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Controlling Poinsettia (*Euphorbia pulcherrima* Will.) Height with Growth Retardant Application in West Java, Indonesia

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Abstract

A study was conducted to evaluate the effects of the growth retardant cycocel application in the growth and development of poinsettia (*Euphorbia pulcherrima*) 'Freedom Red'. Cycocel was applied by spraying plant shoots at the concentrations of 1000, 1500, 2000, 2500 ppm. The increase in cycocel concentrations reduced plant height, leaf size, internodal length, plant spread and the number of flowering plants. All cycocel concentrations resulted in an ideal potted plant height. The optimum spray concentration of cycocel used to obtain compact and uniformly flowering plants under tropical West Java environment was 1000 ppm.

Keywords: cycocel, paclobutrazol, pot plants, short day

Introduction

Poinsettia (*Euphorbia pulcherrima*), or kastuba (Indonesian local name) is an indigenous plants from Mexico, South America. The colorful and most attractive portions of the plant are actually modified leaves called bracts (Adams et al., 1995). These bracts may be red, pink, white, yellow, speckled or marbled; but the most popular color is red. The actual flowers are located in the center at the base of the bracts. The flowers are also known as cyathium and have separate male and female flowers. Potted poinsettias are ready to market when the cyathia open and the stamens or styles protrude from the flowers (Kessler, 2005). Poinsettia red bracts and green foliage and is widely used in Christmas floral displays (Hartley, 1992). The demand for potted poinsettias in Indonesia increases every year especially during the Christmas season.

Poinsettia pot plants have been produced commercially in a number of nurseries in West

Java, Indonesia. It is classified as a short day plant that is they will flower and develops bracts only during long nights or during longer dark durations. However, the critical night period varies with cultivars and temperature. Naturally, poinsettias may grow up to 3 m in height; hence its growth should be controlled if it is grown as an pot plant to allow for a more proportionate pot plant (Krisantini et al., 2014). Tall poinsettia plants could also be a result of tall cuttings; too close spacing and inadequate light during its growth. Therefore, controlling plant size is important for potted ornamental plant production to get attractive and compact pot grown plants, which will ease packing and sleeving, and are more space efficient for transportation (Krisantini et al., 2014).

Growing poinsettia in the warmer temperatures need growth retardant application to slow down stem elongation as application of plant growth retardant can control plant height through inhibition of biosynthesis of gibberellin, a group of plant hormone that control cell elongation (Rademacher, 1995; De Lucas et al., 2008). Retardants can be applied by spraying the shoots of the plants, or by drenching the potting media (Prue and Gregory, 2002). A study by Lopes and Berg (2003) had shown the effectiveness of several retardants such as A-Rest, B-Nine, Bonzi, Cycocel, or Sumagic to control poinsettia height. In addition, Niu et al. (2002) reported that drenching 100 mL per pot of 1 ppm of paclobutrazol was effective to control poinsettia height.

A preliminary study to evaluate the effects of paclobutrazol on controlling poinsettia 'Prestige' height in the tropics was conducted in 2008 to 2009 showed that paclobutrazol at 1 ppm sprayed twice during the early growth of poinsettia was effective in reducing final plant height (Yulistyo et al., 2009). Paclobutrazol is a plant growth retardant from the triazole group which has strong activity. Paclobutrazol reduced internode elongation to give shorter stems, and was effective in tomato, pepper, fruit trees and

shrubs. Although, paclobutrazol has strong and long term effects on plants, it has high soil residual activity (Hampton, 1988).

Cycocel or chlormequat (2-chlorethyl) trimethylammonium chloride is less strong compared to the triazole group. Cycocel is widely available in Indonesia and mainly used for ornamentals, including bedding plants and herbaceous crops.

The recommendation rates mentioned by previous researchers were specific for temperate climates however, little is known about the effectiveness of these compounds in the tropical regions where plants grow relatively faster due to warmer temperatures. Therefore, the objective of the current study is to determine the effects of cycocel on controlling poinsettia 'Freedom Red' height grown in the tropical West Java environment, and to determine the optimum cycocel concentration to obtain an optimum height of potted poinsettia without affecting its flowering and bract size.

