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# Diagnosing Calcium Deficiency of Marigold Blooms

*Diagnosing calcium (Ca) disorders in flowers and fruits can be challenging due to the lack of comparative standards. Evaluation of marigold blooms for Ca was completed to fill the void.*

Last summer, a marigold flower sample was submitted to the NCSU Plant Disease and Insect Clinic to determine the cause of the blossom discoloration. No data existed for comparison to evaluate the nutrient concentration in the flowers to help with the diagnosis. While preparing for a marigold seminar at Cultivate25, we decided to induce Ca deficiency and sample deficient (Figs. 1-3) and complete blooms of African marigold (*Tagetes erecta*) to determine actual concentrations.

## Calcium Evaluation

Whole blooms were sampled from plants subjected to Ca-deficient conditions, which had developed extensive symptoms, and flowers from healthy plants grown with a complete Hoagland's fertilizer solution. When comparing Ca concentrations in symptomatic flowers and healthy ones, levels were lower in deficient plants (0.09% Ca) compared with 0.39% Ca in the asymptomatic plants. Lower values in deficient plants were expected,



Figure 1. Calcium deficiency results in receptacle necrosis. (© Brian Whipker)

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yet it was surprising to see how low Ca is in healthy blooms.

We also sampled the most recently matured leaves (MRLM) from both healthy and Ca-deficient plants for a comparison. Calcium concentrations were 10X higher in healthy leaves (2.36% Ca) compared with 0.20% Ca in the deficient plants. As a comparison, Bryson and Mills in the Plant Analysis Handbook 3 report African marigold (*Tagetes erecta*) leaf tissue values from survey plants at 0.88 to 2.74% Ca.

Uptake of Ca is influenced by many factors. Of course, having an adequate Ca supply and providing the optimal pH (~6.0) are baseline needs. Calcium uptake is by mass flow, so having adequate airflow and leaf transpiration helps ensure Ca gets moved to the newly developing cells as the plant grows. Leaves actively transpire water, so levels are often adequate. Fruit and flowers are huge sinks for Ca, but those organs often are not overly prolific at transpiration, so deficiencies can readily develop. We can see this with blossom end rot of tomato, internal necrosis of apples (bitter pit), and bract edge burn on poinsettias (bracts are modified leaves and are less efficient at transpiration). So, given the lower transpiration



Figure 2. Black leaf spots appear on the upper leaves when calcium is limited. (© Brian Whipker)



Figure 3. Total flower necrosis occurs with advanced calcium deficiency. (© Brian Whipker)

rate in flowers, it is not surprising to observe lower Ca concentrations in healthy marigold flowers, too.

If problems occur, hopefully, these values offer diagnostic values for evaluating Ca disorders in marigolds.

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