Research Report: Fertilizer Rate Effects on Growth of Variegated and Green-leaved Double Impatiens

Brian E. Whipker[1], Shravan Dasoju[2], Michael S. Dosmann[2], and Jeffery K. Iles[2]

Variegated leaves may have an aesthetic appeal for the gardener, but this trait can be detrimental to the plant. Variegated leaves have reduced photosynthetically active tissue and are more attractive to insect pests (Sadof, 1991). With New Guinea impatiens a "rippled" or "wavy" leaf surface is a common indicator of a too high fertilization rate. The authors also have observed "rippled" or "cupped" leaves on variegated cultivars of double impatiens, geraniums, and lantana when grown at fertilization rates of 200 to 300 ppm of N while green-leaved cultivars show no leaf distortion. These facts and observations lead the authors to speculate that variegated plants may require lower fertilization rates than green plants for optimal growth. The objectives of this study were to determine the effect of increased rates of fertility on plant growth and development of both green and variegated double impatiens and to develop fertilization recommendations for growers.

[1] Department of Horticultural Science, Box 7609, North Carolina State University, Raleigh, NC 27695-7609
[2] Department of Horticulture, Iowa State University, Ames, IA 50011-1100

Experimental Design

Rooted cuttings of double impatiens cultivars Blackberry Ice (variegated-leaf type) and Purple Magic (green-leaf type) were potted into 4-inch square containers on 7 Feb. 1997. The root substrate contained 2 soil : 5 sphagnum peat : 3 perlite (by volume) and was amended with ground dolomitic limestone to pH 5.1. Plants were grown under the natural occurring photoperiod (lat. 42 °N [Ames, Iowa]) with day/night temperature set points of 75/64 °F. The plants were grown on flood benches and irrigated with Excel® 15-5-15 Cal-Mag at a rate of 50, 100, 200, or 300 ppm N. Fertilizer solutions were replaced every 6 to 7 days.

Beginning on 7 Feb. and continuing every three weeks until 22 Apr., plant height, plant diameter (measured at the widest dimension and turned 90°, and averaged), and plant fresh weight were recorded for 5 single-plant replications within each treatment. The root substrate was analyzed at each sampling date for pH, EC, NO_3-N, NH_4-N, P, K, Ca, and Mg. Tissue samples were taken at the end of the experiment and analyzed for N, P, K, Ca, Mg, B, Mo, and Zn.

Results and Discussion

Root Substrate Nutrient Levels. The root substrate EC levels increased over time as the fertilizer concentration increased for both cultivars (Fig. 1). EC levels at week 9 were similar for both cultivars at each fertilizer rate, except for the 100 ppm N where EC levels of Blackberry Ice (variegated-leaf) were more than double those of Purple Magic (green-leaf). EC levels for Purple Magic were similar with 50 and 100 ppm N, indicating the plants were utilizing the additional nutrients provided at the 100 ppm N rate. The higher EC levels with 100 ppm N for Blackberry Ice when compared to Purple Magic indicated that variegated-leaved plant nutrient demands were less, and fertilization rates lower than 100 ppm N would be required. The increase in EC levels at the fertilization rates 200 ppm N indicated neither cultivar was utilizing all of the available nutrients and those rates were excessive. Similar accumulations of excess fertilizer salts when fertilization rates exceeded the amount required by the plant have been reported on New Guinea impatiens and several foliage plant species. Levels of N, P, K, Ca, and Mg in the root substrate also accumulated as the fertilizer concentration increased.

Plant Growth. Total plant heights varied by fertilizer concentrations and cultivars over time, with 100 ppm N resulting in the tallest plants (Fig. 2). Total plant heights at week nine were similar for both cultivars at each fertilizer rate, except for 100 ppm N where Purple Magic plants were 20% taller than Blackberry Ice. Purple Magic plants grown with the 200 ppm N were the next tallest plants, while plants grown with 50 or 300 ppm N were the shortest. Blackberry Ice plants grown with 50 or 200 ppm N were similar in height and the shortest plants resulted from 300 ppm N.

