Growth Regulators

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Section Editor

Managing Knock Out Rose and Loropetalum Growth in the Landscape with Cutless .33G

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Index Words: plant growth regulator, flurprimidol, granular formulation, woody ornamental

Significance to Industry: Many shrubs and groundcovers used in the landscape require routine pruning or shearing to keep their shape neat and compact. Pruning is a significant expenditure of time and a major labor cost for the landscape service industry. In addition, over half of the states in the U.S. have passed laws against disposing of yard wastes in landfills, which has increased the interest in using PGRs to reduce pruning or the amount of clippings. Application rates and frequency of Cutless .33G were studied in this study for managing growth of Knock Out rose and Zhu Zhou loropetalum in the landscape.

Nature of Work: Knock Out roses and loropetalums are popular shrubs commonly used in the landscapes. However, they can easily grow up to five feet tall and require regular trimming. Hand pruning is labor intensive and may increase disease problems associated with wounding the plant. Cutless .33G (SePRO Corporation, Carmel, IN) is a granular formulation of flurprimidol which is a gibberellic acid biosynthesis inhibitor. It is absorbed mainly by roots. Being granular, it is easier to broadcast around plants than soil drench a liquid product. Other than growth control, previous observations indicate that flurprimidol may enhance overall quality of established landscape plants with improved foliage color and flowering. The granular formulation for landscape use was effective on azalea and loropetalum in container production (1). However, few research studies have been conducted on its effectiveness in landscape (2).

The objective of this study was to determine effective rate and application frequency of Cutless to regulate the growth of Knock Out rose and Zhu Zhou loropetalum after being established in the landscapes. Two experiments were conducted in landscape research plots at LSU AgCenter Hammond Research Station, Hammond LA from 2009 to 2011. In both experiments, raised beds were made by adding soil mix (Nature's Best, Baton Rouge, LA) and pine bark to existing soil. Individual plots (experimental unit) were 10 feet long x 6 feet wide. A total of 28 and 25 plots were used in Expt. 1 and 2, respectively. Two plants of the same species were planted in each plot and treated as sub-samples. Plants were planted in the fall to allow establishment of roots during winter, and then treated with Cutless in the subsequent spring when new growth is observed. In both experiments, plants were lightly pruned (15%) at the time of the first

(spring) application but not the second (fall) application. Overhead irrigation was provided which facilitated the dissolution and uptake of the active ingredient.

Treatments in Expt. 1 (Knock Out rose) included Cutless applied at 0, 5, 10, or 20 lbs/1000 ft^2 on Apr. 13, 2010, and two applications of 5, 10, and 20 lbs/1000 ft^2 with the first application in April and the second application on Aug. 2, 2010. After April application, plant height (including inflorescences) and width (average of the two perpendicular widths) were measured once per month throughout the study. Plant visual quality was rated monthly by a scale ranged from 1 to 5, where 5 represents the best quality. Flower number per plant was recorded weekly from June to August. Leaf greenness was measured using a chlorophyll (SPAD) meter on the youngest fully expanded (YFE) leaves on June 7 and July 12. Data were analyzed as CRBD with four replications each having two sub-samples.

Treatments in experiment 2 (Zhu Zhou loropetalum) included single application of 0, 7, or 14 lbs/1000 ft^2 Cutless on March 3, 2011, and two applications of 7 or 14 lbs/1000 ft^2 on March 3 and August 23. Plant height and width were measured once per month throughout the study. Plant visual quality was recorded using the same rating scale as for Knock Out rose in Expt. 1. Data were analyzed as CRBD with four replications each having two subsamples.

Results and Discussions: For Knock Out rose, height reduction of 35% was observed at four weeks after the second application at 10 lbs/1000 ft^2. Two applications of 20 lbs/1000 ft^2 resulted in similar height reduction and visual quality as 2x10 lbs/1000 ft^2. Single application of either 10 or 20 lbs rate provided 10% to 15% height reduction, which was not satisfactory because Knock Out rose is a vigorous plant (Fig.1). Overall improvement in plant quality was also observed, including increased lateral branching and darker leaf color in treated plants. The control effect lasted for at least five months and more data are being collected for estimating control duration on this popular landscape rose.

