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Nutrient Deficiency in Anthuriums

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NUTRIENT DEFICIENCY IN ANTHURIUMS

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INTRODUCTION

There are 13 mineral elements in addition to carbon, oxygen, and hydrogen that are essential for plant growth. The macronutrients or major elements, nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium, are required in greater amounts than others. Iron, manganese, boron, copper, zinc, chlorine, and molybdenum are called micronutrients or minor elements because very small amounts are required. Inadequate supplies of a nutrient to a plant generally lead to reduced growth and yield. Inadequate quantities of a nutrient in plant tissues cause deficiency symptoms and may cause plant death. Deficiency symptoms may appear on any part of the plant, depending on the function of the deficient element in the plant.

Nutrition is one of the important cultural factors that a commercial anthurium grower can control. However, relatively little is known about nutrient requirements of the anthurium. Fertilization with nitrogen, phosphorus, and potassium increased flower number, stem length, and spathe size of 'Nitta', whereas only nitrogen increased flower number of 'Kaumana' (*5*). In another study, nitrogen deficiency produced light green anthurium leaves and resulted in minimal plant growth, while lack of potassium resulted in decreased flower size and stem length (*1*).

The purpose of this study was to determine symptoms caused by deficiencies of several nutrients in anthuriums. Knowledge of such symptoms allows growers to recognize and correct specific nutrient deficiencies. The study was conducted at the Waiakea Experiment Station in Hilo, Hawaii.

MATERIALS AND METHODS

Twenty-eight mature *Anthurium andraeanum* André cv. Ozaki plants were established in perlite medium in 20-cm plastic pots. The pots were enclosed in a wooden box with a layer of moist vermiculite to provide constant high humidity for plant roots. The experiment was carried out in a fiberglass greenhouse with additional saran cloth to provide 80 percent shade.

The study was installed in a completely randomized design with each treatment replicated in four plants. The control treatment consisted of a modified Hoagland's (*2*) solution containing all essential elements. The deficiency treatment solutions were identical to the control solution except that they lacked either nitrogen (N), phosphorus (P), potassium (K), sulfur (S), magnesium (Mg), or iron (Fe). All solutions were premixed in 20-liter plastic carboys, and solution pH was adjusted to 6.5 with either H_2SO_4 or NaOH. Two hundred ml of treatment solution was applied to each plant twice a week. One hundred ml deionized water was supplied once a week between treatments.

Plants were observed for nutrient deficiency symptoms. When symptoms became severe all the leaf laminae were excised, oven dried, ground, and analyzed with an x-ray fluorescent quantometer. If no severe deficiency symptoms were observed, the plants were allowed to grow for four years before all leaf laminae were analyzed. Tissue analyses of leaves with nutrient deficiency symptoms were compared to analyses of leaves from plants in the control treatment to confirm a specific nutrient deficiency as the cause of the symptoms.

A similar procedure was used to study calcium deficiency symptoms in anthuriums (*3*, *4*). Twelve mature 'Ozaki' plants established in coarse perlite in 20-cm plastic pots were placed in a wooden box with a layer of moist vermiculite. Nutrient solutions with calcium (Ca) concentrations of either 0, 100, or 200 ppm were premixed in plastic carboys, and solution pH was adjusted to 6.0 with either H_2SO_4 or NaOH. The four plants in each treatment were arranged in a completely randomized design. Two hundred ml of treatment solution was applied to each plant three times a week. Calcium content of the leaf laminae associated with a 75 percent mature flower was determined spectrophotometrically.

RESULTS

Anthuriums are relatively slow-growing plants, and nutrient deficiency symptoms did not become evident until several months after initiation of treatments.

Control plants maintained dark green leaves, increased in size throughout the four years of the study, and regularly produced large flowers.

Young leaves of anthurium plants deficient in nitrogen became chlorotic nine to 12 months after initiation of treatments. At 18 months, plants were noticeably shorter than control plants, and all leaves were light green to yellow. At 24 months, plant height was stunted and leaves were appreciably smaller and yellow; only very young leaves were green. At 30 months, plants were short and petioles drooped. Leaves were stunted and yellow with necrotic spots that increased in size. After 30 months, older leaves became increasingly necrotic and then died, with very few leaves remaining on the plant. Very few small to medium flowers were produced by N-deficient plants. Leaves in advanced stages of N deficiency contained 0.62 percent N, while leaves of control plants contained 1.49 percent N.

