Biological Forum – An International Journal 13(2): 775-780(2021)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Impact of Paclobutrazol, Ancymidol and Cycocel on Growth and Quality of Aglaonema, an Ornamental Foliage Plant

Sripada Swetha[1]* and T. Padmalatha[1]
Dr. Y.S.R. Horticultural University,
College of Horticulture, Rajendranagar, Hyderabad -30, India.

(Corresponding author: Sripada Swetha)*
(Received 12 April 2021, Accepted 22 June, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A study at Floriculture Research Station, Hyderabad, investigated the effect of growth retardants on Aglaonema cv. Ernesto's Favourite. The experiment used a Completely Randomized Design with three replications. Paclobutrazol at 0.1825 mg/pot and 0.25 mg/pot significantly reduced plant height, canopy length, and width. Paclobutrazol at 0.25 mg/pot also resulted in the lowest leaf area and stem diameter. However, paclobutrazol at 0.1825 mg/pot produced the highest visual plant grade, color grade, chlorophyll-a, and chlorophyll-b. The treatments had no significant effect on the number of leaves.

Keywords: Aglaonema, Paclobutrazol, Ornamental Foliage Plant, Ernesto's Favourite, Ancymidol, Cycocel

INTRODUCTION

With increasing urbanization, people are relying on potted plants for a touch of green, even in sprawling bungalows, for interior decoration. Foliage plants, like Aglaonema, are popular for their attractive leaves and ability to thrive in low-light conditions. The demand for these plants is rising in both domestic and export markets. However, foliage plants often become leggy and less marketable when grown in shade. To address this, growth retardants can be used to control plant growth, making them more compact and attractive. Despite their widespread use in floriculture, little research has been done on using growth retardants on foliage plants. This study aimed to investigate the effect of paclobutrazol, ancymidol, and cycocel on Aglaonema cv. Ernesto's Favourite.

MATERIAL AND METHODS

One-month-old Aglaonema cv. Ernesto's Favourite plants were obtained from a nursery in Hyderabad for the experiment. The plants were transplanted into 12"×12" earthen pots filled with a potting mixture of red soil, sand, and vermicompost (2:1:1). The experiment used a Completely Randomized Design with three replications. Growth retardants, including paclobutrazol, ancymidol, and cycocel, were applied as drench applications at different concentrations. Paclobutrazol and ancymidol solutions were prepared by dissolving the required quantities in a small amount of methyl alcohol and then diluting to one liter with distilled water. Cycocel solutions (500, 1000, 1500, and 2000 ppm) were prepared by dissolving the calculated amounts in distilled water and making up the volume to one liter. The treatments were applied 30 and 60 days after transplanting. Observations on growth parameters, such as plant height, leaf number, leaf area, stem diameter, and chlorophyll content, were recorded at monthly intervals. Quality parameters, including visual plant grade and visual color grade, were evaluated at the end of the experiment (150 days after transplanting). The data were statistically analyzed using standard procedures of Panse and Sukhatme (1985). Plant grade system where 1 = Dead, 2 = Poor quality, 3 = Fair quality, 4 = Good quality and 5=Excellent quality (Poole and Conover, 1992)

Colour grade system where 1= Poor colour, 3 = Good, light green, 5 = Excellent, dark green & silver contrast. Henny *et al*. (2008).

RESULTS AND DISCUSSION

The data on plant height at 150 days after transplanting (DAT) revealed significant differences among treatments with plant growth retardants (Table 1). At 30 DAT, no significant differences were observed. However, by 150 DAT, paclobutrazol at 0.1825 mg/pot (T_3) resulted in the shortest plant height (47.53 cm), which was statistically similar to paclobutrazol at 0.25

mg/pot (T_4) (47.70 cm). The tallest plants (53.01 cm) were recorded in the control treatment (T_{13}), which was comparable to CCC at 500 ppm (T_9) and 1000 ppm (T_{10}).

The results showed that growth retardants significantly reduced plant height compared to control plants. Paclobutrazol was the most effective in retarding plant height in Aglaonema. This finding is consistent with previous studies on Dieffenbachia and Peperomia (Mansour and Poole 1987). Paclobutrazol works by inhibiting gibberellic acid biosynthesis, which regulates stem growth and shoot elongation (Rademacher, 1991). This results in shorter plants with reduced internode length, as observed in various studies (Davis, 1987; Kumar and Purohit 1998; Chen *et al*., 2002).

