

## Effect of Media and Naphthalene Acetic Acid Application on Rooting, Growth and Flowering of Carnation (*Dianthus caryophyllus* L.)

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### ABSTRACT

An experiment was conducted at the lath house of Botany Department at the Technical institute at Al - Kufa from January 10.2010 to June 1.2011 to study the effect of growth medium and Naphthalene acetic acid (NAA) concentration on carnation rooting characteristics and its growth and flowering. The experiment included planting "Chabaud" carnation cuttings ( height 10- 12 cm containing four true leaves ) in two growth media (river loam + peat moss (1:1)) and (river loam alone), and immersing cuttings in NAA with three concentrations (i.e. 0, 200 and 400 mg/L) . Results showed that growth medium (river loam + peat moss (1:1)) gave the highest values in rooting percentage , plant height , number of leaves and nodes , shoot and root dry weight , flower diameters and number of petals ( 88.30% , 14.23 root/cutting , 65.74 cm , 35.11 leaf/plant , 17.55 node/plant , 1.99 gm and 0.80 gm , 4.71 cm and 29.97 petal/ flower , respectively) significantly . compared with the lowest value produced in the growth medium (river loam alone) . The results showed that immersing cuttings in NAA with a concentration 400 ppm significantly increased rotting percentage , number of root/ cutting, plant height, number of leaves and nodes, internodes height, shoot and root dry weight, flower diameters and number of petals to 93.86% , 15.92 root /cutting , 76.88 cm , 38.33 leaf / plant , 19.16 node/ plant , 4.05 cm , 2.2 gm , 0.90 cm , 4.94 cm and 35.30 petal/flower , respectively . Meanwhile control treatment gave the lowest values for these . From the interaction between factors, the results showed that cuttings grown in the growth medium (river loam + peat moss (1:1)) and immersed with 400 ppm NAA gave highest values for the previous characteristics, compared with cuttings grown in river loam alone and non - treated with NAA that gave the lowest values .

**Keywords:** Media and Naphthalene,Acetic Acid,Carnation.

### INTRODUCTION

Carnation plant ( *Dianthus caryophyllus* L.), which belongs to the family Caryophyllaceae , is one of the important cut flowers in the world , and Mediterranean region is the origin of the plant , stems branching solid

with clear nodes, with leaves pairs of opposite stripe flowers had many colors, beautiful terminal stamen with five leaves and cylindrical stigma to cups, flowers different in size from small to large, according to varieties (Al- Sultan *et al* ,1992).

Growth medium which plays an important role in growth and production of flowers as it provides plants with all the necessary materials and nutrients essential for growth and flowering . The growth in the balanced media diet provides plants with nutrients good to improve the growth of plants and flowers (Toajin,1987)

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Received on 27/8/2012 and Accepted for Publication on 26/9/2013.

Loamy soils with high permeability and high content of organic matter are suitable soils for the cultivation of carnation. Organic matter in the soil improves the chemical and physical properties of the growth media in addition to it is considered a good source of many nutrients i.e. nitrogen (N) and phosphorus (P) potassium (K) and others (Abu- Dhahi, 1989) .

Peat moss is one of the organic materials used in the preparation of growth media in pots as well as it's easy to be confused with other components when it is wet (Toajni, 1987). This has been pointed out by (Lissie, 1968) when peat moss was added to the soil planted with carnation it caused a significant increase in the plant height and number of leaves per plant, flower diameter compared with plants that are planted in the soil alone . Strojny *et al.* (1994) concluded that using a mixture of growth media consisting of (3 loam soil : 1 peat moss) for "Tanga" carnation gave significant increase in plant height and number of leaves in addition to increasing the diameter of the flower and the number of petals/flower compared with control plants (planting in the soil alone), which gave lowest values . Aswath and Choudhary (2002) found that success of planting of off-set *Gerbera spp* reached 95% in the growth media composed of the peat moss + rivers loam soil by (1:1) compared to the control treatment (rivers loam only). Also Al- Dulaymy ( 2005) found that growing carnation in the growth media consisted of (2 loam soil : 1 peat moss) and spraying the nutritional solution (Mg-Nitro) at a concentration of 2 ml/L significantly increased the stem length, number of leaves , shoot and root dry weight in addition to increasing the diameter of the flower and the number of petals/flower compared with plants that grown in growth media (4 loam soil : 1 peat moss) and the no spraying with nutritional solution which gave the least values.

