Efficacy of Florel on Vegetative Annuals

A way to help growers find PGRs that stimulate lateral bud development and branching and reduce internode elongation.

By Terri Starman, Melissa Robinson and Kristen Eixmann

Growers are challenged to keep 4- and 5-inch annuals with trailing, spreading growth habits sufficiently compact. It is of great interest to growers to find plant growth regulators (PGR) that stimulate lateral bud development and branching and reduce internode elongation to avoid high labor costs associated with manual pinching and pruning.

PGR EFFECTS

In earlier experiments, we determined certain cultivars of vegetative annuals are not responsive to B-Nine (daminozide, Crompton/Uniroyal) at 5,000 ppm, Bonzi (paclobutrazol, Syngenta) at 50 ppm, a tank mix of Cycocel (chlormequat, Olympic Horticultural Products) at 1,250 ppm and B-Nine at 2,500 ppm or manual pinching, and both may delay flowering.

The negligible response to Bonzi and Sumagic (uniconazole, Valent, USA), two triazole-type plant growth regulators that must be absorbed by plant stems, may be due to the dense leaf canopy of these vigorous plants being difficult to penetrate. Sumagic or Bonzi foliar sprays or Bonzi drenches were not effective in reducing plant height and width or promoting branching of bougainvillea (*Bougainvillea glabra* x *Bougainvillea peruviana* 'Barbara Karst'), which has a vigorous growth habit and requires frequent pruning.

Types of plant growth regulators most often used to promote branching of floral crops are cytokinins like benzyl adenine (BA), Atrimmec (dikegulac, PBI Gordon) and Florel (ethephon, Monterey). BA increased branching of english ivy (*Hedera canariensis*) and pothos (*Rhaphidophora aurea*), two climbing, spreading foliage crops. Atrimmec at 780 ppm increased number of branches per node and total number of branches in 18 cultivars of impatiens (*Impatiens wallerana*). At 1,560 ppm, branching was excessive, plants were stunted, and leaves and flowers were mis-shapen. Florel at 500 and 1,000 ppm reduced plant width but delayed flowering by 8-11 days for scaevola (*Scaevola aemula* 'New Wonder'). Florel at 1,500 and 2,000 ppm increased the number of shoots for rose cultivars (*Rosa hybrida*) 'Sonia' and 'Mercedes' budded onto *Rosa canina L.*

Figure 1. The effect of Florel foliar spray treatment (ppm) on plant height (inches) of vegetative annuals.

Common name	Variety	0	500	1,000	Significance[1]
alternanthera		18.3	12.0	9.7	***
trailing snapdragon	'Chandelier Yellow'	6.1	7.2	7.7	**
	'Luminaire Yellow'	9.3	9.9	8.5	NS
brachyscome	'Toucan Tango'	8.5	8.1	8.0	NS
calibrachoa	'Colorburst Red'	10.8	8.5	7.8	**
	'Liricashower Rose'	6.8	6.5	6.5	NS
	'Million Bells Cherry Pink'	8.5	8.4	7.0	***
	Trailing Pink	6.1	6.1	5.8	NS
diascia	'Sunchimes Rose'	10.6	9.2	7.3	***
	'Red Ace'	9.6	9.0	7.7	**
impatiens	'Tioga Red'	9.9	8.7	8.2	***
	'Tioga White'	9.7	8.6	8.5	*
sweet potato vine	'Sweet Caroline Bronze'	6.8	6.2	3.1	*
lantana	'Patriot Cherry'	10.2	8.1	5.5	***
	'Samantha'	7.4	5.7	3.0	*
monopsis	'Royal Flush'	17.4	13.0	12.9	NS
nemesia	'Aromatica Dark Lavender'	10.2	8.1	7.0	**
	'Blueberry Sachet'	7.4	6.2	5.9	*
	'Bluebird'	8.6	7.5	6.6	*
nolana	'Blue Eyes'	20.7	10.7	11.0	***
ivy geranium	'King of Balcon'	17.9	13.5	14.6	NS
persicaria	'Red Dragon'	24.4	21.9	19.2	NS
petunia	'Cascadia Pink'	10.5	10.3	9.1	**
	'Mini Bright Pink'	9.2	8.5	8.1	**
	'Supertunia Mini Purple'	6.4	6.8	7.0	NS
bacopa	'Bridal Showers'	—	—	—	—
vinca vine	'Illumination'	20.0	10.5	10.9	***