Materials and Methods

Experiment was conducted in 2010 to 2011 at Saung Mirwan nursery in Sukamanah Village, Pasir Muncang (-7.7200 S, 108.1722 E), located in the highland area of West Java, Indonesia. Poinsettia cuttings of six to eight nodes were rooted in styro foam then transplanted into 15 cm pots containing rice hull charcoal and cocopeat media (1:1 v/v). Plants were pinched at two weeks after planting. The different concentrations of cycocel (1000, 1500, 2000 and 2500 ppm) were applied by spraying the shoot until runoff at four weeks after planting. This was done on a weekly basis for a total of nine weeks. In this study there was no untreated plants as it has already established that without growth retardant application poinsettia plants will grow to >1 m in height.

The experiment was set up in a complete randomized

block design with the cycocel concentration as a single factor. Every treatment was replicated three times and every replicate consists of three plants. Planting distance were about 35 cm between plants and between rows. Plants were placed in a greenhouse with long-day environment by setting up lighting from 8 pm to 4 am at week 1 to week 8, followed by short-day environment using black polyethylene covers at 4 pm to 8 am daily at week 8 to week 15.

Scoring was conducted on plant height at 11 weeks after planting (WAP), leaf size, internode length, and stem diameter at six WAP, number of flowering plants and plant spread at 15 WAP. Data was analysed using Statistical Analysis System (SAS) version 9.1.

Results and Discussion

Increased cycocel concentration reduced plant height, leaf size and internode length (Table 1). Cycocel application also affected the generative development of poinsettia. In addition, not all plants that were treated with high concentrations flowered during the period of this study as only seven percent of the plants flowered (Table 2).

Plant's spread, measured as the longest distance between the two outer leaves of each plant was reduced with increasing cycocel concentrations (Table 2). The ideal height of a pot plant is generally twice the container height (Kessler, 2005). In this study, all cycocel concentrations produced an ideal proportion of plant to the pot size; however considering that the highest concentration reduced flowering, lower concentrations of Cycocel is recommended.

In our previous study, 1 ppm paclobutrazol applied as a soil drench during the crop growing period significantly reduced poinsettia height and the diameter of bracts. Cycocel in the current study was equally effective to reduce poinsettia height but with different concentrations and application methods.

Table 1. Vegetative growth of Poinsettia 'Freedom Red' after Cycocel treatment*

Cycocel concentration (ppm)	Plant height ¹⁾ (mm)	Leaf length ¹⁾ (mm)	Leaf width ¹⁾ (mm)	Internode length ¹⁾ (mm)	Stem diameter ¹⁾ (mm)
1000	304.2a	107.5a	88.3a	17.0a	8.1ab
1500	276.7b	106.5a	88.3a	15.0b	8.2a
2000	250.8c	95.8b	83.1ab	13.6c	7.7bc
2500	237.9c	93.5b	78.4b	13.4c	7.6c

Note: ¹⁾ Plant height was measured at 11 weeks after planting, whereas leaf size, stem diameter and internodal length was measured at 6 weeks after planting (WAP).

*The values showing the same letter in the same column are not statistically different from each other according to Duncan Multiple Range Test (p=0.05).

Table 2. Generative growth of Poinsettia 'Freedom Red' after cycocel treatment*

Cycocel (ppm)	Number of flowering plants out of 27	Number of red bractea per plant	Plants spread at week 15 (cm)
1000	15 (55%)	35.6	27.39a
1500	15 (55%)	35.1	26.16a
2000	5 (18%)	38.7	24.36b
2500	2 (7%)	36.2	23.93b

*The values showing the same letter in the same column are not statistically different from each other according to Duncan Multiple Range Test (p=0.05).

Cycocel at concentration of >1000 ppm on a weekly interval for nine weeks have been proven to be effective in reducing poinsettia height. According to IFAS (2011) growth retardant application by spraying usually gives greater activity in the warm climates. Niu et al. (2002) reported that drench application may reduce poinsettia bract size, and delayed application may induce this undesired response.

Similar study by Youssef and Abd-El-Al (2013) showed that cycocel and paclobutrazol at similar concentrations were effective in controlling the growth of a popular perennial ornamental pot plant *Tabernaemontana montana*. Therefore, the results derived from this study are in line with other similar studies reported around the region.

Conclusion

Application of cycocel at 1000 ppm in this study was successful to achieve good plant size with less effect on bract development; thus showing the effectiveness of cycocel to control poinsettia height, reduced internode length, stem diameter and plant spread. A high concentration of 2500 ppm delayed flowering; however, these results may vary with cultivars, depending on how vigorous the plants are and the climate where poinsettia is grown.

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