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Hydrangea Nutrition:

Upper Leaf Tip Necrosis - Water Stress or Calcium?

The most common cause of necrotic leaf tip burn of hydrangeas is drought stress. In contrast, tip burn of the youngest leaves has been linked to an environmentally induced calcium (Ca) deficiency. Distinguishing between these two disorders is discussed in this Alert.

Water management of hydrangeas (*Hydrangea macrophylla*) can be a challenge. They are typically grown on the cool side, which tends to limit water use. They also have a very large leaf surface area which results in higher water loss. In addition, they do not close their stomates, so consequently, hydrangeas lack the ability to regulate water loss under drought stress conditions. This can readily lead to wilting and the resulting leaf scorch (Fig. 1).

Leaf scorch is a common problem of hydrangeas. This is often observed when a drip emitter falls out of the pot, and the plant quickly wilts leading to tip burn. Symptoms of an initial light brown necrosis usually appear on the middle to upper leaves. Symptoms begin along the leaf margin closest to the leaf tip. Over time the light brown coloration can

Figure 1. Leaf tip burn readily develops on drought stressed hydrangeas.

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become almost black (Fig. 2). Another key diagnostic characteristic is that the leaf necrosis can expand half way back towards the base of the leaf under severe conditions (Fig. 3).

In contrast, a slight leaf tip necrosis that occurs along the leaf margin of newly expanding leaves has also been observed (Fig. 4). As these leaves expand, they develop a crinkled and cupped appearance because the necrotic leaf margin tissue cannot expand as the internal tissue grows (Fig. 5). These symptoms have been most prevalent after a week of cloudy weather, which would limit transpiration and hence water uptake by the plant. The symptoms develop on plants when the small leaves are still in the whorl and wrapped around the flower buds.

These symptoms have also been reported on other species. Dr. Bill Miller of Cornell University was a co-author of a report that identified the necrosis on 'Stargazer' lilies as being caused by a Ca deficiency (Fig. 6). They found that the flower bud was a greater sink (has preferential demand) for Ca over the leaves that surround the flower bud. Ca bypasses these surrounding leaves and instead goes to the flower buds. Consequently, a Ca limiting situation occurs which results in cell death of the leaves.

Figure 2. Over time the brown leaf discoloration caused by water stress may turn black.

These same conditions can occur with zinnias when grown in the summer under hot and humid conditions. Leaf tip necrosis occurs on the wrapper leaves surrounding the flower bud while the growth is still in the whorl (Fig. 7).

We have observed leaf tip burn on the newly expanding leaves of hydrangeas at three grower locations. A tissue sample was taken of the tissue around the outer margin of the leaf and analyzed for Ca concentration, which was found to be low.

The target substrate pH for pink and white hydrangeas is between 5.8 and 6.2. Blue hydrangeas are grown at a lower pH between 5.2 and 5.5. Thus, a lower amount of lime is typically added to the substrate to keep the substrate acidic. This also means that the amount of Ca provided to

Figure 3. With a severe dry down, necrosis can extend towards the middle portion of the leaf.

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Figure 4. Leaf tip necrosis of the recently expanding tissue on a hydrangea caused by an environmentally and culturally induced calcium deficiency.

Figure 5. Leaf cupping develops when the outside margin of necrotic tissue fails to expand with the leaf interior. The tip necrosis occurred because calcium was limited.

the hydrangea plant is lower. Most Ca-based fertilizers are also basic and are typically avoided to prevent an increase in substrate pH. If Ca does not occur naturally in the irrigation water, then marginally low levels of Ca will be provided to the plants and deficient conditions are more likely to occur.

Calcium deficiency symptoms on the young developing leaves may be exacerbated by high humidity in the greenhouse during flower bud formation. Under these conditions, the lack of plant transpiration limits Ca uptake from the substrate via mass flow. The reduced transpiration limits the available Ca and results in tip burn of the leaves surrounding the developing flower bud. In addition to providing adequate Ca in the range of 50 to 100 ppm, promoting air flow in the greenhouse will help avoid this environmentally induced deficiency. Increased air flow can be achieved by using horizontal flow fans or doing an air exchange to vent the humidity.

Figure 6. With 'Stargazer' lilies, leaf tip burn is the result of a Ca deficiency induced when Ca is preferably transported to the developing flower instead of the developing leaves just below the flower bud.

Figure 7. Tip necrosis can be observed on the leaves that surround the zinnia flower bud. This situation occurs frequently under hot and humid growing conditions.