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DCPTA Enhances Growth and Flowering of Heliconias

Timothy K. Broschat and Sven E. Svenson
University of Florida, Fort Lauderdale Research and Education Center, 3205 College Avenue, Fort Lauderdale, FL 33314

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Abstract. Heliconia stricta **Huber 'Dwarf Jamaican' were grown in 10-liter containers under full sun or 50% shade for 1 year, and** ***H. caribaea*** **Lamarck 'Purpurea' were grown in an open field for 2.5 years. Rhizomes were soaked for 1 hour before planting or plants were sprayed with 30 µM DCPTA after two leaves had emerged.** ***Heliconia stricta*** **grown under full sun produced more inflorescences than those grown under 50% shade, and DCPTA-treated plants grown under shade produced more pseudostems and were taller than control plants. DCPTA-treated** ***H. caribaea*** **produced more pseudostems per plant than control plants during their first year, but differences in the number of pseudostems and inflorescences during subsequent years were not significant. Chemical name used: 2-(3,4-dichlorophenoxy)triethylamine (DCPTA).**

Heliconias have become an important cut flower in the United States since their introduction in the early 1980s (Criley and Broschat, 1992; U.S. Dept. of Agriculture Agricultural Statistics Board, 1993). Small species of heliconias like *Heliconia stricta* 'Dwarf Jamaican' and *H. psittacorum* L.f. flower within 1 year after planting rhizomes, but larger species usually require 1 to 2 years before they first flower. Flower production rates in species other than *H. psittacorum* are also rather low due to the longer time required for individual pseudostems to flower (Criley and Broschat, 1992). Any factor that increases growth rate in these plants would likely also increase flower production rate.

The growth and flowering of some heliconias such as *H. psittacorum* are known to be light-intensity limited (Broschat and Donselman, 1984). Yet other species appear better adapted to slight shade conditions and are easily injured under full sun in the tropics. DCPTA is a synthetically produced tertiary amine bioregulator that has potential for increasing cut-flower crop productivity under high light intensities (Keithly and Yokoyama, 1990). Keithly et al. (1991) reported earlier flowering for some cut-flower crops, including carnation (*Dianthus caryophyllus* L.), chrysanthemum [*Dendranthema* ×*grandiflorum* (Ramat.) Kitamura], and gerbera daisy (*Gerbera jamesonii* H. Bolus ex Hook). The mode of action of DCPTA on earlier flowering of ornamental crops is unknown, but may be due to an acceleration of vegetative growth in some species (Keithly et al., 1991). High light intensities may be required for full expression of plant responses to DCPTA (Gausman et al., 1991), but this aspect of tertiary amine regulation on plant growth has received little study. The objective of our study was to examine how light intensity and DCPTA application influence growth and flowering in two heliconia species.

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Materials and Methods

Three treatments, a control (no DCPTA), a rhizome soak (1 h in 30 µM DCPTA plus 0.1% Tween 80 surfactant), and a foliar spray (applied later at 30 µM DCPTA plus 0.1% Tween 80 to potted plants, after two leaves had emerged) were used in this experiment. DCPTA was evaluated only at 30 µM because Keithly and Yokoyama (1990) found this rate to be optimum for *Phalaenopsis* orchids and other species of plants. Three rooted rhizomes of *H. stricta* 'Dwarf Jamaican' were planted per 10-liter container using a 5 pine bark : 4 sedge peat : 1 sand medium (by volume) amended with 880 g Micromax (Scotts Co., Marysville, Ohio) and 4.9 kg of dolomite/m^3. All rhizomes were soaked and planted on 8 Mar. 1991, with foliar sprays applied 7.5 weeks later. Ten replicate containers of each treatment were grown under full sun (maximum photosynthetic photon flux = 2200 $\mu mol \cdot m^{-2} \cdot s^{-1}$) and under 50% shadecloth with plants arranged in a completely randomized design within each light environment. Containers were spaced 45 cm on centers. All pots were top-dressed with 70 g of Osmocote 17N–2.3P–10K fertilizer (Scotts Co.) every 6 months and received water from rainfall, overhead irrigation, or both. Twelve months after the DCPTA-sprayed plants were treated, the number of pseudostems and inflorescences was counted and maximum plant height was measured.

A second, much larger species, *H. caribaea* 'Purpurea' was treated similarly to the *H. stricta* 'Dwarf Jamaican', except that only one rooted rhizome with two or three eyes each was planted per 20-liter container in the above-noted medium, and the plants were grown under 50% shade for 15 weeks before field planting. Due to their large size (3 to 6 m tall), *H. caribaea* were grown only under full-sun field conditions. Rhizomes were soaked and planted on 17 Apr. 1991, and foliar sprays were applied on 12 July 1991. All plants were set 2 m apart in rows 3 m apart in a Margate fine sand soil covered with 10 cm of woodchip mulch on 22 July 1991. Ten replicate plants per treatment were arranged in a completely randomized design in the field. Each plant received 110 g of Osmocote 17N–2.3P–10K while in containers and 500 g of the same material every 6 months while in the field. Plants received water daily from rainfall, overhead irrigation, or both. The number of pseudostems per plant was counted on 30 June 1992, 30 Dec. 1992, and 15 Sept. 1993, or ≈1, 1.5, and 2.5 years after having been planted out. The number of inflorescences produced during the periods of 1 Apr. 1992 to 30 June 1992, 1 July 1992 to 30 Dec. 1992, and 1 Jan. 1993 to 15 Sept. 1993 was also recorded. Flowered pseudostems were removed after counting. Data from both species were tested by analysis of variance, with mean separation by the Waller–Duncan k ratio method.

