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Effects of NAA and BA on Lily (*lilium spp.*) Propagation by Scaling

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Abstract

The experiment was executed at the Botanical Garden- college of Science, university of Baghdad, Iraq. The period was from November 2016 to March 2017, on the scales of lilium (*Peral Carolina*) belonging to the asiatic hybrids imported from the Netherlands. The scales of lily treated with naphthyl acetic acid (NAA)(0,25,50) mg/l and benzyl aminopurine (BA)(0,10,20) mg/l twice after planting to improve flowering characters of hybrid lily cultures . It was observed that at the concentration BA 20 mg/l and NAA 50 mg/l increased the number of bulbues formed about 0.8% and the number of bulbs as 11.3%, while the root length decreased with the same concentration about 5.7%. The fresh weight of the buds, the length of the buds and the number of roots at the concentration of BA 20 mg/l and NAA 0 mg/l was increased about (0.6%, 2.2%, 66%), respectively . The fresh weight of bulblets increase as 0.8% when the BA concentration was 10 mg/l and NAA 50 mg/l. Therefore we can conclude that the best concentration recommended for hormonal interference is BA 20 mg /l and NAA 50 mg /l, where the number of bulbs formed and number of bulblets was increased.

Keywords: lily(*lilium spp.*), BA(6-benzylaminopurine), NAA(1-naphthylacetic acid).

تأثير NAA و BA في اكاثر نبات اليليوم (*lilium spp.*) بالقشور

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الخلاصة

أجريت التجربة في الحديقة النباتية التابعة لكلية العلوم-جامعة بغداد/العراق. خلال فترة من تشرين الثاني 2016 الى آذار 2017 ،على قشور أبصال نبات اليليوم (*Peral Carolina*) التي تعود المجموعة Asiatic hybrids المستوردة من هولندا. عوملت بمنظمات نمو نباتية (NAA) naphthylacetic acid (0,25,50) ملغم / لتر ، و (BA)benzylaminopurine (0,10,20) ملغم / لتر ، مرتين بعد الزراعة بهدف زيادة الصبغات الزهرية لابصال اليليوم. لوحظ من النتائج انه بتركيز BA 20 ملغم/لتر و NAA 50 ملغم/لتر زاد عدد البراعم المتكونه بنسبة 11.3% وعدد البصيلات بنسبة 0.8% ، بينما انخفض طول الجذر بنفس التركيز بنسبة تقريباً 5.7%. وقد ازداد كل من وزن البرعم الطري وطول البرعم و عدد الجذور المتكونه عند تركيز BA 20 ملغم/ لتر و NAA 0 ملغم/لتر بالنسب المقدره (66%، 2.2%، 0.6%) بالتتابع. وقد ازداد وزن البصيلات الطري بنسبة 0.8% عندما كان التركيز BA 10 ملغم/ لتر و NAA 50 ملغم/ لتر. لذلك نستنتج انه أفضل تركيز يوصى به لاكثر الابصال بالقشور بالنسبة للتداخل الهرموني هو عند BA 20 ملغ \ لتر و NAA 50 ملغ \ لتر، حيث ازدادت عدد البصيلات المتكونة وعدد البراعم .

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Introduction

The genus *Lilium* belongs to family Liliaceae, it comprises over 80 species Lim *et. al.*, [1]. Lily has been used for different purposes including decoration of hotels, houses, luxury buildings, marriages, funeral and religious ceremonies for over 2000 years Ramsay *et. al.*, [2]. Hybrid lilies are excellent cut flowers Ranwala *et. al.*, [3], because of their outstanding fragrance, a range of colors, hardiness and adaptability to diverse environmental conditions its has highly prized by horticulturists Bahr *et. al.*, [4]. Color considered one of the most important characters in combination with flower shape and size Lim *et. al.*, [1].

The bulb is composed of fleshy scales which are attached to a highly compressed basal plate used for multiplication (scaling), Anu [5]. Asexual propagation of *Lilium* species can be accomplished by separation of stem bulb lets or bulbils, division of bulbs and scaling Dhiman and Sindhu [6].

Propagation of liliium through scaling is the most effective, cheap and rapid method for conservation and multiplication, however the commercial sized bulbs are obtained in 3-4 years Park [7] and Suh [8]. Another advanced method of propagation is through tissue culture Jeong [9]. The application of nutrients and plant growth regulators may improve flower quality parameters Sajid [10]. Stem length control also required in order to obtain bulb plants that are proportional to their pot size and to reduce post-harvest stem elongation Francescangeli *et. al.*, [11]. An effective means of controlling plant height is using plant growth regulators Krug [12].