Plants growth and flowering are dependent on many

physiological factors including growth regulators, which affect the growth of plants and flowering . Davies (2004) mentioned that synthetic growth regulators including auxin had actually biological role in the plants similar to that of growth hormone, auxin produces in the apical meristem and doing many functions, including encouraging the growth of lateral roots on the stem cutting, as exploited this property in the propagation of plants , that some plant species characterized by fast rooting without treatment auxin , while others plants need to treat its cuttings with auxin due to the difficulty of its rooting Attia and Khudair (1999) has pointed out that auxin causes the emergence of lateral roots in the cuttings treated with it . According to Dole and James (2006), the auxin preformed roots initials. Abu-leila(1969 )has pointed out that immersion cuttings of chrysanthemum with IBA and NAA at concentration 250 or 500 ppm led to a significant increase for flowers diameter and the number of petals. Amine and Hashim (1992) also reported that treating "Spider" chrysanthemum cuttings with IAA and IBA at concentrations 0, 100, 200, 300 or 400 ppm significantly increased the dry weight of roots and number of roots compared with non- treated cuttings . Debasis ( 2000 ) found that soaking "Super White" *Chrysanthemum indicum* cuttings with NAA at concentration of 2000 ppm significantly increased the growth of the roots, germination percentage and the number of roots . Using *Geranium Pelargonium zonal* and *Petunia spp.*, Jayce (2001 ) found that immersion of cutting base with NAA, IBA and IAA had a significant increase in the length of stem. Banasik (2008) indicated that spraying *Polianthus tuberosa* L. bulbs with NAA at concentration 500 mg/L significantly increased number of leaves. Al Malki and Elmeer (2009) reported that treating rooting medium with IBA and NAA increased rooting percentage , root length and number of lateral

roots in *Ficus anastasia* . Bhatt and Tomar (2010) found that cutting of Swingle (Kagzi – lime) (*citrus auriantifolia*) treated with IBA at concentration 500 ppm significantly increased number of primary roots and the length of longest roots . Al-Sahn (2011) confirmed that spraying carnation (*Dianthus caryophyllus*) with IAA at concentration of 50 ppm significantly increased the plant height, leaf area, dry weight of shoot and root growth in addition to increasing the diameter and the number of flowers. Slim (2011) found that treating five varieties of Rose *Ross spp* with four concentrations of IBA led to an increase in rooting percentage and the length of lateral roots. Al –Raisdi (2012) found that soaking seeds of *Trigonella foenum – graecum* plant with IAA at concentration 200 ppm significantly increased plant height , shoot and root dry weight , length of root and leaf total chlorophyll content.

The aim of this research was to study the effect of two growth media and three concentrations of Naphthalene acetic acid (NAA) on rooting growth and flowering of carnation.

#### Materials And Methods

This experiment was conducted at the lath house of Botany Department at the Technical institute, Al – Kufa in the period January 10 2010 – June 1 2011 "Chabaud" carnation cuttings (height 10-12cm, with four true leaves) were taken on January 1 2010 from Semillas-fito company. Naphthalene acetic acid (NAA) solutions were prepared by dissolving the powder in ethanol (95%) and distilled water .Concentration of zero , 200 and 400 ppm

NAA were used Cuttings bases were immersed in solutions of NAA by quick dipping for a period of 5 seconds (Hartmann and Kester, 2002 ), then they were planted in pots (25cm diameter) filled with growth media (river loam + peat moss (1:1)) and (river loam alone ).Ten cuttings were plant per pot. Samples of soil were taken before mixing peat moss to analyze their chemical and physical properties . Table (1) shows the results of this analyses. Table (2) shows the chemical characteristics of peat moss product from company Sab-Germany.

Pots were placed during January and February in the greenhouse in order to protect them from lower temperature. Irrigation, weeding and fertilization were performed. Cuttings were fertilized with (NPK) fertilizer at ratio (20:20:20) by spraying on leaves at the concentration of 600 mg /L per month (AL- Jabery, 2009).Banntanol was sprayed at a concentration of 50cm<sup>3</sup> /100 L water for prevention of fungal infection according to need for all experimental units.