The data on leaf number per plant at 30 and 150 DAT showed no significant difference among the treatments with different growth retardants (Table 1).

The data in Table 1 show significant variation in canopy length among Aglaonema plants treated with different growth retardants from 30 to 150 DAT. At 150 DAT, paclobutrazol at 0.1825 mg/pot (T_3) and 0.25 mg/pot (T_4) resulted in significantly shorter canopy lengths (41.25 cm and 41.30 cm, respectively). In contrast, control plants had the longest canopy length (45.96 cm), which was comparable to cycocel treatments. The reduction in canopy length due to paclobutrazol is likely attributed to decreased petiole elongation and leaf length, consistent with previous studies (Hagildi and Watad 1992; Wang and Blessington 1990). Paclobutrazol suppresses growth by inhibiting gibberellin biosynthesis (Chaney, 2004), which may contribute to the observed reduction in canopy length.

Significant differences in canopy width were observed among Aglaonema plants treated with growth retardants at 150 DAT (Table 1). Paclobutrazol at 0.1825 mg/pot (T_3) resulted in the shortest canopy width (44.63 cm), which was statistically similar to paclobutrazol at 0.25 mg/pot (T_4) (45.60 cm). The control plants had the widest canopy (53.50 cm), comparable to CCC at 500 ppm, 1000 ppm, and 1500 ppm. The reduction in canopy width due to paclobutrazol might be attributed to decreased petiole and leaf length. According to Barrett and Bartuska (1982), paclobutrazol inhibits gibberellin synthesis by being absorbed by roots and translocated to actively growing tissues. Similar results have been reported in other studies (Emily Anna Stefanski, 2008; Li *et al*., 2009).

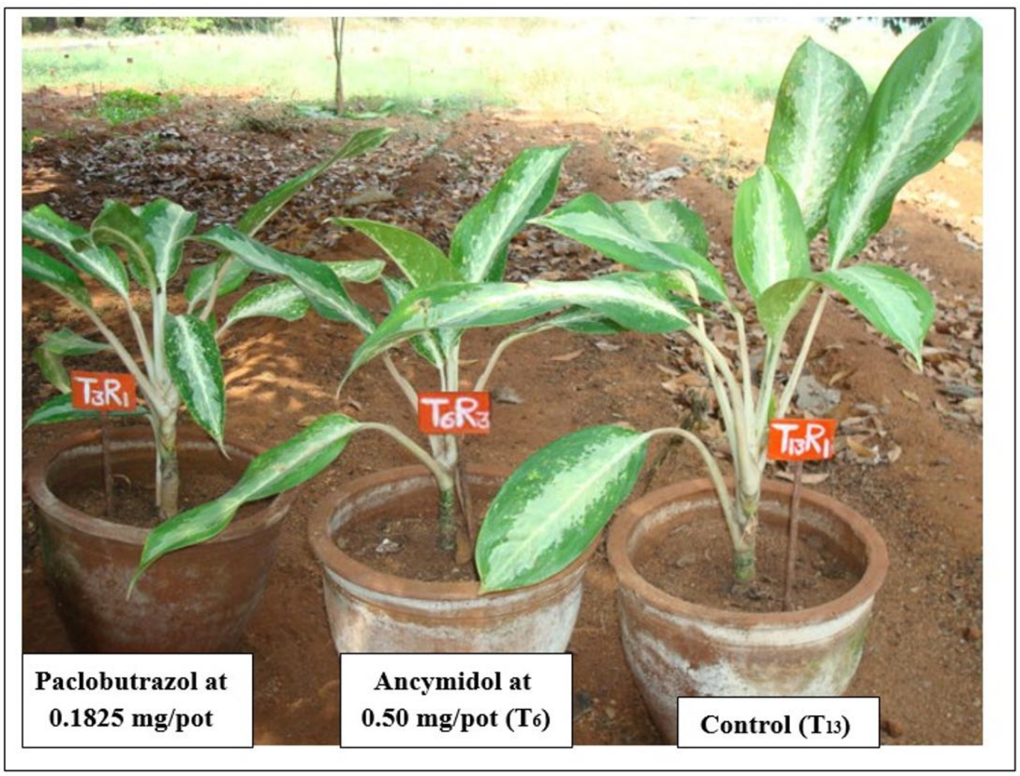

Plate 1: Relative growth Retardant effect on aglaonema cv. Ernesto's Favourite.

