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Effect of GA_3 and BA on Lateral Shoot Production on Anthurium

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Additional index words. topping, growth regulator, propagation, apical dominance

Abstract. **Juvenile anthurium (*Anthurium andraeanum* Andre) plants were treated by topping and/or with foliar sprays of GA_3 and BA. With increasing concentration (0 to 500 ppm) of GA_3, topped plants showed an increase in lateral shoots. With increasing concentration (0 to 1000 ppm) of BA, the number of lateral shoots increased on both topped and intact plants. Topping alone increased lateral shoots. Chemical names used: *N*-(phenylmethyl)-*1H*-purin-6-amine (BA), gibberellic acid (GA_3).**

Anthuriums are vegetatively propagated to ensure uniformity of cultivars. Conventional methods of propagation involve sprouting of vegetative buds positioned opposite each leaf, at alternate nodes (1). Topping (manual removal of the terminal portion) of mature plants induces development of one or more lateral shoots, which are planted as cuttings once roots have developed. Excised vegetative buds are used in tissue culture propagation of anthuriums (4). Propagation by topping of mature plants is slow, whereas tissue culture propagation is economically prohibitive for many commercial growers.

Higaki and Rasmussen (3) used various growth regulators to increase shoot development on mature anthurium plants. Foliar treatment with BA at 1000 ppm induced more shoot formation than BA at 0, 100, 500, and 1500 ppm, or (2-chloroethyl)phosphonic acid (ethephon) or N-(phenylmethyl)-9-(tetrahydro-2*H*-pyran-2-yl)-9*H*-purin-6-amine (PBA) at 100, 500, 1000, or 1500 ppm. Nakasone and Kamemoto (6) observed no effect on stem length, flower production, or flower size of anthuriums treated with 10, 25, 50 or 100 ppm GA, either with one application or four monthly applications. During a previous experiment in which GA_3 effects on anthurium flowering were studied, increased side shoot production was observed in mature plants treated with GA_3 concentrations of 250 to 1000 ppm (unpublished data).

GA_3 has been shown to enhance bud development in other plants. GA_3 spray application in May or June stimulated lateral budbreak of *Skimmia japonica,* with effects only slightly modified by sprays of N^6-benzylaminopurine (BAP) and 2,3,5-triiodo benzoic acid (TIBA); GA_4 had no effect (8). Branching of *Hedera helix* was enhanced and secondary lateral shoots were produced on pruned plants when GA_3 was applied as a foliar spray (5). Injections of GA_3 into *Musa* lateral buds before floral initiation stimulated bud development into suckers (7).

Use of juvenile plants, which have more nodes per unit stem length than do mature plants, appears to be a potentially rapid and inexpensive method of propagating anthuriums, as topped juvenile anthurium plants were found to produce more suckers than untopped plants (2).

Experiments were conducted to determine whether GA_3 and/or BA could replace topping in promoting shoot development in juvenile anthurium plants and/or enhance shoot development on topped plants.

The first experiment used a split-plot design, with five replicates and five plants per replicate. Test plants were juvenile, 10 to 15 cm in height 'Marian Seefurth' anthuriums growing in polyethylene bags in volcanic cinder medium under 80% Saran shade. Topping treatments comprised the main plots, with one-half of the plants topped and one-half left intact. In topped plants, stems were cut with the basal portion retaining at least two leaves and the upper section retaining at least one or two adventitious roots. The GA treatment subplots were 0, 125, 250, 375, and 500 ppm GA_3, with 0.05% Tween 20 surfactant. GA_3 was applied once as a foliar spray to runoff in Jan. 1985. Plants were sprayed 5 to 10 min after topping. The number of new lateral shoots was counted 6 months after treatment.

The second experiment was a split-plot design with four replicates, with topping as the main plot. Experimental units consisted of four 'Mauna Kea' anthurium plants, 10 to 15 cm in height, grown in cinder–peat medium in polyethylene bags under 80% shade. BA treatments were 0, 500, and 1000 ppm aqueous solutions with 0.05% Tween 20 surfactant. Topped plants were sprayed within 5 to 10 min after topping in Jan. 1985. GA_3 treatments of 0 and 500 ppm aqueous solutions with 0.05% Tween 20 were applied as

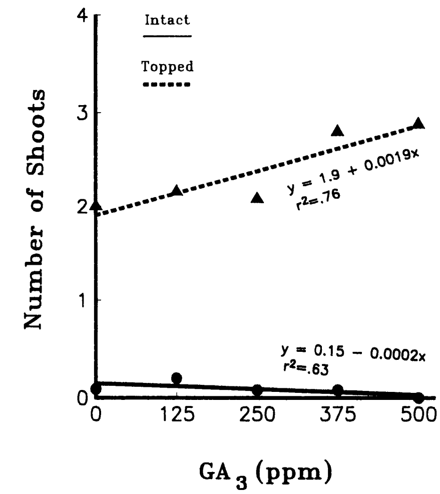

Fig. 1. Effect of topping and GA_3 on 'Marian Seefurth' anthurium lateral shoot production.

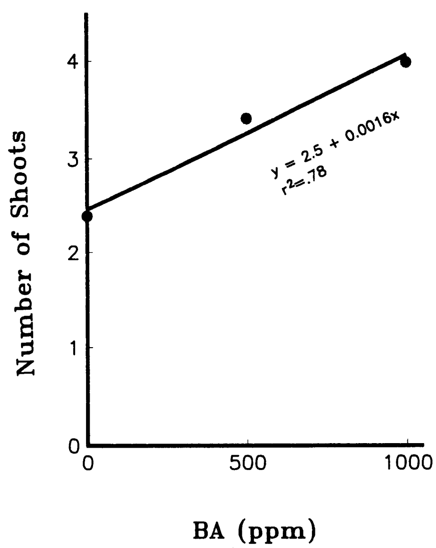

Fig. 2. Effect of BA on 'Mauna Kea' anthurium lateral shoot production.