The experiment was conducted in a Randomized Complete Block Design (R.C.B.D) with three replicates in two factors; the first was two types of growth medium i.e. (river loam only) and (rivers loam + peat moss 1:1 . The second factor was NAA concentration 0, 200 and 400 ppm . Means of the first factors were compared according to Independent t-test with two groups( $P \leq 0.05$ ),and the means of second factor and there interactions were tested by Duncan Multiple Range Test at the level 0.05 (Al-Rawi and Khalaf- Alla, 1980) .

**Table 1. Chemical and the physical properties of the soil**

Type of analysis	Unit of measurement	Value
Texture	—————	Sandy Salt
Sand	Gm/kg	700.80
Salt	Gm/kg	200.20
Clay	Gm/kg	990.0

Type of analysis	Unit of measurement	Value
pH	—————	7.71
EC	des/m	2.25
Organic matter	Gm/kg	1.70
Mg <sup>++</sup>	mol/L	8.00
Ca <sup>++</sup>	mol/L	14.00
Na <sup>+</sup>	mol/L	3.00
K <sup>+</sup>	mol/L	1.00
Cl <sup>-</sup>	mol/L	2.50
SO <sub>4</sub> <sup>=</sup>	mol/L	20.00
HCO <sub>3</sub> <sup>-</sup>	mol/L	0.50

**Table 2. The Chemical properties of peat moss**

K <sub>2</sub> O(ppm)	P <sub>2</sub> O <sub>5</sub> (ppm)	N (ppm)	pH	Salt content (g/L)
80-190	70-180	160-70	5.7-6.5	0.7-0.9

On March 10 2011( two months after treatment) two pots of each treatment were used to measure the percentage of rooting and the number of the main roots and the rest of the pots were left to the end of the experiment to measure the vegetative growth and flowering characteristics of the plants.

At the stage of full bloom, the following characteristics were estimated:

1. Plant height (cm)
2. Total number of leaves / plant
3. Number of nodes / plant
4. Length of internodes (cm)
5. Shoot dry weight (gm): by using electric furnace at 70°C .
6. Root dry weight (g): Pots were soaked in a large bowl filled with clean water until the separation of all soil around the roots, then, they were put in electric furnace at 70°C .
7. Flower diameter (cm): was measured at full bloom by Varner Caliper.

8. Number of petals/flower

### Results And Discussion

Results showed that cuttings grown in growth medium (rivers loam + peat moss 1:1) had significantly higher percentage of rooting and number of main roots which gave 88.30% and 14.23 roots /cutting while cuttings grown in the river loam alone gave the lowest values ( 82.45% and 13.05 root/cutting ) (Table 3) . As for the effect of concentration of NAA , it is clear from the same table that the immersion of cuttings in 400 ppm NAA was superior over the concentration 200 mg /L concentration and control in increasing percentage of rooting and number of main roots which gave 93.86% and 15.92 roots /cutting , while control treatment gave the lowest values (76.31% and 10.62 roots / cutting) .The increases in %rooting and number of roots resulted from 400 ppm NAA treatment may be due to auxin ability to enhance cell division of meristem as well as format of the initial roots, this in turn

promoted the earlier appearance of roots (Hartmann and Kester, 2002) which at the end led to increase the rooting percentage and the number of the main roots in cutting

.These results agree with findings of the Bhatt and Tomar (2010) and Slim (2011) using Swingle and Roses cuttings .

**Table 3. Main Effect of growth media or NAA concentration on the rooting characteristics of carnation cuttings.**

Treatment	Rooting percentage %	Number of roots (root/ plant)
River loam	82.45	13.05
River loam + peat moss ( 1:1)	88.30 *	14.23 *
_____	_____	_____
NAA ( 0 ppm)	76.31 c	10.62 c
NAA ( 200 ppm)	85.96 b	14.40 b
NAA ( 400 ppm )	93.86 a	15,92 a

Rates that carry the same alphabetic characters within a column do not differ significantly among themselves as less significant difference test at the 0.05 level of probability

\*significantly ( $P \leq$ ) by T - Test

Concerning the interaction between the growth medium and concentration of NAA, the results shown in table (4) indicate that planting cuttings in growth medium (river loam + peat moss 1:1) and immersing them with 400 ppm NAA significantly increased

%rooting and number of roots (94.73% and 16.85 root / cutting, respectively) compared to all treatments . The lowest values of %rooting and number of roots (73.68% and 9.99 root/cutting ) were observed in the NAA non-treated cuttings grown in river loam .