Several studies in overseas showed the effective of benzyl adenine and naphthylacetic acid on vegetative and flowering characters [13,14,7,15]. However, little attention has been drawn to the effect of plant growth regulators on the lilies in the world particularly in Iraq. Therefore, this study aiming to improve flowering characters of hybrid lily cultivars by using plant growth regulators.

Materials and Methods

The experiment was conducted during 2016-2017. The scales of hybrid lilies *Pearl Carolina* is asiatic hybrids. The outer and the medal scales were taken and grown in inside pots (22cm), which were planted with 13 scales distributed in 36 pots. The plants were treated with plant growth regulators after one and two weeks as first and second applications. The BA(6-benzylaminopurine) was used in different concentration 0, 25, 50 mg/l, and with NAA(1-naphthylacetic acid) in different concentration 0,10, 20 mg/l. Each content of BA dissolved in HCL while NAA dissolved in NAOH, and completed the volume to 1000 ml with distilled water.

The Parameters

During the period of this experiment the scales were monitored and the data were collected as follows:

1. The number of buds formed:
The number of buds formed in each replicate were recorded after two weeks from planting.
2. The buds heights (cm):
Heights of buds of each replicate were measured from the base of plant to the height region. Buds heights were recorded after two weeks from planting.
3. The number of bulblets formed :
The number of bulblets formed in each pot were measured.
4. The number of roots formed :
The number of roots formed in each pot were calculated.
5. The fresh weight of bulblets formed(gm) :
The fresh weight of bulblets formed in each pots were recorded.
6. The fresh weight of roots formed(gm) :
The fresh weight of roots formed in each pots were collected.
7. The fresh weight buds formed(gm) :
The fresh weight of buds formed in each pots were measured.

Experimental design and analysis

This experiment was arranged in a completely randomized design (CRD). Each treatment consisted of three replications, and each replication consisted of 12 scales. Data were subjected to analysis of variance using statistical analysis system (SAS) program SAS [16]. The separation was performed using least significant differences test (LSD) to compare between differences concentration of plant growth regulator, at the 5% level of significance.

Result and discussion

The number of buds

According to the results, there were no significant effects of single application of BA or NAA on number of bulbs (Table-1) . The interactions between them showed that the concentration of BA 20 mg/l with NAA 50 mg/l , gave 38.3 buds which was higher by 11.3% compared with control (Table- 1). Little and Macdonald [17]observed that when seedlings of Scots pine (*Pinus sylvestris* L.) and white spruce (*Picea glauca* (Moench) Voss)were observed growth and terminal vegetative buds developed when treated with two auxins, indole- 3-acetic acid (IAA) and naphthalene acetic acid (NAA) for both 1 µg- 20 µg .

Naji *et. al.*, [18] showed that the number of leaves increased in Brunello by (14.10%) when used auxins 50 mg/l ,this increase caused by the role of auxins in the activation of the photosynthesis process by activating the synthesis of P700. The auxins play an important role in the photosystem light reaction (Hill reaction) and by consumption of CO₂ with the activation of Rubulose- Biphosphate Carboxylase enzyme ie. activation of dark reaction. The researchers [18, 19] found that using of BA stimulate leaf primodia and increase cell division.

This effect is in agreement with Al-hasnawi [20] in the studies on *Chrysanthemum hortorum* Hort and he observed an increase in leaf number due to sprayed with 50 mg/l of BA. Al-abbasi [19] also agree with these results, he showed an increase in leaf number due to treat of *Dianthus caryophyllus* L. With 50 mg/l of Kinetin.

Table 1-The effects of PGR on the number of buds

BA NAA	0	10	20	Mean NAA
0	27	32	27.3	20.4
25	19.3	34.7	26	29.8
50	15	22.7	38.3	30.6
LSD	18.446 *			NS
Mean BA	28.8	26.7	25.3	
LSD BA	NS			

The weight of buds

Treatment with these concentration, there were no significant effects of single application of BA or NAA on number of bulbs (Table-2). The interactions between them showed that the concentration of BA 20 mg/l with NAA 0 mg/l, gave 0.9 buds which was higher by 0.6% compared with control (Table- 2). This effect agrees with Rahdari *et. al.*, [21] by their studies on *Avene sativa* L. They reported an increased in fresh weight of stem. Attiya *et. al.*, [18] showed that BA increased in fresh weight of a leaf in Brunello by(25.15%), Which attribute to increase in the weight of buds, leaf area ,and leaf number due to increase in vegetative growth.