Table 1. Effect of GA_3 and topping treatments on 'Mauna Kea' anthurium shoot production.

Topping treatment	GA_3 (ppm)	No. shoots
Intact	0	1.6 c[z]
	500	2.0 b
Topped	0	3.3 b
	500	5.8 a

[z]Mean separation by Duncan's multiple range test, 5% level.

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foliar spray to runoff 1 week after application of BA treatments. The number of lateral shoots was counted 6 months after GA_3 treatment.

A maintenance program of fertilizers (1600 $kg \cdot ha^{-1} \cdot year^{-1}$ of 14N–6.1P–11.6K) and pesticides was followed for both experiments. Data were analyzed by single degrees of freedom analysis of variance.

In the first experiment, an interaction between topping and levels of GA_3 was observed ($P < 0.01$) (Fig. 1). A slight linear decrease in the number of shoots produced by untopped plants occurred with increased GA_3 concentration. However, a linear increase in number of shoots produced in topped plants was evident with increasing GA_3 concentration.

Topped plants in the second experiment produced more lateral shoots (4.5) per plant than did intact plants (1.8) ($P < 0.01$). The number of shoots produced increased linearly with increasing BA concentration (Fig. 2) and was not affected by topping ($P < 0.01$). As in the first experiment, an interaction between topping and GA_3 application was observed ($P < 0.01$). However, application of 500 ppm GA_3 increased shoot number for both topped and intact plants (Table 1). No significant interaction was observed between BA and GA_3 treatments or among the three factors.

BA application increased the number of lateral buds developing on juvenile plants, irrespective of topping. This response is consistent with observations by Higaki and Rasmussen on mature plants (3). Concentrations of BA >1000 ppm may be more effective on juvenile plants (Fig. 2); however, a few plants treated with the various levels of BA produced some abnormal white leaves, which did not develop fully. In addition, some shoots that developed after BA treatment died back after several weeks.

Similar undesirable effects were not observed on GA_3 treated plants. The conflicting results obtained in the two experiments on the effect of GA_3 on intact juvenile plants may have been due to the use of different cultivars; the tendency for sucker production in mature as well as juvenile anthuriums has been noted to be highly cultivar-dependent. As with *Hedera helix* (5), once apical dominance was removed through topping, GA_3 enhanced development of lateral buds of anthuriums. Plants topped and sprayed with 500 ppm GA_3 produced the greatest number of shoots of all treatments. Use of GA_3 at concentrations >500 ppm may be more effective than lower concentrations, as evidenced by the linear trend in Fig. 1; this warrants further investigation.

BA on intact plants and topping treatments and the same effect on promotion of shoot development. Although GA_3 application enhanced growth of shoots apparently stimulated by topping, this effect was not observed on plants treated with BA, which may be due to the fact that the GA_3 may not have been applied at the optimal time after BA treatment.

Results showed that both BA and GA_3 applications increased shoot development of juvenile anthurium plants and may be used for anthurium clonal propagation.

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Growth and Quality of Hinodegiri Azalea as Influenced by Isobutylidene Diurea, Urea, and Nitrapyrin

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Additional index words. Nitrification inhibitor, container media, leachate, nitrogen, controlled-release fertilizer, *Rhododendron obtusum*

Abstract. **Extensive losses in N applied to container-grown woody ornamental plants prompted this investigation to determine a) leaching of N from urea (U) and isobutylidene diurea (IBDU); b) influence of nitrapyrin (NI), a nitrification inhibitor, on N leaching losses from U; and c) to evaluate influences of these materials on growth, quality, and N uptake by *Rhododendron obtusum* Lindl. cv. Hinodegiri. In root medium composed of 60 pine bark : 30 sand : 10 soil (by volume), 48.8% of applied N from U was leached after 87 days, whereas leachate losses of N from IBDU and U + NI were 42.3% and 37.2%, respectively. All plants attained marketable quality by the end of the study. Azaleas fertilized with IBDU were of significantly higher quality on days 70 and 77 than those treated with U + NI and higher quality on days 77, 84, and 87 than those treated with U. No differences were found in shoot dry weight or N content in shoot tissues.**

Nitrogen is the mineral nurtrient used by plants in greatest amounts and is often limiting for plant growth due, in part, to the various mechanisms by which it is removed from the rhizosphere. Mills and Pokorny (7) stated that 50% of applied N may be leached from highly organic growing media. Leachate losses of NO_3^--N in excess of 10 $mg \cdot liter^{-1}$ pose an environmental hazard (4, 12). Retention of NH_4^+-N by bark also reduces plant available N (7).

Considerable losses of N from container media as leachate not only result in the inefficient use of soluble N fertilizer, but prompt the use of controlled-release N fertilizers such as urea-formaldehyde, sulfur-coated urea,

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Table 1. Particle size distribution by percent weight of pine bark and sand used in this study.

Sieve size (mm)	Bark (%)	Sand (%)
4.7	8.7[z]	0.0[z]
2.0 –4.7	28.3	1.4
1.0 –2.0	22.0	5.9
0.5 –1.0	20.7	21.7
0.25–0.5	12.7	51.2
0.1 –0.25	5.7	19.2
0.05–0.01	0.4	0.1
Pan	0.4	0.1

[z]Mean of three replications.