e-GRO Alert



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Mimics: Mexican Sunflower

Upon inspection of some problematic Mexican sunflower plants with lower leaf interveinal chlorosis and purplish-black coloration, the initial diagnosis pointed towards a direction, while the data from the leaf tissue and substrate samples supported a different conclusion. Thus this e-GRO Alert points out the importance of supportive data and knowing possible problems when diagnosing plant disorders.

Mexican sunflower or red sunflower (*Tithonia rotundifolia*) is a tall growing background plant that attracts bees, butterflies, and birds. During a grower visit, we were asked to look at a set of plants to help diagnose a case of lower leaf interveinal chlorosis (Figs. 1 & 2) and purplish-black coloration (Figs. 3 & 4). The symptomatic plants were the remainders from a landscape order that the grower fulfilled. As a result, they were mature, in bloom, and fertilization was sporadic.

Figure 1. Intermediate symptoms of interveinal chlorosis on the lower foliage. Normally this is associated with low magnesium (Mg) concentrations, but in this case, potassium (K) was the limited element. (Photo: Brian Whipker)

In North Carolina, our irrigation water is normally low in magnesium (Mg) because we do not have limestone bedrock to supply Mg. Therefore, when one observes lower leaf interveinal chlorosis, there is a very high probability that the cause is due to insufficient Mg. It is also common that late-season crops are more likely to develop a Mg deficiency after any Mg from the dolomitic limestone, which is added to adjust the substrate pH, has leached out.

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Advanced Mg deficiency can also develop into a purplish-black coloration on the lower leaves. This adds uncertainty because low substrate pH levels (<~5.0) result in excess iron (Fe) and manganese (Mn) accumulations, which also results in purplish-black lower leaves. This situation also tends to occur late in the season as the dolomitic limestone leaches out.

With the two primary suspects identified, with an estimated 90% confidence level, the grower was told about the initial diagnosis. To confirm the diagnosis, tissue and substrate tests were necessary. The tests came back with a different conclusion.

Leaf symptomology mimics do occur, which is why visual diagnosis should always be confirmed with testing. This is especially true if the diagnosticians are not familiar with the plant species. None of us had grown Mexican sunflowers before and we did not know what to expect.

Substrate Test Results. The substrate test results primarily reported overall low fertility levels [electrical conductivity (EC) at 0.33 mS/cm]. This was not a surprise because the plants were extras, and thus were being held for an extended period whilst not receiving constant fertilization. Most nutrients were low: nitrogen (N) at 1.49 ppm, phosphorus (P) at 2.6 ppm, potassium (K) at 13.3 ppm, calcium (Ca) at 21.5 ppm, Mg at 6.71 ppm, and sulfur (S) at 29.1 ppm. With Mg being low, that supported the idea that a Mg deficiency was a possible cause.

Yet the substrate pH was 6.40. This was a little surprising because it negated the possibility that a low substrate pH induced micronutrient toxicity as being the cause, but on a positive note, it helped narrow down the diagnosis.

Leaf Tissue Test Results. The results from the leaf tissue analysis tests changed the initial diagnosis (all value interpretations are based on averages for floriculture species because no species-specific recommendations exist for Mexican sunflowers). While low N (2.44%), satisfactory P (0.20%), and satisfactory S (0.26%) concentrations were in the leaves, Mg was excessive (1.65%) and so was Ca (6.42%). In addition, K was considered deficient (1.06%) and Fe excessive at 1280 ppm. Mn (167 ppm), Zn (70.6 ppm), and Cu (7.59 ppm), were considered satisfactory and B was considered elevated at 63.3 ppm.

Figure 2. Initial symptoms of interveinal chlorosis on the lower foliage due to insufficient potassium (K). (Photo: Brian Whipker)

Figure 3. Lower leaf purplish-black coloration on Mexican sunflowers. On other species, low magnesium (Mg) can result in similar symptoms, but here potassium (K) was deficient and iron (Fe) was excessive in the leaf tissue. (Photo: Brian Whipker)