Table 2- the effect of PGR on the weight of buds (gm)

BA NAA	0	10	20	Mean NAA
0	0.3	0.3	0.9	0.5
25	0.6	0.4	0.4	0.5
50	0.4	0.7	0.3	0.5
LSD	0.4195 *			NS
Mean BA	0.5	0.5	0.5	
LSD BA	NS			

The number of bulblets

In these concentration, there were no significant effects of single application of BA or NAA on number of bulblet (Table-3). The interactions between them showed that the concentration of BA 20 mg/l with NAA 50 mg/l , gave 25.3 bulbet which was higher by 0.8% compared with control (Table- 3). This result is agree with Park *et. al.*, [7] that propagate lily with scale bulbets by using different temperature and different concentrations of (NAA,BA). They found that the perfect temperature was 25C gave best growth of bulblet and number of bulblets per scale .They turned that maybe the auxins help in activation of type of genes for RNA constructing that is important to building of proteins, so the water potential become more negatively . Those lead to decrease the compacting pressure and increase the passing of water and nutrient material, and increase the size of a cell Al-Sahn [22]. This result agrees with Dawood [15] who observed an increase in leaf area of Strawberry due to treat with of IAA. Zia *et. al.*, [23] observed an increase leaf area of Marigold due to treat with 200 ppm of IBA.

Table 3-The effects of PGR on the number of bulblets

BA NAA	0	10	20	Mean NAA
0	24.5	45	19.3	20.4
25	21.7	24	18.3	29.8
50	16.7	21.7	25.3	30.6
LSD	19.81*			NS
Mean BA	29.6	21.3	21.2	
LSD BA	NS			

The weight of bulblets

The results show that no significant effects of single application of BA or NAA on number of bulblets (Table-4) .At the interactions between them showed that the concentration of BA10 mg/l with NAA50mg/l , the value weight of bulbets is 1.2 which was more about 0.8% according to control

(Table- 4), This increase may be due to increase in vegetative growth as number of buds and bulbels were increased Tables-(1, 3).

Dawood [15] studied the effect of indole acetic acid (IAA) as foliar spray in three concentrations (0, 10 and 20 ppm) on strawberry (*Fragaria x ananassa* duch.) cv. Hapil. His results indicated that there was a significant increase of auxin on average of leaf area, total chlorophyll and total dry weight compared to the control. Naji *et. al.*, [18] found the treatment with auxin increased the fresh weight of the bulb in Tiger Edition, while foliar spray with BA increased this trait in White heaven, As the total dry weight was improved. However Kurtar *et. al.*, [24] reported that decrease in bulb weight of Tulip (*Tulip agesneriana* Var. Cassini) due to spray with BA due to ensure all nutrient for stalk elongation.

Table 4 -The effect of PGR on the weight of bulbets (gm)

BA NAA	0	10	20	Mean NAA
0	0.4	0.5	0.8	0.5
25	0.6	0.5	0.5	0.7
50	0.6	1.2	0.4	0.6
LSD	0.3985 *			NS
Mean BA	0.6	0.5	0.7	
LSD BA	NS			

The height of buds

The results in (Table- 5) show no significant effects of single application of BA or NAA on of height buds. In the interactions between two concentration of BA20 mg/l with NAA0mg/l, the height of buds almost as 13.6 that is more about 2.2% from control. Farris *et. al.*, [19] found that a single foliar spray or basal drench of (250 to 2000 ppm) benzyladenine (BA) can greatly enhance vegetative shoots in 'Moonbeam' coreopsis. They observed using (1000 or 2000) concentrations of BA caused temporary foliar chlorosis and a significant delay in flowering. Therefore they concluded it should not be applied of BA at rates above 500 ppm.

Naji *et. al.*, [18] Leaf area was increased in Tiger Edition and Brunello due to spray with BA. Cytokinins have an important role in the movement of dissolvent to the side of sink source, it can be delay senescence and consequently increase leaf number Al-hasnawi [20]. He observed increase in leaf area of *Chrysanthemum hortorum* Hort. due to spray with 50mg/l of BA.

