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Research Reports

Offset Increase in Hosta Following Benzyladenine Application[1]

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Abstract

A single foliar application of benzyladenine (BA) at 1250 to 3750 ppm stimulated axillary and rhizomic budbreak and offset formation in *Hosta sieboldiana* (Lodd.) Engl. Plants with no initial offsets formed a similar number of offsets as those with one initial offset but 143% more offsets than plants with two or three initial offsets. Growth index was either not affected or increased by BA application. Plant appearance was enhanced by late season offset formation in BA-treated plants.

Index words: plaintain lily, blue hosta, cytokinin, growth regulator.

Growth regulator used in this study: Pro-Shear [benzylaminopurine or benzyladenine (BA)], N-(phenylmethyl)-1*H*-purin-6-amine.

Species used in this study: blue hosta [*Hosta sieboldiana* (Lodd.) Engl.].

Significance to the Nursery Industry

Most hosta cultivars produce very few offsets per year, which limits the rapid multiplication of certain cultivars without using tissue culture techniques. A foliar spray of the synthetic cytokinin, Pro-Shear (BA), can stimulate offset development from axillary and rhizomic buds, leading to more rapid multiplication. However, stock plants with two or three offsets at the time of BA application form fewer offsets in response to BA than stock plants with no or one offset. These findings should facilitate the development of a practical system for the accelerated multiplication of hosta using BA to stimulate offset formation.

Introduction

Hostas are among the most popular herbaceous perennials in the United States (8), being well- suited for partial-to-full shade areas in landscapes. Hostas are conventionally propagated in the spring or fall by crown division, a process that produces only a few plants per stock plant. Rapid increases in plant numbers and the introduction of new cultivars may be impeded by this limitation.

Vegetative buds of hosta develop on rhizomes and in leaf axils (9), but the shoot apex appears to suppress outgrowth of these buds by apical dominance. A primary factor in the mechanism of apical dominance is a hormonal interaction between auxins and cytokinins (1). Auxin, produced at the shoot tip and transported basipetally, inhibits the release of buds from apical dominance. This action of auxin is antagonized by cytokinin, as demonstrated by the release from inhibition of lateral buds in many species by the exogenous application of cytokinin (6). A previous study demonstrated that application of the synthetic cytokinin, benzyladenine (BA), to single-shoot plants of *Hosta sieboldiana* or blue hosta induced the outgrowth of lateral and rhizomic buds (3). Offsets formed from BA-induced buds were removed from treated plants within 30 days of BA application and

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Table 1. Change in initial offset number of blue hosta stock plants treated with 0, 1250, 2500, or 3750 ppm BA[z].

	Change in offset number					
	30 DAT[y]			60 DAT		
Initial offset number	0	1	2, 3	0	1	2, 3
BA rate (ppm)						
0	0.1a[x]	0.8b	–1.4c	0.1a	0.1a	–0.7b
1250	1.5a	2.3a	–0.4b	2.3a	2.8a	0.3b
2500	1.3a	1.3a	1.4a	1.9a	1.4a	1.7a
3750	3.1a	2.4a	1.1b	3.0a	2.1a	1.9a
Significance[w]	L***	L***	L***	L***	L*Q*	L***

[z]BA rate × initial offset number significant.

[y]DAT = days after treatment.

[x]Means within BA rate and time separated by Duncan's multiple range test, P = 0.05.

[w]L, Q: linear or quadratic response, respectively, at the 0.05 (*) or 0.01 (***) level within columns; control included in regression analysis.

rooted under intermittent mist (4). Application of this technique to hosta production would likely employ stock plants with various numbers of initial offsets. However, because apical dominance is at least partially controlled by auxins produced in the shoot tip, the presence of multiple shoot apices may alter the response of hosta to BA application. The objective of this study was to determine effects of number of initial offsets on response of blue hosta to a range of BA rates.