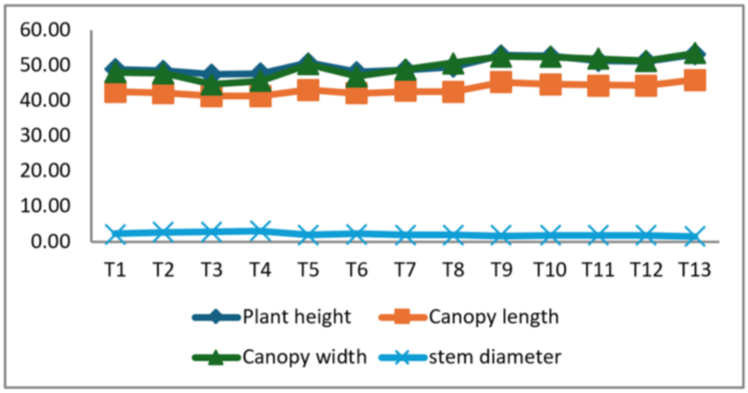

Fig. 1. Effect of paclobutrazol, ancymidol, cycocel on growth performance of aglaonema cv. Ernesto's Favourite.

The influence of plant growth retardants on leaf area was significant at 150 DAT (Table 1). Initially, at 30 DAT, leaf area did not differ significantly among treatments. However, by 150 DAT, paclobutrazol at 0.25 mg/pot (T_4) resulted in the lowest leaf area (140.66 cm²), which was statistically similar to paclobutrazol at 0.1825 mg/pot (T_3) (141.16 cm²). The control plants had the maximum leaf area (150.93 cm²). The reduction in leaf area due to paclobutrazol might be attributed to decreased leaf length, consistent with previous studies (Hagiladi and Watad 1992). Additionally, paclobutrazol's ability to bind to enzymes essential for gibberellin production and alter leaf morphology (Chaney, 2004) may also contribute to reduced leaf area. These findings are consistent with earlier reports (Mansour and Poole 1987).

The growth retardant treatments had a significant impact on stem diameter of Aglaonema at 150 DAT (Table 1). Paclobutrazol at 0.25 mg/pot (T_4) resulted in the highest stem diameter (2.90 cm), followed by paclobutrazol at 0.1825 mg/pot (T_3) (2.72 cm). In contrast, the control plants (T_{13}) had the lowest stem diameter (1.46 cm). The observations suggest that paclobutrazol (0.25 and 0.1825 mg/pot) had a pronounced effect on reducing stem growth, resulting in thicker stems. This is consistent with previous findings that growth retardants like paclobutrazol can reduce internode elongation, leading to shorter plants with thicker stems (Dole and Wilkins 2004). These results are in consonant with earlier findings of Wang and Gregg (1994) in golden pothos with paclobutrazol.

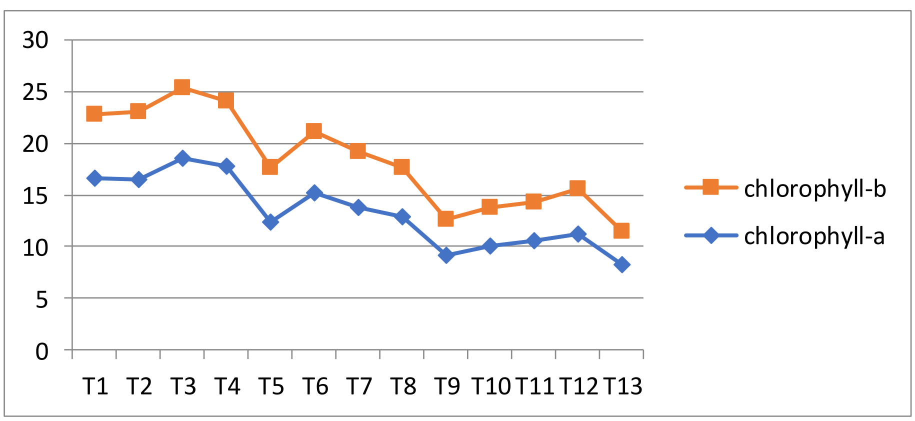

Fig. 2. Influence of Paclobutrazol, Ancymidol, and Cycocel on Chlorophyll Content in Aglaonema cv. Ernesto's Favourite.

