt content, so we have a reverse osmosis unit on site and sometimes back-mix the well water with R.O. water, especially for salt-sensitive crops. But that's expensive, and we haven't done it with the geraniums much."

SPECIALIST: "It looks like your mix has some soil in it."

GROWER: "Yeah--about 10 to 15%. And its got peat and perlite, and then that Osmocote that I mentioned."

SPECIALIST: "What about lime and any other pre-plant amendments?"

GROWER: "Ummm, dolomitic lime and a micronutrient package."

SPECIALIST: "Anything unusual about your soil this year?"

GROWER: "No. We bought it in from the same guy and same place as the last 10 years and pasteurized it with methyl bromide like we always do."

SPECIALIST: "You're not going to use the methyl bromide much longer."

GROWER: "Don't remind me."

SPECIALIST: "That's another conversation. So have you done any pH and EC testing?"

GROWER: "Yeah. We took some samples and got EC readings ranging from 1.3 to 1.7 and pH readings ranging from 5.2 to 5.4."

SPECIALIST: "So your mix is a little acid, but within an acceptable range. How'd you do the extracts?"

GROWER: "Two parts water to one part mix. Those EC readings are also higher than we like. We've leached with plain water a couple times since we took those samples."

SPECIALIST: "Well, certainly sounds like nutrition could be at the root of the problem. Leave these plants with me and we'll do some tissue analysis and probably do a saturated medium extract test to verify your pH and EC readings. We sure could use a current water quality test to see what's going on in that area."

GROWER: "OK. So I'll send off a water sample pronto and fax you the results."

SPECIALIST: "And I'll get the SME done and tissue analyzed; when I have all the pieces of the puzzle, I'll give you a call. In the meantime, why don't you."

Assignment: You assume the role of the Specialist.

1. Finish the specialist's last sentence above to include a temporary corrective strategy. Approach this from the standpoint: "Well, even if this advice turns out not to help, it won't hurt in the meantime, and it won't cost much." This grower has 18,000+ plants that have what is likely a nutritional problem--waiting four or more days for all of the test results before beginning a corrective strategy may just be delaying the inevitable. What advice can you give the grower for the short-term based upon what you know from the conversation?

2. Evaluate all of the analyses shown below. Answer the questions:

What is the problem?

What caused it?

How can it be corrected for the long term?

Support your statements by pointing to specifics in the analyses and/or the conversation with the grower.

Water Quality Analyses

Total Alkalinity	276 ppm = 4.5 milliequivalents bicarbonate/liter (me/l)
Chlorides	32.2 ppm
Electrical Conductivity	1.9 (dS/m)
Total Hardness	350 ppm
pH	7.27
Nitrate-Nitrogen	4.1 ppm
Calcium	86 ppm
Magnesium	22 ppm
Sodium	42 ppm
Iron	79 ppm
Manganese	0.3 ppm
Zinc	0.8 ppm
Copper	0.1 ppm

Root Medium Analyses

Saturated Medium Extract (SME)			2:1 Extract		
	pH	EC		pH	EC
Pot 1	5.4	6.9	Pot 1	5.3	2.0
Pot 2	5.2	5.1	Pot 2	5.4	1.6

Tissue Analyses

	K (%)	Ca (%)	Mg (%)	Na (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
Pot 1, young lvs	4.4	1.4	0.4	0.27	1164	25	0.9	8.3
Pot 2, young lvs w/o symptoms	3.9	1.3	0.4	0.28	1126	21	0.7	8.1
Pot 1, old lvs w/symptoms	4.7	2.2	0.6	0.39	1512	30	1.1	8.9
Pot 2, old lvs w/symptoms	3.8	2.6	0.7	0.43	1612	31	1.1	8.7