Materials and Methods

Uniform liners of blue hosta were transplanted into 3.8 liter (#1) pots containing pinebark:sand (7:1 by vol) medium amended per m^3 (yd^3) with 8.3 kg (14 lb) Osmocote 17N–3P–10K (17–7–12), 3 kg (5 lb) dolomitic limestone, and 0.9 kg (1.5 lb) Micromax on September 14, 1993. In April 1994, plants were topdressed with 18 g (1 Tbsp) of 24N–1.7P–13.3K (Polyon 24–4–16). Plants were grown under 47% shade and overhead irrigated. In July 1994, plants were selected for uniformity and divided into three groups based on the number of offsets present: those with no offsets, those with one emerged offset, and those with two or three offsets. On July 20, plants in each group received a single foliar spray of 0, 1250, 2500, or 3750 ppm BA (Pro-Shear, Abbott Laboratories, Chicago, IL) using a CO_2 sprayer fitted with a cone nozzle. Buffer-X (Kalo Agr. Chemicals, Overland, KS) was added to each BA solution as a surfactant at 0.2%. Each BA treatment was applied as a full coverage spray applied to runoff; average spray volume was 8.8 ml (0.3 oz) per plant.

When treated, a growth index [(height + width at widest point + width 90° to first width) ÷ 3, in cm] and leaf count were determined for five plants in each offset group. Mean growth index and leaf counts were 30.9 cm (12.2 in) and 10.8 for plants with no offsets, 32.4 cm (12.8 in) and 13.6 for those with one offset, and 31.2 cm (12.3 in) and 13.5 for those with two or three offsets, respectively. At 30, 60, and 90 days after treatment (DAT), plant height, growth index, and offset counts were recorded for each plant. Treatments in this 3 × 4 factorial experiment were completely randomized with eight single-plant replications. Data were subjected to analysis of variance to test for significance of main effects and interactions. Regression analysis was used to determine rate response to BA, and Duncan's multiple range test was used to test significance of initial offset numbers.

Results and Discussion

The interactions between initial offset number and BA rate for change in initial offset number at 30 and 60 DAT were significant (P ≤ 0.05) (Table 1). Generally, offset number increased linearly with increasing BA rate, regardless of initial offset number. These offsets developed from both axillary and rhizomic buds. For plants with no initial offsets, offset counts increased from 0.1 to 3.1 at 30 DAT, with no further increase at 60 DAT, with 3750 ppm BA. The interaction between initial offset number and BA rate for change in initial offset number was not significant at 90 DAT. Change in offset number, averaged across initial offset number, again increased linearly with increasing BA rate (Table 2). This stimulatory effect of BA on offset formation in hosta concurs with previous studies (2, 3).

At 30 DAT, change in offset number among controls was greatest for plants with no initial offsets, followed by those with one initial offset, and least for plants with two or three initial offsets. When treated with 1250 ppm or 3750 ppm BA, plants with no or one initial offset formed similar numbers of offsets 30 DAT but more offsets than those with two or three initial offsets. A similar trend was detected 60 DAT with controls and plants treated with 1250 ppm BA. However, plants with different initial offset numbers formed simi-

Table 2. Change in initial offset number of blue hosta stock plants treated with 0, 1250, 2500, or 3750 ppm BA, 90 DAT[z].

BA rate (ppm)	Change in offset number
0	–0.3
1250	1.5
2500	1.4
3750	2.4
Significance[y]	L***
Initial offset number	
0	1.7a[x]
1	1.3ab
2, 3	0.7b

[z]BA rate × initial offset number not significant, P = 0.05; DAT = days after treatment.

[y]L: linear response at the 0.05 (*) level; control included in regression analysis.

[x]Means separated by Duncan's multiple range test, P = 0.05.

Table 3. Growth index[z] of blue hosta treated with 0, 1250, 2500, or 3750 ppm BA, 90 DAT[y].

	Initial offset number		
BA rate (ppm)	0	1	2, 3
0	23.6b[x]	23.0b	33.0a
1250	30.3a	32.3a	34.0a
2500	34.2a	28.9a	31.7a
3750	34.0a	33.9a	29.5a
Significance[w]	L***	L**	NS

[z]Growth index = (height + width at widest point + width 90° to first width) ÷ 3, in cm.

[y]BA rate × initial offset number significant, $p \leq 0.05$; DAT = days after treatment.

[x]Means within a BA rate separated by Duncan's multiple range test, P = 0.05.