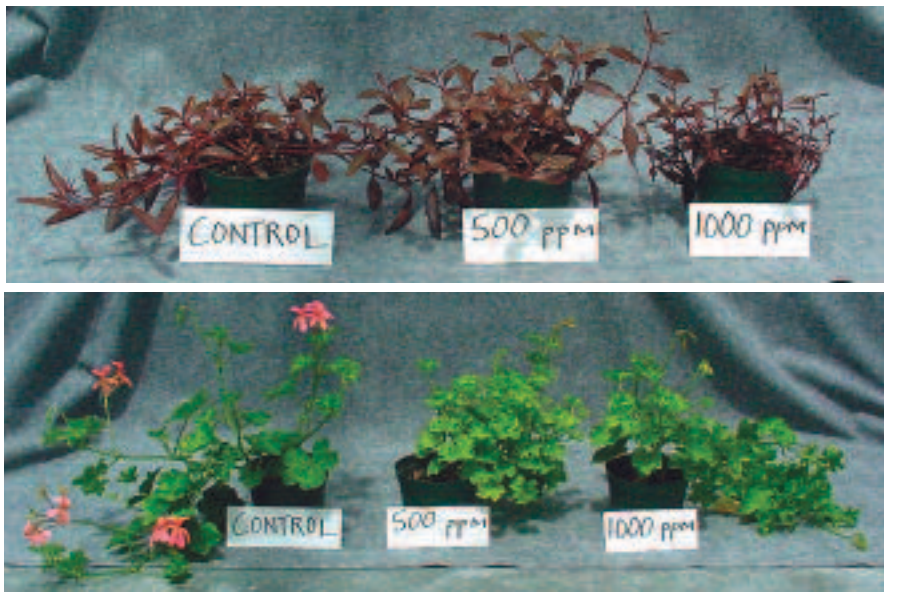
[1]*Plant heights for an individual variety in the significance column are NS = not significantly or are significantly different with a confidence level of * = 95 percent; ** = 99 percent; or *** = 99.9 percent.*

FLOREL EFFECTS

Florel releases ethylene to the plant, thereby causing various physical effects such as height retardation, flowering, branching and leaf drop. The effects of Florel depend on the age, size and type of plant. Commercially, Florel is applied to stock plants to shorten internodes and provide healthier cuttings in greater amounts. Once propagules have been potted and roots are established, Florel is sprayed to increase branching. After cuttings have begun growth, plants can be sprayed to decrease internode elongation, increase branching and improve plant quality, i.e. marketability.

Most plants are treated with Florel 1-2 weeks after potting and can be sprayed again in another 1-2 weeks. It is essential that leaves stay wet for 3-4 hours after treatment. The effective pH of the water/Florel solution in the spray tank is between 4.0 and 4.5. Most floral crops are treated with a Florel concentration between 250 and 500 ppm. Florel is applied as a foliar spray and uniform application and run off ensure complete coverage. Plants under stress, then sprayed with Florel, exhibit leaf yellowing or leaf drop and have delayed rooting and slower growth. This is termed "stress exaggeration." Therefore, plant health should be optimum before treating with Florel.

The objective of this research project was to ascertain the potential use ➧



Top: The effect of Florel foliar spray application at 0, 500 or 1,000 ppm (left to right) on Alternanthera dentata*; bottom: the effect of Florel foliar spray application at 0, 500 or 1,000 ppm (left to right) on* Pelargonium hybrida *'King of Balcon.' (Photos courtesy of Terri Starman)*

of Florel on vegetative annuals with spreading and trailing growth habits. These plants require a manual pinch, repeated pruning or plant growth regulator application to produce well-proportioned, easy-to-ship plants. To reach this goal, the most commonly used commercial concentration and a more astringent one for herbaceous floral crops were compared to a water control to determine the efficacy of Florel.

MATERIALS AND METHODS

Rooted cuttings of vegetative annuals were planted upon receipt from mid-January to early February 2002. One rooted cutting was potted per 4-inch container using Pro Mix BX (Premier Brands). Plants were irrigated by hand and fertilized with constant liquid feed at 15-5.4-14.1, with nitrogen at 200 ppm. Warm-season plants were grown at 75/65º F, and cool-season plants were grown at 65/55º F day/night set points in separate glass greenhouses.