**Table 4. Effect of the interaction between the growth medium and NAA on the rooting characteristics of carnations**

Treatment		Rooting percentage %	Number of root (root/plant)
Growth media	NAA (ppm)		
River loam	0	73.68 e	9.99 e
	200	80.69 c	14.18 c
	400	92.98 b	14.98 b
River loam + peat moss (1:1)	0	78.94 d	11.24 d
	200	91.22 b	14.61 b
	400	94.73 a	16.85 a

Rates that carry the same alphabetic characters within a column do not differ significantly among themselves as less significant difference test at the 0.05 level of probability .

Table (5) showed that growth medium (river loam + peat moss 1:1) significantly affected plant height, number of leaves and nodes and shoot and root dry weights that gave highest values (65.74 cm and 35.11 leaf / plant , 17.55 nods/ plant, 1.99 g and 0.80 g, respectively) compared to the all treatments. The lowest values of plant height, number of leaves and nodes and shoot and root dry (62.22 cm, 34.00 leaf/plant, 17.00 nods/plant, 1.96g and 0.77 g, respectively) were obtained with cuttings grown in the rivers loam alone. This increment in growth may be justified regarding peat moss that contain high concentrations of elements. Moreover, peat has a pH degree (5.7 to 6.5) (Table 2) , which is important in liberating the micro nutrients absorbed from root to leaves , which lead to increases in the photosynthesis, as well as the activity of apical meristem. Therefore, cell division and elongation might be increased . Conclusionally, plant height, number of leaves and nodes and shoot and root dry weight

improved . The results achieved by the current study matched findings of (Strojny *et al.*, 1994) on carnation.

Treating the cutting with 400 ppm NAA (Table , 5 ) significantly increased plant height, number of leaves and nodes, the length of internodes, shoot and root dry weight of shoot over those of 200 ppm and control treatments. The highest values of plant height, number of leaves and nodes, the length of internodes, shoot and root dry weight ( 76.88 cm , 38.33 Leaf / plant , 19.16 node/plant , 4.05 cm , 2.23 g and 0.90 g, respectively ) were obtained from cuttings treated with 400 ppm NAA , while the lowest values ( 47.42 cm , 31.00 Leaf / plant , 15.50 nods/plant, 3.12 cm , 1.82 g and 0.64 g, respectively) were observed in control treatments. The resulted increases in the vegetative characteristics may be due to auxin which has the ability to enhance cell division and elongation of meristem cells (Abu leila, 1969) , in addition to its ability in promoting the appearance lateral roots on the cuttings (Toajin, 1987) , which finally promoted the vegetative growth of the plant.

**Table 5. Effect of the growth medium and NAA on the vegetative and rooting characteristics of carnation .**

Treatment	Plant height (cm)	Number of leaves (leave/ plant)	Number of nodes (node/ Plant )	Length of internodes (cm)	Shoot dry weight (g)	Root dry weight (g)
River loam	62.2	34.00	17.00	3.70	1.96 b	0.77 b
River loam + peat moss ( 1:1)	65.74*	35.11*	17.55*	3.71*	1.99*	0.80*
NAA ( 0 ppm)	47.40 c	31.00 c	15.50 c	3.12 b	1.82 c	0.64 c
NAA ( 200 ppm)	64.60 b	34.33 b	17.17 b	3.95 a	1.88 b	0.83 b
ppm( 400 NAA)	76.80 a	38.33 a	19.16 a	4.05 a	2.23 a	0.90 a

Rates that carry the same alphabetic characters within a column do not differ significantly among themselves as less significant difference test at the 0.05 level of probability

\*significantly ( $P \leq$ ) by T - Test

Results of the interaction between the two factors (Table 6) showed that planting cuttings in the growth medium (river loam + peat moss 1:1) and treating them with 400 mg/ L NAA had significant increases in the vegetative characteristics of carnation cuttings, and gave the highest values of plant height, number of leaves and nodes, the length of internodes and shoots and root dry

weights to (78.40 cm, 39.33 leaf / plant, 19.66 nods / plant, 3.98 cm, 2.25 g to 0.94 g, respectively), compared with the lowest obtained by using non NAA and river loam ( 45.36cm, 30.66 leaves/plant, 15.33 node/plant, 3.08cm, and 1.84g and 0.63g , respectively). These results agree with findings of the Al- Raisdi , (2012) in *Trigonella foenum – graecum* plant .