For Zhu Zhou loropetalum, results indicated that Cutless at 14 lbs/1000 ft^2 applied once in the spring is effective on controlling shoot growth from spring to summer. Additional application in August did not provide further growth control compared to single application in April (Fig. 2). Darker purple leaves were noted and confirmed by a chlorophyll content meter. These results were similar to what was found with another variety, Merlot Lace (2).

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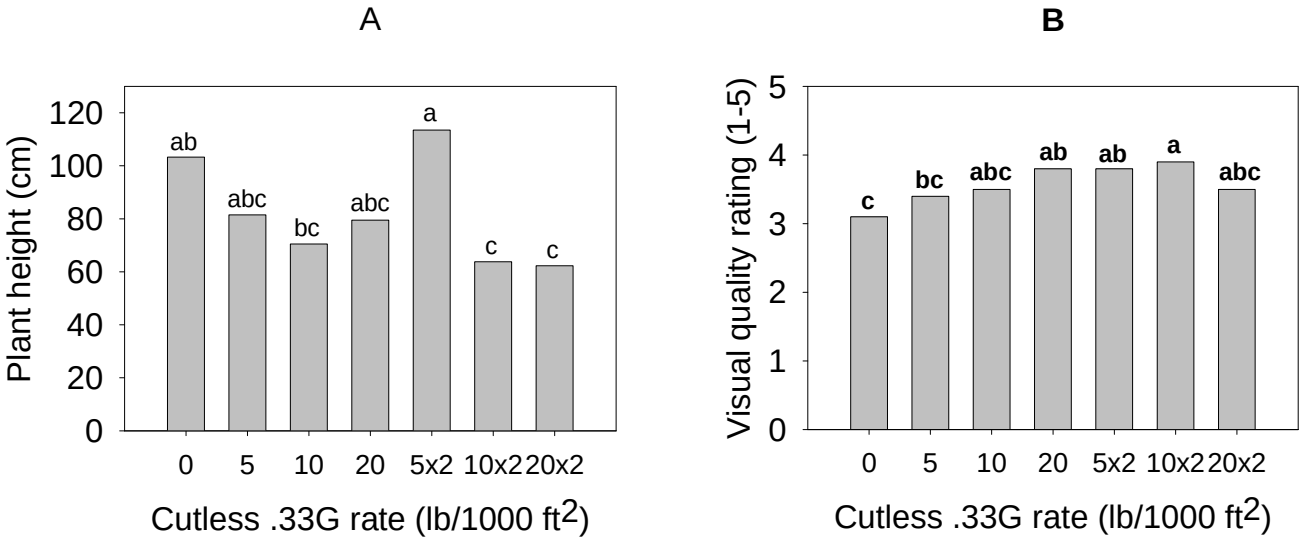

Figure 1. Plant height (A) and overall visual quality (B) of Knock Out roses at 4 weeks after the 2nd treatment of Cutless .33G in August 2011. First application was applied in March 2011.

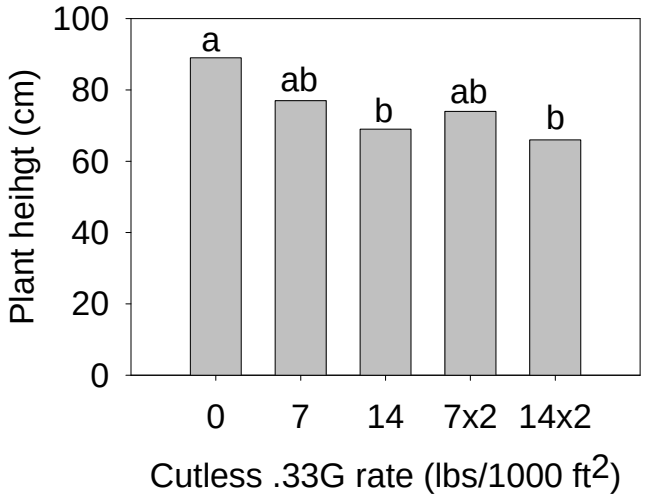

Figure 2. Loropetalum Zhuzhou plant height at 4 weeks after the 2nd application of Cutless .33 G in August. First application was applied in April 2011.

