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Branching Response of Poinsettia 'Orange Spice' to a Combination of Pinching, No Pinching, and Atrimmec

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Abstract. **This study aimed to identify the best method to improve poor branching of poinsettia 'Orange Spice'. Treatments included pinched and unpinched alone and in combination with four different rates (3.9, 7.8, 11.7, and 23.4 mL·L^{-1}) of Atrimmec. Pinching reduced plant height, as did unpinched + 11.7 mL·L^{-1} and unpinched + 11.7 mL·L^{-1} Atrimmec. Neither pinching nor Atrimmec had any effect on plant width, stem caliper, or shoot dry weight. Atrimmec did not increase the number of laterals in combination for pinched or unpinched treatments, but unpinched plants generally produced more laterals. Unpinched with any rate of Atrimmec resulted in tertiary shoots, which improved the visual appearance and quality.**

Poinsettia (*Euphorbia pulcherrima* Willd. Ex Klotsch.) is a member of the Euphorbiacae family and can grow to 4.5 m tall (Ecke et al., 2004). This plant is popular at Christmas and has been the most popular potted crop until the early 2000s; furthermore, it is currently ranked second among potted plants, with a value of $153 million among states reporting (USDA, 2020). The popularity of this traditional holiday plant can be attributed to the release of new cultivars with improved postharvest life, growth habits, and varying colors and maturity dates (Dunn et al., 2011).

Sales and transportation of poinsettias rely heavily on height, compactness, and branching habit (Alem et al., 2015; Meijón et al., 2009). Most commercially sold poinsettias are free branching and show weak apical dominance in association with poinsettia branch-inducing phytoplasma (POiBI) (Lee et al., 1997). During the past 190 years, breeders have developed cultivars that are much smaller, more compact, and have greater branching than the wild type (Trejo et al., 2012). Many growers today use manual pruning to reduce apical dominance and height while increasing lateral branch growth to achieve good growth habits (Cox, 2001; Larson, 1982). Stimart (1983) reported that branching in poinsettia cultivars is highly variable. The main disadvantage of manual pruning is the high input of labor; however, if done improperly, pruning can reduce the number of flowers of a plant (Sun et al., 2015).

Plant growth regulators (PGRs) are commonly used to control plant growth habit, including plant height and branching, while reducing the time of production and labor costs and improving plant quality (Cohen, 1978; Sajjad et al., 2017). One such PGR is dikequlac sodium, which is absorbed by the leaves and transferred to the tip of the main stem; it inhibits cell division and differentiation in the meristem, leading to reduced apical dominance (Cohen, 1978). Atrimmec contains 18.5% dikequlac sodium and is known to induce lateral branching. Sun et al. (2015) reported that species, rates, and cultural and environmental conditions affect the efficiency of dikegulac sodium on plant growth. The objective of this study was to compare plant growth and branching among pinched, unpinched, and Atrimmec applications on poinsettia 'Orange Spice', which shows limited lateral branching.

Materials and Methods

Rooted cuttings of poinsettia 'Orange Spice' were received from ParkSeed (Greenwood, SC) on 12 Aug. 2020. All rooted cuttings were placed under intermittent mist until transplanting on 14 Aug. 2020. Cuttings were transplanted into 15.24-cm Elite Azalea Pots (ITML Horticultural Products, Middlefield, OH) filled with BM7 media (Berger Peat Moss, Quebec, Canada). Poinsettias were grown in greenhouses at the Department of Horticulture and Landscape Architecture in Stillwater, OK.

No supplemental lighting was used until 9 Oct. 2020, when high-pressure sodium lights were used to maintain a daily light integral of 10 to 15 mol·m^{-2}·d^{-1}. Greenhouse temperatures were set at 21 °C during the day and 18.5 °C during the night. Plants were watered as needed with pressure-compensated drip emitters at 2 gph allowing ≈10% leaching. Plants were fertigated at each watering with 250 mg·L^{-1} 15N–2.2P–12.5K (Jack's Professional General Purpose acidic fertilizer; J.R. Peters Inc., Allentown, PA). On 18 Sept. 2020, cultivars were treated with 907 g magnesium sulfate, 114 g Soluble Trace Element Mix (J.R. Peters Inc.), and 0.5 g molybdenum. Marathon (OHP Inc., Bluffton, SC) was applied on 2 Oct. 2020. TriStar WPS 70 (Cleary Chemicals Company, Dayton, NJ) was applied on 9 Oct. 2020, and then weekly thereafter to control whiteflies.