The data in Table 2 show significant differences in chlorophyll content among growth retardant treatments. At 150 DAT, paclobutrazol at 0.1825 mg/pot (T_3) resulted in the highest chlorophyll 'a' content (18.50 mg/g fresh wt.), which was statistically similar to paclobutrazol at 0.25 mg/pot (T_4) (17.80 mg/g fresh wt.). The control plants (T_{13}) had the lowest chlorophyll 'a' content (8.26 mg/g fresh wt.). Similarly, paclobutrazol at 0.1825 mg/pot (T_3) resulted in the highest chlorophyll 'b' content (6.78 mg/g fresh wt.), which was comparable to paclobutrazol at 0.125 mg/pot (T_2) and 0.25 mg/pot (T_4). According to Chaney (2004), the increased chlorophyll content in treated plants might be due to smaller cell size, resulting in more concentrated chlorophyll, or an increase in phytyl production, which is essential for chlorophyll synthesis.

The data in Table 2 show significant differences in visual plant grade among treatments. Treatment T_3 (paclobutrazol at 0.1825 mg/pot) recorded the highest visual quality rating (4.57) at 150 DAT, which was on par with T_2 (4.42), T_4 (4.30), and T_1 (4.21). The lowest plant grade was observed in the control (T_{13}) (3.38), which was comparable to T_{10} (3.38) and T_9 (3.43). These findings confirm that paclobutrazol-treated plants exhibit superior visual quality. Paclobutrazol's ability to delay senescence by inhibiting hydrolases and reducing lipid peroxidation (Malik and Thind 1994) likely contributed to the improved plant quality. This delay in senescence enables leaves to maintain photosynthetic activity for a longer period and retain their color (Kumar and Purohit 1998). The persistence of paclobutrazol in the soil also helps maintain plant size (Cox and Whittington 1988). Our results are consistent with previous studies on angel-wing begonia (Conover, 1994) and golden pothos (Conover and Satterthwaite 1996).

Regarding color grade, treatment T_3 (paclobutrazol at 0.1825 mg/pot) resulted in a dark green color (4.60), which was comparable to T_2 (4.50), T_4 (4.45), and T_1 (4.25). The lowest color grade was recorded in the control (T_{13}) (3.30). The deep green color of paclobutrazol-treated leaves may be attributed to increased chlorophyll synthesis (Table 1) or reduced leaf area (Table 5) (Kumar and Purohit, 1998). Paclobutrazol has been reported to reduce leaf abscission and intensify green leaf color (Cox and Whittington 1988; Wang and Blessington, 1990). Overall, our results suggest that soil drench application of paclobutrazol at 0.1825 mg/pot or 0.25 mg/pot effectively reduces growth and improves the quality of Aglaonema cv. Ernesto's Favourite.

Table 1: Growth Response of Aglaonema cv. Ernesto's Favourite to Paclobutrazol, Ancymidol, and Cycocel at 30 DAT and 150 DAT.

