GROWTH REGULATOR TRIALS FOR BEDDING PLANTS

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Maintaining compact bedding plants before sale is desired to increase the marketable period. Chemical growth regulators are often used by growers to achieve compactness. Several chemicals currently available to shorten overall plant height may also produce phytotoxicity responses such as leaf scorch, yellowing, and leaf curl. New growth regulators such as Bonzi^{R} (paclobutrazol--ICI Americas), and Sumagic^{R} (uniconozole--Chevron), reduce internode elongation, usually without phytotoxic effects. The purpose of this trial was to evaluate uniconozole on several species of bedding plants.

METHODS

Eleven bedding plant species were studied. Six of the species were grown in 6" pots, in full sun, outside. These included: carnations (*Dianthus caryophyllus* 'Night Series'); pinks (*Dianthus chinensis* 'Princess Mix'); *Nierembergia frutescens*; petunia (*Petunia hybrida* 'Sugar Daddy'); snapdragon (*Antirrhinum majus* 'Floral Carpet Mix'); and *Verbena hybrida* 'Showtime'. Temperature extremes were 7-40°C during the trial period (April to June).

Three summer bedding plant species were grown in the greenhouse or under 50% shade cloth in cell-packs which measured 5 cm x 10 cm x 10 cm (individual cells were 5 cm x 5 cm x 3.3 cm). The species studied were: *Impatiens wallerana* 'Accent Mix' (greenhouse); *Impatiens wallerana* 'Super Elfin White' (shade); marigold (*Tagetes patula* 'Inca Orange' and *T. patula* 'Orange Boy' (shade); and *Petunia hybrida* 'Royal Sails (shade). Temperatures under shade cloth were similar to those listed above. Greenhouse temperatures ranged from 18 to 27°C during the trial period.

Plants received water and fertilizer as needed using standard nursery practices. At the time of the first spraying, all plants were at marketable size or within 1 week of being at marketable size. Plants were sprayed weekly for 4 weeks with 0 (water only), 2.5, 5.0, or 10.0 ppm a.i. uniconozole. Plant heights were recorded weekly.

In a subsequent experiment, fall-seeded bedding plant cultivars were grown in cell-packs in a greenhouse as described above. The three cultivars studied were pansy (*Viola x wittrockiana* 'Majestic Giants'), and two violas, *V. cornuta* 'Blue' and *V. cornuta* 'Arkwright Ruby'. Plants received two weekly sprays of 10 ppm (0.05 mg a.i./cell pack) uniconozole, beginning five weeks after seeding (before flower buds were visible). An additional group of pansies was treated 6.5 weeks after seeding, when plants had attained a marketable size but before flower buds were evident. Control plants were untreated. Each treatment was replicated four times.

For plants in 6" pots, the treatment consisted of 20 ml of spray solution per pot. For cell packs, treatments consisted of 5 ml of spray solution per pack. This foliar spray rate is equivalent to 2 quarts of solution per 100 sq. ft., or "spraying to runoff." The uniconozole product used was formulated as .05% emulsifiable concentrate (EC) with an added antibacterial agent and a surfactant, Tween 20.

RESULTS AND DISCUSSION

Uniconozole caused a significant reduction in growth of all cell-pack varieties within one week of treatment (Figs. 1 and 2). Varieties responded differently to the uniconozole application, depending on the timing of the first spray. 'Inca Orange' marigolds first sprayed at 8 weeks, with plants in full bud, showed no significant reduction in growth at any rate of uniconozole, whereas those first sprayed at 6 weeks, before buds were visible, showed significant growth reduction with treatment. In contrast, uniconozole reduced growth in petunias whether treated in pre-bud or full bud stages.

Pansies and violas treated with 10 ppm uniconozole nearly ceased growth (Fig. 2). As a result, the pansies that had attained a marketable size before treatment (i.e., those sprayed 6.5 weeks after seeding) remained saleable for a longer period than untreated controls. However, pansies and violas that were treated five weeks after seeding did not reach a marketable size during the trial.

Uniconozole increased the marketable period for cell-packs of impatiens, marigolds, and petunias (Fig. 3). The 2.5 ppm rate (0.0125 mg a.i./cell-pack) was as effective as 10 ppm (0.050 mg a.i./cell-pack) in increasing the saleable period for impatiens. For marigolds and petunias, the marketable period increased with uniconozole concentration throughout the treatment range.

The growth of plants in 6" pots was not reduced significantly by any concentration of uniconozole tested (data not shown). This may be explained by the absence of vegetative growth in both treated and control plants during the 4 weeks in which the plants were sprayed and monitored. The height increases exhibited by the carnations and petunias during this period is due primarily to the onset of flowering, rather than to vegetative growth. The other four species were in full flower at the time of their first spray application.

