Sequential Benzyladenine (BA) Applications Enhance Offset Formation in *Hosta*

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A study was conducted to determine the effects of repeated benzyladenine (BA) applications and subsequent repeated offset removals on offset yields from hosta stock plants. Two hosta cultivars, 'Francee' and 'Frances Williams', received either 0, 1, 2, 3, or 4 foliar applications of 3000 ppm BA. Plants receiving multiple applications were retreated at 30-day intervals following offset removal from all plants. BA application stimulated offset formation in both cultivars, but repeated applications were necessary for a continued response following offset removal. Offset removal did not inhibit a subsequent response to BA, and total offset yield increased with an increasing number of BA applications. Over the 120-day study, plants of 'Francee' receiving four applications formed 124% more offsets than controls, while plants of 'Frances Williams' receiving four applications formed an average of 18 offsets over the 120-day study, compared to none for controls.

INTRODUCTION

Hostas are herbaceous perennials in the lily family. They are the most popular of all herbaceous perennials (Rhodus, 1995), and are well suited for use in the shaded landscape. Hostas are conventionally propagated by crown division or tissue culture, but there are limitations to these methods. Division yields relatively few plants per clump, and is typically accomplished only annually (Walters, 1981). Tissue-cultured explants are costly to produce and may not come true to type (Meyer, 1980). Moreover, propagation of plants by tissue culture requires skilled technicians, specialized materials, and facilities unavailable to most growers. Rapid increases in plant numbers and the introduction of new cultivars may be impeded because of these limitations. Increasing the number of propagules available may reduce production costs and facilitate accelerated production. In hosta this can be accomplished by promoting the outgrowth of lateral buds, a process which is under phytohormone control.

Vegetative buds and roots of hosta grow from rhizomes (Schmid, 1991), but the rhizomic or shoot apex appears to suppress outgrowth of lateral axillary and rhizomic buds by apical dominance. A primary factor in the mechanism of apical dominance is a hormonal interaction between auxins and cytokinins (Cline, 1988), and exogenous application of cytokinin can release lateral buds from inhibition in many plants (Mok and Mok, 1994). Previous studies have demonstrated that application of the synthetic cytokinin, benzyladenine (BA), induces the outgrowth of rhizomic and axillary buds in hosta (Keever, 1994), and that offsets formed from BA-induced buds can be removed from the mother plant within 30 days of BA application and rooted under intermittent mist (Keever et al., 1995). These findings

suggest that production of BA-stimulated offsets can provide an effective alternative to conventional propagation methods by increasing the number of offset cuttings available. BA application has been shown to enhance offset cutting production of *Gerbera jamesonii* Hook. stock plants when BA is reapplied after each cutting harvest (Kaminek, et al., 1987). A successful strategy for propagating hosta in this manner may require the use of hosta stock plants which could be treated with BA at 30-day intervals and serve as a source for BA-stimulated offset cuttings throughout the growing season. The objective of this study was to determine the effects of multiple BA applications and subsequent repeated removal of BA-induced offsets on offset yield from hosta stock plants.

MATERIALS AND METHODS

On 20 Feb. 1995, dormant, bareroot divisions of hosta cultivars 'Francee', which forms offsets readily, and 'Frances Williams', which does not (Garner et al., 1996), were potted in 3.7-liter (1-gal) containers in a pine bark and sand medium (6:1, v/v). The medium was amended with 4.8 kg m^{-3} (8 lb yd^{-3}) dolomitic lime, 3.0 kg (5 lb yd^{-3}) Micromax (The Scotts Co., Marysville, Ohio), and 7.4 kg m^{-3} (12.5 lb yd^{-3}) 24N-$1.8P_2O_5$-$10K_2O$ (Polyon 24-4-14, 12-month formulation, Pursell Industries, Sylacauga, Ala.). Plants were grown under 47% shade and irrigated by overhead rotary nozzles twice daily for 30 min per application, for a total of 3 cm (1.2 in) per day.