Two weeks after planting, treatments included pinching (leaving seven nodes), no pinching, no pinching plus Atrimmec (PBI-Gordon Corporation, KS City, MO) with rates of 3.9, 7.8, 11.7, and 23.4 mL·L^{-1} using tap water, and pinching with similar rates and conditions mentioned. Chemical treatments were applied to glisten on stems and leaves 2 d after pinching. The final solution pH ranged from 7.9 to 9.0, which was within the recommended range for the final solution pH (Camberato et al., 2014). Atrimmec is labeled for use on greenhouse crops, but not specifically for use on poinsettia. End measurements were collected on 23 Nov. 2020, and included plant height (from soil to the top of the plant), width (average of two perpendicular measurements), stem caliper (2 cm above soil), number and length of lateral branches, and shoot dry weight (plants dried for 3 d at 60 °C). There were 10 plants per treatment and three replications. The experimental design was a completely randomized factorial design with a total of 390 pots. The statistical analysis was performed using SAS/STAT software (version 9.4; SAS Institute, Cary, NC). The data were analyzed using generalized linear mixed models methods. Tukey multiple comparison methods were used to separate the means at the level of 0.05.

Results and Discussion

For height, unpinched + 3.9 mL·L^{-1} produced the tallest plants at 32.5 cm, but the heights resulting from this treatment were not different from those of unpinched or unpinched + 7.8 mL·L^{-1} (Table 1). Lower Atrimmec rates generally resulted in plants with greater height. Taylor et al. (2011) reported that the industry height standard in the United States for poinsettias grown in 15-cm pots should be 36 to 41 cm tall. There were no significant differences observed for plant width, stem caliper, and shoot dry weight among any treatments (Table 1). Grossman et al. (2013) also found that dikegulac sodium alone compared with the control showed no effect on plant width and shoot dry weight for catnip (*Nepeta* L.), but they did find that the plant width and shoot dry weight of other species were affected. Plant responses to PGR application

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Table 1. Different rates of Atrimmec on pinched and unpinched 'Orange Spice' poinsettias grown in Stillwater, OK, in 2020.

Terminal shoot (TS)	Atrimmec (mL·L^{-1})	Ht (cm)	Width (cm)	Stem caliper (mm)	No. of lateral branches	Avg. lateral length (cm)	Dry wt (g)
Unpinched	0	32.2 a[z]	41.2 a	7.3 a	5.9 abc	17.1 b	17.3 a
Unpinched	3.9	32.5 a	42.8 a	7.0 a	6.6 abc	17.5 ab	17.2 a
Unpinched	7.8	28.1 ab	42.2 a	6.8 a	7.6 a	16.9 b	15.6 a
Unpinched	11.7	25.8 b	41.6 a	6.4 a	7.3 ab	16.4 b	14.7 a
Unpinched	23.4	25.5 b	39.3 a	6.8 a	7.3 ab	15.7 c	12.2 a
Pinched	0	26.0 b	42.7 a	7.0 a	4.9 c	18.9 ab	14.4 a
Pinched	3.9	27.1 b	43.4 a	6.8 a	4.6 c	20.6 a	14.2 a
Pinched	7.8	25.3 b	43.2 a	6.8 a	5.2 bc	18.7 ab	13.5 a
Pinched	11.7	23.5 b	40.6 a	6.6 a	5.9 abc	17.6 ab	13.3 a
Pinched	23.4	24.0 b	40.8 a	6.6 a	5.7 abc	17.0 b	12.0 a
TS		***	NS	NS	***	***	NS
Atrimmec		***	NS	NS	NS	***	NS
TS × Atrimmec		NS	NS	NS	NS	**	NS

[z]Means (n = 30) with a similar letter are not significantly different at $P < 0.05$.
NS = not significant.

Fig. 1. Unpinched with Atrimmec (left) and pinched with Atrimmec (right).

can vary depending on rates, timing, type of application, number of applications, and cultural and environmental factors (Cochran and Fulcher, 2013).

The number of lateral branches was greatest for unpinched + 7.8 mL·L^{-1}, and unpinched plants produced more lateral branches than pinched plants. Lyons and Hale (1987) also reported that dikegulac sodium was ineffective on some foliage houseplants. Unpinched with any rate of Atrimmec resulted in tertiary shoots that developed in the leaf axils of the lateral (secondary) shoots off the main stem (Fig. 1). Contrary to our results, Karunananda and Peiris (2010) did show that a single pinch on poinsettia '1101' produced more shoots than the unpinched control, and that a double pinch produced the greatest number of lateral branches.

The average lateral length showed an interaction and was greatest for pinched + 3.9 mL·L^{-1}, but it was not different from unpinched + 3.9 mL·L^{-1}, pinched, pinched + 7.8 mL·L^{-1}, and pinched + 11.7 mL·L^{-1}. Only unpinched + 23.4 mL·L^{-1} resulted in reduced lateral branch length compared with all other treatments (Table 1). Bruner et al. (2002) also found that Atrimmec can suppress the shoot length of goldflame honeysuckle (*Lonicera xheckrottii* Rehder); however, Cohen (1978) did not find a difference in shoot length when it was applied to *Rhododendren* L. cultivars.

Conclusion

Pinching of 'Orange Spice' did not improve branching compared with unpinched plants and further reduced plant height. There were no differences observed for plant width, stem caliper, and shoot dry weight among any treatments. Pinching in combination with Atrimmec increased the average lateral shoot length, whereas unpinched in combination with Atrimmec increased the tertiary shoot number.

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