Plant Growth Regulator Impact on Calibrachoa and Verbena Branching

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Index Words: lateral branching, height control, phytotoxicity, Augeo, Configure, Florel

Significance to Industry: *Calibrachoa* sp. and *verbena* sp. are two popular ornamental plants and many commercial cultivars are available. Some cultivars have more branches than others. Consumers prefer well branched, compact plants with abundant flowering shoots. Plant growth regulators (PGR) are often used to enhance branching and hence increase the number of flowering shoots. However, the effectiveness of a PGR on branching depends on the type of PGR, application rate, and the genotype of the plant (1, 2). In this study, four cultivars of calibrachoa and four cultivars of verbena were treated with three PGRs, Augeo, Configure, and Florel, at two rates as a foliar spray. Effects of PGRs on plant performance varied with type of PGR and cultivars.

Nature of Work: On May 17, rooted cuttings of calibrachoa 'Balcanapt' Can-Can™ Apricot, 'Balcanoa' Can-Can™ Mocha, 'Balcanoran' Can-Can™ Orange, 'Balcanerry' Can-Can™ Strawberry, and verbena 'Balazvelu' Aztec™ Blue Velvet, 'Balazreve' Aztec™ Red Velvet, 'Balazwilro Aztec™ Wild Rose, 'Balwildared' Wildfire Dark Red were received in El Paso, TX from Ball Horticulture (Chicago, IL). Uniform un-pinched rooted cuttings were selected and subsequently transplanted to 4-in diameter round plastic pots filled with No. 1 Sunshine Mix (SunGro Hort., Bellevue, WA). Plants were then grown in the greenhouse and irrigated with a nutrient solution made from 15N-5P-15K Cal-Mag Special (Scotts, Marysville, OH) with total N at 125 ppm.

On May 25, plants were sprayed with PGRs after plants were well watered (Table 1). Before spraying, plants were arranged in four completely randomized blocks with 16 or 10 plants per block, depending on cultivar. Can-Can Apricot and Can-Can Mocha calibrachoa and Aztec Blue Velvet and Aztec Wild Rose verbena had 16 plants per block. The remaining cultivars had 10 plants per block. Eight pots were placed in each flat (9.5 inch wide by 20 inch long). To compare the efficacy of PGRs, a group of untreated and un-pinched plants served as control, and another group of untreated but pinched plants served as pinched control. The greenhouse temperature was controlled by a pad-and-fan cooling system. The average daily maximum temperature in the greenhouse during the experimental period were 30.3 ± 1.2 °C, average daily minimum

temperature were 23.7 ± 1.6 °C, relative humidity ranged from 20 to 45%, and daily light integral ranged from 15 to 21 $mol \cdot m^{-2} \cdot d^{-1}$.

At the end of the experiment (6 weeks after PGR treatments), plant width (two perpendicular widths) was measured for all plants, and plant height was measured for verbena. Total number of shoots and number of blooming shoots were counted. Visual quality was evaluated at 9, 21, and 33 days after PGR treatments. Phytotoxicity was also rated 21 days after PGR treatments. Criteria of evaluation are noted in the footnote of the result tables.

Results and Discussions: For calibrachoa, Augeo treated plants improved branching slightly compared to untreated control and pinched control plants and had the best visual quality among all treatments. Augeo 400 and 800 ppm treated plants had more or similar number of shoots compared to untreated and pinched control plants (Table 2). Configure and Florel did not improve branching, regardless of cultivars. Similar to total shoot number, Augeo 400 and 800 ppm treated plants had a similar number of blooming shoots compared to untreated control and pinched control plants for all cultivars (Table 3). Florel 500 and 1000 ppm also resulted in similar numbers of blooming shoots in Can-Can Orange and Can-Can Strawberry compared to untreated and pinched control plants. Plants treated with Configure at both rates resulted in the lowest numbers of blooming shoots. Right after the Configure foliar spray, plants appeared stressed and growth was stunted for a while. By the time the experiment was terminated, the majority of plants reached peak flowering. Configure treated plants had many small shoots that were in vegetative growth without flower buds. This may indicate that Configure rates, 150 and 300 ppm may be too high for calibrachoa. The effects of PGRs on final plant size were similar to their effects on branching. Augeo 400 and 800 ppm treated plants had similar widths or were bigger compared to untreated and pinched control plants. Other PGR treatments led to smaller plants (Table 4). Similarly, plants treated with Augeo 400 ppm had the best visual quality scores, followed by those treated with Augeo 800 ppm in all calibrachoa cultivars (Table 5). Configure 300 ppm and Florel 1000 ppm treated plants tended to have lower qualities. Minor phytotoxicity was observed in calibrachoa cultivars.