Treatment (T)	Plant height (cm)		Number of leaves		Canopy length (cm)		Canopy width (cm)		Leaf area (cm^2)		Stem diameter (cm)	
	30 DAT	150 DAT	30 DAT	150 DAT	30 DAT	150DAT	30 DAT	150DAT	30 DAT	150DAT	30 DAT	150DAT
(T_1) PBZ 0.0625 mg/pot	30.38	48.90^c	4.10	8.94	25.07	42.53^b	26.86	48.03^c	64.66	143.78^c	0.82	2.21^c
(T_2) PBZ 0.125 mg/pot	30.30	48.50^c	3.50	8.06	24.63	42.23^b	26.86	47.76^c	63.86	143.20^c	0.77	2.59^c
(T_3) PBZ 0.1825 mg/pot	28.90	47.53^d	4.25	8.22	25.53	41.25^c	27.40	44.63^d	64.66	141.16^d	0.65	2.72^b
(T_4) PBZ 0.25 mg/pot	29.43	47.70^d	3.60	8.95	24.87	41.30^c	28.66	45.60^d	62.66	140.66^d	0.75	2.90^a
(T_5) A-rest 0.25 mg/pot	28.91	50.70^b	3.78	9.19	24.53	43.08^b	27.83	50.30^b	64.20	146.86^b	0.75	1.83^d
(T_6) A-rest 0.50 mg/pot	29.21	48.10^c	3.25	9.00	25.22	42.00^b	28.21	46.93^c	63.23	144.56^b	0.85	2.25^c
(T_7) A-rest 0.75 mg/pot	30.40	48.70^c	4.27	9.26	26.16	42.63^b	28.26	48.88^c	63.93	145.26^b	0.82	1.92^d
(T_8) A-rest 0.1 mg/pot	30.80	49.55^c	4.30	9.41	26.10	42.50^b	27.80	50.70^b	62.86	146.86^b	0.73	1.94^d
(T_9) CCC 500 ppm	28.80	52.85^a	3.15	9.67	24.50	45.26^a	26.46	52.56^a	64.56	149.56^a	0.84	1.64^e
(T_{10}) CCC 1000 ppm	30.28	52.66^a	4.00	9.16	26.00	44.73^a	26.48	52.36^a	63.83	149.16^a	0.68	1.67^e
(T_{11}) CCC 1500 ppm	30.41	51.26^b	3.75	9.32	25.16	44.47^a	28.11	51.86^a	62.96	149.96^a	0.72	1.68^e
(T_{12}) CCC 2000 ppm	30.39	51.20^b	3.87	9.49	25.48	44.28^a	27.43	51.36^b	64.56	150.56^a	0.68	1.69^e
(T_{13}) Control	30.40	53.01^a	4.20	10.44	26.02	45.96^a	27.21	53.50^a	64.13	150.93^a	0.75	1.46^f
S.Em.±	0.5	0.55	0.35	0.42	0.41	0.59	0.5	0.71	0.48	0.88	0.04	0.04
C.D at 5%	NS	1.61	NS	NS	NS	1.72	NS	2.07	NS	2.56	NS	0.14

Table 2: Influence of Paclobutrazol, Ancymidol, and Cycocel on Chlorophyll Content (Chlorophyll-a and Chlorophyll-b), Plant Grade, and Color Grade in Aglaonema cv. Ernesto's Favourite.

Treatment (T)	chlorophyll 'a'	chlorophyll 'b'	Plant grade	Colour grade
	150DAT	150DAT	150DAT	150DAT
(T_1) PBZ 0.0625 mg/pot	16.59[b]	6.15[b]	4.21[a]	4.25[a]
(T_2) PBZ 0.125 mg/pot	16.50[b]	6.58[a]	4.42[a]	4.50[a]
(T_3) PBZ 0.1825 mg/pot	18.50[a]	6.78[a]	4.57[a]	4.60[a]
(T_4) PBZ 0.25 mg/pot	17.80 [a]	6.25[a]	4.30[a]	4.45[a]
(T_5) A-rest 0.25 mg/pot	12.40[e]	5.19[c]	3.91[b]	3.85[b]
(T_6) A-rest 0.50 mg/pot	15.22[c]	5.85[b]	4.04[b]	4.00[b]
(T_7) A-rest 0.75 mg/pot	13.78[d]	5.34[c]	4.00[b]	3.91[b]
(T_8) A-rest 0.1 mg/pot	12.92[d]	4.67[d]	3.98[b]	4.00[b]
(T_9) CCC 500 ppm	9.21[g]	3.46[e]	3.43[c]	3.66[b]
(T_{10}) CCC 1000 ppm	10.10[f]	3.72[e]	3.38[c]	3.33[c]
(T_{11}) CCC 1500 ppm	10.53[f]	3.80[e]	3.55[b]	3.53[b]
(T_{12}) CCC 2000 ppm	11.17[e]	4.43[d]	3.56[b]	3.85[b]
(T_{13}) Control	8.26[g]	3.23[f]	3.38[c]	3.30[c]
S.Em.±	0.44	0.19	0.17	0.18
C.D at 5%	1.28	0.56	0.50	0.54

Plant grade system where 1 = Dead, 2 = Poor quality, 3 = Fair quality, 4 = Good quality and 5=Excellent quality
Colour grade system where 1= Poor colour, 3 = Good, light green, 5 = Excellent, dark green & silver contrast.

CONCLUSIONS AND FUTURE SCOPE

A perusal of experimental results reveals that soil drench application of paclobutrazol at 0.1825 mg/pot resulted in maximum reduction in growth parametres and improved quality parameters of aglaonema cv. Ernesto's Favourite and to which paclobutrazol at 0.25 mg/pot was found to be on par. Further research is warranted to investigate the long-term effects of growth retardants on interior landscape plants with different growth retardants, as well as their interaction with varying light intensities and potting media. Additionally, exploring the combined effects of growth retardants and potting mixtures on commercially important foliage plants could provide valuable insights.