Plant diameter was significant affected only by fertilizer concentration over time and not by cultivar. Differences in plant diameter occurred only after 6 weeks of growth, with smaller plant growth resulting with 50 or 300 ppm N. After 9 weeks, plants grown with 100 ppm N were 22% larger than plants grown with either 50 or 200 ppm N. Fertilization rates of 50 ppm N resulted in plants which were covered with a higher percentage of blooms per unit of leaf area, but the plants were smaller (Fig. 3). Similar reductions in plant diameter, due in part to a reduction in leaf size as the N fertilization rate increased, have been reported for New Guinea impatiens.

Purple Magic plants had a greater dry weight than Blackberry Ice over all the fertilization rates. Plant tissue dry weight (leaf, bud, stem, and total) increased to the highest level at 100 ppm N, then decreased as fertilization rate increased. Judd and Cox (1992) reported a similar reduction in New Guinea impatiens dry weight with EC levels >1.5 mS/cm.

Leaf Tissue Nutrient Concentration. Leaf tissue concentrations of N, P, and K increased with the

fertilization rate, however, levels were higher for Blackberry Ice than Purple Magic over all fertilization rates. Higher tissue-N concentration was in agreement with Sadof and Raupp (1991) who reported elevated N in the phloem of variegated plants compared to green plants. Tissue-Ca concentrations were similar for both cultivars and levels decreased as the fertilizer rate increased. The decrease in leaf tissue Ca concentrations may be attributed to the antagonistic relationship between K and Ca. Competition from increased rates of K has been reported to decrease Ca content in poinsettias.

Conclusions

Fertilization rates of 50 ppm N resulted in plants which were smaller. Higher fertilization rates of 200 to 300 ppm N resulted in an

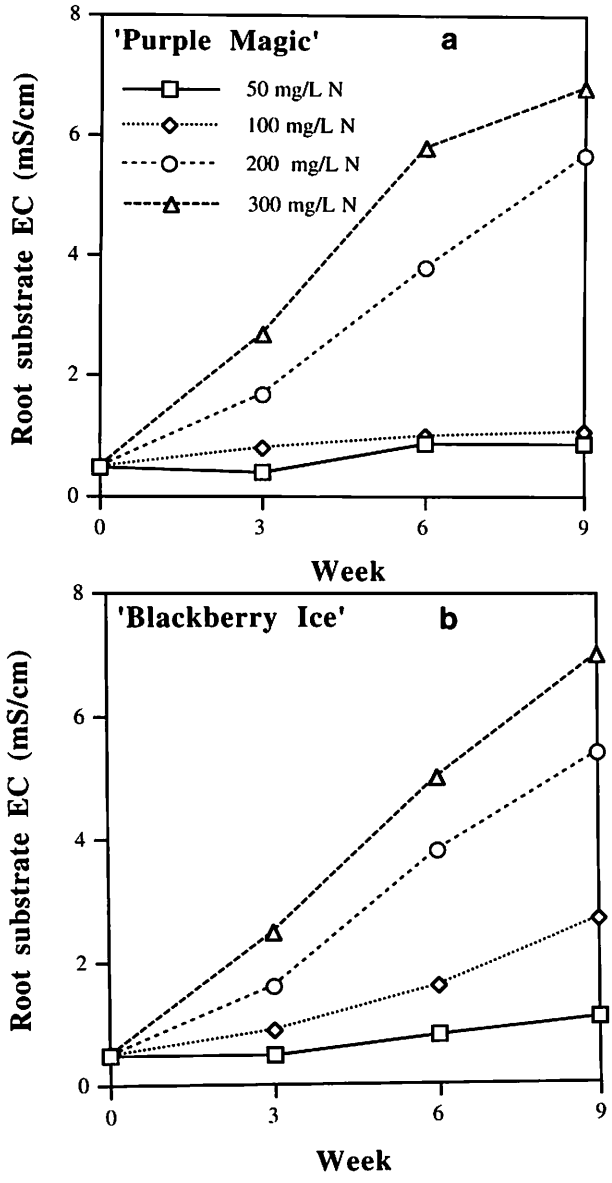

Fig. 1. Root substrate EC levels of Purple Magic (green-leaf) (a) and Blackberry Ice (variegated-leaf) (b) double impatiens fertilized with 50, 100, 200, or 300 ppm N on flood benches.