For verbena, none of the PGR treatments improved branching, regardless of cultivar. For Aztec Blue Velvet, plants treated with Configure 300 ppm and Florel 500 ppm had similar total shoot numbers as the untreated and pinched control plants, while all other PGR treatments reduced shoot number (Table 6). For Aztec Wild Rose, plants treated with Configure 150 ppm and 300 ppm and Florel 500 ppm had similar shoot numbers as the untreated and pinched control plants and all other PGR treated plants had fewer shoots. For Aztec Red Velvet and Wildfire Dark Red, all PGR treated plants had fewer shoots than the untreated and pinched plants except for Augeo 400 ppm on Wildfire Dark Red. Therefore, PGR treatments reduced shoot number in these two cultivars (Table 6). PGRs did not affect plant height in Aztec Blue Velvet. All PGR treatments led to shorter and more compact plants compared to untreated and pinched control plants except for Configure 150 and 300 ppm and Florel 500 ppm in Aztec Wild Rose (Table

7). Pinched plants had the best visual quality compared to PGR treated plants, regardless of cultivar (Table 8). The effect of PGR treatments on visual quality varied with cultivar. For example, Configure 150 and Florel 500 ppm resulted in better quality in Aztec Blue Velvet and Aztec Wild Rose than other PGR treatments. However, for Wildfire Dark Red, Augeo 400 ppm had better visual score (3.7) than any other PGR treatment. All verbena cultivars exhibited phytotoxicity (Table 9), although the degree of damage varied with cultivar and PGR. For example, in Aztec Blue Velvet, the most severe phytotoxicity (2.2) was observed with Configure 300 ppm treatment, while in Aztec Red Velvet the most severe phytotoxicity (4.2) was observed with Augeo 800 ppm treatment.

In summary, for calibrachoa cultivars, Augeo treated plants improved branching slightly compared to untreated control and pinched control plants and had the best visual quality. For verbena, none of the PGR enhanced branching and improved quality. Little phytotoxicity was observed in calibrachoa cultivars, while all verbena cultivars exhibited phytotoxicity with varying degrees of damage depending on cultivar, PGR, and application rate.

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Table 1. List of plant growth regulators, application rate and time.

Product	Rate(s)	Application Type	Date of Application	Crop Growth Stage	Application Volume
Augeo (dikegulac)	400 ppm 800 ppm	Foliar spray	May 25, 2011	8 days after transplanting	One gallon per treatment
Configure (benzyladenine)	150 ppm * 300 ppm	Foliar spray	May 25, 2011	8 days after transplanting	One gallon per treatment
Florel (ethephon)	500 ppm 1000 ppm	Foliar spray	May 25, 2011	8 days after transplanting	One gallon per treatment
Untreated, not pinched	-	-	-	-	-
Untreated, pinched	-	-	-	-	-

*Two applications at 1 week interval.

Table 2. Final number of shoots of Calibrachoa cultivars counted on Day 33.

Treatment	Can-Can Apricot	Can-Can Mocha	Can-Can Orange	Can-Can Strawberry
Control	58.5 bc	64.4 ab	74.7 ab	90.2 ab
Pinched	68.7 ab	52.3 bc	76.3ab	99.6 a
Augeo 400	76.3 a	72.3 a	86.8 a	101.8 a
Augeo 800	77.8 a	58.1 abc	76.4 ab	98.0 a
Configure 150	45.6 cd	56.3 abc	48.0 cd	74.2 abc
Configure 300	29.3 e	69.0 ab	36.0 d	62.9 c
Florel 500	57.3 bc	58.6 abc	57.5 bc	63.9 bc
Florel 1000	39.2 de	45.4 c	47.9 cd	58.3 c

Means in the same column with same letters are not significantly different.

Table 3. Final number of blooming shoots for Calibrachoa cultivars counted on Day 33.

