e-GRO Alert


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Stevia:

High Substrate pH Induced Iron Chlorosis

Stevia is an alternative sweetener and is produced by greenhouse growers as a vegetative plant for garden sales similar to a herb. Stevia is originally from South America and prefers acidic soil conditions.

Stevia (*Stevia rebaudiana*) has gained popularity as an alternative sweetener because it contains glycosides that are up to 300 times sweeter than white cane sugar. In warmer climates (USDA zones 9-11), it is a perennial herb, but it will not overwinter in areas with more severe winters and in those locations, it is treated like an annual. A group led by Dr. David Shew of North Carolina State University conducted extensive field trials to investigate its use as an alternative crop. NC State also a breeding program developing new cultivars suitable to the hot and humid summer conditions prevalent in the Southern U.S.

Figure 1. The newly expanded leaves exhibiting interveinal chlorosis.

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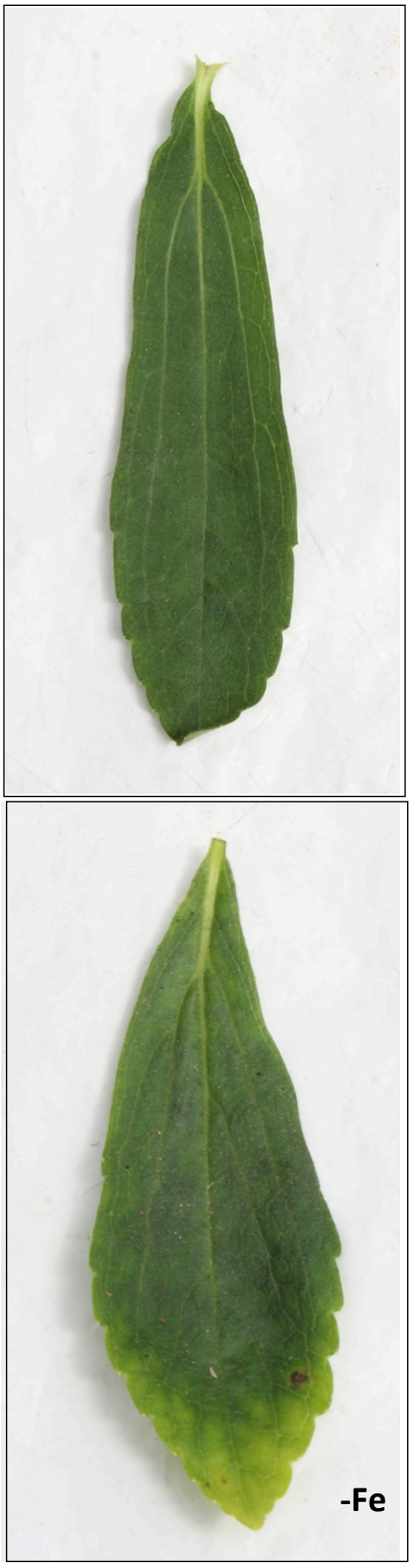
Recently, we observed a group of stevia plants exhibiting yellowing and interveinal chlorosis on the upper leaves of the plant (Fig.1&2). The plants were receiving adequate irrigation and were on an optimal fertility program. A PourThru test was conducted to determine the pH and electrical conductivity (EC) of the plants to accurately diagnose the problem. The pH values on average were 7.9, with a range of 7.7 to 8.3 The high pH accompanied by low EC values of 0.52 mS/cm indicates that iron (Fe) is most likely limited.

All plants have an optimal pH range outside of which plants will struggle. At higher substrate pH levels nutrients such as Fe, manganese (Mn), zinc (Zn), and copper (Cu) become less available to the plant. In most cases plants with abnormally high pH values will experience Fe-deficiency symptoms. Iron is an immobile element in the plant and in result cannot be translocated from lower foliage to meet the plants needs in the new developing portions of the plant. Thus, when attempting to diagnose Fe-deficiency it is important to account for the location of the symptomology to help eliminate other nutrient deficiencies. In this case of stevia, the plants upper portions are exhibiting yellowing and interveinal chlorosis (Fig. 3). Thus, with the combination of symptom location, and the alkaline substrate pH values the cause of the interveinal chlorosis is Fe-deficiency due to elevated substrate pH levels.

Figure 2. The leaf at the bottom is from a stevia plant that was exhibiting high pH induced iron chlorosis on the upper foliage compared to a healthy plant (top) which is exhibiting dark green coloration.



Corrective Procedures:

To manage high pH induced Fe-deficiency, the substrate pH should be monitored to ensure that it stays within an optimal range. The target pH for many species is between 5.8 and 6.2. Higher pH values will result in Fe deficiency and lead to the development of interveinal chlorosis on the upper leaves. Check the substrate pH to determine if it is too high. Be careful when lowering the substrate pH, because going too low can be much more problematic and difficult to deal with. If the substrate pH is just beginning to increase, then first consider switching to an acidic-based fertilizer. These ammoniacal-nitrogen (NH_4 -N) based fertilizers are naturally acidic and plant nitrogen (N) uptake will help moderate the substrate pH over a week or two. Acid water drench can also be used by growers as an intermediate correction if pH levels are not excessively high and a quick reduction of the substrate pH is desired. Use sulfuric acid to acidify your irrigation water to a pH 4.0 to 4.5. Apply this acid water as a substrate drench providing 5 to 10% excessive leaching of the substrate. Rinse the foliage to avoid phytotoxicity. Results should be visible within 5 days. Retest the substrate pH and repeat if needed. If the levels are excessively high, then an Fe chelate application can be made to the substrate.

Below are the options. Iron Chelate Drench (options)

- Iron-EDDHA: mix 5 ounces in 100 gallons of water
- Iron-DTPA: mix 5 ounces in 100 gallons of water
- Iron sulfate: mix 4-8 ounces in 100 gallons of water
- Apply as a substrate drench with sufficient volume to leach the pot.
- Rinse foliage immediately.

Figure 3. Iron chlorosis will occur in the newly expanding upper leaves of the plant. Circled is the region where the high pH induced iron chlorosis was present.

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