Table 5- The effects of PGR on the height of buds (cm)

BA NAA	0	10	20	Mean NAA
0	11.3	11.6	13.6	12.2
25	12.7	13.2	13.4	11.8
50	12.6	10.5	11	12.7
LSD	2.3945 *			NA
Mean BA	12.2	13.1	11.4	
LSD BA	1.3825 *			

Height of roots

According to the results, there is significant effects of single application of BA that at 10 mg/l increase in the root height, at 20 mg/l there is no effect on the root height. But NAA have no significant effects of single application. In the interactions between the concentration of BA10 mg/l with NAA50mg/l, the height of roots was heights at 22.3 that is less than the control about 5.7% (Table- 6), This results disagree with Al-Hasnawi [25] as used five concentration of Auxin and found significantly increased in vegetated character. Gilberto [26] showed that with increased NAA from 1.25, 2.5, 5, 10 mg/l gave high growth of roots due to callus growth so new cell formed. Torrey [27] mentioned that BA (cytokinins) have inept effect on the callus form, so if the BA was in high concentration it may be decreased the length of the root.

Table 6-The effects of PGR on the height of roots in cm.

BA NAA	0	10	20	Mean NAA
0	28.0	20.3	12.3	20.7
25	16.7	13.5	15	18.7
50	17.5	22.3	15.7	14.3
LSD	5.7512 *			NA
Mean BA	20.2	15.0	18.5	
LSD BA	3.3205 *			

The number of roots

In these results, no significant effects of single application of BA, but NAA have significant effects of single application, with different concentration on the root number. but, the interactions between the concentration of BA20 mg/l with NAA0mg/l, the number of roots were formed are 136.7, as 66% increase according to control (Table- 7), Matsumoto [28] found that application of BA (25 or 50 mM) on Miltoniopsis Orchid hybrid promoted new vegetative shoots. Mogens [29] growth rate was very low in the absence of both BA and NAA, and also at the lowest NAA concentration unless the BA concentration was high. He found BA alone resulted in increasing rate with increasing concentration. In the combinations this BA effect was only apparent at the lowest NAA concentration. At higher NAA-concentrations this effect of BA could not be discerned since all segments survived.

Table 7- The effects of PGR on the number of roots.

BA NAA	0	10	20	Mean NAA
0	70	146	136.7	86.2
25	115.3	128.7	94	131.2
50	37.3	119	128.7	119.8
LSD	71.839 *			41.476 *
Mean BA	117.6	112.7	107	
LSD BA	NA			

References

1. Lim, K.B. and Van Tuyl, J. M. **2007**. *Lilium* hybrids. In: Anderson NO (ed) Flower breeding and genetics-issues, challenges and opportunities for the 21st century. Springer, Dordrecht, pp 517–537.
2. Ramsay, J.L., Galitz, D.S. and Lee, C.W. **2003**. Basal medium and sucrose concentration influence regeneration of eastern lily in ovary culture. *Hort. Sci.*, **38**(3): 404-406.
3. Ranwala, A. P. and Miller, W. B. **2002**. Using Gibberellins to Prevent Leaf Yellowing in Cut Lilies. *Greenhouse Product News*, **12** (1): 30-34.
4. Bahr, L.R. and Compton, M.E. **2004**. Competence for *in vitro* bulblet regeneration among eight *Lilium* genotypes. *Hort. Sci.*, **39** (1): 127-129.
5. Anu, B. **2015**. Effect of calcium nitrate on propagation of la hybrid lilles through scaling .M.S.c. theses . College of horticulture university of horticulture and Forestry, Nauni Solan - 173 230 (H P), INDIA .
6. Dhiman , M R. and Sindhu, S S. **2007**. Effect of propagation media and growth regulators on bulblet formation through scale propagation in Lilium. *Journal of Ornamental Horticulture*, **10**(3): 181-183.
7. Park, N B., Lee, Jong Suk (eds.) and Roh, M S. **1996**. Effect of temperature, scale position and growth regulators on the bulblet formation and growth during scale propagation Lilium. *Acta Horticulturae*, **414**: 252-267.
8. Suh, J K., Lee, J S. and Roh, M S. **1996**. Bulblet formation and dormancy induction as influenced by temperature, growing media and light quality during scaling propagation of Lilium species. *Acta Horticulturae*, **414**: 251-256.
9. Jeong, J H. **1996**. *In vitro* propagation of bulb scale section of several Korean native lilies. *Acta Horticulturae*, **414**: 269-271.
10. Sajid, G. M., Kaukab, M. and Ahmed, Z. **2009**. Foliar application of plant growth regulators (PGRs) and nutrients for improvement of lily flowers. *Pak. J. Bot.*, **41**(1): 233-237.
11. Francescangeli, N., Marinangeli, P. and Curvetto, N. **2007**. Short communication. Paclobutrazol for height control of two *Lilium* L.A. hybrids grown in pots. *Spanish J. of Agri. Res.* **5**(3): 425-430.
12. Krug, B.A. **2004**. The chemical growth regulation of bulb crops using flurprimidol as foliar sprays, substrate drenches, and pre-plant bulb soaks. M.Sc. Thesis, North Caroline State Univ, Raleigh, USA.
13. Amling, J.W., Keever, G.J. Kessler, J.R. and Eakes, D.J. **2005**. Response of ‘Moonbeam’ Coreopsis and ‘Goldsturm’ Rudbeckia to B-Nine and Cycocel. *J. Environ. Hort.* **23**(1): 25–28.
14. Carey, D., Whipker, B., Mccall, I. and Buhler, W. **2007**. Cytokinin based PGR affects growth of vegetative petunia. *SNA Research Conference*, **52**: 102-108.
15. Dawood, Z. A. **2010**. Effect of indole acetic acid and naphthalene acetic acid on growth and yield of strawberry (*Fragaria x ananassa* Duch.) CV. HAPIL. *ISSN 16X 815-31*, **38** (2).
16. SAS. **2010**. *Statistical Analysis System*, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.
17. Little, C. H. A. and Macdonald, J. E. **2003**. Effects of exogenous gibberellin and auxin on shoot elongation and vegetative bud development in seedlings of *Pinus sylvestris* and *Picea glauca*. *Tree Physiology*. **23**: 73-83.
18. Dhoha, A., Naji, Hatim, J., Attiya, Hassan, Askar, M. **2015**. Effect of Plant Growth Regulators (IBA, BA, and CCC) on Some Vegetative Characters of Three Hybrid Lily Cultivars of (*Lilium spp.* L.). *Iraqi Journal of Science* , **56**(2A): 972-982
19. Al-abbasi, A. M. A. **2009**. Response of carnation plant *Dianthus caryophyllus* L. to kinetin, cycocel and phosphorus, potassium and its position in landscape gardening. Ph.D. Thesis. College of Agriculture at the University of Basrah, Iraq.
20. Al-hasnawi A. N. H. **2011**. Effect of benzyladenine and chelated magnesium spraying on growth and flowering of *Chrysanthemum hortorum* Hort. M.Sc. Degree. Department of Horticulture and Landscape, College of Agriculture, University of Kufa, Iraq.