Plants were sprayed when roots had reached pot edge (approximately two weeks after potting) with Florel at either 0, 500 or 1,000 ppm. Florel was mixed with distilled water and one drop of Capsil (The Scotts Co.), a blend of polyether-polymethylsiloxane copolymer and nonionic surfactant, before applying to plants. Capsil was used because it is recommended as a spray adjuvant. Plants were harvested in mid-April when they were considered marketable. Marketable stage was defined as when the majority of control plants had foliage covering the pot so that no media showed, branches beginning to drape over the pot edge and flowering with flowers distributed evenly across the plant canopy. Measurements included plant height, width index and flower number (See Figures 1-3, pages 82-87). Plant width index was computed by averaging two plant widths taken across the leaf canopy in perpendicular directions. Plant height was measured from the bottom of the pot to the top of the plant.

Flower number was determined differently for each cultivar because mode of flowering differed among genera. Individual flowers were

Top: The effect of Florel foliar spray application at 0, 500 or 1,000 ppm (left to right) on Ipomoea batatas *sweet potato vine 'Sweet Caroline Bronze'; bottom: The effect of Florel foliar spray application at 0, 500 or 1,000 ppm (left to right) on* Nolana paradoxa *'Blue Eyes'.*

Figure 2. The effect of Florel foliar spray treatment (ppm) on plant width index (inches) of vegetative annuals.

Common name	Variety	0	500	1,000	Significance
alternanthera		9.4	8.7	7.8	NS
trailing snapdragon	'Chandelier Yellow'	14.7	15.0	10.9	**
	'Luminaire Yellow'	8.1	13.5	10.8	***
brachyscome	'Toucan Tango'	9.9	9.7	8.0	*
calibrachoa	'Colorburst Red'	21.2	16.7	16.1	*
	'Liricashower Rose'	29.1	28.6	26.9	NS
	'Million Bells Cherry Pink'	9.8	9.7	5.7	***
	Trailing Pink	23.4	13.6	10.7	***
diascia	'Sunchimes Rose'	15.1	10.8	9.1	***
	'Red Ace'	28.7	18.8	14.4	***
impatiens	'Tioga Red'	11.8	12.0	11.1	NS
	'Tioga White'	12.6	11.7	11.5	NS
sweet potato vine	'Sweet Caroline Bronze'	6.3	5.6	3.0	**
lantana	'Patriot Cherry'	8.5	7.5	5.4	***
	'Samantha'	7.0	5.0	4.4	NS
monopsis	'Royal Flush'	10.6	9.1	9.0	NS
nemesia	'Aromatica Dark Lavender'	8.0	5.9	5.5	***
	'Blueberry Sachet'	9.1	7.0	5.9	*
	'Bluebird'	11.1	10.3	9.8	NS
nolana	'Blue Eyes'	11.6	7.3	8.6	**
ivy geranium	'King of Balcon'	13.2	10.1	9.9	***
persicaria	'Red Dragon'	20.7	20	19.5	NS
petunia	'Cascadia Pink'	18.5	14.8	12.3	***
	'Mini Bright Pink'	22.3	20.3	17.8	**
	'Supertunia Mini Purple'	28.3	24.8	25.7	*
bacopa	'Bridal Showers'	12.8	10.2	8.5	**
vinca vine	'Illumination'	8.7	8.5	7.2	NS

*'Plant widths for an individual variety in the significance column are NS = not significantly or are significantly different with a confidence level of * = 95 percent; ** = 99 percent; or *** = 99.9 percent.*

counted on those species with single flowers, and inflorescenses were ▶ counted on those with spikes, racemes or umbels.

RESULTS

Florel did not affect either plant height or width index of three of the 27 cultivars: calibrachoa 'Liricashower Rose', monopsis 'Royal Flush' and persicaria 'Red Dragon'. The morphology of the control, 500 and 1,000 ppm plants showed no observable differences and plants treated with the highest concentration remained vigorous. Flower number was reduced with increased Florel concentration, because flowering was delayed in calibrachoa Liricashower Rose and monopsis Royal Flush did not flower. Flower number of persicaria Red Dragon was not affected. Further studies involving higher concentrations or multiple applications of Florel on these cultivars may be beneficial.

It is interesting to note that trailing snapdragon 'Chandelier Yellow' had increased height, and trailing snapdragon 'Luminaire Yellow' had increased plant width and flower number with Florel treatment.

Results for the remaining 22 cultivars showed brachyscome 'Toucan Tango', calibrachoa 'Million Bells Trailing Pink', ivy geranium 'King of Balcon' and petunia 'Supertunia Mini Purple' had no reduction in plant height when treated with Florel compared to the controls. Six cultivars only had reduced height when treated with the highest rate of Florel. Eight cultivars had the same height reduction with both concentrations of Florel compared to the control.