For photographs and a summary of N deficiency symptoms, see Appendix, Figures 1 through 5.

Phosphorus deficiency symptoms were not observed until more than a year after initiation of treatments. At 18 months, plant growth was noticeably reduced, and leaves exhibited yellow edges and a few brown spots. At 24 months, plants were stunted, leaves were slightly yellow, and younger leaves were smaller than older leaves. At 30 months, the plants and young leaves were stunted with older leaves showing interveinal chlorosis. After 30 months, young leaves were small, narrow, and dark green with short, drooping stems, while older leaves were chlorotic with increasing areas of necrosis along edges of leaves. A few medium to large flowers were produced, and size decreased as the severity of the deficiency increased. Percentage dry weight of P in control plant leaves was 0.17 percent, while P-deficient leaves contained 0.08 percent P.

For photographs and a summary of P deficiency symptoms, see Appendix, Figures 6 through 9.

Potassium deficiency symptoms appeared as a yellowing of older leaves a year after initiation of treatments. By 18 months, plant stunting was evident, leaves were small, and lower leaves yellow. At 24 months, interveinal yellow spots preceded necrotic areas in older leaves. After 30 months, plants were stunted with few leaves. Young leaves were small, narrow, and dark green. Older leaves were chlorotic with increasingly necrotic yellow spots between veins and on edges. Small to medium flowers were produced fairly regularly, but size decreased with increasing severity of the deficiency. Control plant leaves contained 3.25 percent K, while leaves from treated plants contained 0.57 percent K.

For photographs and a summary of K deficiency symptoms, see Appendix, Figures 10 through 14.

Magnesium deficiency symptoms appeared about a year after treatments began. Older leaves and edges of younger leaves became yellow. At 18 months, plants were severely stunted, older leaves showed interveinal chlorosis, and new leaves were light green and distorted. At 20 to 24 months, all except very young leaves were yellow with necrotic areas. Main terminals died and small side shoots were produced on which leaf deficiency symptoms were also apparent. Very few medium-sized flowers were produced; when symptoms became severe, flower production ceased. Control plant leaves contained 0.21 percent Mg compared to 0.08 percent Mg in leaves of deficient plants.

For photographs and a summary of Mg deficiency symptoms, see Appendix, Figures 15 through 18.

Sulfur deficiency symptoms did not appear until after 36 months of treatment. Plants were slightly smaller than control plants, and leaves were slightly chlorotic. Medium to large flowers were produced regularly throughout the study. Leaves from the control treatment plants contained 0.19 percent S compared to 0.08 percent S in leaves of S-deficient plants.

For photograph and a summary of S deficiency symptoms, see Appendix, Figure 19.

Anthurium plants showed no deficiency symptoms from lack of iron. Plants were large and green and large flowers were produced regularly. Tissue Fe content (103.25 ppm) was similar to that of control tissues (105.25 ppm). Iron reserves in plants at the start of the experiment were apparently sufficient to maintain plant development. Alternatively, there may have been a source of Fe contamination in the experimental set-up.

After six months of culture, plants treated with 0 ppm calcium solution produced flowers that developed color breakdown symptoms. Water-soaked lesions that eventually became necrotic occurred initially at the lobe of the spathe and later spread

throughout the spathe. The leaves developed necrotic spots with eventual dieback of the growing tip of the plant. No deficiency symptoms were noticed after 12 months in plants receiving Ca. Calcium content in leaves of plants receiving 0, 100, and 200 ppm Ca were 0.13 percent, 0.86 percent, and 1.16 percent, respectively.

For photographs and a summary of Ca deficiency symptoms, see Appendix, Figures 20 through 22.

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APPENDIX

Figure 1. Nitrogen deficiency. Symptoms first appear as a general stunting of the plant. Control plant on the right, N-deficient plant on the left.

Figure 2. Nitrogen deficiency. Older leaves become yellow as young, actively growing leaves draw N.

Figure 3. Nitrogen deficiency. In prolonged N deficiency, an increasing number of older leaves develop necrosis.

Figure 4. Nitrogen deficiency. Leaf petioles droop.

