Growth of New Guinea Impatiens Inhibited by High Growth-medium Electrical Conductivity

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Abstract. To test the effects of fertilizer concentration and growth medium electrical conductivity (EC) on the growth of New Guinea impatiens (*Impatiens* sp. hybrids or *I. platypetala* Lindl.), plants of 'Selenia' were grown 70 days in a commercial soilless medium and irrigated with solutions of 20N-4.3P-16.6K at concentrations of 0.5, 1.0, 1.5, or 2.0 g-liter⁻¹. In a fifth treatment ("delay"), no fertilizer was applied for the first 14 days after planting, then 0.5 g-liter⁻¹ was applied for the next 14 days, followed by 1.0 g-liter⁻¹ until the end of the experiment. Measurements of shoot dry weight and growth medium EC were made at 14-day intervals. Differences in dry weight between fertilizer treatments became significant ($P = 0.0001$) 42 days after planting. Over the 70-day experiment, plants grew most with 0.5 g-liter⁻¹ and delay treatments. High fertilizer concentrations (1.5 and 2.0 g-liter⁻¹) caused the most growth suppression and resulted in increasing growth medium EC with time. An EC of ≈ 1.5 dS·m⁻¹ or higher was associated with suppressed growth beginning 42 days after planting. A mild chlorosis developed on the leaves of some plants at the two highest fertilizer concentrations.

New Guinea impatiens has become an important greenhouse pot crop since its commercial introduction in the early 1970s. Although some fertilizer recommendations for New Guinea impatiens exist (Schram, 1984), there has been little research done on the nutrition or fertility requirements of the crop. Many commercial producers of New Guinea hybrid impatiens have experienced poor growth of rooted cuttings soon after planting. The plants appear normal but their development is very slow. In these in-

stances, the poor growth cannot be traced to disease organisms or abnormal environmental conditions, but the electrical conductivity (EC) of the growth medium is often moderate to high. The inhibitory effects of salinity on growth of many plants are well known; also, species of floricultural crops vary in tolerance to salinity (Devitt and Morris, 1987). There are anecdotal reports suggesting that New Guinea impatiens are intolerant of moderate to high growth-medium EC, but we found no research basis for this conclusion. Therefore, the objective of this study was to determine whether growth suppression of New Guinea impatiens is associated with high levels of fertilizer and growth-medium EC.

Rooted cuttings of 'Selenia' New Guinea impatiens were obtained from a commercial propagator and potted 14 Jan. 1991 in 10-cm-diameter (520-ml) standard plastic pots containing a soilless medium, Pro-Mix BX (Premier Brands, New Rochelle, N.Y.). Plants received fertilizer solutions of Peter's 20N-4.4P-16.6K Peat-lite Special (Grace-

Sierra, Fogelsville, Pa.) at 0.5, 1.0, 1.5, or 2.0 g-liter⁻¹. EC of the solutions was 0.63, 1.18, 1.77, and 2.30 dS·m⁻¹, respectively. A fifth treatment, henceforth referred to as "delay treatment," consisted of no fertilizer for the first 14 days after planting, 0.5 g-liter⁻¹ for the next 14 days, and 1.0 g-liter⁻¹ until the end of the experiment at 70 days.

Plants in all treatments were irrigated by hand with the appropriate fertilizer solution twice weekly, ≈ 3 days apart, beginning at transplanting. Additional waterings between regular irrigations were unnecessary until ≈ 9 weeks after planting. After this time, when an extra watering was necessary, plain tap water was applied to all plants, regardless of fertilizer treatment or growth medium moisture status. At all times when plants were irrigated, enough fertilizer solution or water (≈ 150 to 200 ml/pot) was applied to cause drainage from the bottom of the pot at $\approx 30\%$ of applied volume.

At 14-day intervals, two replicate pots were sampled from each fertilizer treatment to determine shoot dry weight and growth-medium EC. Shoot samples consisted of all leaves, stems, and flowers from individual plants. At the end of the experiment, a size index was calculated as the sum of plant height and the average of two plant width measurements made at right angles to each other, divided by two. Growth-medium samples consisted of all of the medium in each pot with as much of the root system removed as possible. Samples were air-dried and screened

Table 1. Effect of fertilizer concentration on growth of New Guinea hybrid impatiens measured 70 days after planting.

Fertilizer (g·liter ⁻¹)	Shoot dry wt (g)	Size index (cm) ²	Growth medium EC (dS·m ⁻¹)
Delay ^y	3.2*	14.3	0.8
0.5	3.6	14.6	0.5
1.0	2.6	13.8	1.4
1.5	1.9	11.6	2.2
2.0	1.6	10.5	2.6
Significance	L*Q*	L**	L**

²Size index (cm): height + [width₁ + width₂]/2.