[w]L: linear response at the 0.01 (**) or 0.001 (***) level or non-significant (NS) at the 0.05 level; control included in regression analysis.

lar numbers of offsets 60 DAT when treated with 2500 ppm or 3750 ppm BA. At 90 DAT, plants with no initial offsets had a similar increase in offset number as those with one initial offset and a 143% greater increase compared to plants with two or three initial offsets. These results indicate that the presence of one offset on stock plants had little or no effect on hosta's response to BA compared to stock plants with no initial offsets. However, the presence of two or three offsets reduced subsequent formation of offsets in response to BA application. We are unaware of other studies that have examined how the number of shoot apices affects apical dominance. However, apical dominance is often explained in terms of auxin produced in the shoot tip and transported basipetally down the stem where it inhibits axillary bud outgrowth (1). One possible explanation for the observed response in hosta is that plants with two or three initial offsets produced more auxin than those with zero or one offset, thus apical dominance was stronger and BA was less effective in promoting outgrowth of additional axillary or rhizomic buds.

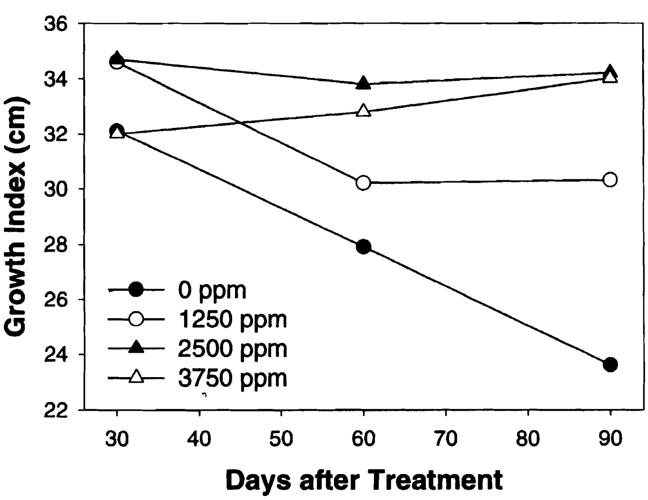

Fig. 1. Growth index of blue hosta with no initial offsets and treated with 0, 1250, 2500, or 3750 ppm BA. Growth index = (height + width at widest point + width 90° to first width) ÷ 3, in cm.

The change in offset number decreased in controls with one (30 DAT) or two or three (30 and 60 DAT) initial offsets and at 30 DAT in plants with two or three initial offsets treated with 1250 ppm BA. This decrease in offsets has been previously reported (3) and may reflect a random abortion of offsets. Lateral buds of other species have been stimulated to develop after applying synthetic cytokinins, but induced buds failed to elongate and did not increase branching (7). However, to our knowledge, this is the first report of a decrease in offsets among control plants.

Plant height and growth index data followed similar trends, hence only the latter are presented. Growth index was not affected by treatments at 30 or 60 DAT; however, at 90 DAT there was a significant interaction between initial offset number and BA rate for growth index (Table 3). Growth index increased linearly with increasing BA rate when the initial offset number was zero or one. When the initial offset number was two or three, growth index was not affected by BA rate. Growth index was similar among plants with different numbers of initial offsets, except among controls in which growth index for plants with zero or one initial offset was lower than for plants with two or three initial offsets. These results showing no effect or an increase in growth index with BA application to hosta are consistent with other studies (2, 3).

However, in August and September, plants in all treatments grew very little, and foliage developed marginal necrosis contributing to a general decline in plant appearance and size. Symptoms appeared related to summer dormancy induced by heat stress, a condition *Hosta sieboldiana* and its cultivars have been reported to experience (5). No treatment-related phytotoxicity was noted on any plants. The outgrowth of BA-induced lateral buds enhanced the appearance of plants (personal observation) and offset the decline in growth index, particularly among plants with no initial offsets (Fig. 1).

These data support previous studies showing that BA stimulates outgrowth of lateral buds in hosta. However, fewer additional BA-stimulated buds are likely to develop into shoots when two or three initial offsets are present on the stock plants than when zero or one offset is present. These results provide a clearer understanding of stock plant response to BA application and should facilitate the development of a practical system for the accelerated multiplication of hosta.

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