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THE EFFECT OF LIGHT INTENSITY AND PACLOBUTRAZOL ON FLOWERING OF LANTANA PLANTS (*LANTANA CAMARA L.*)

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ABSTRACT

Lantana camara L. widely planted in the city park as a bedding plant. *Lantana* grows in shaded place will experiencing stem elongation (etiolation) and decrease the number of flowers. This study use Nested Design that examined the effect of light intensity combined with four concentration of paclobutrazol with three replications. The results show that there was reduction of light intensity up to 50% with the addition of 80 ppm paclobutrazol concentration could inhibit plant length and increase the number of flower bunches of *lantana* plants. Concentration of 80 ppm paclobutrazol in 50% light intensity was able to inhibit plant length of 22,44% and increase the number of flower bunches by 20,81% compared to without paclobutrazol at 100% light intensity.

KEY WORDS

Lantana, shaded place, light intensity, paclobutrazol, growing, flowering.

Lantana (*Lantana camara* L.) is an perennial bush ornamental plant that is often planted in city parks. *Lantana* has attractive flower colors including white, beige, yellow, pink, orange, purple and red. *Lantana* plants do not grow well in shaded places because *lantana* requires a place with high light intensity (Australian Weed Management, 2003). In fact, *lantana* plants in city parks are often planted in shaded places. Placement of *lantana* plants in a shaded place allowing the received light intensity will be reduced. *Lantana* plants placed in full intensity with reduced light intensity have different responses to the growth and flowering of the plants. Plants that are placed in shaded places tend to grow faster (etiolation) and the number of flowers decreases compared to plants in a place that are not shaded. Therefore, it is necessary to conduct research to obtain technology that can increase flowering of *lantana* plants even though *lantana* plants are in shaded conditions. The effort that can be done is to apply the growth regulating substances that are inhibiting vegetative growth of plants and able to increase flowering of plants.

Paclobutrazol is a growth inhibitor that works in sub meristems by inhibiting giberellin's biosynthesis through inhibition of kaurene oxidation to become kaurenic acid, so that cell elongation and enlargement is inhibited (Upreti, Reddy, Prasad, Bindu, Jayaram and Rajan, 2013). The working principle of paclobutrazol is to inhibit the oxidation reaction between kaurene and kaurenic acid in the synthesis of gibberellins which causes stress on plant stems (Salisbury and Ross, 1995). The research was conducted to get the interaction of light intensity and the right concentration of paclobutrazol which is able to control the length of the plant and increase the number of flowers.

MATERIALS AND METHODS OF RESEARCH

The research was conducted at nursery gardens of Housing and Residential Area (DISPERKIM) located at Bareng Village, Klojen Sub-district, Malang City at an altitude of $\pm$ 505 m above sea level with air temperatures ranging between 22,2°C-24,5°C, maximum temperature reaches 32,3°C and minimum temperature 17,8°C. Average air humidity ranges

74%-82% with maximum humidity reaches 97% and minimum reaches 37% from August to November 2017. This research uses Nested Design with two factors that is light intensity as the first factor and the concentration of paclobutrazol as the second factor (nested in intensity). The first factor consists of I_{50} (Intensity of light 50% (45.400 lux)), I_{75} (Intensity of light 75% (73.400 lux)) and I_{100} (100% intensity of light (101.300 lux)). The second factor consists of P_0 (Without Paclobutrazol), P_{40} (concentration of paclobutrazol 40 ppm), P_{80} (Concentration paclobutrazol 80 ppm) and P_{120} (Concentration paclobutrazol 120 ppm). Parameters observed were length of plant, number of internodes, number of branches, number of leaves, leaf area, relative growth rate (RGR), dry weight of plant, leaf color, chlorophyll content, number of stomata, specific leaf area, flower color, number of flowers bunches, number of flowers per bunches and diameter of flowers bunches. The results were analyzed using the analysis of variance (F test) at 5% level and followed by BNT test at 5% level.

RESULTS AND DISCUSSION

Length of plants. Intensity of light 50% (45,400 lux) resulted in the highest plant length compared to 75% (73,400 lux) and 100% (101,300 lux) intensity. Reduction of light intensity up to 50% (45,400 lux) with the addition of 80 ppm paclobutrazol was able to reduce plant length by 22,44% compared to without paclobutrazol at 100% light intensity (101,300 lux) (Figure 1).

A) Plant length at various light intensities, B) Plant length at 100% light intensity with different paclobutrazol concentrations, C) Plant length at 75% light intensity with different paclobutrazol concentrations and D) Plant length at 50% light intensity with different paclobutrazol concentrations.