**Table 6. Effect of the interaction between growth medium and NAA concentration on vegetative and rooting characteristics of carnations**

Treatment		Plant height (cm)	Number of leaves (leave/ plant)	Number of nodes ( node/ plant)	Length of internodes (cm)	Shoot dry weight (g)	Root dry weight (g)
Growth media	NAA (ppm)						
River loam	0	45.36 f	30.66 e	15.33 c	3.08 c	1.84 f	0.63 c
	200	65.94 d	34.00 c	17.00 b	3.89 b	1.85 d	0.82 b
	400	75.35 b	37.33 b	18.66 a	4.12 a	2.20 b	0.85 a
River loam + peat moss (1:1)	0	49.48 e	31.33 d	15.66 c	3.16 c	1.81 e	0.64 c
	200	69.33 c	34.66 c	17.33 b	4.00 a	1.92 c	0.83 ab
	400	78.40 a	39.33 a	19.66 a	3.98 a	2.25 a	0.94 a

Table (7) showed significant differences in the flower number of petals due to the effect of growth medium. The result showed that the medium ( river loam + peat moss 1:1) gave the highest values of flowers diameter and the number of petals (4.7 cm, 29.97 petal/flower, respectively) compared to the lowest rates (4.51cm and 27.69 petal/ flower ), resulted from cuttings grown in the river loam only. This may be attributed to the effects of providing higher available nutrients concentrations (Table 2) and the role of peat moss when added to the media to improve soil

properties by increasing their ability of keeping water which serve the uptake of macro elements (Toajin, 1987), that may led to increase the efficiency of the process of photosynthesis and increase the formation of carbohydrates in the leaves and thus the transfer of those materials to the flower bud, in addition to an increase in the process of cell division in the flower bud (Mangel and Kirkby,1987), and ultimately leading to improving the qualities of flowering diameter and the number of petals .

**Table 7. Effect of growth medium and NAA concentration on the flowering characteristics of carnation cuttings**

Treatment	Flower diameter (cm)	Number of petals ( petal / flower )
River loam	4.50	27.63
River loam + peat moss ( 1:1)	4.71*	29.97 *
NAA ( 0 ppm)	4.21c	25.30 b
NAA ( 200 ppm)	4.67 b	25.80 b
NAA ( 400 ppm)	4.94 a	35.30 a

Rates that carry the same alphabetic characters within a column do not differ significantly among themselves as less significant difference test at the 0.05 level of probability

\*significantly ( $P \leq$ ) by T - Test

The treatment of the NAA had a significant effect on the flower diameter and the number of petals. Immersing the cuttings with 400 mg /L NAA gave the highest values of these two characters (4.94 cm and 35.30 petal/flower) compared to the lowest values (4.21cm 25.30 and petal. flower<sup>-1</sup>) (Table, 7). The increases in flower diameter and the number of petals resulted from 400 ppm NAA may be due to the increasing plant height and number of leaves (Table 5), and that may be led to increase carbohydrates synthesis in the leaves by

promoting photosynthesis which are transferred to the flowers buds, and finally increases flower diameter by increasing petals number. These results agree with findings of Jeffcoat (1977) on carination.

Regarding the interaction between factors observed in the table (8), it is clear that using the media (river loam + peat moss 1:1) and 400 ppm NAA significantly gave the highest values of flower diameter and number of petals (5.06 cm and 38.0 petal/flower) compared with least values (4.10 cm and 25.0 petal/flower) given by river loam alone.

