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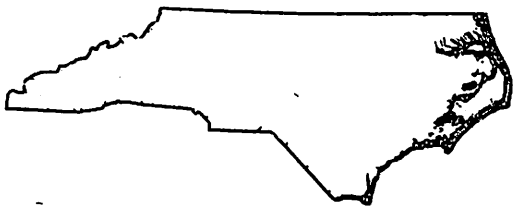

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NUTRIENT DEFICIENCIES OF RIEGER ELATIOR BEGONIA

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A series of experiments were conducted to establish the visual symptoms of the more common nutrient deficiencies of Rieger begonia. All studies were conducted on the cultivar Schwabenland Red. The symptoms can be seen in Figure 1. They are summarized in the following key and are described in detail in the text that follows. A full accounting of this study can be found in Nelson, P. V., D. M. Krauskopf, and N. C. Mingis. 1977. Visual Symptoms of Nutrient Deficiencies in Rieger Elatior Begonia. J. Amer. Soc. Hort. Sci. 101 (1) : 65–68.

a. Chlorosis is a dominant symptom.
  b. Chlorosis interveinal.
    c. Interveinal chlorosis on older leaves followed by light tan necrotic spots within chlorotic areas which expand until leaf dies. . . . . Mg
    cc. Interveinal chlorosis on younger leaves. . . . . Fe
  bb. Chlorosis not interveinal.
    c. Lower leaves uniformly yellow then purplish yellow and finally necrotic. . . . . N
    cc. Margins of canopy leaves yellow, then murky green-brown, and finally necrotic; all symptoms spread toward the leaf center. . . . . Ca

aa. Chlorosis not a dominant symptom.
  b. Necrosis begins along the margin of lower leaves and progresses inward. . . . . K
  bb. Plants stunted but normal green. . . . . P
  bbb. Rust color, striations and cracks develop on young leaf petioles and peduncles perpendicular to their axes; internodes shortened and lateral shoots prolific; young leaves brittle crinkled around rust color spots which turn necrotic; chlorosis and necrosis spreading inward from the margin of young leaves. . B

Nitrogen. Green pigmentation of foliage became progressively lighter, and the foliage eventually turned yellow and finally yellow with a purple cast (Fig. 1A). Loss of color was uniform over each leaf. Chlorosis occurred first at the base of the plant and then progressed upward. The final leaf symptom was light-brown necrosis developing inward along the margin. Growth rate of the plant was greatly reduced, particularly in the lateral shoots. Because few lateral shoots developed to support the main stems, plants fell over easily. The N content of canopy leaves on these plants at 10 weeks of growth was 0.88%.

Phosphorus. Plants were severely stunted, but no other symptoms developed (Fig. 1B). Plants were of normal proportions because all tissues were uniformly smaller in size. Lateral shoots continued to develop. These plants did not fall over. Color was the same as that in the check treatments. The P content of canopy leaves of plants described here and pictured in Fig. 1B was 0.15%.

Potassium. Symptoms originated on older leaves. Yellow-green areas 2-3 mm in diameter developed along the leaf margin and 5-15 mm in diameter over the rest of the leaf. Chlorotic areas along the leaf margin turned medium-brown and died. The K content of canopy leaves at this time was 0.7%. Quickly, chains of necrotic circles formed along the leaf margin and coalesced into bands which then developed inward. Chlorotic spots away from the leaf margin developed medium-brown necrotic centers which continually enlarged (Fig. 1C). This condition was formed at a canopy leaf K content of 0.5%.

Finally the entire leaf died. These symptoms progressed to younger leaves.

Calcium. Deficiency symptoms of Ca originated on canopy leaves as irregularly shaped and sized chlorotic patches, exterior to the center 3 cm of the leaf, at a canopy leaf Ca content of 0.5%. The margins of these leaves eventually became more uniformly chlorotic, followed by the development of medium-brown necrotic spots about 1 mm in diam which continually enlarged, coalesced, and progressed inward until the entire leaf was killed. The Ca content of canopy leaves were 0.13% at that time. These symptoms spread to younger leaves from the canopy leaves (Fig. 1D).