Treatment	Can-Can Apricot	Can-Can Mocha	Can-Can Orange	Can-Can Strawberry
Control	70.3 ab	68.8 ab	75.0 ab	80.0 a
Pinched	79.2 ab	68.3 ab	75.0 ab	67.5 a
Augeo400	87.5 a	67.2 ab	77.5 a	85.0 a
Augeo800	75.0 ab	84.4 a	87.5 a	87.5 a
Configure150	7.8 c	32.8 c	55.0 b	62.5 a
Configure300	5.0 c	25.0 c	7.5 c	8.3 b
Florel500	79.7 ab	59.4 b	87.5 a	62.5 a
Florel1000	60.7b	38.3 c	87.5 a	67.5 a

Means in the same column with same letters are not significantly different.

Table 4. Final width [(width 1 + width 2)/2] of Calibrachoa cultivars measured on Day 33.

Treatment	Can-Can Apricot	Can-Can Mocha	Can-Can Orange	Can-Can Strawberry
Control	36.7 b	29.8 a	35.6 a	30.8 a
Pinched	37.9 b	28.7 ab	33.0 abc	31.1 a
Augeo400	44.2 a	27.8 abc	33.9 ab	33.6 a
Augeo800	37.0 a	25.3 bcd	28.6 cd	29.2 a
Configure150	20.9 d	24.8 cd	24.6 d	24.5 b
Configure300	15.4 e	22.4 de	19.3 e	21.3 b
Florel500	31.2 c	22.7 de	29.6 bcd	24.5 b
Florel1000	18.1 de	20.9 e	26.5 d	21.7 b

Means in the same column with same letters are not significantly different.

Table 5. Visual quality of Calibrachoa recorded 9, 21, and 33 days after treatment.

Treatment	Can-Can Apricot			Can-Can Mocha			Can-Can Orange			Can-Can Strawberry		
	D9	D21	D33	D9	D21	D33	D9	D21	D33	D9	D21	D33
Control												
Pinched	1.8	3.8	4.9	1.6	2.8	4.5	1.6	3.6	4.3	1.4	4.0	4.7
Augeo 400	3.2	4.4	5.2	3.4	3.7	4.6	4.5	4.5	4.9	4.0	3.9	4.4
Augeo 800	3.5	3.7	4.6	2.6	2.2	4.2	2.5	2.1	4.1	2.0	2.1	4.1
Configure150	3.2	1.8	2.5	3.6	2.6	3.5	2.0	1.6	1.9	2.8	2.0	3.6
Configure300	2.8	1.2	1.4	3.1	2.1	3.2	2.0	1.6	1.9	1.7	1.2	2.2
Florel 500	1.8	2.8	3.6	1.9	2.4	3.6	1.8	1.7	3.5	1.8	2.0	3.0
Florel 1000	1.3	1.1	1.8	1.7	1.8	2.7	1.3	1.3	2.9	1.6	1.8	2.8

Evaluation criterion: 1 = significantly worse than untreated; 2 = moderately worse than untreated; 3 = slightly worse than untreated; 4 = no difference from untreated; 5 = slightly better than untreated; 6 = moderately better than untreated; 7 = significantly better than untreated.

Table 6. Final number of total and blooming shoots of verbena cultivars counted on Day 33.

Treatment	Aztec Blue Velvet		Aztec Red Velvet		Aztec Wild Rose		Wildfire Dark Red	
	Total	Blooming	Total	Blooming	Total	Blooming	Total	Blooming
Control	11.7 a	8.8 a	16.2 a	12.4 a	9.6 a	7.2 ab	13.7 a	11.9 a
Pinched	9.5 ab	7.8 abc	14.5 a	11.0 a	9.3 a	7.6 ab	11.8 ab	8.6 b
Augeo 400	6.6 c	4.9 de	7.5 b	4.4 c	2.9 b	2.3 c	12.1 ab	8.5 b
Augeo 800	4.0 d	3.5 e	2.3 c	0.9 d	2.3 b	1.4 c	1.7 c	1.1 d
Configure 150	8.2 bc	6.3 bcd	8.4 b	4.8 c	10.6 a	8.9 a	4.2 c	1.6 d
Configure 300	9.7 ab	6.8 abcd	6.7 b	3.8 c	9.4 a	6.6 b	1.6 c	0.9 d
Florel 500	11.1 a	8.3 ab	9.3 b	7.1 b	11.0 a	6.6 b	10.2 b	5.7 c
Florel 1000	7.8 bc	5.9 cd	2.6 c	0.6 d	2.5 b	0.7 c	4.7 c	2.3 d

Mean in the same column with same letters are not significantly different.