Results and Discussion

For *H. stricta* 'Dwarf Jamaican', a small species that flowers <1 year after emergence of a pseudostem (Criley and Kawabata, 1986), light intensity and DCPTA affected growth and flowering (Table 1). Under 50% shade, plants produced few flowers, whether or not they were treated with DCPTA, but plants receiving DCPTA foliar sprays or rhizome soaks produced more pseudostems per container and were significantly taller than the controls. When grown under full sun, there were no differences among treatment in terms of number of pseudostems or plant height, but rhizomes soaked in DCPTA produced significantly more inflorescences than sprayed or control plants. Overall effects of light intensity and DCPTA treatment, as well as their interaction on *H. stricta* 'Dwarf Jamaican', were highly significant for number of inflorescences and plant height, but only DCPTA treatment significantly affected the number of pseudostems produced.

Most plants, including *H. stricta*, grow taller under shade than in full sun. In this experiment the greater height of full-sun plants may have been due to plants elongating as a result of shading because of higher pseudostem density for controls under full sun and with all DCPTA treatments. Also, all full-sun plants had more inflorescences than shaded plants, possibly due to abortion of flower buds under suboptimal light intensity.

Heliconia caribaea with DCPTA-soaked rhizomes had produced significantly more pseudostems than control plants after 1 year in the field (Table 2). DCPTA-sprayed plants produced as many pseudostems as the rhizome-soaked plants. The number of inflorescences produced during the first year, however, was too small to result in any statistically

Table 1. Effects of light intensity and 30-µM DCPTA treatment on growth and flowering of container-grown *Heliconia stricta* 'Dwarf Jamaican' after 12 months.

Treatment	No. inflorescences/ container	No. pseudostems/ container	Maximum ht (cm)
50% shade			
Control	1.0 a[z]	23.0 b	52.1 b
Rhizome soak	1.7 a	31.9 a	67.5 a
Foliar spray	1.6 a	32.3 a	66.2 a
Full sun			
Control	7.3 b	29.2 a	71.3 a
Rhizome soak	15.0 a	32.8 a	76.0 a
Foliar spray	8.0 b	28.3 a	68.8 a
Overall effects (*P*)			
Light intensity	0.0001	NS	0.0001
DCPTA treatment	0.0001	0.013	0.003
Light × DCPTA	0.0009	0.058	0.017

[z]Mean separations within columns and light intensities by the Waller–Duncan k ratio method (k = 100).
[NS]Nonsignificant.

Table 2. Effects of a single 30-µM DCPTA treatment on the growth and flowering of field-grown *Heliconia caribaea* 'Purpurea'.

	Time since planting (years)					
	0–1		1–1.5		1.5–2.5	
DCPTA application	Pseudostems/ plant[z]	Flowers/ plant	Pseudostems/ plant	Flowers/ plant	Pseudostems/ plant	Flowers/ plant
None	16.9	0.4	18.6	0.5	24.1	9.4
Rhizome soak	23.2	0.9	25.9	1.4	31.0	12.4
Foliar spray	22.4	0.8	25.7	1.7	29.6	15.6
Significance (*P*)	0.05	NS	0.11	0.17	NS	NS

[z]Number of pseudostems was counted at the end of each time interval.
[NS]Nonsignificant.

significant differences among treatments. After 1.5 and 2.5 years in the field, there were no significant differences among treatments in the number of pseudostems or inflorescences produced per plant.

These preliminary studies suggest that heliconia growth and flower production may be increased by using the tertiary amine bioregulators DCPTA. Because DCPTA had previously been tested primarily on annual crops (Keithly et al., 1991), the effective life of a single application on a perennial crop was not known at the time these experiments were started. These experiments suggest that the useful life of one application for heliconias is probably <1 year. *Heliconia stricta* 'Dwarf Jamaican' showed a strong response to this material because it flowers in <1 year. For *H. caribaea*, however, significant flower production does not occur during the first 1.5 years in southern Florida. DCPTA-treated plants produced more pseudostems during the first year than nontreated plants. The increased number of pseudostems appeared to produce more flowers in subsequent years, but without additional applications, any significant effects of DCPTA were lost during the time required for *H. caribaea* to reach flowering age. Follow-up studies with annual or more frequent applications of DCPTA on long-term crops such as *H. caribaea* are needed before the true value of this compound can be determined. Evaluating other rates of DCPTA may also result in improved effectiveness on heliconias.

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