^yNo fertilizer until 14 days after planting.

*Underscored means are significantly different from the delay treatment by Dunnett's test, $P = 0.05$.

*,**Effect of fertilizer rate are significant at $P = 0.05$ or 0.01 and are linear (L) or quadratic (Q).

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Fig. 1. Effect of fertilizer concentration on (A) shoot dry weight and (B) growth medium electrical conductivity over 70 days. Vertical bars represent SE of the mean. Effect of sampling time is significant at $P = 0.05$ (*) or 0.01 (**) and is linear (L) or quadratic (Q). (●) 0.5 g-liter⁻¹: A and B, L**Q** (■) 1.0 g-liter⁻¹: A, L**Q*; B, L**Q** (▲) 1.5 g-liter⁻¹: A, L**Q** (▼) 2.0 g-liter⁻¹: A and B, L** (○) delay: A and B, L**Q**.

to pass a 20-mm opening (no. 10 sieve). The 1:2 (growth medium : deionized water) extract method was used to determine growth medium EC using a 40-ml sample of growth medium.

The experiment was conducted in a glass greenhouse maintained as closely as possible to 24/16C (day/night). The experiment was conducted as a completely randomized design with eight replicates per treatment (fertilizer concentration and sample date combination). Fertilizer concentration means were compared at each sampling time using analysis of variance, and Dunnett's procedure was used for comparing fertilizer concentration means for 0.5, 1.0, 1.5, and 2.0 g-liter⁻¹ with those of the delay treatment. Trend analysis was accomplished using orthogonal polynomials. The experiment was terminated 27 Mar. A similar experiment was

conducted between 22 Apr. and 12 June to determine if response to fertilizer concentration and growth-medium EC would differ under higher light and temperature conditions; however, there were no important differences in plant response between the experiments so only the results of the first experiment are discussed here.

Significant ($P = 0.0001$) differences in dry weight between treatments first occurred 42 days after planting (Fig. 1A). EC data (Fig. 1B) suggest that this was related to the accumulation of soluble salts in the growth medium. Specifically, at the time when the differences in dry weight became significant, EC levels were ≈ 1.5 dS·m⁻¹ or higher at fertilizer concentrations >0.5 g-liter⁻¹.

The highest dry weight and size index resulted from the 0.5 g-liter⁻¹ treatment followed by the delay and 1.0 g-liter⁻¹ treatments

(Fig. 1A; Table 1). Growth was suppressed the most during the experiment by the two highest fertilizer levels, 1.5 and 2.0 g-liter⁻¹. Some plants receiving these treatments developed a mild foliar chlorosis that may have been a symptom of a salt toxicity. Several plants also developed fusarium crown rot; disease was absent at fertilizer concentrations < 1.5 g-liter⁻¹. A soil drench of Banrot (etridiazole + thiophanate methyl) 56 days after planting was used to control this problem. Both the salt toxicity symptoms and the fusarium infection may have been related to the high EC in the potting medium; there is evidence that high EC increases plant susceptibility to certain pathogens (Gladstone and Moorman, 1990; Moorman, 1986).

Delay fertilization resulted in a favorable growth response. In terms of dry weight, size index, and growth medium EC, plants in this treatment were similar to those at 0.5 g-liter⁻¹ (Table 1). While some savings in fertilizer and labor might result from delaying fertilization, there appears to be no additional benefit to using this method to fertilize New Guinea impatiens than in regular application of a low fertilizer concentration beginning at planting.

It is clear that New Guinea impatiens do not benefit from heavy fertilization. Although most growers do not apply fertilizer concentrations as high as 1.5 and 2.0 g-liter⁻¹, the high EC levels achieved here may occur for other reasons than fertilizer concentration alone. Frequency of fertilizer application, amount of leaching, subirrigation techniques, use of a controlled-release fertilizer supplement, and type of growth medium are all factors that may interact with the fertilizer solution concentration to affect growth-medium EC and plant response to fertilizer level.

Growth of New Guinea impatiens was suppressed when growth-medium EC exceeded ≈ 1.5 dS·m⁻¹, which occurred between 42 to 56 days after planting at fertilizer levels >0.5 g-liter⁻¹. The lowest concentration of fertilizer we used (0.5 g-liter⁻¹) and the gradual increase of fertilizer level with the delay application resulted in growth-medium EC levels < 1.5 dS·m⁻¹ and the best growth of New Guinea impatiens.

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