Table 7. Final height and width [(width1 + width2)/2] of verbena cultivars measured on Day 33.

Treatment	Aztec Blue Velvet		Aztec Red Velvet		Aztec Wild Rose		Wildfire Dark Red	
	Height	Width	Height	Width	Height	Width	Height	Width
Control	19.8 a	20.5 a	15.4 a	31.5 a	12.0 a	23.7 a	15.2 a	33.9 a
Pinched	13.2 a	20.3 a	15.1 a	28.2 a	10.5abc	27.1 a	11.4 bc	36.6 a
Augeo 400	13.2 a	13.7 cd	8.0 c	14.0 cd	9.0 c	14.9 cd	14.3 ab	21.2 b
Augeo 800	11.2 a	12.4 d	5.8 c	9.8 d	9.5 bc	10.7 e	8.0 d	9.0 d
Configure 150	11.2 a	15.7 bcd	11.9 b	16.0 bc	12.1 a	19.0 b	9.8 cd	15.6 bc
Configure 300	11.7 a	16.8 bc	10.8 b	9.8 d	12.1 a	18.4 bc	7.7 d	10.5 cd
Florel 500	13.8 a	18.6 ab	11.9 b	19.4 b	11.3 ab	24.1 a	12.3 abc	20.8 b
Florel 1000	13.7 a	15.9 bc	6.9 c	11.1 d	8.5 c	13.7 de	10.7 cd	14.5 cd

Means in the same column with same letters are not significantly different.

Table 8. Visual quality of verbena cultivars recorded on 9, 21, and 33 days after treatment.

Treatment	Aztec Blue Velvet			Aztec Red Velvet			Aztec Wild Rose			Wildfire Dark Red		
	D9	D21	D33	D9	D21	D33	D9	D21	D33	D9	D21	D33
Control												
Pinched	1.1	2.7	4.0	1.6	3.9	4.8	1.6	4.1	4.9	1.5	4.7	4.8
Augeo 400	3.7	2.4	2.0	2.7	2.2	2.4	2.7	2.4	2.0	3.9	3.1	3.7
Augeo 800	4.2	2.1	1.7	2.1	1.2	1.0	2.6	2.2	1.4	2.3	1.8	1.2
Conf. 150	2.9	2.3	3.4	2.0	1.7	2.5	2.9	2.4	3.5	1.6	1.3	1.4
Conf. 300	1.9	1.4	3.0	1.5	1.5	2.5	3.0	2.0	2.8	1.8	1.1	1.4
Florel 500	2.0	2.7	3.6	1.6	1.7	2.7	3.9	3.6	3.6	1.8	1.9	2.4
Florel 1000	2.0	1.9	3.1	1.5	1.0	1.3	2.6	1.9	1.3	1.7	1.4	1.8

Evaluation criteria: 1 = significantly worse than untreated; 2 = moderately worse than untreated; 3 = slightly worse than untreated; 4 = no difference from untreated; 5 = slightly better than untreated; 6 = moderately better than untreated; 7 = significantly better than untreated.

Table 9. Phytotoxicity of verbena cultivars assessed 21 days after PGR treatment.

Treatment	Aztec Blue Velvet	Aztec Red Velvet	Aztec Wild Rose	Wildfire Dark Red
Control	0	0	0	0
Pinched	0	0	0	0
Augeo 400	1.5	1.0	1.1	0.3
Augeo 800	1.5	4.2	2.3	0.8
Conf. 150	0.4	1.2	0.9	0.7
Conf. 300	2.2	2.4	2.0	0.8
Florel 500	0.4	0.8	0.8	0.6
Florel 1000	0.7	3.4	3.4	1.8

Phytotoxicity rating: on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) taken on Day 21.

Growth Regulation in Container Produciton with TopflorG

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Index Words: flurprimidol, granular formulation, herbaceous perennial, greenhouse production

Significance to Industry: Many herbaceous perennials need to be pruned several times during production for a fuller growth and a compact shape. Pruning is a significant expenditure of time and labor in their production costs. Plant growth regulator may help reduce pruning needs and improve plant quality. A granular formulation of flurprimidol (TopflorG) was tested in a production greenhouse on three herbaceous perennials. Results indicate that TopflorG provided effect and long-lasting growth control on all three varieties. However, there were issues with crop quality possibly because of application timing. Further research is needed for making appropriate application recommendations.