On 7 July 1995, 50 single-eye (no offsets) plants of each cultivar were selected for uniformity, and 10 plants of each cultivar were randomly assigned to each of five treatments, 0, 1, 2, 3, or 4 foliar applications of 3000 ppm BA (Abbott Laboratories, N. Chicago, Ill.). Buffer-X (Kalo Agr. Chemicals, Inc., Overland Park, Kan.) at 0.2% was added to all BA solutions as a surfactant prior to foliar application at 0.5 gal per 100 ft^{-2} (0.2 liter m^{-2}). Application was made with a CO_2 sprayer fitted with a cone nozzle at 30 psi (207 kPa). At commencement of the study, 40 plants of each cultivar received BA treatment and 10 untreated controls of each cultivar did not. Plants were completely randomized within cultivar following initial treatment. At 30-day intervals thereafter, all offsets were removed from each plant. The number of treated plants was then reduced each time by 10, and BA was reapplied to the remaining plants, resulting at 90 days after initial treatment (DAT) in a total of five treatments.

At 30, 60, 90, and 120 DAT, visible offset counts and a growth index [(height + width at widest point + width 90° to first width)/3] were determined for each plant. Offsets present were removed from each plant, and offset stage of development, based on number of unfurled leaves, was determined for each offset. Data were tested by analysis of variance, using SAS General Linear Model procedure, and single degree of freedom contrasts were used to make specific planned comparisons (SAS Institute, 1988).

RESULTS AND DISCUSSION

As in previous studies (Keever, 1994), BA application promoted formation of offsets in hosta. At 30 DAT, offset counts were higher in treated plants of both cultivars compared to untreated controls (Table 1). At 60 DAT, plants of 'Frances Williams' that received two BA applications had more offsets than controls or plants that received only one BA application. In 'Francee' at 60 DAT, sufficient offsets had

formed in controls such that offset counts in plants that received one or two BA applications were similar to controls. At 90 and 120 DAT, plants of both cultivars that were retreated following offset removal had higher offset counts than controls or plants not retreated. Repeated BA application was required to achieve a continued response in offset production, but removal of offsets prior to reapplication of BA did not appear to affect subsequent response to BA. Total offset yield over the 120-day duration of the study increased with an increasing number of BA applications. Total yield of offsets with 0, 1, 2, 3, or 4 BA applications was 9.8, 9.5, 13.9, 17.4, or 22.0 for 'Francee' and 0, 6.3, 8.6, 14.0, or 18.2 for 'Frances Williams', respectively. Compared to controls, there was a 124% increase in offset counts for plants of 'Francee' that received four BA applications. With four BA applications, 'Frances Williams' averaged 18 offsets per plant, while no offsets formed in controls over the 120-day period. Growth index or offset stage of development were generally not affected by BA treatment (data not shown).

SUMMARY

These data indicate that hosta stock plants can be treated with BA at 30-day intervals throughout the growing season to provide greater numbers of offset cuttings than could otherwise be obtained by conventional division. Offset formation in response to BA application was cultivar-dependent, but in either cultivar, repeated application was required for a continued response, and offset removal did not prevent subsequent response to BA. BA application can promote offset formation in cultivars that readily form offsets and those that do not. By increasing the number of propagules available, introduction and multiplication of cultivars, including those which do not readily form offsets, may be accelerated. A practical system for the accelerated multiplication of hosta may increase propagation efficiency and decrease production costs. These findings are a significant step toward the development of such a system.

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Table 1. Offset counts, 1995, at 30, 60, 90, and 120 days after initial treatment (DAT) in two hosta cultivars treated with 0, 1, 2, 3, or 4 applications of 3000 ppm BA.

	Offset number									
	Application number					Application number				
DAT	0	1	2	3	4	0	1	2	3	4
	'Francee'					'Frances Williams'				
30	3.7	4.5	-	-	-	0.0	3.9	-	-	-
60	4.9	3.6	5.9	-	-	0.0	2.4	3.7	-	-
90	1.2	1.4	3.5	6.0	-	0.0	0.0	1.0	5.4	-
120	0.0	0.0	0.0	1.0	5.6	0.0	0.0	0.0	1.0	5.2

Significant contrast:[z]

DAT	Application number	
	'Francee'	'Frances Williams'
30	0 v. 1	0 v. 1
60	-	0 v. 2, 1 v. 2.
90	0 v. 3, 1 v. 3, 2 v. 3	0 v. 3, 1 v. 3, 2 v. 3
120	0 v. 4, 1 v. 4, 2 v. 4, 3 v. 4	0 v. 4, 1 v. 4, 2 v. 4, 3 v. 4

[z] Single degree of freedom contrast. $P \leq 0.05$.