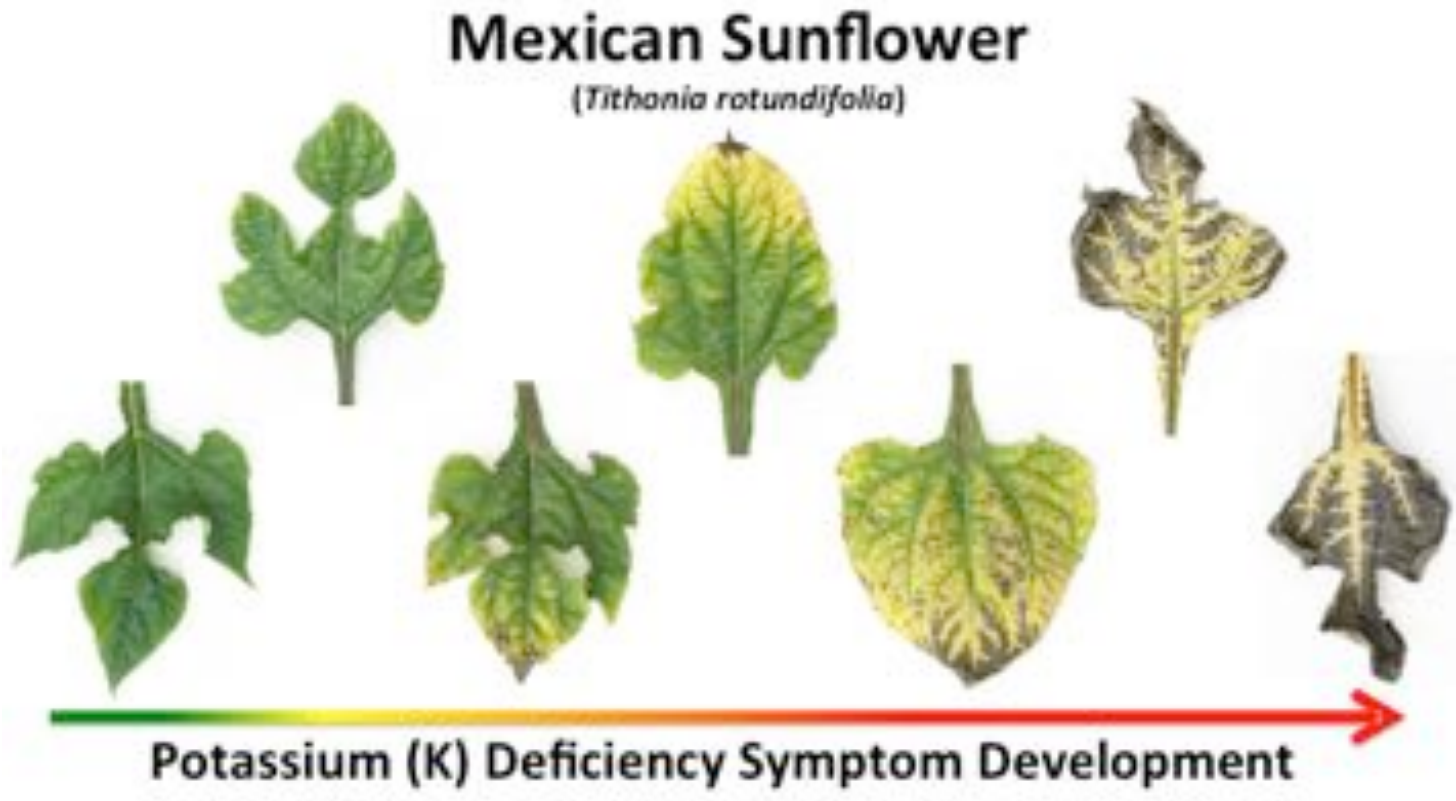

Figure 4. The progression of lower leaf interveinal chlorosis to necrosis in Mexican sunflowers due to low potassium and possibly excessive iron contributes to the purplish-black leaves. (Photo: Brian Whipker)

The high concentrations of Mg discount the possibility of a Mg deficiency. Excessive Ca concentrations can inhibit plant uptake of K and Mg. While K was low, it is doubtful that uptake was limited by the excessive levels of Ca because excessive Ca usually has a greater impact on Mg uptake and those levels were also excessive. This situation suggests that the lower leaf interveinal chlorosis was due to insufficient K fertilizer levels. This conclusion is further supported by the author's observations that plants with a higher proportion of stems usually require a higher supply of K. [Stem tissues usually require higher amounts of K and it is an important component of providing stem strength (Bryson et al., 2014)].

It is far easier to diagnose a problem when only one parameter is causing the issue. It is much more difficult to separate two factors that overlap. The excessive Fe concentrations at 1280 ppm cannot be ignored in the diagnosis. In general, Fe concentrations >800 ppm (Bryson et al., 2014) start to become problematic and leaf symptomology may appear due to toxic accumulations. The excessive Fe concentrations are the most likely what contributed to the lower leaf purplish-black discoloration, although advanced K deficiencies will also result in total necrosis of the lower leaves. How the excessive Fe accumulated is still unknown because, with a substrate pH of 6.40, it is clear it was not caused by acidic substrate levels.

Conclusions.

The diagnosis is a combination of low K and excessive Fe as the most likely causes of this discoloration. But without clear-cut data to support this, one needs to acknowledge the limitations of this diagnosis. Conducting a K rate study to determine optimal K fertility levels and a substrate range experiment would help with clarity on this issue in Mexican sunflowers. In the meantime, consider providing higher levels of K fertilization to Mexican sunflowers and monitor the tissue for elevated Fe concentrations to hopefully avoid this issue.

Additional Resources:

Bryson, G.M. H.A. Mills, D.N. Sasseville, J.B. Jones, and A.V. Barker. 2014. Plant analysis handbook III. Micro-Macro Publ., Athens, GA.

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