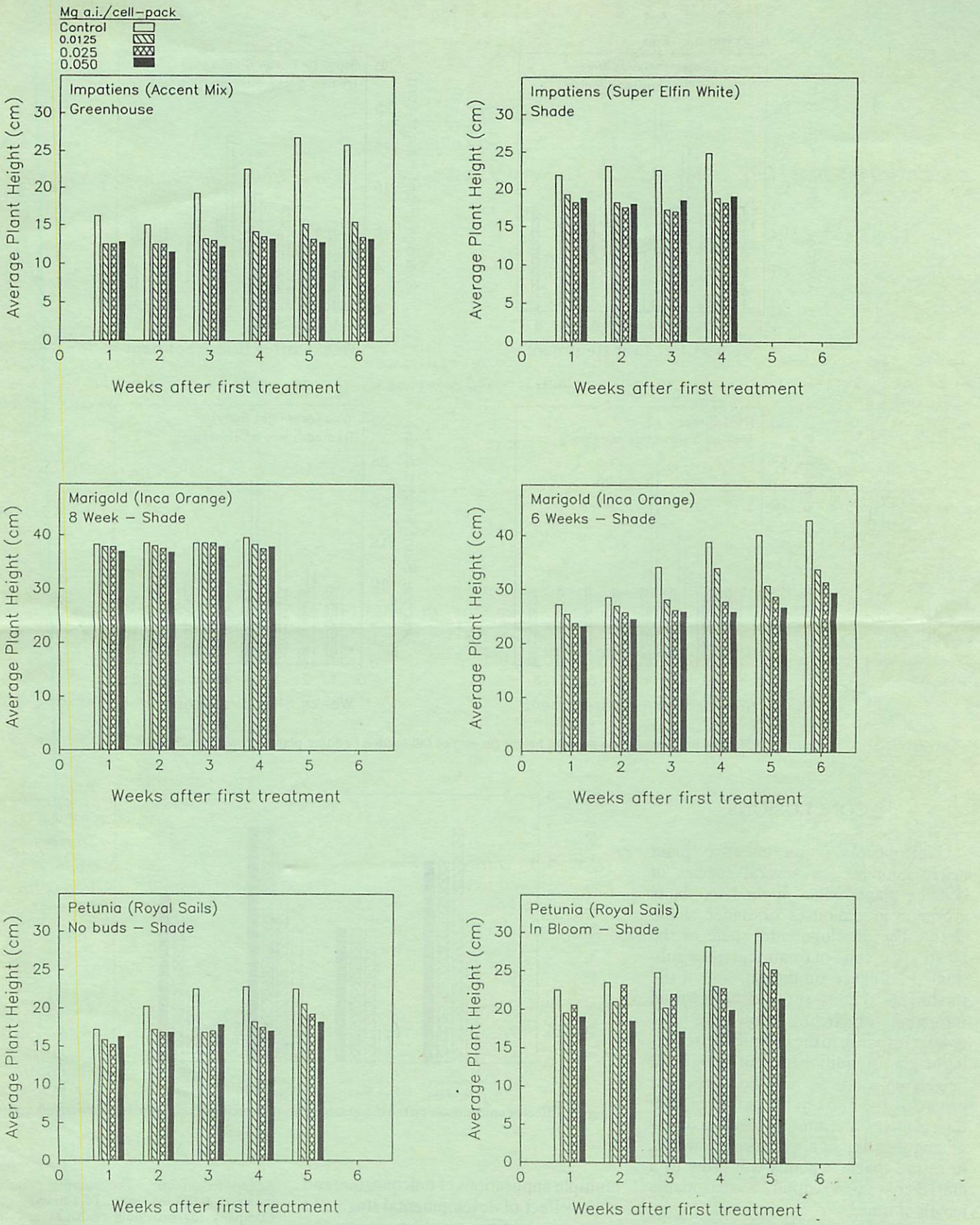

Figure 1. Effect of uniconozole on average height (in cm) of spring-seeded bedding plants grown in cell packs.