Figure 1 – Effect of Light Intensity and Paclobutrazol Concentration on Plant Length
(The same letter at the same plant age is not significantly different in the 5% BNT test)

Auxin hormones will increase along with the reduction in light intensity. Auxin will be buried in plants under conditions of low light intensity which can lead to faster elongation so

that plants grow taller/etiolation (Ardie, 2006). Paclobutrazol is a giberelin biosynthesis inhibitor that can significantly inhibit growth and increase flowering in some perennial plants. Giberelin production is inhibited by paclobutrazol by inhibiting entkaurene oxidation to become ent-kaurenoic acid in the process of giberellin's biosynthesis, which causes a reduction in the rate of cell division which causes the growth of plant length to be inhibited. (Mansuroglu *et al.*, 2009).

Relative Growth Rate. Intensity of light 50% (45,400 lux) tends to produce a higher relative growth rate compared to the relative growth rate at 75% (73,400 lux) and 100% (101,300 lux) light intensity. Reduction of light intensity up to 50% (45,400 lux) with the addition of 80 ppm paclobutrazol was able to reduce the relative growth rate of 11,71% compared to without paclobutrazol at 100% light intensity (101,300 lux) (Figure 2). Low light intensity can increase the relative growth rate of plants due to low light intensity capable of producing plant length, number of stem segments, greater number of leaves and leaf area compared to the high light intensity. If the length of the plant, the number of stem sections, the number of leaves and leaf area are higher, it indicates that the relative growth rate is also higher. High concentrations of paclobutrazol will significantly reduce the dry weight of the plant. According to Nazarudin (2012) the inhibited gibberellins synthesis will affect the speed of cell division, then cause a reduction in the rate of plant growth.

Figure 2 – Effect of Light Intensity and Paclobutrazol Concentration on Relative Growth Rate of the Plant

Specific Leaf Area. Reduction of light intensity up to 50% (45,400 lux) with the addition of 80 ppm paclobutrazol was able to reduce the specific leaf area by 17,67% compared to without paclobutrazol at 100% light intensity (101,300 lux) (Figure 3). Increased concentrations of paclobutrazol at all light intensities will significantly reduce the specific leaf area. Sitompul and Guritno (1995) state that specific leaf area values are inversely proportional to biomass or leaf thickness. If the specific leaf area values are low indicate that the leaves are thicker. According to Jaleel, Manivannan, Sankar, Kishorekumar, Sankari and Panneerselvam (2007), leaf thickness treated with paclobutrazol will increase compared to control leaves. This is due to an enlargement of the size of the leaf mesophyll cells. Epidermal cells increase in size, palisade cells experience elongation and dilation, sponge cells grow larger and the cuticle layer thickens. Leaves at low light intensity will be thinner and wider, which aims to increase the interception of light by leaves. Decrease in leaf thickness at low light intensity is a form of plant adaptation to increase light transmission either to photosynthetic cells in the leaves and to the leaves located underneath.

Figure 3 – Effect of Light Intensity and Paclobutrazol Concentration on Specific Leaf Area of the Plant

Number of Flower Bunches. Intensity of light 50% tends to produce a lower number of flower bunches compared to the number of flower bunches at 75% and 100% light intensity. Reduction of light intensity up to 50% (45,400 lux) with the addition of 80 ppm paclobutrazol was able to increase the number of flower bunches by 20,81% compared to without paclobutrazol at 100% light intensity (101,300 lux) (Figure 4). Increased concentration of paclobutrazol applied to the plant at all light intensities will significantly increase the number of flower bunches and the lower the intensity of light will reduce the number of flower bunches. According to Weaver (1972) the biosynthesis of gibberellins that is inhibited due to the given of retardant in the sub apical meristem causes a decrease in the rate of cell division, which causes vegetative growth to be inhibited, so that it will stimulate the plant to enter the generative phase which is forming flowers and seeds. According to Youssef and Abd.El-Aal (2013) states that flowering of plants treated with retardants is related to cytokinin synthesis. Therefore, vegetative and generative growth is determined by cytokines known as canopy hormones which are able to regulate flower formation and flowering buds in plants.

Figure 4 – Effect of paclobutrazol concentration treatment and light intensity on the number of flower bunches of Lantana plants

CONCLUSION

Reduction of plant length at a reduction in light intensity of 25-50% (45,400 - 73,400 lux) can be controlled with 80 ppm paclobutrazol concentration due to it can produce plant lengths below 30 cm and have a higher number of flower bunches compared than without paclobutrazol at 100% light intensity (101,300 lux).

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