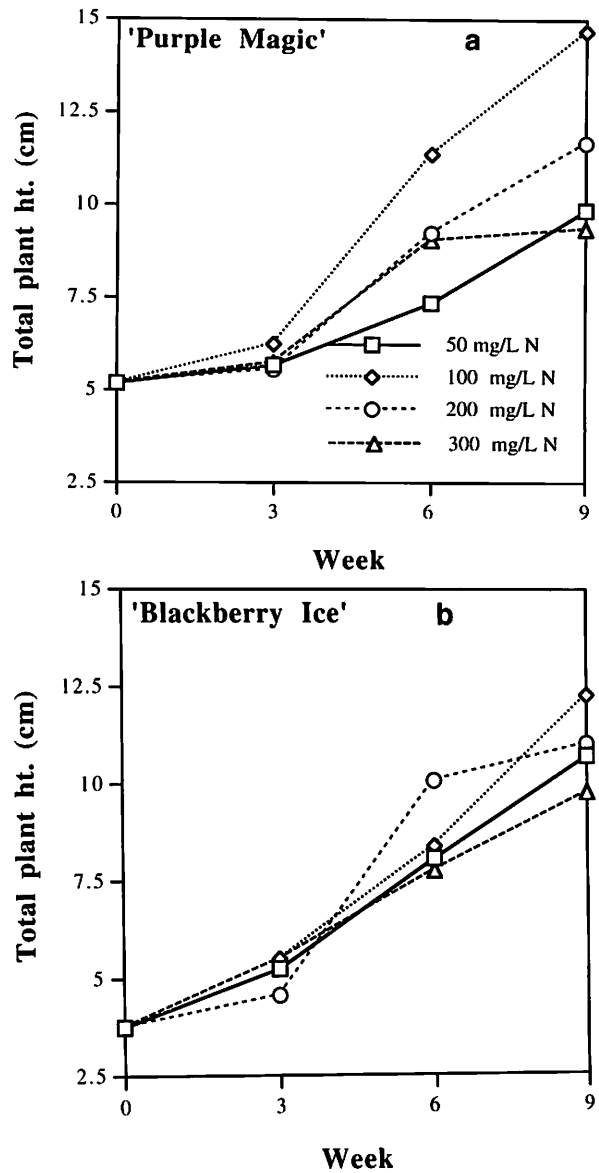

Fig. 2. Total plant height of Purple Magic (green-leaf) (a) and Blackberry Ice (variegated-leaf) (b) double impatiens fertilized with 50, 100, 200, or 300 ppm N on flood benches (1 inch = 2.5 cm).

accumulation in root substrate fertilizer salts and a reduction in plant growth. For maximum shoot growth, growers should apply 100 ppm N when growing Purple Magic (green-leaved) double impatiens on flood benches. Because Blackberry Ice (variegated-leaved) plants have a lower growth rate and higher accumulation of fertilizer salts than green plants, fertilization rates slightly lower than 100 ppm N would be recommended with flood benches. General grower recommendations suggest applying 33% to 50% less fertilizer to flood bench grown plants than hand-watered plants. Therefore, assuming this applies to double impatiens, adjusting the 100 ppm N recommended fertilization rate of flood bench irrigated plants to hand-watering would result in a recommended hand-watering irrigation rate of 150 to 200 ppm N, with the lower range suggested for variegated-leaved varieties.

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Fig. 3. Plant growth of Purple Magic (green-leaf) (top row) and Blackberry Ice (variegated-leaf) (bottom row) double impatiens fertilized with (left to right) 50, 100, 200, or 300 ppm N on flood benches.