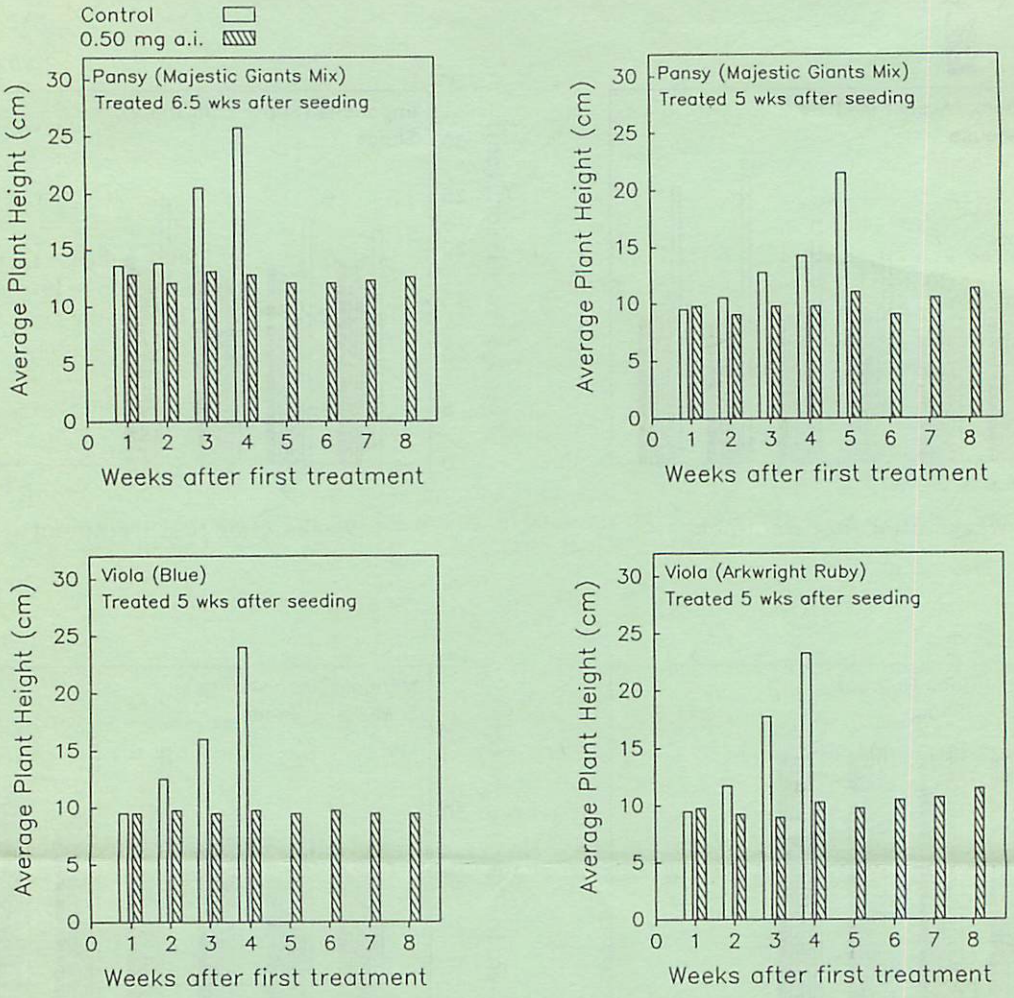

Figure 2. Effect of uniconozole on average height (in cm) of fall-seeded bedding plants grown in cell-packs.

CONCLUSIONS

Uniconozole is an effective plant height inhibitor for several species of bedding plants when applied to plants grown in greenhouses or under shade cloth. The developmental stage of the plants at the time of treatment has a substantial influence on the efficacy of the treatment. Plants sprayed before bud formation or before flowering had greater response to the chemical in reducing height. In addition to controlling plant height, uniconozole may be useful for extending the marketable period of bedding plants. Care must be taken in determining the time of application, however, to assure that the plants will grow to a marketable size within a reasonable length of time.

Additional trials will be conducted to investigate effects of different rates and multiple applications of uniconozole, and of the effect of developmental stage and growing conditions on plant response to uniconozole.

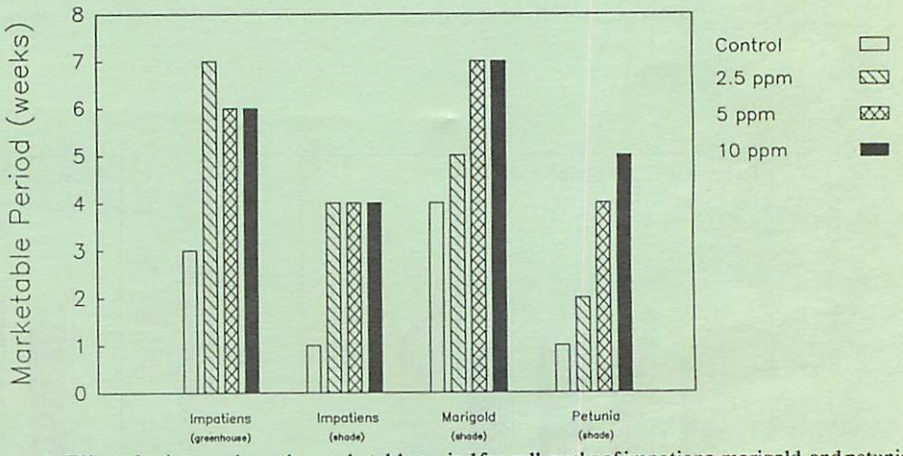

Figure 3. Effect of uniconozole on the marketable period for cell-packs of impatiens, marigold, and petunia.