Magnesium. The older leaves turned light green and then large chlorotic patches (0.5 to 1 cm wide) formed between the veins toward the margin of those leaves. The chlorotic patches at the margin of the leaf turned brownish-green and then medium-brown as the tissue died. The necrotic areas extended inward from the leaf margin in a half-moon shape and had concentric rings in them 2 mm apart. The necrotic areas expanded along the leaf margin, eventually connecting with one another. While the necrotic areas at the leaf margin formed, patches of cells 1 to 4 mm in diam developed a sunken and grey appearance in random locations from the margin inward to a distance of 2 cm from the leaf center. Cells in these grey areas turned light tan as they died (Fig. 1E). These spots enlarged and coalesced. The canopy leaf content of Mg was 0.13% at this point. The center of each leaf was the last part to be affected. Eventually entire leaves died, displaying areas of medium-brown necrosis with numerous light tan necrotic patches scattered throughout. These symptoms progressed from older to younger leaves. Plants were moderately stunted.

Iron. Symptoms began when the green pigmentation of young leaves turned lighter than normal. Small irregular chlorotic patches soon developed between the veins (Fig. 1F). As the chlorotic patches enlarged and coalesced, the classical symptoms of interveinal chlorosis became apparent. Plants were only moderately stunted. These conditions occurred at a canopy leaf Fe content of 80 ppm and Mn content of 880 ppm.

Boron. The first symptom was stunting due to shortened internode length. Petioles became soft, and vascular tissue within them turned rust color. Groups of cells perpendicular to the axis of and on the upper side of young leaf petioles turned rust color and failed to develop as the petiole developed (Fig. 1G). At first these appeared as striations and then cracks which continually deepneed until the leaf collapsed at this point. The same condition occurred on flower peduncles (Fig. 1H) resulting in collapse and death of flowers. Incomplete petal formation occurred in flowers which did not collapse. While symptoms developed on the petioles, 1-3 mm patches of cells turned rust colored and sunken on the young leaf blades. These spots appeared at first near the point of attachment of petiole to leaf blade and later at random across the leaf blade. As the leaf expanded, folds and creases ensued from these spots resulting in crinkled leaves (Fig. 1I). Leaf blades were very brittle. Irregular chlorotic patches appeared along the outer edges of young leaves followed by wilting of tissue, development of a green-brown discoloration, and finally necrosis (Fig. 1I). These symptoms progressed inward eventually killing the entire leaf. Symptoms described appeared at a canopy leaf B content of 10-12 ppm.

NC GREENHOUSE VEGETABLE GROWERS WILL HOLD FIRST SHORT COURSE

The first annual short course of the NC Greenhouse Vegetable Growers will be held January 17-18, 1978 at the Hilton Inn in Raleigh. The program is as follows:

Tuesday, January 17

10:00-12:00	*Registration and visit Trade Fair*
12:00- 1:00	*Lunch (on your own)*
	H. L. Liner, Presiding
1:00-1:15	*Welcome and Remarks*
	R. E. Doberstein, President
1:15-1:35	*Starting in the Greenhouse Business - A. A. Banadyga*
1:35-2:00	*Growing your Tomato Plants -- A. A. Banadyga*
2:00-2:30	*Soil Testing & Tissue Analysis - M. Ray Tucker*
2:30-3:00	*Coffee Break*
	G. G. Kennedy, Presiding
3:00-3:20	*Control of Soil Borne Diseases - C. W. Averre*
3:20-3:40	*Control of Virus Diseases - C. W. Averre*
3:40-4:00	*Biological & Physical Control of Tomato Diseases - S. F. Jenkins*
4:00-4:30	*Can you manage White Flies and Leaf Miners? - K. A. Sorensen and G. G. Kennedy*
4:30-5:00	*Business Meeting*
6:00-7:00	*Social Hour*
7:00-9:00	*Banquet and Program -*
	Speaker: Honorable James A. Graham
	Commissioner of Agriculture