Acknowledgement. I thank my advisor, Dr. T. Padmalatha, and my advisory committee for their guidance and support. I also appreciate the faculty, field workers, and friends from the Department of Floriculture and Landscape Architecture, Dr. YSR Horticultural University and my family for their contributions.

REFERENCES

Barrett, J. E. and Bartuska, C. A. (1982). PP333 effects on stem elongation dependent on site of application. *Hortscience*, *17*, 737-738.

Chaney, W. R. (2004). Paclobutrazol: More than just a growth retardant. Presented at Pro-Hort Conference, Peoria, Illinois, 4th February.

Chen, J., Henny, R. J. and Caldwell, R. D. (2002). Ethephon suppresses flowering of purple passion (*Gynura aurantiaca*). *Journal of Environmental Horticulture, 20*, 228–231.

Conover, C. A. (1994). Angle-wing begonia growth and water requirements affected by paclobutrazol. Central Fla. Res. and Educ. Ctr.-Apopka Res. Rpt. RH-94-4, Univ. of Fla. /IFAS.http://mrec.ifas.ufl.edu.lp.hscl. ufl.edu/Foliage/ Resrpts/rh_94_4.htm.

Conover, C. A. and Satterthwaite, L. N. (1996). Paclobutrazol optimizes leaf size, vine length and plant grade of golden pothos on totems. *Journal of Environmental Horticulture, 14*(1), 44-46.

Cox, D. A. and Whittington, F. F. (1988). Effects of paclobutrazol on height and performance of aluminium plant in a Simulated Interior Environment. *Hortscience., 23*(1), 222.

Davis, T. D. (1987). Interior performance of three foliage plant species treated with paclobutrazol. *Journal of Applied Agricultural Research, 2*, 120–123.

Dole, J. M. and Wilkins, H. F. (2004). Floriculture Principles and Species.2nd ed., Prentice Hall, Upper Saddle River, N.J.

Emily, Anna Stefanskia, (2008). Consumer response to containerized foliage plant combinations. M.Sc. Thesis. Graduate School of the University of Florida.

Hagiladi, A. and Watad, A. A. (1992). *Cordyline terminalis* plants respond to foliar sprays and medium drenches of paclobutrazol. *Hortscience, 27*(2), 128-130.

Henny, R. J., Chen, J. and Mellich, T. A. (2008). New Florida foliage plant cultivar: aglaonema 'Stripes'. University of Florida, IFAS Extension.

Kumar, K. and Purohit, B. (1998). Plant Physiology Fundamentals and Applications. 2nd Ed. 337p.

Li, Qiansheng, Deng, Min, Chen, Jainjun and Henny, R. J. (2009). Effects of light intensity and paclobutrazol on growth and interior performance of *Pachiraaquatica. Hortscience, 44*(5), 1291-1295.

Malik, C. P. and Thind, S. K. (1994). Regulation of plant behaviour: Triazoles as potential plant growth regulators. *Journal of Mendel., 11*, 15 – 91.

Mansour, H. A. and Poole, R. T. (1987). Trials with growth retardants on ornamental foliage plants. *Proceedings of the Florida State Horticultural Society*, *100*, 375-378.

Panse, V. G. and Sukhatme, P. V. (1985). Statistical Methods for Agricultural Workers. 2nd Ed., ICAR, New Delhi.

Poole, R. T. and Conover, C. A. (1992). Water use and growth of eight foliage plants influenced by paclobutrazol. *Foliage Digest*, *15*(12), 1-3.

Rademacher, W. (1991). Biochemical effects of plant growth retardants. In: H.W. Gausman (ed.). Plant Biochemical Regulators. Marcell Dekker, New York, pp. 169-200.

Wang, Y. T. and Blessington, T. M. (1990). Growth of four tropical foliage species treated with paclobutrazol or uniconazol. *Hortscience, 25*(2), 202-204.

Wang, Y. T. and Gregg, L. L. (1994). Chemical regulators affect growth, post production performance, and propagation of golden pothos. *Hortscience, 29*(3), 183-185.

How to cite this article: Sripada Swetha and T. Padmalatha (2021). Impact of Paclobutrazol, Ancymidol and Cycocel on Growth and Quality of Aglaonema, an Ornamental Foliage Plant *Biological Forum – An International Journal*, *13*(2): 775-780.