21. Rahdari, P., Sarifzadeh, V., Safarnejad, F. , Poor, F. G. and Aframjani, S. K. **2013**. Effects of auxin and cytokinin on morphological and physiological factors in stem and root in (*Avene sativa* L). *Life Science Journal*, **10**(1): 788-795.
22. Al-Sahn, J. H. A. **2011**. Effect of spraying with gibberellic acid and indol-3-acetic acid concentrations on vegetative and flowering growth parameters of carnation *Dianthus caryophyllus* L. M.Sc. Degree , Department of Horticulture and Landscape Design, College of Agriculture, University of Kufa, Iraq.
23. Zia ullah , Abbas, S. J. , Naeem, N., Lutfullah, G. ,Malik, T. , Khan, M.A. and Khan I. **2013**. Effect of indolebutyric acid (IBA) and naphthaleneacetic acid (NAA) plant growth regulators on Mari gold (*Tagetes erecta* L.). *Afr. J.Agric. Res.*, **8**(29): 4015-4019.
24. Kurtar, E. S. and Ayan, A. K. **2005**. Effect of gibberellic acid (GA4) and indole-3- acetic acid (IAA)on flowering , stalk elongation and bulb characteristics of Tulip (*Tulipa gesneriana* Var. Cassini).*Pak. J. Sci.*, **8**(2): 273-277.
25. Al-Hasnawi, A. N. **2012**. Spraying effect of different concentration of IBA on vegetative and flowering characteristics of *Zinnia haageana*. *Kufa journal for agricultural science*, **4**: 281-286.
26. Gilberto B.kerbaury.**1984**. plant regeneration of *Oncidium varicosum* (Orchidaceae) by means of root tip culture .*plant cell report*, **3**: 27-29.
27. John G. Torrey. **1976**. Root hormones and plant growth .Cabot foundation ,Harvard university . *Ann Rev Plant Physiol*, **27**: 435-459.
28. Matsumoto, T.K. **2006**. Gibberellic acid and benzyl adenine promote early flowering and vegetative growth of Maltoniopsis orchids hybrids. *Hortscience*. **41**: 131-135.
29. Mogens Fønnesbech. **1974**. The Influence of NAA, BA and Temperature on Shoot and Root Development from *Begonia x cheimantha* Petiole Segments Grown *in vitro*. Department of Plant Physiology & Anatomy, Royal Veterinary & Agricultural University, Thorvaldsensvej 40, DK 1871 Copenhagen V, Denmark