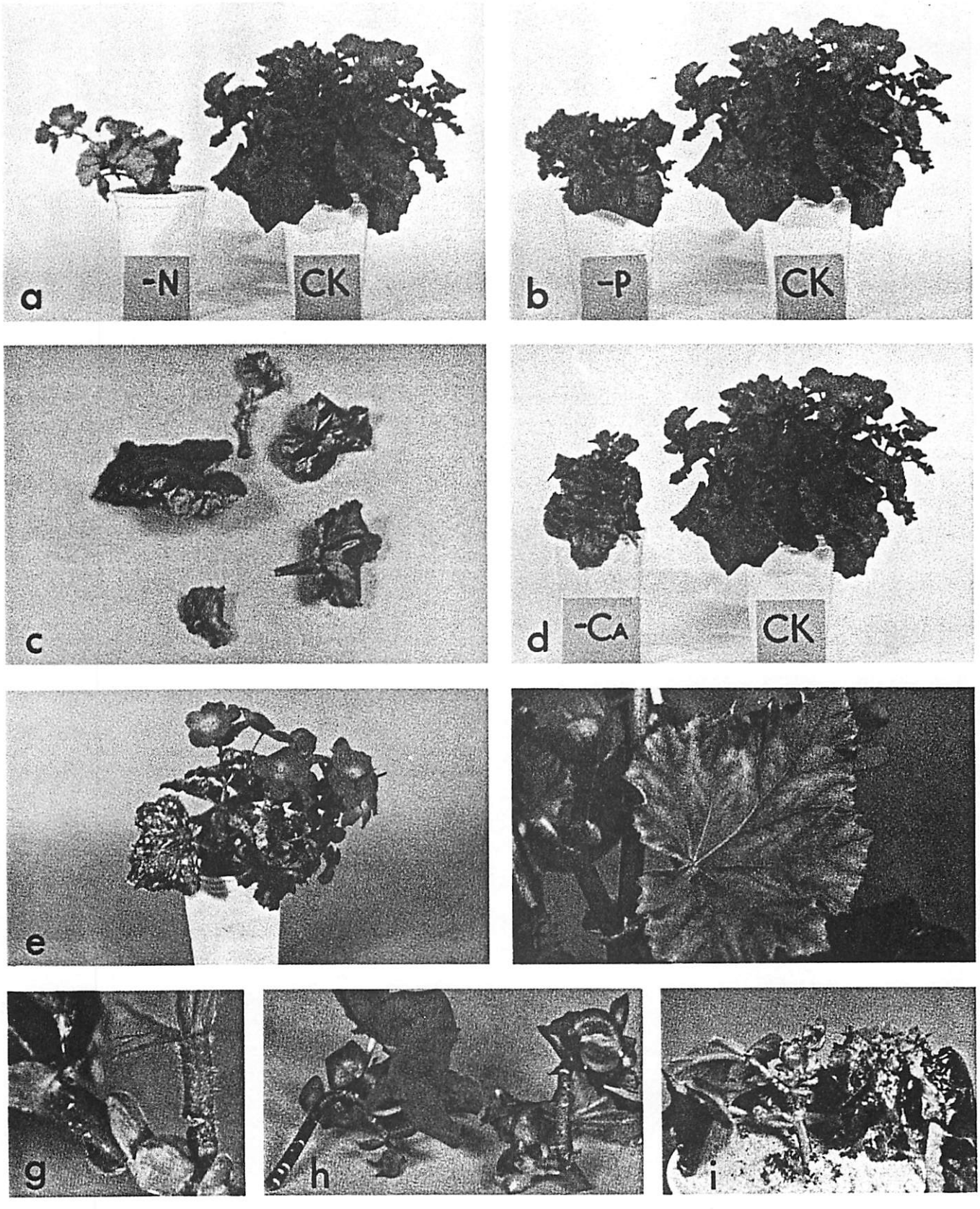

Fig. 1. Nutrient deficiency symptoms of elatior begonia, 'Schwabenland Red'. a) N, b) P, c) K – leaves are detached in the order they appeared on the stem, d) Ca, e) Mg, f) Fe, g-i) B.

Wednesday, January 18

	R. E. Sneed, Presiding
8:15-8:45	*Energy Conservation - R. A. Larson*
8:45-9:30	*Greenhouse Vegetable Programs in New York - P. A. Schippers*
9:30-9:50	*Greenhouse Tomato Varieties (Testing & Developing) - R. G. Gardner*
9:50-10:10	*Tomato Quality and Storage - W. R. Henderson*
10:10-10:40	*Coffee Break - Visit Trade Fair*
	E. A. Proctor, Presiding
10:40-11:05	*Marketing Tomatoes and UNCAP - J. M. Warren*
11:05-11:30	*Greenhouse Cucumber Production - T. R. Konsler*
11:30-12:00	*Cool Season Greenhouse Vegetables - C. H. Miller*
12:00-1:15	*Lunch on your own - Visit Trade Fair*
	D. H. Willits, Presiding
1:15-2:15	*Nutrient Film Technique (NFT), Growing Vegetables Without Soil - P. A. Schippers*
2:15-3:00	*Questions and Answers - Panel*
3:00-4:30	*Tour Research Greenhouses*
4:30	*Adjourn*

Many of these topics are as valid for flower growers as they are for vegetable growers. The cost of registration is $5.00. Banquet tickets ($8.00 each) must be purchased by January 12, from Albert A. Banadyga, Department of Horticultural Science, N. C. State University, Raleigh, N. C. 27607. Growers should contact the Hilton Inn by January 3 for room reservations.