Nature of Work: TopflorG (SePRO Corp., Carmel, IN) is a granular formulation of flurprimidol (0.17%) which is a gibberellic acid biosynthesis inhibitor. It is absorbed mainly through roots and stems. Being granular, it is easier to be broadcast around plants than “spray-drench” or soil drench of a liquid product. The slow-release feature may provide longer growth control compared to some other PGRs currently available for greenhouse production. Other than growth control, previous observations indicate that flurprimidol may enhance the overall quality of plants with darker green foliage (1), more flowers (2), improved drought tolerance in foliage plant (3), and reduced cold injury in Fraser fir (4). Several application aspects of this PGR have not been fully tested with herbaceous perennials in container production. For example, application timing, effective rates, and residual effect after being transplanted into the landscape, are still unknown for many commonly used varieties. The objective of this preliminary study was to determine effects of TopflorG at various rates on the growth and quality of lantana, Mexican Heather, and verbena.

The study was conducted in a greenhouse at the Bracy’s Nursery (Amite, LA) in 2011. Rooted cuttings of New Gold lantana, Mexican heather, and Homestead Purple verbena were transplanted into trade gallon pots (1.4L) on March 22. Potting mix was a custom pine bark mix. A single cutting was planted per pot for Mexican Heather and verbena, while two cuttings were planted in each pot for lantana as a grower’s practice to obtain fuller plants. A total of 24 pots of each variety were treated with Topflor at 0, 1/8, or 1/6 teaspoons with eight plants treated for each rate. A soft pinch was conducted on verbena and lantana before treatments. After application, plants were maintained by

nursery staff with the same practices across treatments and varieties. Plant height (including inflorescences) and width (average of the two perpendicular widths) were measured at 3, 5, and 7 weeks after treatment (WAT). Number of inflorescences in lantana and verbena were recorded at 5 WAT. Overall crop quality was assessed for each plant as 'salable' or 'unsalable' at 8 WAT based on criteria provided by the grower. A salable plant needs to be full (canopy cover the pot surface, no medium can be seen from a top view), balanced, and with good number of flowers presented on top of canopy. Plants that were not able to cover the pot (medium can be seen), skewed to one side of the pot, or without flowers are considered 'unsalable'. All data, except salability assessment, were analyzed as Completely Randomized Design with eight replications.

Results and Discussion: All three varieties responded to TopflorG from 3 WAT. Compared with untreated control, lantana treated with 1/8 or 1/6 teaspoons had 50% to 60% less increase in height by 3 WAT, and 70% to 75% less increase in height by 5 WAT (Fig. 1A). Mexican Heather plants treated at both rates had 40% to 60% less increase in height, and verbena had 50% to 65% less increase in height (data not shown). Effects were also significant with plant width in lantana (Fig. 1B) and the other two varieties (data not shown). The difference in numbers of flowers was not statistically significant among treatments (lantana data in Fig. 1C); however, there was a trend that plants treated with higher rates may have fewer flowers in both lantana and verbena. In addition, the treatments plants had better flower presentation possibly because the canopy of treated plants was more compact and flowers were presented on shorter stems (Fig. 2). Lantana was the only variety planted with two cuttings in each pot. About 25% pots treated with TopflorG exhibited some degree of difference in terms of receiving and responding to the treatment between the two cuttings (Fig. 3). Among treated plants at both rates, about 50% to 56% lantana, 31% Mexican Heather, and 31% to 44% verbena plants (either rate) were unsalable either because plant canopy was not full enough or plant skewed to side of pot (Fig. 4).

In summary, TopflorG is effective in controlling growth of the three perennials tested, but issues such as uneven growth between multiple cuttings and unable to produce full canopy were found and possibly related to application timing. Apparently, applying early at the time of transplant (as recommended by manufacture) or very early stage of production, plant may not have enough time to grow and "cover the pot", or, root development of multiple cuttings are limited to a small soil amount that may miss the material applied nearby. Further study is needed for better timing.