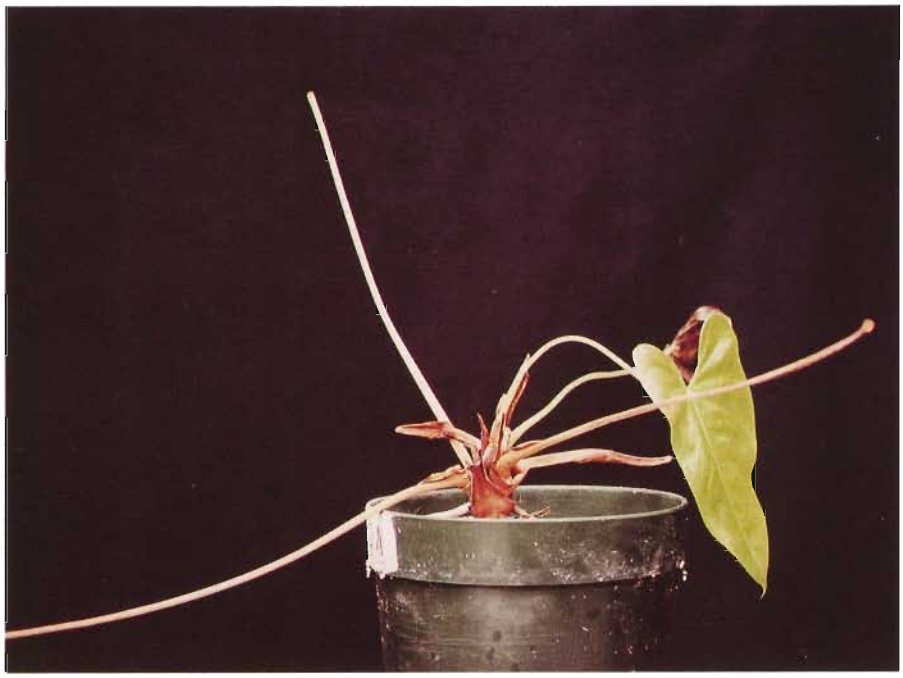

Figure 5. Nitrogen deficiency. Older, necrotic leaves fall off, resulting in the eventual death of the plant.

Figure 6. Phosphorus deficiency. First symptoms include stunting of the plant with some yellowing of leaf edges. Control plant on the left, P-deficient plant on the right.

Figure 7. Phosphorus deficiency. Young leaves (left) are considerably smaller and darker green than older leaves (right).

Figure 8. Phosphorus deficiency. Older leaves may develop interveinal chlorosis.

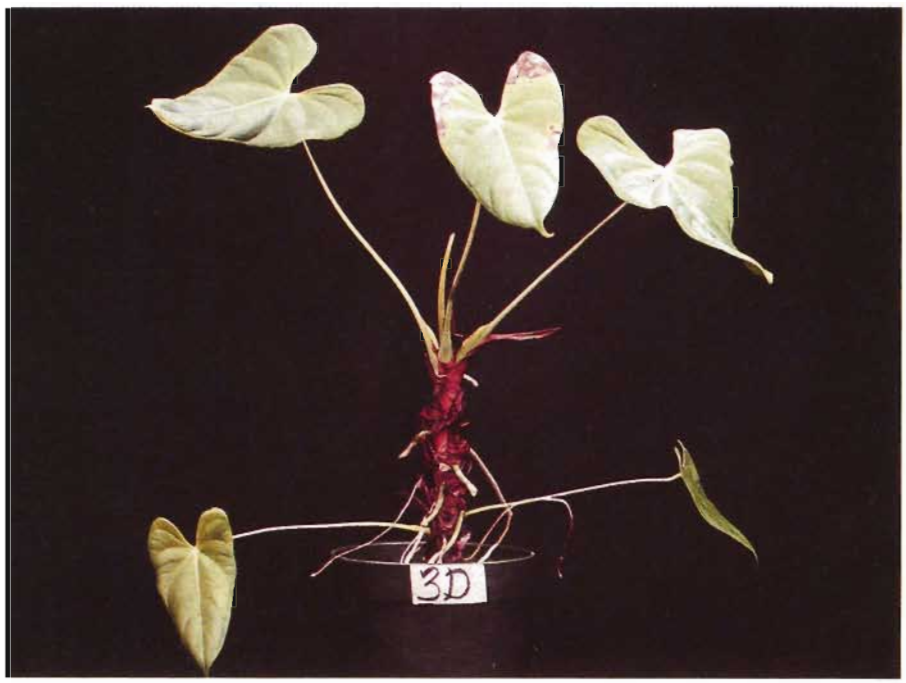

Figure 9. Phosphorus deficiency. In severe cases, leaves and petioles are stunted with necrotic areas increasing on leaves.

