e-GRO Alert


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Volume 13 Number 37 July 2024

Zinnia:
Leaf Tips Gone Bad

The high humidity conditions of summer can lead to the development of leaf tip necrosis of zinnias. This situation is visible on the leaves surrounding the flower bud as it develops. This is an environmentally induced calcium deficiency situation.

Figure 1. Tip burn of the leaves that surround the flower bud and leaf distortion can occur when calcium is limited. (Photo: Brian Whipker)

Large pots of zinnias are a popular summer crop. With summer production, tip burn of the leaves that surround the flower bud and leaf distortion can occur (Fig. 1). Upon closer inspection, the tip burn occurs primarily on the set of leaves that form the whorl around the flower bud (Fig. 2). In extreme cases, the next sets of older leaves lower on the stem may also exhibit symptoms (Fig. 3). A secondary *Botrytis* infection may opportunistically form on the dead tissue too (Fig. 4). This disorder has been observed

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each summer over the past few years. The symptoms are typical for a calcium deficiency. At NC State University, we conducted experiments on zinnias by withholding calcium and were able to induce the disorder, thus confirming the cause.

Past research investigating leaf tip burn on Stargazer lilies by Dr. Bill Miller of Cornell University appears to apply to this situation. When the young leaves surrounding the flower bud are forming, that enclosed environment at the growing tip lacks airflow. Calcium uptake by plant roots and transportation within the plant is driven by water loss (transpiration) from the leaves. If the humidity is excessive, water loss decreases, and calcium (and boron) uptake is also limited.

Calcium is a primary building block of plant cells. On most plants, the reproductive flower bud is the preferred tissue (sink) for calcium, especially if it becomes limited. If this occurs, the leaves surrounding the flower bud are then unable to obtain sufficient levels of calcium. As those young leaves complete the final 50% expansion of their ultimate leaf size, their demand for calcium increases. If calcium is limited or lacking, then leaf cell death occurs at the leaf margin. This is what is occurring with zinnia plants.

Figure 2. Tip burn begins on the young set of leaves that form the whorl around the flower bud as observed here in a controlled experiment conducted at North Carolina State University. (Photo: Brian Whipker)

Figure 3. Tip burn can occur on multiple pairs of leaves. (Photo: Brian Whipker)

Management

Control of this environmentally induced, physiological disorder is a challenge.

Provide Adequate Calcium.

For starters, make sure you are supplying adequate levels of calcium either via your irrigation water or fertilizer. Levels of 75 to 100 ppm Ca should be adequate.

Proper Substrate pH.

Maintain the substrate pH between pH 5.6 and 6.2   Calcium available decreases with pH. In addition, substrate pH levels below 5.4 can lead to iron/manganese toxicities (blackish-purpled discoloration of the lower foliage). On the opposite end of the spectrum, calcium availability increases with the substrate pH, but there is a limit of exceeding pH 6.4 because zinnias are not an iron-efficient plant, and with elevated pHs iron deficiencies occur (interveinal chlorosis of the upper foliage).

Humidity.

Controlling excessive humidity may help while being able to do this is a challenge. Avoiding irrigating late in the day to allow excessive water to evaporate will help.

Airflow.

Increased airflow will help improve calcium uptake in the plant. There may be a limit to how effective this will be because the damage to the leaf tips actually occurs when the leaves are just forming inside the growing tip. Note the work by Dr. Miller's graduate student found that with Stargazer lilies one could manually unfold the leaves to expose them to airflow to prevent tip burn. Leaf unfolding most likely will work on zinnias too, but being able to influence that part of the plant is not practically or economically possible.

Calcium Sprays.

Calcium sprays may be an option, but the research is lacking. Calcium chloride (high quality technical grade) at 100 to 200 ppm is commonly applied to poinsettia bracts. That may be a starting point for conducting in house trials on a small scale. The target application timing would most likely be a week before the flower bud set.

Summary

Leaf tip burn is an environmentally induced calcium deficiency that occurs when the leaves surrounding the flower bud out grow the available supply. Increasing airflow and controlling humidity may help prevent the disorder.

Leaf Tissue Analysis.

Submitting a normal tissue sample for laboratory analysis may not confirm lower calcium levels in the leaves. The recommendation is to submit the most recently mature leaves. Calcium levels in those leaves will most likely be within the recommended range. With the symptoms occurring on younger leaves, you would need to submit a sample of those smaller leaves instead. In addition, to magnify the extent of the problem, it would be better to cut off the outside 1 cm of tissue exhibiting necrosis for submission. Calcium levels lower than the recommended range most likely will be present.

Figure 4. A secondary *Botrytis* infection may opportunistically form on the dead tissue. (Photo: Brian Whipker)

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