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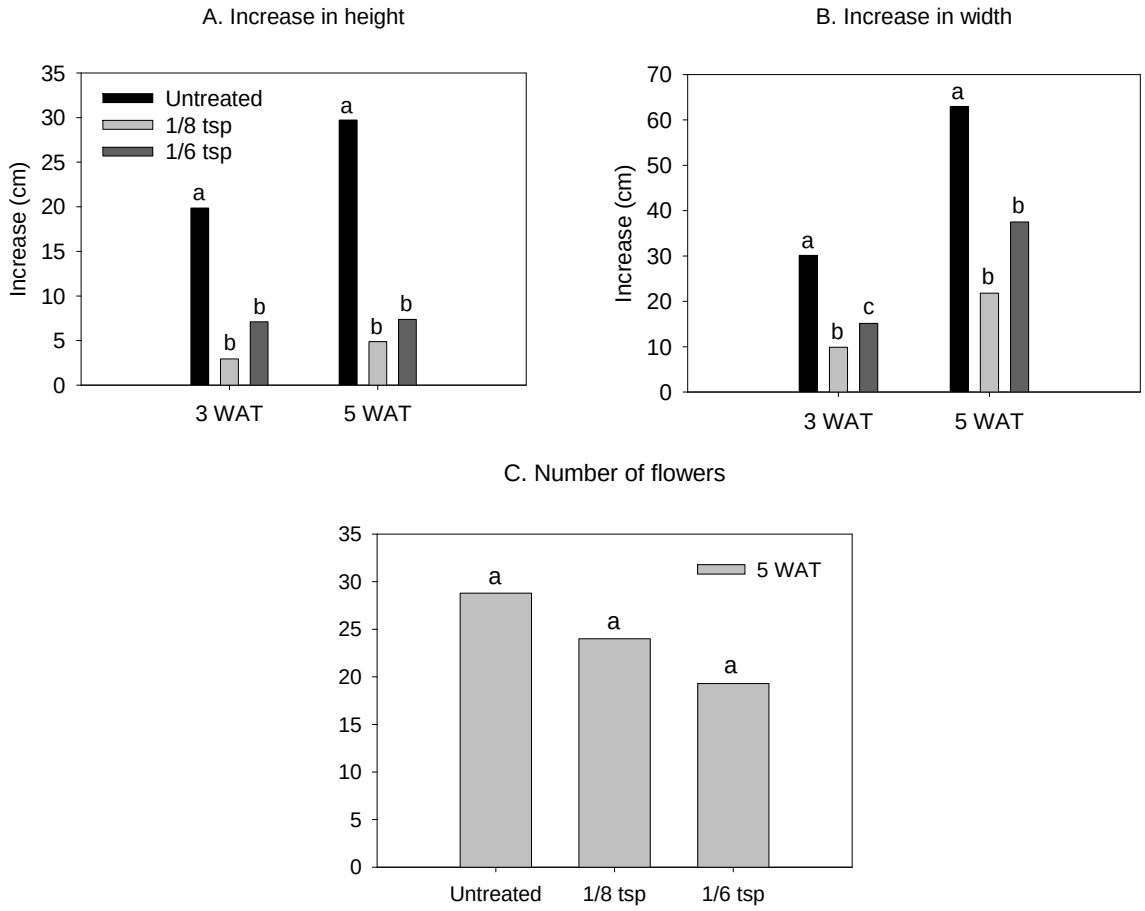

Figure 1. Increase in plant height (A) and width (B) at 3 and 5 weeks after treatments (WAT), and number of inflorescences at 5 WAT in lantana treated with Topflor 3 days after transplant.

Figure 2. Untreated lantana plants, and those treated with TopflorG at 1/8 or 1/6 teaspoon, showing better flower presentation on treated plants.

Figure 3. One of the issues found with lantana is that the granular material may not distribute evenly between the two cuttings planted in the same pot, or these cuttings may not respond equally. In this photo, the cutting on the right (circled) received and responded to the treatment but the cutting on the left did not.

Figure 4. Untreated Mexican Heather (above) or Homestead Purple verbena (below), and plants treated with 1/8 or 1/6 teaspoon of TopFlorG. Both photos indicate that if treatment was applied too early (3 days after transplant in this study); growth was suppressed before the canopy can cover the pot.