Excluding trailing snapdragon Luminaire Yellow, which showed an unusual increase in width index, nine of the cultivars had no reduction in width index when treated with Florel at either concentration compared to the controls. Of the cultivars that had reduced width with Florel treatment, six cultivars were reduced only when treated with the highest rate, four showed a dose response and seven resulted in the same width index reduction with either concentration compared to the control.

Florel reduced flower number of eight cultivars when applied at both concentrations, caused a dose response in two cultivars and reduced flower number in another five cultivars only when the chemical was applied at the highest rate.

Eleven cultivars had both a reduction in plant height and width index. Of these 11, only three did not experience a delay in flowering including calibrachoa 'Colorburst Red'; sweet potato vine 'Sweet Caroline Bronze', which does not have significant flowers; and lantana 'Patriot Cherry', which was just starting to flower when plants were harvested.

Florel controlled the growth of calibrachoa, nemesia and petunia cultivars, but response varied among cultivars. However, efficacy was obtained for both cultivars of diascia. Although Florel reduced size parameters of lantana Patriot Cherry, lantana Samantha was the only cultivar among all those tested that exhibited stress exaggeration. This cultivar was slow growing and may have been overwatered during

Figure 3. Flower number after Florel foliar spray (per ppm) treatment on vegetative annuals.

Common name	Variety	0	500	1,000	Significance
alternanthera		8	0	0	***
trailing snapdragon	'Chandelier Yellow'	4	6	4	NS
	'Luminaire Yellow'	2	11	6	**
brachyscome	'Toucan Tango'	14	10	6	***
calibrachoa	'Colorburst Red'	24	20	18	NS
	'Liricashower Rose'	63	33	16	*
	'Million Bells Cherry Pink'	3	3	0	***
	Trailing Pink	47	13	5	**
diascia	'Sunchimes Rose'	24	10	0	***
	'Red Ace'	19	1	0	***
impatiens	'Tioga Red'	16	14	12	NS
	'Tioga White'	8	5	1	NS
sweet potato vine	'Sweet Caroline Bronze'	0	0	0	NS
lantana	'Patriot Cherry'	1	0	0	NS
	'Samantha'	0	0	0	NS
monopsis	'Royal Flush'	0	0	0	NS
nemesia	'Aromatica Dark Lavender'	7	1	0	***
	'Blueberry Sachet'	6	4	0	*
	'Bluebird'	17	3	0	***
nolana	'Blue Eyes'	17	5	1	***
ivy gerainum	'King of Balcon'	3	2	0	*
persicaria	'Red Dragon'	11	9	8	NS
petunia	'Cascadia Pink'	13	5	2	***
	'Mini Bright Pink'	22	12	4	*
	'Supertunia Mini Purple'	19	2	2	**
bacopa	'Bridal Showers'	73	69	52	NS
vinca vine	'Illumination'	0	0	0	NS

*[1]Flower number for an individual variety in the significance column are NS = not significantly or are significantly different with a confidence level of * = 95 percent; ** = 99 percent; or *** = 99.9 percent.*

the early part of the experiment, aggravating the condition.

Florel proved to be an effective tool for improving plant proportion by reducing plant height and/or width index in 22 cultivars of vegetative annuals. Only three cultivars had no reduction in plant height and width index. Our results are in agreement with Roger Styer's, results in the article "Using Florel Effectively" (*GPN* October 2002), which listed brachyscome, double impatiens, sweet potato vine, lantana, ivy geranium, trailing petunia, bacopa and vinca vine as responsive to Florel, although no data was presented. Our results disagree with his on its effectiveness on trailing snapdragon.

CONCLUSIONS

We recommend you include Florel in your trials of plant growth regulators on vegetative annuals. Different species and cultivars would need individual testing to determine the best rate for each. Florel could prove to be a useful tool on trailing and spreading vegetative annuals to facilitate shipping, reduce production costs by allowing closer spacing and improve quality of plants.

Florel may be more effective on some vegetative annuals than antigibberellin-type plant growth regulators. The results of this experiment serve to demonstrate Florel efficacy on 22 of 27 cultivars of vegetative annuals for future testing. Florel caused reductions in plant height and/or width index for 22 cultivars, therefore, it was concluded that Florel was an effective growth-retarding chemical on 81percent of the cultivars tested. GPN

Terri Starman is associate professor of floriculture, Melissa Robinson is a graduate student and Kristen Eixmann is a research assistant at Texas A&M University, College Station, Texas. They can be reached by phone at (979) 862-2910 or E-mail at tstarman@tamu.edu.

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