Figure 10. Potassium deficiency. Symptoms first appear as stunting of plants and yellowing of older leaves. Control plant on the left, K-deficient plant on the right.

Figure 11. Potassium deficiency. Older leaves exhibit yellow edges and well-defined interveinal spots that develop into large necrotic areas.

Figure 12. Potassium deficiency. Leaves develop interveinal necrotic areas.

Figure 13. Potassium deficiency. Leaf necrosis increases until the leaf dies.

Figure 14. Potassium deficiency. In prolonged K deficiency, young leaves are small and dark green. Older leaf on the left, young leaf on the right.

Figure 15. Magnesium deficiency. Plants first appear stunted with yellowing of older leaves. Control plant on the left, Mg-deficient plant on the right.

Figure 16. Magnesium deficiency. Older leaves develop interveinal chlorosis.

Figure 17. Magnesium deficiency. Chlorotic areas on leaves eventually become necrotic.

Figure 18. Magnesium deficiency. In cases of prolonged Mg deficiency, plants are severely stunted, main terminals may die, young leaves are distorted.

Figure 19. Sulfur deficiency. Plants are slightly stunted and leaves may be slightly chlorotic. Control plant on the left, S-deficient plant on the right.

Figure 20. Calcium deficiency. The leaf margins become irregular initially, then chlorotic, and eventually necrotic.

Figure 21. Calcium deficiency. The young leaves become chlorotic, small, and distorted. Leaf margins become irregular and frequently contain spotted and necrotic areas. New leaves and flowers continue to emerge, but die before unfurling. The entire plant becomes stunted and eventually dies.

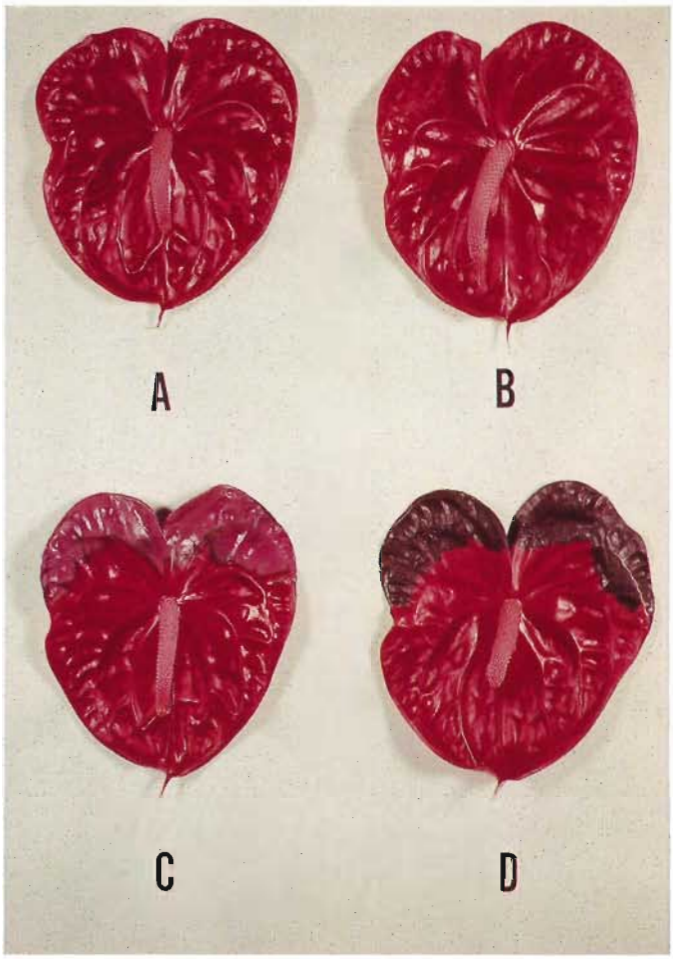

Figure 22. Various stages of calcium deficiency symptoms. A = normal flower; B = flower with lobe section showing tiny water-soaked lesions; C = flower with lobe section showing the lesions coalesced to affect the entire lobe area; D = flower with lobe section turned brown and necrotic. Cv. Ozaki.

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