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# Zinnia: Tip Burn of Young Leaves

*Leaf tip necrosis is a common problem encountered during summer production of zinnias. This problem is due to an environmentally induced calcium deficiency.*



The flower power and low production cost of zinnias (*Zinnia elegans*) have turned this plant into a major summer color crop. During periods of high humidity, tip burn of the leaves that surround the flower bud has been reported. This e-GRO Alert identifies the cause of this disorder.

A number of growers have reported tip burn and leaf distortion on zinnias (Fig. 1, 4). Upon closer inspection, the tip burn occurs primarily on the set of leaves that form the whorl



Figure 1. Necrotic leaf edge burn caused by an environmentally induced calcium deficiency.

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## **e-GRO Alert**

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around the flower bud. In extreme cases, the next sets of lower leaves on the stem may also exhibit symptoms (Fig. 2). A secondary *Botrytis* infection may opportunistically form on the dead tissue too (Fig. 3).

At NC State University, we have observed this disorder over the past four years. It can occur with late spring production and summer production. To duplicate the symptoms, we conducted experiments by withholding calcium and were able to induce the disorder, thus confirming the cause.

The work on Stargazer lilies by Dr. Bill Miller then

at Clemson University, and now at 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 in the plant are 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. With most plants, the reproductive flower bud is the preferred tissue (sink) for calcium, especially if it becomes limited. If this

### **Tissue Testing**

*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 found.*

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Figure 2. Close up of marginal leaf necrosis on most of the upper leaves.



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Figure 3. A secondary *Botrytis* infection has occurred on necrotic leaves which originally died due to insufficient calcium.



Figure 4. Tip necrosis occurring only on the youngest leaves.

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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 zinnias.

### **Management**

Control of this environmental situation may be difficult.

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. 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-purple

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).

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.

Increase airflow will help improve calcium uptake in plants. 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 with Stargazer lilies that one could manually unfold the

leaves to expose them to air flow and that prevented tip burn from occurring. 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 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 flower bud set.

### **Summary**

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