**Table 8. Effect of the interaction between growth medium and NAA concentration on the flowering characteristics of carnation cuttings**

Treatment		Flower diameter (cm)	Number of petals ( petal / flower )
Growth media	NAA (ppm)		
River loam	0	4.10 c	25.0 c
	200	4.60 b	25.3 c
	400	4.82 b	32.6 b
River loam + peat moss (1:1)	0	4.32 c	25.6 c
	200	4.74 b	26.3 c
	400	5.06 a	38.0 a

Rates that carry the same alphabetic characters within a column do not differ significantly among themselves as less significant difference test at the 0.05 level of probability

## CONCLUSION

The current study concludes that use of growth medium (river loam + peat moss 1:1) and treated

cuttings carination with 400 ppm NAA could improves rooting , vegetative and flowering characteristics of carnation plant .

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## تأثير وسط النمو والمعاملة بنفتالين حامض الخليك (NAA) في تجذير، نمو وأزهار نبات القرنفل (*Dianthus caryophyllus* L.)

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### ملخص

أجريت تجربة في الظلة الخشبية التابعة لقسم الإنتاج النباتي /المعهد التقني - الكوفة في محافظة النجف في الفترة من 2010/1/10 لغاية 2011/6/1 لدراسة تأثير وسط النمو وتركيز نفتالين حمض الخليك (NAA) في صفات تجذير عقل نباتات القرنفل ونموها وأزهارها. تضمنت التجربة زراعة عقل نباتات القرنفل صنف Chabaud ( ذات طول 10-12 سم وتحتوي على أربعة أوراق حقيقية ) في وسطي نمو (زميزج نهري + البيت موس بنسبة (1:1)) و (زميزج نهري لوحده) وتغطيس العقل بثلاثة تراكيز من NAA هي ( 0 ، 200 و 400 جزء بالمليون). أظهرت النتائج أن وسط النمو (زميزج نهري +البيت موس (1:1)) أعطت أعلى القيم لكل من النسبة المئوية للتجذير ، عدد الجذور الرئيسة لكل عقلة ، ارتفاع النبات ، عدد الأوراق ، عدد العقد، والوزن الجاف للمجموع الخضري والجذري، قطر الأزهار وعدد البتلات، إذ بلغت 88.30% و 14.23 جذراً. عقلة<sup>-1</sup> و 65.74 سم و 35.11 ورقة. نبات<sup>-1</sup> و 17.55 عقدة. نبات<sup>-1</sup> و 1.99 غم و 0.80 غم و 4.71 سم و 29.97 بتله. زهرة<sup>-1</sup> معنوياً وعلى التوالي ، مقارنة بأقل والقيم التي نتجت من وسط النمو ( الزميزج النهري لوحده). أظهرت النتائج إن تغطيس العقل في منظم النمو نفتالين حمض الخليك (NAA) بتركيز 400 جزء بالمليون قد زادت معنوياً من النسبة المئوية للتجذير ، عدد الجذور الرئيسة لكل عقلة ، ارتفاع النبات، عدد الأوراق، عدد العقد، طول السلاميات، الوزن الجاف للمجموع الخضري والجذري، قطر الأزهار وعدد البتلات، إذ بلغت 93.86% و 15.92 جذراً. عقلة<sup>-1</sup> و 76.88 سم و 38.33 ورقة. نبات<sup>-1</sup> و 19.16 عقدة. نبات<sup>-1</sup> و 4.05 سم و 2.23 غم و 0.90 غم و 4.94 سم و 35.30 بتله. زهرة<sup>-1</sup> وعلى التوالي ، بينما أعطت معاملة المقارنة ( النباتات غير المعاملة بهرمون التجذير) أقل القيم لهذه الصفات . اظهرت نتائج التداخل بين العاملين أن زراعة العقل في وسط النمو (زميزج نهري + البيت موس) بنسبة (1:1) وتغطيسها بنفتالين حامض الخليك بتركيز 400 جزء بالمليون تفوق معنوياً في جميع الصفات المدروسة مقارنة مع زراعة العقل في وسط الزميزج لوحده وعدم المعاملة بنفتالين حمض الخليك والتي أعطت أقل القيم .

الكلمات الدالة: النفتالين، حامض الخليك، نبات القرنفل.

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تاريخ استلام البحث 2012/8/27 وتاريخ قبوله 2013/9/26.