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PEONIES AS A POTENTIAL FORCING CROP

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The genus *Paeonia* (Family Paeoniaceae) consists of over 30 species most of which are of European or Asian origin. There are two horticultural groups: the woody "tree" types and herbaceous peonies. The latter are derived principally from *P. lactiflora* (Siberia) and *P. officinalis* (Europe), and consist of a large number of cultivars developed over many years and grown mainly as garden plants in cold winter climates. These are very hardy, bushy perennials 2 to 4 feet tall that die back in the winter but develop new flowering stems each spring from a tuberous crown. The blooms make excellent cut flowers. They store well and exhibit much the same vase characteristics as cut roses. Interest in herbaceous peonies as a commercial crop in this country apparently was abetted by the establishment of a large variety garden at the University of Illinois in 1926; by 1935 some 2000 acres of the plants are reported to have been in production in the vicinity of Evansville, Indiana, and horticulturists at Purdue University were investigating a number of cultural and post-harvest concerns of local growers. One of their more important conclusions was that flowers harvested when the buds first show color maintain their quality when stored dry for 3 to 4 weeks at 1°C (34°F). Field-grown cut-peonies continue as a minor floricultural commodity in the midwest, although today's total acreage is greatly reduced.

Locally, herbaceous peonies were grown as a cut-flower field crop in the Mission San Jose district of the city of Fremont, CA, for many years, even though freezing temperatures in that particular locale are rare. Although this planting has been moved to a nearby coastal valley where it is exposed to more extreme temperatures, it is still subject to production problems related not to climate but to the timing of the harvest period: it lasts only from late May until early June and misses most of the prime spring market. A solution to this problem may be to force the plants, since it has been reported that peony clumps may be forced successfully after a period of natural cooling.

Preliminary research at Davis indicates that herbaceous peonies do indeed have potential as a late winter/early spring low-energy greenhouse forcing crop. One obvious question is: How much chilling is required to break dormancy? To answer this, large dormant plants were dug from the field in Sunol during the winter, divided at Davis into crown segments of about 20 cm diameter, planted in a sand/peat/redwood sawdust medium in 15.2 liter plastic containers and maintained outdoors. Sufficient natural cooling was received by 'Festiva Maxima' the following fall and early winter to allow flower forcing as early as mid-December, but increasing the duration of the natural cold treatment before forcing resulted in longer shoot growth and more flower buds per shoot (Table 1).

Experiments with artificial cooling at Davis indicate that peony flower bud dormancy can be broken by storing dormant plants for a minimum of four weeks at 6°C, or about the temperature of a typical household refrigerator (Table 2.). However, increasing the storage time at this temperature to six weeks, or reducing the storage temperature to just above freezing for four weeks, increased the total number of shoots that grew during forcing (Table 3).

Peonies appear to initiate flower buds regardless of the environment, so every shoot is potentially a harvestable flower. Initiation probably occurs soon after the current season's flowers bloom; developing flower buds were observed at Davis in the larger basal buds of 'Sarah Bernhardt' in late June. On the other hand, initiation in 'Festiva Maxima' has been reported as occurring in late August in Japan. Long days do not appear to promote senescence and dormancy in her-

Table 1. Growth characteristics of 'Festiva Maxima' peonies grown outdoors and forced at different times during the winter (Davis, 1983-84).

Date Forced	Shoots/plant			Date First Harvest
	Total	> 10 cm	Flowering	
15 Dec	3.2	2.6	2.6	19 Feb
15 Jan	13.8	7.6	4.6	19 Mar
15 Feb	20.0	11.0	7.2	28 Mar
Not forced	14.0	10.8	11.0	29 Apr
SE	1.41	1.79	1.52	

Table 2. Growth characteristics of 'Festiva Maxima' peonies after storage at 6°C for 0,2,4,6, or 8 weeks (Davis, 1983-84).

Cold Storage (Weeks)	Shoots/plant			Forcing Time (Days)
	Total	> 10 cm	Flowering	
0	0.6	0.0	0.0	-
2	1.2	0.0	0.0	-
4	8.4	6.8	4.6	67.2
6	11.0	7.2	4.8	66.8
8	13.4	9.8	7.8	68.9
SE	1.43	1.34	1.28	